

The Dynamics of Expert Work:

A case study of anti-doping laboratory directors

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DECLARATION

This thesis contains no material published elsewhere or extracted in whole or in part from a thesis by which I have qualified for or been awarded another degree or diploma. No other person's work has been used without due acknowledgement in the main text of the thesis.

This thesis has not been submitted for the award of any degree or diploma in any other tertiary institution. All research procedures reported in the thesis received the approval of the relevant Ethics Committees.

Alanah Kazlauskas

Date

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ABSTRACT

As humanity is increasingly confronted by shared, complex, multi-faceted problems, experts with particular knowledge and expertise are called upon to develop solutions which can be implemented internationally. Such a role requires that experts work alongside professionals from a variety of different fields as well as creating the necessary knowledge and skills to solve the problems at hand.

This thesis presents the outcomes of grounded research into the dynamics of expert work based on a case study of the scientific directors of accredited sports anti-doping laboratories.

The study addressed questions about how both the directors and their stakeholders viewed the work of these scientific experts. It also investigated how these experts maintained their expertise in the rapidly changing context of doping in sport. The research design integrated the methods of case study, grounded theory and developmental work research. Qualitative data was elicited using a combination of standard qualitative research methods such as semi structured interviews, surveys and participant observation, and an adaptation of the activity theory based developmental work research methods. The results of data analysis were interpreted using the theoretical frameworks of Activity Theory, Communities of Practice and the complexity based *Cynefin* model of organic sense-making. The subsequent development of a grounded theoretically informed model pointed to the existence of multiple objects for expert work and the critical role of a trusted, private, shared space for the development of individual and collective identities, the expansion and application of validated knowledge within the field and the establishment of a shared and informed base from which experts can engage with other professional groups working in the field. The model identified relationships between the volume of routine processes within a workplace and both the extent of knowledge-generating research work and the development of an awareness by experts of the benefits of greater participation with other stakeholders in the broader problem context.

This international study also provided insights into the complex, evolving and emergent nature of multi-stakeholder activity and identified avenues for further research into the optimum dynamics of inter-agency working in both local and global contexts.

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GLOSSARY OF TERMS

Anti-doping	Strategies directed toward the detection and deterrence of doping in sport – scientific, educational, organisational, regulatory, etc.. Also referred to as doping control
Cologne Workshop	The Manfred Donike Workshop on Doping Analyses; an annual meeting held in Cologne, Germany that is limited almost exclusively to scientists who work in accredited anti-doping laboratories
Directors	The Scientific Directors of the laboratories accredited for chemical analysis of urine (and sometimes blood) to detect athletes' use of banned performance enhancing substances
Dope testing	The collection of athletes' samples for analysis to detect banned pharmaceuticals or techniques
Doping in sport	The administration to athletes, or the use by them, of pharmaceuticals or techniques listed by international sports organisations as banned because they unfairly enhance an athlete's performance or are harmful to an athlete's health
Doping control	See 'anti-doping'
DWR	Developmental Work Research: An activity theory based research method that presents participants with the opportunity to reflect on their current and future activities through the process of mirroring.
IAAF	The International Association of Athletics Federations
IOC	The International Olympic Committee: Responsible for the accreditation of doping control laboratories until 2004 and for the introduction of dope testing at the Olympic Games.
UCI	Union Cycliste Internationale – the International Cycling Union
WADA	World Anti-Doping Agency: Formed in 1999 to harmonise anti-doping efforts internationally, WADA took responsibility for the accreditation of doping control laboratories in 2004
WAADS	World Association of Anti-Doping Scientists: membership restricted to scientists who work in accredited anti-doping laboratories

RESEARCHER'S NOTE

Within the text, data excerpts from interviews with study participants have been indicated by the use of italics and the placement of a coded identification number at the end of the excerpt. Brackets [] around a word or words within a quote indicate that the researcher has either inserted the word or changed its tense to promote clarity of meaning.

Chapter 1 INTRODUCTION

The changing nature of the world in which we live, and the effect of those changes on both individuals and society, has provided a rich context for social research. A major aspect of these changes has been the rapid and continuing increase in the volume of knowledge. The mobilisation of this new knowledge to ensure that benefits can be obtained through its application is of obvious importance to society. Of particular interest for this researcher has been the changing role of experts in the modern world. Traditionally, experts have been called upon to provide definitive answers to problems. However, increased commercial and social expectations have been placed on experts. Experts participate in the rapid generation of new knowledge and its mobilisation in goods and services but they are not the only professionals involved in this process. Experts are also called upon to solve the local and global social problems that face society but they are not the only professionals involved in generating solutions to these problems.

To better understand what it is that we expect experts to do and to enhance the contributions of experts themselves, the aim of this qualitative research is to investigate the dynamics of expert work in the post-industrial context of 21st century society. To achieve this aim, the research uses a sociological rather than cognitive perspective in its focus on the work of a group of internationally recognised experts, the scientific directors of accredited doping control laboratories. This group was selected because their number represented a manageable but internationally distributed population; the high-profile nature of doping in sport could be expected to provide rich, accessible public data that would highlight aspects of their work, and this context was interesting to the researcher.

THESIS OVERVIEW

Chapter Two provides an overview of the sociological approach to the study of expertise and how expertise is maintained. The changing perception of the public role of the expert in the early 21st century is also presented. Against this background three broad questions are raised. Two questions related to the nature of the work of experts: from the perspective of the experts themselves and from the perspective of their stakeholders. The third question asks how experts, who are already regarded as having mastered their field, maintain their expertise. Three frameworks are identified as conceptual lenses with which

to interrogate and discuss the research data and thereby promote the building of a theoretically informed model of expert work.

In **Chapter Three**, the frameworks of activity theory, communities of practice and the complexity based *Cynefin* model of sense making are described in order to provide a theoretical base for the interpretation of the research results and findings presented in later chapters. A short overview of the relevance of these frameworks to aspects of the research has been included at the end of this chapter.

Chapter Four, addresses the design of this research. The influence of the researcher's own cultural history on the refinement of the research questions is presented at the beginning of this chapter. These questions limit the research scope to that of the work of the scientific directors of accredited sports doping control laboratories:

1. What perceptions do the scientific directors of accredited doping control laboratories hold about their work?
2. How do the scientific directors maintain their expertise?
3. What perceptions do other stakeholders involved in anti-doping work in sport hold about the work of the scientific directors of accredited doping control laboratories?

The narrowness, high-profile, international nature, and demands upon these experts accompanied by a small population size recommended this context as an attractive one for this research into the dynamics of expert work. A description of the pilot study that established the feasibility of the research prefaces a discussion of the case-based, grounded research method into which the activity theory based, developmental work research method was integrated. Details of research strategies including the measures taken to establish trust between the participants and the researcher are provided.

After a brief overview of doping control efforts in sport, **Chapter Five**, sets out the scientific directors' perceptions of their work in answer to the first of the research questions defined in Chapter Four. Following this, theoretical insights into the dynamics of being the director of an accredited laboratory contribute to the early stages of the development of a grounded model for the dynamics of the work of these experts.

Chapter Six addresses the second of the research questions about how the directors maintain their expertise, an issue of import to both the directors and their stakeholders. After an investigation of the avenues through which new anti-doping scientific knowledge is investigated, the nature and role of the Manfred Donike Workshop on Doping Analyses

held annually in Cologne, Germany, is considered at length. Theoretical insights into knowledge mobilisation within this community are considered from the perspectives of all three frameworks, thus providing a deep understanding of the role of the trusted, private, shared space of the Cologne workshop. This is reflected in the adjustments made to the model for the dynamics of the work of these experts.

In **Chapter Seven**, after a brief discussion of the high profile context of doping control work, the anti-doping stakeholders' perceptions about the past contributions of the directors are presented. Following this, stakeholders' views about the desired attributes of current and future scientific directors are set out. As well as confirming the scientific directors' perceptions of their work, stakeholders' views highlight the role of communication in the dynamics of the work of these expert scientists. Accordingly, the model for the work of expert scientists has been revised to reflect the views of stakeholders.

Throughout the period of this research, the World Anti-Doping Agency (WADA) was gradually taking on a leadership role with international responsibility for anti-doping efforts. This change was reflected in the research data. Both this aspect of the research and its impact on the dynamics of anti-doping work have been presented in **Chapter Eight**. Supported by the use of the *Cynefin* framework to interpret the evolution of doping control work, the challenges to experts and managers working in the complex evolving context of anti-doping have been discussed.

Finally, **Chapter Nine** summarises the research findings, its implications and future research directions. It also explains the limitations of the research and how these were addressed. The key findings of the importance to experts of personal and professional satisfaction, routine experience, access to a trusted, private space together with the changing nature of their work in a changing context are summarised. Methodological findings relate to the conduct of research in a high-profile and dynamic global context. These include establishing trust and effective communication channels over the considerable distances between the researcher and the participants, the use of theoretical frameworks to promote higher level interrogation and interpretation of the data and the use of the developmental work research Change Laboratory methods to enable validation and understanding of the emerging phenomena in a changing and complex context. A number of future research projects, some relating to fields other than anti-doping work, have been

suggested. Limitations of this study relate to the personal cultural history of the researcher, the timing of data collection during a period of considerable change in the context, the lack of face-to-face contact between the researcher and the participants, and the use of English as the only language for communication in the research.

Chapter 2 BACKGROUND LITERATURE TO THE STUDY

“New economic conditions and ways of working require that we expand our theories.”

Nardi, Whittaker and Schwarz (2002, p. 207)

2.1 INTRODUCTION

Society’s increased reliance upon knowledge has made the work of experts and expertise an appropriate and interesting area for investigation. Experts in any field of endeavour, be it biotechnology or bonsai, have held respected positions amongst those who either belong to or come into contact with that particular field. They have acquired considerable knowledge and/or skills as a result of considerable effort and/or experience that other people in their own and other professions lack. They have the knowledge and skills to solve problems that others are unable to solve and have been called upon to do just that. This research has investigated and built theory about the dynamics of the work of a group of expert scientists, the directors of accredited sports doping control laboratories. The complex evolving international workspace in which these experts work is similar to the contexts of many other groups of early 21st century workers. In such environments, the rapidly expanding volume of knowledge in our global society and society’s need to mobilize that knowledge quickly and effectively has made it imperative that, as Nardi, Whittaker and Schwarz (2002) stated, theories about work, and in particular the work of experts, are improved. To build grounded theories that will improve the use of the knowledge and capabilities of experts in this climate, questions need to be asked.

To provide a frame for the questions to be answered by this grounded research, this chapter has not provided an extended literature review of the work of experts and expertise. Rather, it explores some perspectives about experts and expertise in the early 21st century in order to raise broad questions that have been refined by the research design in Chapter Four. A number of existing approaches to the study of experts and expertise have been presented in Section 2.2. Section 2.3 considers how experts stay expert when they are already at the top of their field. Finally, Section 2.4 looks at changing attitudes to experts and expertise.

2.2 BEING AN EXPERT: THE STUDY OF EXPERTS AND EXPERT KNOWLEDGE

The literature contained a variety of approaches to the study of experts and expert knowledge. Huber (1999) described two main approaches to the study of experts and expert knowledge: cognitive and sociological. Huber stated that psychologists defined expertise as a “task-specific competence in problem solving that permanently enables a person to perform an outstanding cognitive activity, whose success is determined by particularly distinguished thinking processes resulting from that individual’s brain capacity” (p. 17). On the other hand, sociologists regarded experts as knowing “how to act or play the expert as well as by being authorized to provide instruction in a certain domain and knowing how to reject the claims of directives from others within the field of knowledge successfully” (p. 17). This latter approach is better suited to addressing Nardi et al.’s (2002) call for improved theories about the work of experts in the complex context of the 21st century, and has been adopted for this research.

Further exploration of the literature located some research into the work of experts. The models of expert work proposed by Gaines (1995) and Yelder (2004) attempted to capture what experts do. These models outlined below suggested an image of the work of experts that was dynamic rather than static, and as such suited to the evolving context of current times.

Hawkins’ (1983) work on expert systems led him to conclude that “human expertise should be better understood before the users of expert systems specify the services needed and expected from such systems” (p. 1). Hawkins’ analysis of expert thinking was later summarized diagrammatically by Gaines’ (1995, Section 3.2) (see Figure 2-1). In the diagram, Gaines highlighted the roles of the professional community, the client and the client’s community in the process of the development of specialized knowledge by individual experts. Gaines’ (1995, Section 3.2) diagram pointed to the multi-faceted, situated nature of expert work. Experts

- worked for a client from whom the expert elicited data about the problem
- interacted with the client’s community to gain and expand their experience of novel situations and to receive resources, rewards and criticism
- accessed a profession’s body of knowledge through education, training, instruction, apprenticeship, books, journals, conferences and workshops as well as accessing the profession’s own recognition system

- generated and regenerated model solutions to the client’s problem based on the expert’s experience and knowledge as well as that of the profession
- gave advice based on the model, and responded to queries from the client.

The use of double headed arrows in the diagram highlighted the dynamic nature of the formation and dissemination of expertise by individual experts.

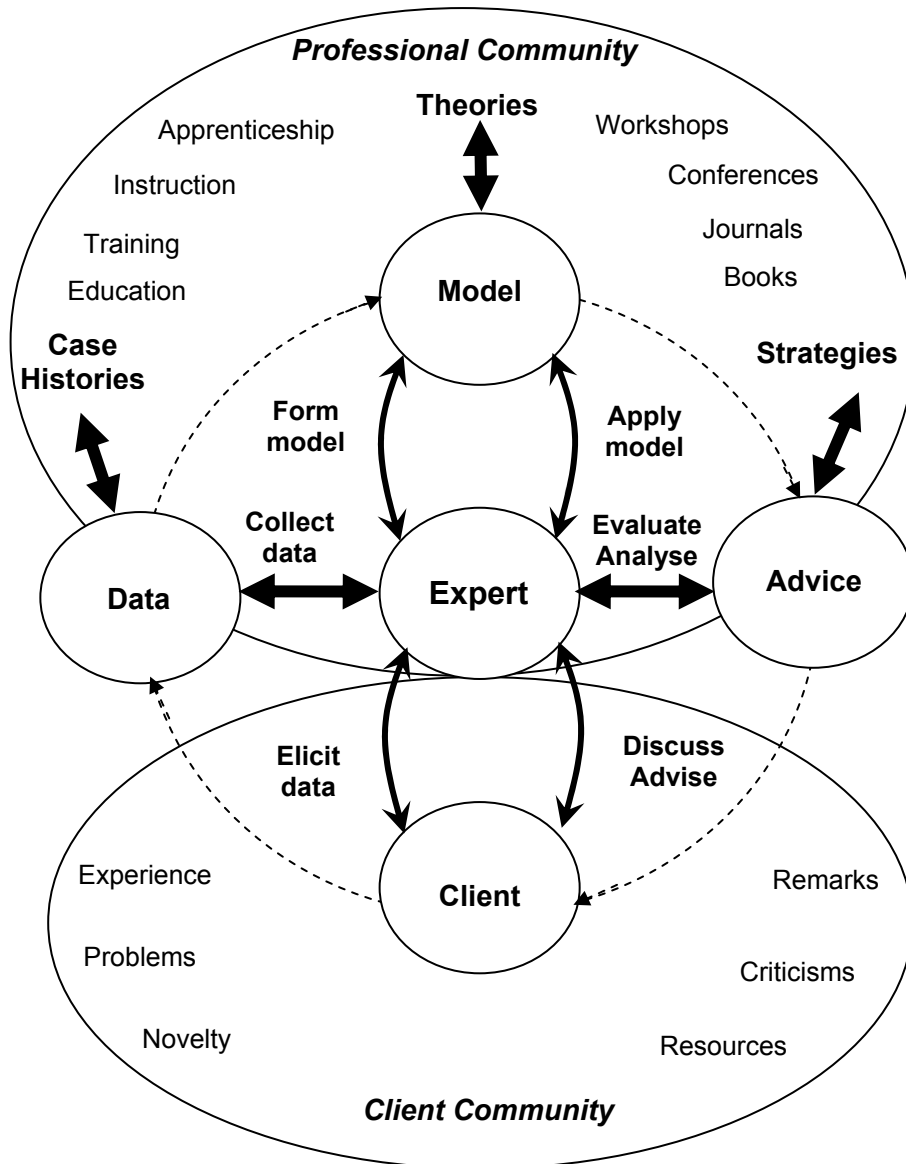


Figure 2-1: Gaines’ (1995) depiction of the processes in the formation and dissemination of expertise

Yielder’s (2004) case study of the professionals working in the newly developed, complex and expanding field of medical imaging, broke away from the examination of professional expertise from the distinct use of either a single cognitive or an experiential focus when it

integrated both these approaches along with other perspectives. Yelder concluded that “while expertise is situated in the context of practice, it incorporates several dimensions working together in an integrated, seamless fashion through the medium of the individual practitioner” (p. 60). Yelder listed five key dimensions of professional expertise: knowledge base; cognitive processes; internal integrative processes; interpersonal relationships; and professional practice. The professional personally integrated these dimensions as they maintained effective performance and managed change (p. 78). Yelder’s model (see Figure 2-2) also emphasised the dynamic interactions between these elements through the use of double-headed arrows. However, Yelder’s model did not explicitly suggest how experts deal with novel situations which may require knowledge they do not have.

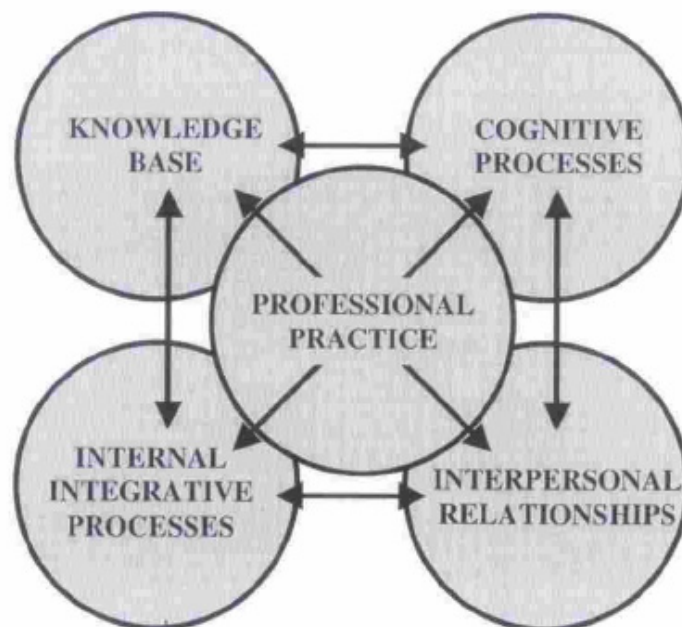


Figure 2-2: Yelder’s (2004) model of professional expertise

Lee and Roth’s (2003) study was also contextually situated. Lee and Roth stated that the scientific expert they interviewed in their work in the fishing industry, represented himself as having a trained eye, as running an excellent scientific program and having a life-long passion for science, as proclaiming objective truth, and being able to communicate scientific matters despite their complexity (par. 20). Lee and Roth’s grounding in activity theory and subsequent understanding of identity as a dialectical relationship between identity and activity was reflected in the conclusion that world-class expert identity is “a

situated accomplishment, an outcome of activity rather than its precedent, and that its formation depends on numerous unknown contingencies” (par 36). This description also pointed to the dynamic nature of the work of experts and suggested that experts use and expand their problem solving abilities in the course of their work.

In a similar vein, Engeström’s (1991) early research into the use of the activity theory based, developmental work research (see Chapters Three and Four) criticised the view of expertise as something that resided “under the individual’s skin, in the form of explicit or tacit knowledge, skills and cognitive properties e.g. mental models” (p. 266). Engeström commented that research that had taken into account the larger context of expert performance had left experts as isolated, even helpless, in novel situations involving non-standard problems. That is, previous researchers had failed to answer questions about how experts become, and stay, expert in the changing contexts within which they work. Engeström was disturbed that these “dominant traditions [said] practically nothing about the factors that make experts learn and perform their discrete tasks in the first place” (p. 267). Consequently, an accurate model of expertise should represent how experts expand their expertise.

Engeström’s approach to understanding expertise was “through an historical analysis of the evolution of the activity system, using documents and oral history interviews as data” (1991, p. 275). Engeström’s early study challenged notions of work and expertise “as individual performances [and] as purely structural formations dictated from above, by anonymous societal forces” (p. 286). Rather, Engeström concluded that the learning associated with the ongoing resolution of problems related to expert work was expansive in nature and led to the transformation of individuals, groups and institutions (p. 287). Engeström and Middleton (1996) later described expertise as “ongoing collaborative and discursive construction of tasks, solutions, visions, breakdowns and innovations” (p. 4).

More recently, Engeström wrote:

Experts operate in and move between multiple parallel activity contexts ... [that] demand and afford different, complementary but also conflicting cognitive tools, rules and patterns of social interaction. Criteria of expert knowledge and skill are different in the various contexts. Experts face the challenge of negotiating and combining ingredients from different contexts to achieve hybrid solutions (2005a, p. 217-8).

Engeström (2005a, p. 218) went on to state his opinion that the two central features of expertise were polycontextuality and boundary crossing. Experts, he commented, were engaged “in multiple simultaneous tasks and task-specific participation frameworks within one and the same activity” (p. 219). The coordination of these multiple tasks within a set of distributed participation frameworks, or polycontextuality, represented a challenge in the environment of larger collaborative activity systems. Boundary crossing occurred when ideas, concepts and instruments were transported from one domain to another between different activity systems. It also occurred in contexts where there was a need for innovation which involved “ ‘encountering difference, entering onto territory in which we are unfamiliar and, to some extent therefore, unqualified’ ” (Suchman in Engeström, 2005a, p. 220).

The writings of Gaines (1995), Yelder (2004), Lee and Roth (2003), Engeström (1991; 2005a) and Engeström and Middleton (1996) provided some idea of what it is to be an expert. The models proposed by Gaines and Yelder described above, Lee and Roth’s description of the situatedness of expert work together with Engeström’s concepts of expansive learning, polycontextuality and boundary crossing all point to the dynamic nature of expert work. This dynamism is related to the context rather than the particular discipline, to interactions between the expert and other people as well as to the expert’s knowledge of the field. These authors have laid a foundation for a study of what it means to be an expert in the rapidly changing global context of the early 21st century. They found that experts did not work alone but they paid little attention to those with whom professionals communicated in order to enhance and use their expertise. Nor did they consider the impact of geographical dispersion on experts and expertise that is increasingly common in the workplace. Further effort was needed to develop an informed understanding of the dynamics of expert work in complex evolving global workspaces if society was to be able to make the most of the experts upon whom they rely in their times of need. This need led to the first of three broad research questions:

What are the dynamics of the work of experts?

To answer to this question this research developed a rich description of and grounded model for the experiences of group of globally dispersed experts using the research design outlined in Chapter Four. Whilst this question addressed the nature of the daily work of

experts, it did not attend to the processes through which they maintained their expertise. This issue has been considered in the next section.

2.3 STAYING EXPERT

The demand for solutions to the steady flow of new problems has resulted in an ever-present need for experts to expand their knowledge and skills. To maintain their expertise, individual experts acquire new knowledge and skills and then apply that knowledge and those skills to deal with problems that they are called upon to solve. Either such new knowledge and skills already exist and so must be learnt, or they must be generated and put to work. This section considers theories that relate to ways that experts expand their knowledge and so keep abreast of developments in their field, including theories related to the learning process, and social theories of learning.

Before reporting the results of their investigation into how professionals learn in practice, Cheetham and Chivers (2001) described a number of theories about how professionals learn and so gain and maintain expertise. Cheetham and Chivers began with Kolb's four stage learning cycle: concrete experience, observation and reflection, generalisation and abstract conceptualisation and active experimentation (see Figure 2-3). Cheetham and Chivers pointed out that "the learner is seen as moving from one stage to the next until the cycle is completed" (p. 256). They noted that the learner could enter the cycle at any point. They commented that experience was "a major element for professional competence acquisition" (p. 256-7) but suggested that various theories of experiential learning had "limitations in terms of explaining how the process works" (p. 257). Cheetham and Chivers also noted that people varied in the way they learnt. Those with an 'activist' learning style learnt through constant activity in contrast to those with a 'reflector' learning style where time was taken to observe and engage in depth reflection before participating actively in the learning context. Whereas 'theorists' took a hands-off approach, preferring to rationalise and synthesise information into logical patterns, 'pragmatists' like to experiment by trying out ideas and turning theories into practice. Rather than individuals having only a single learning style, Cheetham and Chivers noted Honey and Mumford's suggestion that "an individual is likely to display elements of each [learning style]" (p. 262).

Cheetham and Chivers (2001) also described Knowles' approach to adult learning. Knowles suggested that adults autonomously direct their own learning: they were experiential learners who were aware of their own learning needs as determined by their life or work and had a need to apply newly-acquired knowledge or skills to their immediate circumstances. To adults, learning was a partnership between teachers and learning that built on the learners' own experiences.

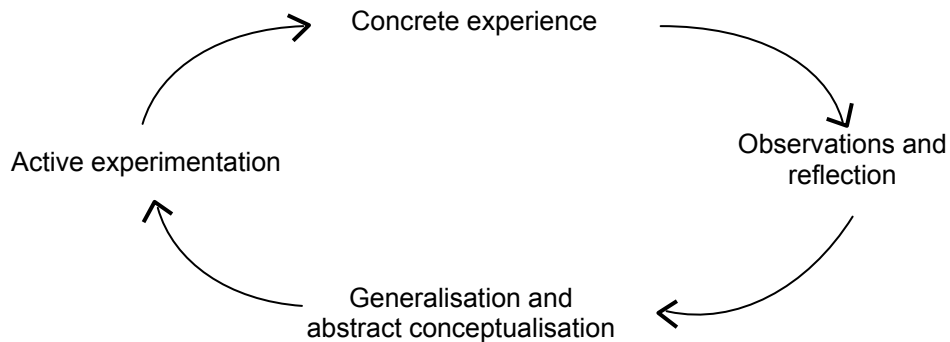


Figure 2-3: Kolb's Learning Cycle (Cheetham and Chivers, p. 256),

However, as recognised authorities in their field, experts know more about their particular field than anyone else. They are, in a sense, the teachers or leaders; there is no group of people in their field that know more than they do. Standard professional development techniques such as formal classroom-based instruction and tutoring or simulation techniques which transfer the knowledge of the field are inappropriate because experts already know and understand that knowledge. To expand their knowledge and skills, experts need to generate the required knowledge, develop and master the necessary skills themselves. Further, once they have learned these new concepts and skills, they hand them on to others to learn in order to increase the collective expertise in their field.

When describing learning theories that focussed on the individual, Cheetham and Chivers (2001) reported that other writers had emphasised the social aspects of learning and argued that “individuals often learn better by co-operating with others than they would on their own” (p. 262). This social and cultural perspective also implied that “learning at work cannot be separated from the everyday working practices of the workplace” (Hodkinson, 2004, p. 12). Wenger (1998) classified social learning theories broadly as:

- organisational theories that concerned themselves with “the ways individuals learn in organizational contexts and with the ways in which organizations can be said to learn

as organizations” (p. 280) citing those of Argyris and Schön, Senge, Nonaka and his co-workers

- socialization theories that focused on “the acquisition of membership by newcomers within a functionalist framework” (p. 280) citing the work of Parsons
- activity theories that focused on “the structure of activities as historically constituted entities” and direct attention to “the gap between the historical state of an activity and the developmental stage of a person with respect to that activity” (p. 280) known as the ‘zone of proximal development’ and cited the work of Vygotsky, Wertsch and Engeström as proponents of activity theory.

As will be seen, the existence of a space for learning was apparent in a number of these theories. In Chapters Five and Six, the role of such a space for anti-doping scientific experts has been explored.

2.3.1 Organisational theories of learning

For organisational researcher Nonaka and his co-workers, the concept of *Ba* was a critical element of the knowledge creation process such as the one that enables firms to be innovative and experts to maintain their expertise. Nonaka and Konno (1998) described the concept of *Ba* (authors’ italics) as “a shared space for emerging relationships” (p. 40). They explained that *Ba* provided “a platform for advancing individual and/or collective knowledge” (p. 40) and represented it diagrammatically as shown in Figure 2-4. Nonaka and Toyama’s commented that “subjective tacit knowledge held by an individual was externalized into objective explicit knowledge to be shared and synthesized. The newly created knowledge was then used and embodied by individuals to enrich their subjective tacit knowledge” (p. 422). The use of the directional arrows in Figure 2-4, highlighted the interactive and dynamic nature of knowledge creation. This diagram also encapsulated Nonaka and Toyama’s understanding of *Ba* as the place, the space, the platform where “knowledge is shared, created and utilized” (p. 428).

Nonaka and Toyama (2005) stressed that the shared context of *Ba* itself was dynamic because of the interactions between participants and the environment, through changes in meanings and contexts that resulted in new knowledge assets. Such knowledge assets were “intangible, specific to the firm and change dynamically ... they must be built and used internally in order for full value to be realized” (p. 429). Nonaka and Toyama also referred to the environment of a knowledge-“phenomenological ‘life-world’ to live in and experience as a reality” (p. 430), where

the ecosystem of knowledge consists of multi-layered *ba*, which exists across organizational boundaries and is continuously evolving. ... Through interactions with the ecosystem, a firm creates knowledge, and the knowledge created changes the ecosystem. The organization and environment should thus be understood to evolve together. ... The constant accumulation and processing of knowledge helps firms to redefine their visions, dialogues and practices, which in turn impact the environment through their new or improved services/products. (Nonaka & Toyama, 2005, p. 430)

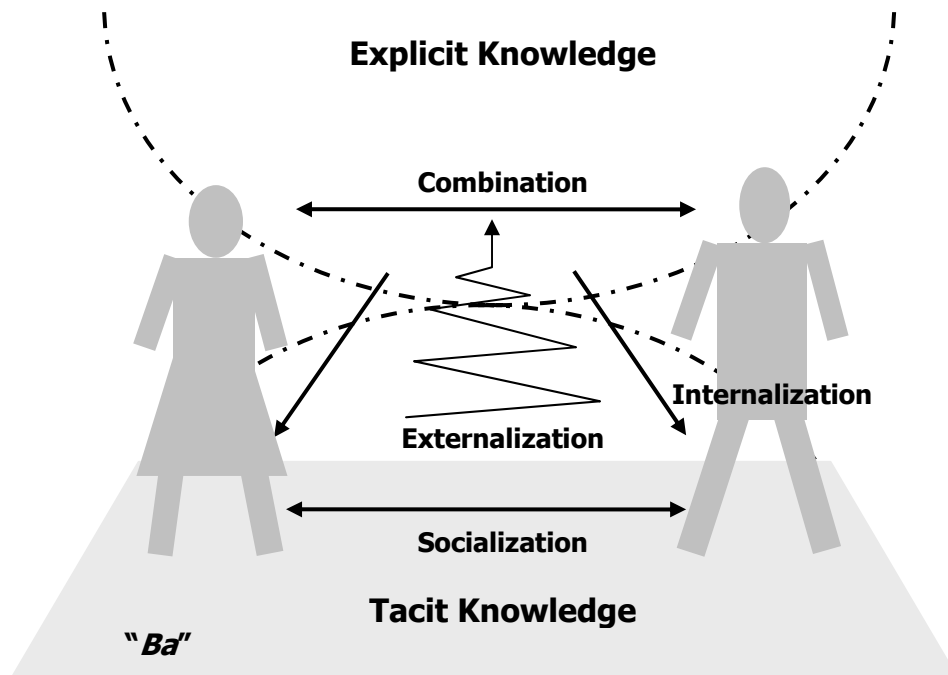


Figure 2-4: Nonaka and Konno's representation of *Ba* and knowledge conversion (1998, p. 44)

Nonaka and Toyama concluded that knowledge creation is a dynamic process and that knowledge itself is neither objective nor static 'truth' (p. 433) as it "emerges through the subjectivity of context embedded actors, and objectified through the social process of knowledge validation" (p. 433).

In this description of the ecosystem of knowledge, there are echoes of the concepts of polycontextuality and boundary crossing referred to by Engeström and described in the previous section. However, as Engeström (2005c, p. 380) pointed out, this model of knowledge creation and application failed to locate the source and subsequent formulation of emerging problems for which new knowledge would be needed by those experts engaged in finding solutions to novel problems.

Innovation represents a particular type of problem solving, namely generating and applying new ideas in order to develop new products or new services to address an existing or newly created need. Victor and Boynton's (1998) examination of innovative firms led to their description of a relationship capability for innovation based on the development of specific types of knowledge within and between organisations. Victor and Boynton stressed the transformative nature of innovative work that was accomplished through expertise located within the workplace. They identified five types of knowledge associated with innovation: tacit, articulated, practical, architectural and configuration knowledge. These types of knowledge were involved in transformations resulting from innovation (see Figure 2-5).

Victor and Boynton (1998) believed that the constant interactions within the workplace, be they related to craft work, mass production, process enhancement or customisation of processes for particular purposes, resulted in the development of the various types of knowledge and associated expertise shown in Figure 2-5 which draws on Victor and Boynton (Figure 10.1, p. 187). These interactions were also reflected in the development of a number of processes. These processes were associated with mass production from the research and development activities of craft work, with the linking of the various mass production processes in a way that enhanced the production, with the modularization of particular aspects of mass production for specific purposes and with the specific renewal of what can be done through craft work. Victor and Boynton also referred to the networking required for successful co-configuration work, that is, work that is carried out jointly by an organisation and its customer when together "they [built] and [sustained] a fully integrated system that [could] sense, respond, and adapt to the individual experience of the customer" (p. 195). Victor and Boynton stated that such work was not easily carried out, describing it as "an organizational, knowledge, and technology challenge that is simply beyond the vast majority of companies" (p. 207). They went on to state that

With co-configuration, there are no final products; no service is ultimately delivered. Instead, the boundaries between learning and work, customer and product, customer and company disappear. What replaces those boundaries are tightly coupled linkages, which feature constantly shared information, ideas, and experiences around the product or service experience. (Victor & Boynton, p. 207)

Importantly, Victor and Boynton (1998) regarded renewal as using the insights on the firm's capability limits, arising from any of the other forms of work, to direct a process of invention and to build completely new capabilities. It was the "basis from which all

organizational knowledge is created” (p. 24) and a pervasive element of innovation. Victor and Boynton also emphasised the importance of “daily conversations between specialists from all over the firm ... [that allowed] ideas, concepts, and information... to flow through [a firm] at lightning speed ... [and to] keep up with a world of changing technologies and customer needs” (p. 186). Victor and Boynton stated that these informal conversations with trusted peers together with more formal ones formed the basis of developing and maintaining expertise in an evolving context because they provided access to the various types of knowledge: tacit, articulated, practical, architectural and configuration, built up through the various, at times extensive, experiences of individuals.

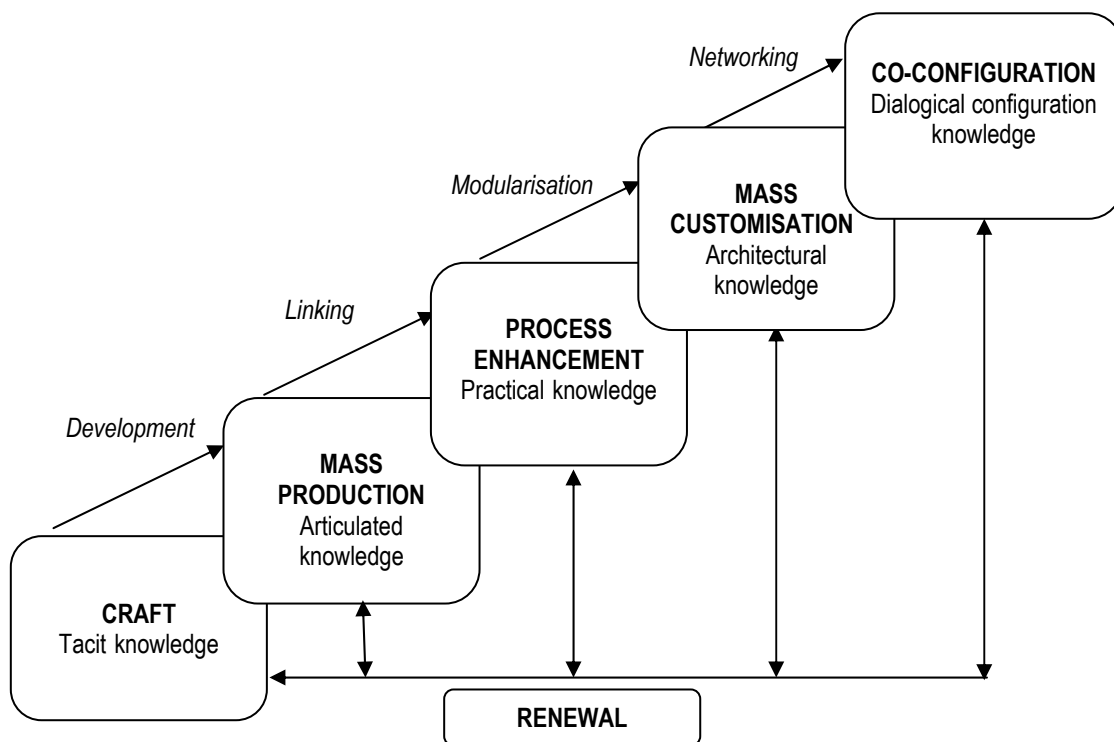


Figure 2-5: Victor and Boynton's model of innovative transformations

Such daily conversations as those referred to by Victor and Boynton would likely occur in the comparative privacy of one-to-one or small group interactions, advancing the knowledge of both individuals and groups of workers, in much the same manner as proposed by Nonaka and Toyama’s (2005) concept of *Ba* which was described earlier in this section. These conversations provided a private space that helped learners to learn what they needed to learn at a time when it was appropriate for them to do so, when they were in a state of readiness to expand their knowledge. As will be seen in Chapter Three where the theoretical frameworks for this research have been discussed, the role of

discourse in knowledge generation has also been acknowledged in activity theory's concept of negotiated knotworking (see Section 3.2.3.3).

Experts learn in order to contend with unfamiliar and newly evolved types of complex problems, some of which are related to their area of expertise and others to the context within which they work. Klein (2004) states that such complex problems arise from

environments characterized by turbulence and uncertainty, [and are] typically value-laden, open-ended, multidimensional, ambiguous, and unstable. Labelled 'wicked' and 'messy', they resist being tamed, bounded, or managed by classical problem-solving approaches. ... Complex problems are not in the book but in the "indeterminate zones of practice" and in the "swamp of important problems and nonrigorous inquiry." Furthermore, they are not solved once and forever. They must be continuously managed. (Klein, 2004, p. 4)

According to Waldrop (1992), complexity theory was developed initially for use in the physical sciences. Recently, social researchers have used complex systems theory as a lens through which to examine some of the more difficult contemporary contexts. More recently complexity theory has provided a new approach in the social sciences, and has, according to Jackson (2003) had a "most profound impact on thinking about management" (p. 113). Complex systems thinking has offered an approach to dealing with the "aspects of organizational life that bother most managers most of the time – disorder, irregularity and randomness" (p. 113). It has also offered a new approach to knowledge management in an increasingly information based society.

Snowden and his co-workers' (Kurtz & Snowden, 2003; Snowden, 1999a, 1999b, 2005; Snowden & Stanbridge, 2004) incorporation of complexity concepts into the *Cynefin* framework as an approach to sense making, learning and decision-making in the wider context of knowledge management in organisations has particular relevance to the complex, evolving context of this study. Consequently, the *Cynefin* framework will be described in more detail in the Chapter Three which deals with the frameworks used for this research.

The organisational theories of social learning described in this section emphasised role of organisations as a learning space for those who work within them. As will be seen in the

next section, other researchers have focused on the relationships between those involved in a particular field.

2.3.2 Socialization theories of learning

Morrison (2002) described organizational socialization as “the process by which an individual acquires the attitudes, behaviour and knowledge she or he needs to participate as an organization member” (p. 1149). Morrison regarded this as “one of the primary ways by which organizational culture is maintained” (p. 1149) and through which newcomers acquired information and so learn about their new work and new organization.

Van de Ven (2005) noted that breakthroughs or innovations were social in nature and rarely the result of the efforts of a single person or organisation. The numerous contributors to an innovation came from diverse, distributed organisations resulting in the co-evolution of both the new technologies and associated institutions. Consequently, breakthroughs reflected “the institutional practices and social norms of the cultures in which they [had been] socially constructed” (p. 369). Van de Ven described the innovation process as “not merely a technical and rational process; it was also a contested and negotiated political process” that required “politically savvy”(p. 365) to successfully mobilise technological change and deal with the intertwined and divergent interests of the multiple contributors who combined their efforts ‘cooperatively’, i.e. cooperatively and competitively (Tsai, 2002). Such joint efforts, Van de Ven (2005) suggested, were a key factor in creating the critical mass of actors needed to provide legitimacy during the emergence of a new technology.

Socialization should be not regarded as a one-way process during which a newcomer or learner adjusts to an existing situation and during which the surrounding organization changes little, if at all. Wenger (1998) suggested that previous socialization theories fell short of providing an adequate framework for understanding ongoing professional development (p. 280), preferring to promote Lave and Wenger’s (1991) concept of communities of practice as a learning theory that regarded learning as situated in a community whose members engaged in and shaped a common practice.

Lave and Wenger’s (1991) work on situated learning emphasised the role of the community in supporting the learning of community newcomers and used the term ‘community of practice’ to describe “a set of relations among persons, activity, and world,

over time and in relation with other tangential and overlapping communities of practice” (p. 98). Hodkinson pointed to such communities of practice as the particular locus of learning at work, noting Lave and Wenger’s claim (in Hodkinson, p. 13) that “in order to learn ... a person [had] to belong to something”. Such communities of practice, commented Hodkinson, could be geographically co-located or dispersed or even virtual. Wenger’s more recent work (Wenger, 1998, 1999; Wenger, McDermott, & Snyder, 2002) which has been concerned with the ongoing learning of experienced practitioners as their practice evolved over time. Wenger suggested that as a social theory of learning, the framework of communities of practice provided “a coherent level of analysis” (1998, p. 4) and yielded “a conceptual framework from which to derive a consistent set of general principles and recommendations for understanding and enabling learning” (p. 4). A more detailed discussion of communities of practice has been given in the Chapter Three (see Section 3.3) as its theory provided a useful lens with which to examine the role of community in the routine and day-to-day learning of experts whose practice has been the focus of this research.

The socialization theories of social learning described in this section have emphasised the role of personal interactions between professionals of various backgrounds and levels of experience in learning and innovation. As will be seen in the next section, other researchers have explored learning through examining focused activity.

2.3.3 Activity as a basis for learning

Individual, social and organisational theories of learning point to the role of both the individual and their community in learning. Wenger (1998), and other researchers including Boud and Middleton (2003), Bjorke (2004) Cheetham and Chivers, (2001), and Worthen (2004), have referred to Activity Theory as providing another means of understanding collaborative learning. De Jong (in Cheetham & Chivers, 2001, p. 266) regarded activity theory as stressing “the social nature of both learning and work and sees learning at work as collective and collaborative”. Boud and Middleton (2003) saw the value of using activity theory as a means of “considering the patterns of learning [they had] observed” (p. 201) in a variety of workplaces. In particular, (Y.) Engeström (1999b) noted (R.) Engeström’s description of innovative organizational learning as “collaborative

learning in work organizations that produces new solutions, procedures, or systemic transformations in organizational practices” (p. 377).

Boud and Middleton (2003) pointed to Engeström’s notion of expansive learning as a means of attending to “horizontal or sideways learning and development in which problem solving occurs essentially through interactions among peers” (p. 201). Engeström and other activity theorists (including Bergland, 2004; Engeström, 1999a, 2005a; Gregory, 2000a; Nardi, 2005; Warmington et al., 2005) used the theoretical tools of activity theory to investigate the learning that accompanies the resolution of tensions in various organisational contexts. A number of other researchers (Hasan & Crawford, 2003; Hasan & Gould, 2001; Kuutti, 1991; Virkkunen & Kuutti, 2000) claimed a broader role for activity theory for the sense-making and decision making associated with knowledge mobilisation and research and development. These and other researchers’ use of activity theory to study collaborative work (Engeström, n.d.; Engeström, Engeström, & Kerosuo, 2003; Kontinen, 1999; Miettinen & Hasu, 2002; Saari & Miettinen, 2001) has recommended its use in this study. Consequently, activity theory and its associated concepts have been described in more detail in Chapter Three.

This exploration of learning has identified a variety of approaches to understanding the ways in which adults learn in the workplace in order to solve the problems associated with their practice. Since the work of experts could be expected to involve the solution of an ongoing stream of problems, including novel ones, it is important that highly qualified professionals engage in learning that enables them to innovate and to solve unusual or atypical problems. Thus, the second broad question for this research became:

How do experts maintain their expertise?

To answer to this question this research examined the means through which groups of experts disseminated existing and generated new knowledge in their field. These means will be described in Chapter Three and Six.

Whilst the learning of experts both individually and collectively is critical for meeting the challenges of unfamiliar problems, Van de Ven’s (2005) assertion reported above suggests that experts also required political skills liaise with the wider community in order to

promote the success of their innovations and problem solutions. Consequently, the next section considers the broader, public context within which experts work.

2.4 THE PUBLIC ROLE OF THE EXPERT

Huber (1999) commented that in economies that are “characterized by a complex social distribution of knowledge” (p. 4) and where “knowledge production and distribution is specialized and fragmented ... experts play a significant role as generators, holders, and distributors of expert knowledge” (p. 4-5). In a world where it has often been stated that knowledge is power, the knowledge of experts can act as “a decisive resource in organizational value creation” (p. 3). Huber states that the manipulation of sense and meaning is gaining importance as economic work against the decreasing significance of the manipulation of things (p. 5). Huber commented that an “ever-increasing number of knowledge professions, which are commonly known as consultants, advisors, counsellors or, more precisely as experts” (p. 5), work in knowledge-intensive economies.

Over recent years, in spite of an increased demand for specialist knowledge, reliance on expert advice as the sole determinant of policy has been questioned. Schmidt (1999) stated that “our society is very complex and that there is hardly any doubt that there is much need for expert advice” (p. 475). In particular, the role of scientific experts as consultants in the policy development process has been commented upon by a number of writers including Beers, van Asselt, Vermunt, and Kirschner (2003). These researchers concluded that “policy makers’ information needs generally [involved] ... ‘linkages’, relations between the policy issue of concern and other policy issues. Such linkages [could] be causal, synergetic, or conflicting. They [might] also concern relations between different scale levels” (p. 77). This need for and integration of information from a variety of perspectives was the reason “why some policy strategies are accepted, and others are not” (Beers et al., 2003, p. 77). This need for the integration of various perspectives is reminiscent of Engeström’s comments regarding the need for experts to cross boundaries so that ideas, concepts and instruments can be transferred from one domain to another between different activity systems (see Section 2.2). Huber (1999), Jackson (2003) and Klein (2004) also wrote about the role of experts as meaning makers in the complex polycontextual environments of larger collaborative activity systems.

In particular, the role of the scientific expert has come under particular scrutiny. Curien, (1999), a former French Minister for Research and Technology, stated the need for interdisciplinarity, internationalism and the generation of speedy solutions to meet society's demands. Curien commented that policy evaluations can "no longer ... [be] restricted to just one field or sub-field of science ... one must take into account the necessity of having an interdisciplinary view" (p. 467). As a former policy-maker, Curien stressed that scientists should take "into account what is going on ... throughout the world. Political aspects must also be taken into consideration. This means that science must meet the needs and claims of society" (p. 467). Curien warned that "science and technology budgets will never be increased if this is not taken into account. Governmental ministers must be able to prove that investment is being made in fields of public interest" (p. 467). Bäckstrand (2003) pointed out that the public concern about various issues confronting modern society had highlighted "the status of scientific expert knowledge in democratic societies as well as the role of the citizen in the age of experts" (p. 24).

In a world where expertise was both indispensable and contested, Nowotny (2003) called for the democratisation of scientific expertise and the generation of socially robust knowledge as a way of addressing the vulnerability of expertise. Nowotny commented on the comparatively well-educated nature of many modern societies and on their ability to articulate their needs (p. 151). Nowotny stated that these societies expected that "science not only ... listen to these demands, but also ... satisfy them" (p. 151). The traditionally practical, context-based aspects of expertise had been joined by other aspects which required experts to "synthesise all available knowledge and of necessity transgress the boundaries of their discipline as well as the constraints of their own limits of knowledge" (p. 152). Scientific expertise, Nowotny stated, "must address issues that can never be reduced to the purely scientific and purely technical. ... To have any predictive value at all, expertise must be able to understand the inter-linkages that bind diverse practices, institutions and networks of diverse actors together" (p. 152). Nowotny continued that expertise now addressed "audiences that [were] never solely composed of fellow-experts. The narratives of expertise [had] to be sensitive to a wide range of demands and expectations and related to the heterogeneous experience of mixed audiences" (p. 152). Janczak's (2005) more recent argument for the need for decision making strategies that evaluated "events with their natural complexity" (p. 58) and were "more environment focussed" (p. 58) supported Nowotny's view that experts, through their role as managers, operated in contexts that extended beyond the confines of their own profession and

workplace. There was a need for decision-making to take into account the complexity and diversity of those contexts and for experts to cross the boundaries between their own and other contexts.

After studying the work of North American environmental scientists, Lach, List, Steel and Shindler (2003) commented that

Research scientists who [worked] closely with managers and the public to conduct ecological science and formulate new environmental policies ... [would not only] have to leave the comfort of their own labs and field locations and their traditional interactions with scientist colleagues, they [would] also have to learn to work more effectively with agency personnel and managers, public interest groups, and the public. (Lach et al., p. 177)

Lach et al. also pointed out that

At the same time, managers, representatives of interest groups, and the public [would] have to learn how to accept the uncertainties that come with scientific experimentation and modelling and to avoid posturing and distortions of the results of ecological science. (Lach et al., p. 177-8)

The impact of new technologies on the majority of disciplines from art to zoology and on the organisations that have responsibility for those technologies, has resulted in many problematic, multi-stakeholder situations for which no current solution exists. The issue of the governance of the internet is one example of such a problem, genetic engineering of food crops is another. The universal unfamiliarity of such complex situations presents challenges to all who work in these contexts, be they managers, experts and other types of workers demand consideration of a variety of perspectives. The issue of generating and implementing solutions that are acceptable to the multiple stakeholders affected by a problem resulted in the third broad research question for this research:

How do stakeholders perceive the work of experts?

2.5 CONCLUSION

As is appropriate for research which seeks to generate outcomes on the basis of grounded theory, this chapter has looked briefly at the literature surrounding the nature of the work of experts and learning. An exploration of the literature about experts and expertise has identified the three broad research questions to be investigated by this research:

- 1. What are the dynamics of the work of experts?**
- 2. How do experts maintain their expertise?**
- 3. How do stakeholders perceive the work of experts?**

Answers to these questions will result in a better understanding of what is required of those who work in the evolving complex contexts generated by our increasingly global society.

The discussion in this chapter has also identified the three theoretical frameworks that have been integrated into this research: activity theory, communities of practice, and the complexity based *Cynefin* framework. These frameworks have supported the construction of a model for the dynamics of the work professionals at the cutting edge of the one particular specialised context, namely anti-doping science. Consequently, a more detailed exploration of these theoretical frameworks has been presented in Chapter Three. An explanation of their use as a data stream to support data collection, analysis and interpretation has been given in Chapter Four which outlines the design of this research which has expanded understanding of what experts do and how they maintain their expertise in the complex, evolving context of the workplaces of the current times.

Chapter 3 FRAMEWORKS FOR THE STUDY OF COMPLEX EVOLVING WORKSPACES

3.1 INTRODUCTION

The ongoing transformation of work and workplaces is integral to the changing world in which we live. The constant challenges that are part of that changing world mean that the activity of ‘being an expert’ is a dynamic one that involves the ability to address newly evolved problems. As presented in Chapter Two, there have various approaches to studying, and models to represent, the work of experts. There have also been changes in the public perception of the role of experts in our society. The aim of this research has been to building a theoretical model of expert work based on the answers to the broad questions posed in the previous chapter about the work of experts and how experts maintain their expertise. As stated in Chapters Two, three theoretical frameworks have been selected to support this theory building: activity theory, communities of practice and the *Cynefin* framework. Whilst none of these are theories in the strict sense of the word, they were selected because provided not only the concepts, heuristics, approaches and methodologies used to interrogate and better understand the context investigated by this research, but also the language with which to describe, think and write about the context and the issues raised by the research.

The purpose of this chapter is to describe each of these frameworks. In this way, the chapter reconstructs the knowledge base that the researcher developed as the research progressed. The first theoretical framework described in this chapter is that of activity theory which uses as the unit of analysis the activity system to which the subjects, the object of their activity, and their community belong together with consideration of tools, division of labour and rules as mediators. Following this, overviews of the frameworks of communities of practice and the complexity based *Cynefin* model of sense-making in dynamic contexts have been given as they provided additional lenses with which to examine the interactions within a community group and between experts and the broader community. Whilst a summary of the explanatory power of the frameworks for answering the research questions has been provided at the end of the chapter, their potential will become more evident in subsequent chapters. In particular, in Chapter Eight, the power of

the *Cynefin* framework has been demonstrated through its application in an analysis of the adaptive responses of anti-doping work to the wicked problem of doping in sport.

3.2 ACTIVITY THEORY

Activity Theory originated in the ideas of Russian psychologists Vygotsky (1978) and Leont'ev (1978) in the early 1900's. Its central thesis was that "the structure and development of human psychological processes [emerged] through culturally mediated, historically developing, practical activity"(Cole, 1996, p.108). Lektorsky (1999) wrote:

according to Vygotsky, human activity presupposes not only the processes of internalization ... but also the process of externalization. Humans not only internalize ready-made standards and rules of activity but externalize themselves as well, creating new standards and rules. Human beings determine themselves through objects that they create. (Lektorsky, 1999, p. 66)

Engeström and Miettinen (1999) pointed to "the non-dogmatic nature of the current phase of discussion and collaboration in activity theory" (p. 2) and commented that

activity theory should not be regarded as a narrow psychological theory but rather as a broad approach that takes a new perspective on and develops novel conceptual tools for tackling many of the theoretical and methodological questions that cut across the social sciences today. (Engeström & Miettinen, 1999, p. 8)

Kuuti (1999) stressed this breadth by noting the multi-disciplinarity of activity theory and commenting that

if we hold to the basic assumption that activities are minimal meaningful objects of study ... in which essentially human qualities have to be taken into account, we must then admit that activities as wholes cannot be exhaustively studied by any individual discipline. In fact, one arrives at the conclusion that several disciplines should actually have the same context with respect to the research object, namely, the context formed by activity. (Kuutti, 1999, p. 372-3)

Kuuti (1999) also noted the ability of activity theory to maintain the "relationship between the individual and social levels in the objects to be studied, especially in situations where there is a need to grasp emergent features in individual and social transformation" (p. 372).

Activity theory then is itself an evolving research framework whose developers and proponents point to its usefulness in the increasingly complex contexts of modern living.

3.2.1 The evolution of Activity Theory

Activity theory has been applied to the study of work and technologies and described as a “global multidisciplinary research approach ... which is increasingly oriented toward the study of work and technologies” (Engeström, 2000a, p. 961). This section describes the historical evolution of activity theory to provide a basis for understanding of the application of this theory to the study of learning and work which will be examined in Sections 3.2.2 and 3.2.3 respectively. Subsequent sections will address those aspects of activity theory that have proved particularly relevant for this study.

3.2.1.1 *First generation activity theory*

When describing the early history of the Vygotskian school of Activity Theory, Minick (1997) pointed to what Vygotsky regarded as the fundamental error on the part of psychologists who took traditional approaches to the study of consciousness, namely, the disconnection of the mind from behaviour by “trying to investigate the flow of ideas, perceptions, and associates in conceptual isolation from the individual’s activity or behaviour” (p. 119). Vygotsky focused his efforts on reconceptualising mind and behaviour so that “they could be understood as aspects of an integrated object of psychological research” (p. 119-20). Minick noted that initially Vygotsky’s early work on relationships between thinking and speech in verbal thinking led to his proposal that “units of analysis in psychological theory must be defined such that they are at one and the same time units of mind and units of social interaction” (p. 122). Vygotsky’s early death resulted in the exploration of the implications of Vygotsky’s conceptual moves being left to Vygotsky’s students and colleagues in the cultural-historical school and to researchers who followed later. Finally, Minick highlighted three points:

the idea that psychological characteristics develop in connection with the systems of social actions and activities that constitute the individual’s life provided the basic explanatory framework for activity theory (p. 124)

Vygotsky’s concern with identifying an analytic object that is simultaneously a unit of mind and a unit of social activity led to the identification of the goal-oriented action as the focus of psychological analysis in activity theory (p. 124-5)

Vygotsky’s approach to the definition of psychological constructs ... was extended to whole systems of theoretical constructs designed to maintain conceptual links between not only mind and activity, but between mind, activity and the external object world in which human activity occurs. (Minick, 1997, p. 125)

More recent developments of activity theory have been based on Vygotsky's early work. Engeström (1987) referred to Vygotsky's discussion of sign operations and the extension of the simple stimulus-response process to the complex, mediated act representing it as shown in Figure 3-1 (Engeström, 1987, p. 59)

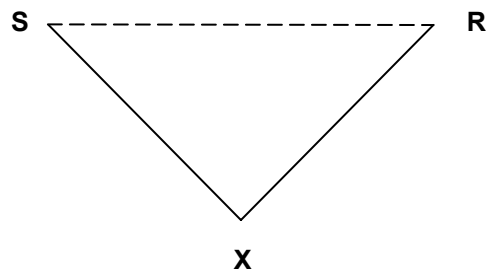


Figure 3-1: The structure of the mediated act

Activity theorists more commonly represent this process as a mediated action with a tripartite structure which consists of an individual subject, an object, and a mediating tool or artefact, shown in Figure 3-2 (retrieved 5th June, 2002, from <http://www.edu.helsinki.fi/activity/>). Object-orientation is central to activity theory and consequently recent discussions of the object have been presented in Section 3.2.4. At this stage, it is important to note that it is the object that reflects the intention of the activity: its target. As such the object of activity theory is not always observable, whereas the response in the stimulus-response process is observable.

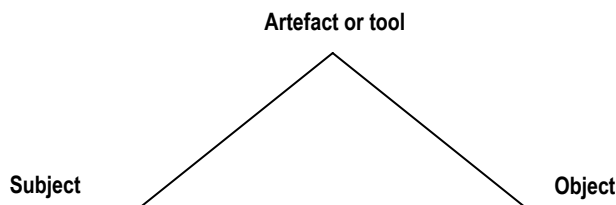


Figure 3-2: The common reformulation of the mediated act

The tool or artefact in a mediated act can be a technical tool used to manipulate physical objects or a psychological tool used to influence others. A pair of scissors and string are examples of physical tools used by a person (the subject) for the action of cutting a piece of string to a required length for the object of 'securing a parcel'. A published timetable is

an example of a psychological or mental tool used by a person to find out the departure time of the next bus to achieve the object of ‘getting to work on time’ (see Figure 3-3). Importantly, another person, a child, might use those same tools scissors and string to achieve a different object: making a necklace from pieces of pasta and the bus timetable could be used for meeting a visitor. Thus, the object of an activity can only be interpreted rather than determined by observing the activity.

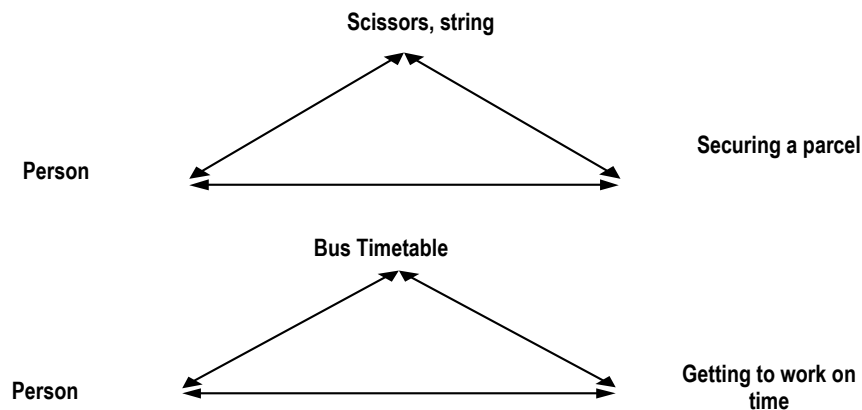


Figure 3-3: Examples of tripartite structure of actions act

3.2.1.2 *Second generation activity theory*

Leont’ev’s three-level model of activity and his distinction between collective activity and individual action expanded Vygotsky’s theoretical model of activity. Leont’ev described activity as consisting of operations, actions and activity. ‘Operations’ referred to the routine or unconscious methods by which an action could be accomplished in a given context. ‘Actions’ were performed by an individual or a group in order to achieve a particular goal. ‘Activities’ were driven by motives which can be material or ideal. This is summarised in Table 3-1, retrieved 5th June, 2002 from <http://www.edu.helsinki.fi/activity/>.

Table 3-1: Leont'ev's three level model of activity

Level	Oriented towards	Carried out by
Activity	Object/Motive	Community
Action	Goal	Individual or group
Operation	Conditions	Routinized human or machines

Whilst mediation by other human beings and social relations was not part of Vygotsky's model, Leont'ev's model incorporated the concept of collective activity, that is, activity that is the result of the actions of more than one person. Kontinen (1999) stated that Leont'ev saw "collectivity as a fundamental characteristic of human activity since human culture is considered to have begun with the emergence of tool making and using through the production of surplus value and the development of the social division of labour" (Section 'A.N. Leont'ev and the social division of labour', par.1).

Engeström (1987; 1991) explained this concept by first considering the adaptive nature of animal activity (1987, p. 74), and representing it as shown in Figure 3-4, and then deliberating upon the transition of activity from animal to man (p. 76), as in Figure 3-5, where tool-making, culture and divided labour practices were apparent.

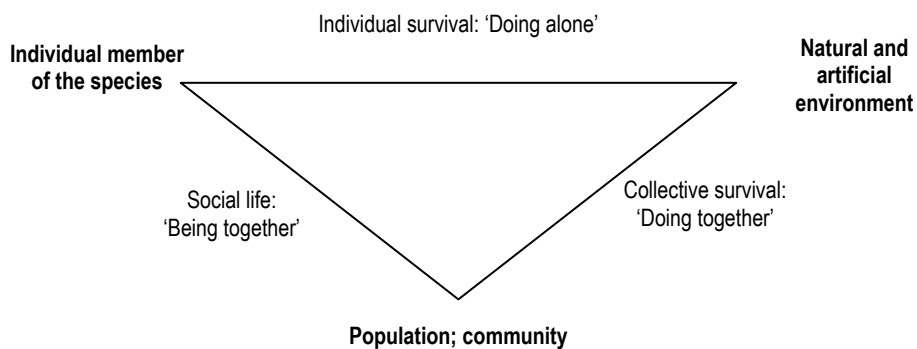


Figure 3-4: The general structure of the adaptive nature of animal activity

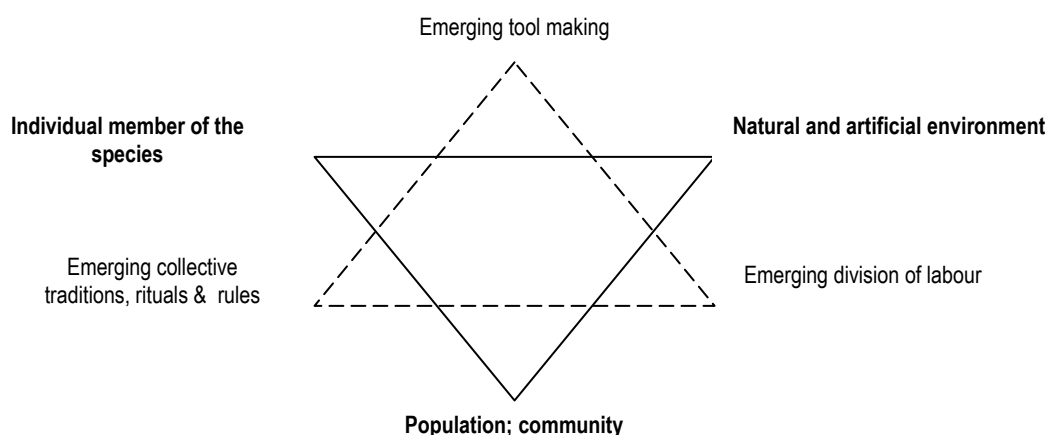


Figure 3-5: The structure of activity in transition from animal to human

Engeström’s (1987) subsequent well-known depiction of the structure of human activity (p. 78), shown in Figure 3-6, transformed the adaptive activity of animals into the human activity of consumption, which comprised production, distribution and exchange.

Engeström (1999b) regarded “activities are social practices oriented at objects” (p. 380) that met human needs. Since the object was constructed by the subject and was related to the subject’s need, it possessed the “motivating force that gives shape and direction to activity. The object determines the horizon of possible actions” (p. 381). Thus it was not just a single goal attached to specific actions which had clear start and finish points and a comparatively short half-life (p. 381). The longer life and cyclical nature of activity systems was reflected in the constant generation of “actions through which the object of the activity is enacted and reconstructed in specific forms and contents – but being a horizon, the object is never fully reached or conquered” (p. 381). Subsequently, the object in Figure 3-6 has been represented by an oval to indicate that “object-oriented actions are always, explicitly or implicitly, characterized by ambiguity, surprise, interpretation, sense making, and potential for change” (Engeström, 2005b, p. 61).

The social infrastructure within which activity occurred was indicated by the additional elements of rules, community and division of labour. These elements focused on the complex interrelations between the subject and the community (Engeström, 2005b, p. 61) which had been included below the subject-object dialectic across the horizontal middle of Engeström’s triangular model of activity (Figure 3-6). Hasan (2005) explained that whereas the tool mediated the relationship between the subject and object in the basic

model of activity, the characteristics of the community within which the subject works also mediated the activity (p. 32). Such communities, Hasan commented, were “usually a small close-knit group, such as the members of an Intensive Care Unit, and [could] be considered a collective subject” (p. 32). In an earlier publication, Hasan (1998) noted that rules mediated the relationship between the subject and the broader community whilst the division of labour mediated the relationship between broader community and object Kontinen (1999) described these additional elements as social mediators : “[The] explicit or implicit rules guide the activity; the community means the people occupied with the same object of activity; and the division of labour is the division of tasks and power between the members of the community” (In 'Using activity theory for studying change and development in work activities, par. 3).

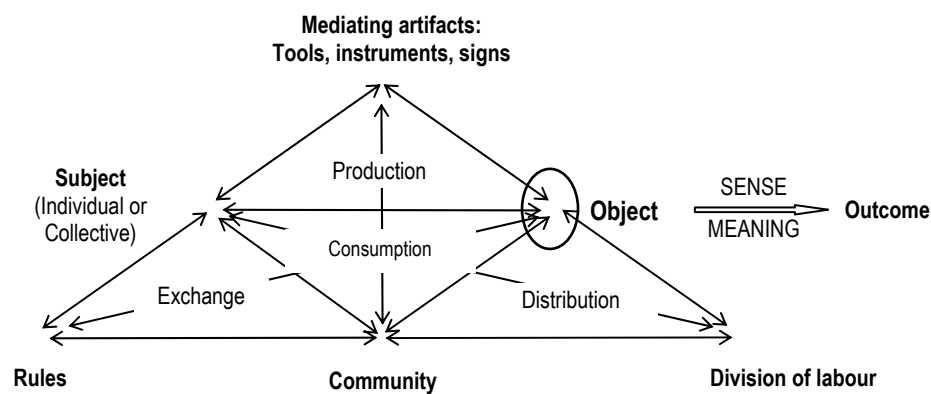


Figure 3-6: The structure of the human activity system

The second generation of activity theory focused on the central role of contradictions within activity as the source of change. Matusov (1996) stated that “any joint activity [had] multiple agendas, goals, contexts, tasks, and actors with different intentions. It [involved] dynamics of agreements, disagreements, and coordination of participants’ contributions” (p. 30-1). Engeström (1987) pointed to the “clash between *individual actions and the total activity system*” (p. 82, author's italicisation) as fundamental because it meant that any specific production must simultaneously be “*independent of and subordinated to the total societal production*” (p. 82, author's italicisation). The inherent double bind was a “social, societally essential dilemma which [could] not be resolved through separate individual actions alone – but in which joint co-operative actions [could] push a historically new form of activity into emergence” (p. 165). The production and exchange of items as

commodities meant that they had gained exchange value in addition to the original use value they held for their producer. Commodities were also the result of human labour which itself has a dual nature. Engeström cited Marx's explanation:

Articles of utility [became] commodities only because they [were] products of the labour of private individuals or groups of individuals who [carried] on their work independently of each other. ... This division of a product into a useful thing and a value [became] practically important only when exchange [had] acquired such an extension that useful articles [were] produced for the purpose of being exchanged, and their character as values [had] therefore to be taken into account, beforehand, during production. From this moment the labour of the individual producer [acquired] socially a two-fold character. ... as a definite useful kind of labour, [satisfying] a definite social want, and thus part and parcel of the collective labour of all ... [and] on the other hand ...[satisfying] the manifold wants of the individual producer himself. (Engeström, 1987, p. 84)

The contradictory double nature and inner unrest resulting from this simultaneous mutual exclusivity dependency resulted in four levels of contradictions. When describing these contradictions, Engeström referred to his triangular representation of the activity system (see Figure 3-6):

The primary contradictions ... live as the inner conflict between exchange value and use value within each corner of the triangle of activity. The secondary contradictions are those appearing between the corners. ... The tertiary contradiction appears when representatives of culture ... introduce the object and motive of a culturally more advanced form of the central activity into the dominant form of the central activity. ... Quaternary contradictions are those that emerge between the central activity and the neighbouring activity in their interaction. (Engeström, 1987, pp. 87-8)

On a later occasion, Engeström stressed that

Contradictions are not the same as problems or conflicts. Contradictions are historically accumulating structural tensions within and between activity systems. ... Such contradictions generate disturbances and conflicts, but also innovative attempts to change the activity. (Engeström, 2005b, p. 64)

Consequently, Engeström (1991) regarded an activity system as a “virtual disturbance - and innovation-producing machine” (p. 269) as it was “constantly working through tensions and contradictions within and between its elements” (p. 269) through cycles of expansive reorganization that were “above all a process or learning” (p. 270). In this context, learning became “a venture of designing, implementing and mastering the next developmental stage of the activity system itself” (p. 271) thus allowing the contradictions inherent in the activity system to be dialectically elucidated and their solutions tested then

implemented. Engeström represented these graphically (1987, p. 189; 1991, p. 270) as shown in Figure 3-7 .

The interaction of additional elements of rules, community and division of labour in the second generation of activity theory and the application of the concepts associated with consumption presented a much broader view of activity and provided methodological tools with which to analyse the complex reality of changing human activities in a wide variety of situated contexts. Researchers have investigated contexts such as hospital clinics (Engeström, 1999a), information systems (Hasan, 1998), consultancy work, manufacturing and horticultural environments (Bodrozic, 2005; Engeström, 1999b; Hill, Capper, Hawes, Wilson, & Bullard, 1998; Hill, Capper, Wilson, & Otto, 2005), educational contexts (Coupland & Crawford, 2002; Gordon, 1998), decision support systems (Hasan & Gould, 2001), knowledge management (Crawford, 2003; Hasan & Crawford, 2003; Krogstie & Krogstie, 2002), and scientific contexts (Lee & Crawford, 2002; Nardi, 2005; Roth & Breuer, 2003).

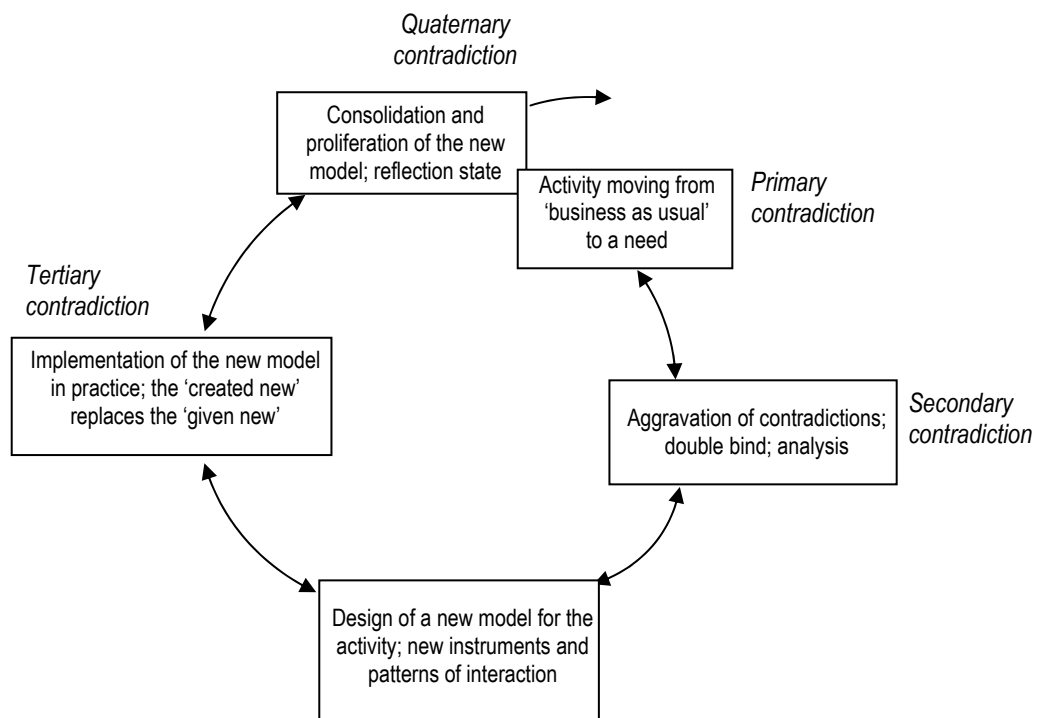


Figure 3-7: Expansive cycles of reorganization and associated levels of contradiction

Hasan (1998) pointed out that many of the host of activities taking place in most organisations were interrelated. Engeström and Miettinen (1999) described the movement and transformation of artefacts within such networks of activity systems:

Any local activity resorts to some historically formed mediating artefacts, cultural resources that are common to the society at large. Networks between activity systems provide for movement of artefacts. These resources can be combined used and transformed in novel ways in local joint activity. Local, concrete activities, therefore, are simultaneously unique and general, momentary and durable. In their unique ways, they solve problems by using general cultural means created by previous generations. (Engeström & Miettinen, 1999, p. 8)

As has been presented in later chapters where the findings of the pilot study and subsequent main investigation into the dynamics of expert work have been reported and discussed, this hierarchical framework provided researchers investigating complex contexts such as the context of this research with

a way to make sense of the dynamic nature of activities. The one activity may be undertaken by many alternative sets of actions and operations. A subject may be concurrently involved in multiple activities consisting of goal-oriented actions which may serve those different activities (Hasan, 1998, p. 31)

Engeström's expanded model of activity (Figure 3-6) was followed by the development of the concepts of 'expansive learning' (Section 3.2.2), 'developmental work research' (Section 3.2.3.1), and more recently the 'expansive visibilization of work' (Section 3.2.3.1) and 'knotworking' (Section 3.2.3.3) but also by the third generation of activity theory which aimed to deal with interacting activity systems. As all of these concepts have proved relevant for this study into the dynamics of expert work and maintenance of expertise, they have been described below in Sections 3.2.2 and 3.2.3.

3.2.1.3 Third generation activity theory

Engeström and Miettinen (1999) referred to the challenges to activity theory presented by the work of symbolic interactionists including Strauss, Fujimura, Star and others on encounters between different social worlds and to their development of "the concepts of boundary object, translation and boundary crossing to analyse the unfolding of object-oriented cooperative activity of several actors" (p. 7). Consequently, Engeström and Miettinen stated that "it is no longer sufficient to focus on singular, relatively isolated activity systems. Activity theory needs to develop tools for analysing and transforming networks of culturally heterogeneous activities through dialogue and debate" (p. 7). This third generation of activity theory, which Engeström (2001a, p. 136) represented graphically as shown in Figure 3-8) reflected activity theory's expansion so that it could

“understand dialogue, multiple perspectives and voices, and networks of interacting activity systems” by examining the interaction of multiple activity systems.

Engestrom (2005a, p. 63-65) summarized the third generation of activity theory using the following five principles:

1. The collective, artefact-mediated and object-oriented activity system, related to a network of other activity systems, is the prime unit of analysis.
2. Activity systems are multi-voiced and have a community of multiple points of view, traditions and interests resulting from the division of labour amongst the participants.
3. The problems and potentials of activity systems which have evolved over time can only be understood against their particular history.
4. As the accumulation of structural tensions within and between activity systems, contradictions play a central role in change and development within an activity system through their generation of disturbances, conflicts and innovation.
5. Activity systems can transform expansively to reconceptualise the object and motive of the activity to journey through a zone of proximal development and embrace a radically wider horizon of possibilities.

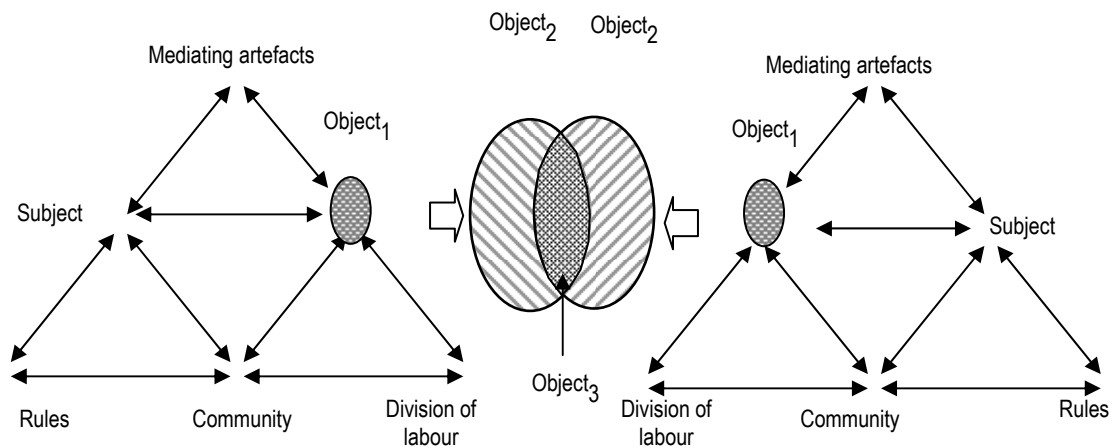


Figure 3-8: The third generation of activity theory: The minimal model of two interacting activity systems

Kontinen (1999) applied this framework to her work on cooperation between Finnish and Tanzanian non-governmental organizations on a development project in Tanzania. A number of more recent projects including those of Daniels (2004), Gregory (2000b), Leadbetter, Daniels et al. (2005), Toiviainen (2003) and Warmington et al. (2004) have also been based on this third generation of activity theory.

The expansive transformations described by the third generation of activity theory make demands on the individuals engaged in those activity systems and challenge them to learn new ways of acting as the activity systems to which they belong are reorganised to achieve the new jointly constructed object of the interacting activity systems. The nature of this learning has been presented in greater detail in the following section (Section 3.2.2) as it was provided a framework for interpreting the means by which the group of experts who participated in this research maintained their expertise.

3.2.2 Activity Theory and Learning

As stated above, Engeström believed that the cycles of expansive reorganization as represented in Figure 3-7 were essentially a process of learning. As a model of learning, activity theory accommodated the knowledge creation processes associated with building the revised expanded activities needed to address new situations. This approach to learning has been relevant for this study into the expert work of anti-doping scientists who, as will be seen in later chapters, need to develop new approaches to doping control such as the detection of the use of previously unknown designer steroids. There are a number of concepts associated with this learning related aspect of activity theory including expansive learning, the zone of proximal development, expansive visibilization, knotworking and the method of developmental work research. Whilst some of these concepts have been mentioned above, they will be described further in the following sections as they have been incorporated into the theory building presented in Chapters Five through Eight.

3.2.2.1 Expansive learning

Engeström's work on the notion of expansive learning proved relevant in this research because of this study's focus on experts and how they maintain their expertise when what they need to know is not yet known. Engeström (1987) hypothesised that

1. Human learning begins in the form of learning operations and learning actions embedded in other activities ...
2. Learning activity has an object and a systemic structure of its own
3. The essence of learning activity is production of objectively, societally new activity structures (including new objects, instruments, etc.) out of actions manifesting the inner contradictions of the preceding form of the activity in question.

(Engeström, 1987, p. 124-5)

Engeström (1987) went on to describe learning activity as the "*mastery of expansion from actions to a new activity*" (p. 125, author's italicisation) and an "*activity-producing*

activity” (p. 125, author's italicisation) whose object “appears to the subject first in the form of discrete tasks, problems and actions” (p. 125) that are first questioned and analysed then subsequently transformed and applied through the learning activity which expands theoretically then contracts to application as it

- a) *analyses* and *connects* these discrete elements with their systemic activity contexts,
- b) *transforms* them into contradictions demanding creative solution, and
- c) *expands* and *generalizes* them into a qualitatively new activity structure within societal productive practice.

(Engeström, 1987, p. 125, author's italicisation)

Engeström (2000a) represented this cyclic process diagrammatically (p. 970) as shown in Figure 3-9.

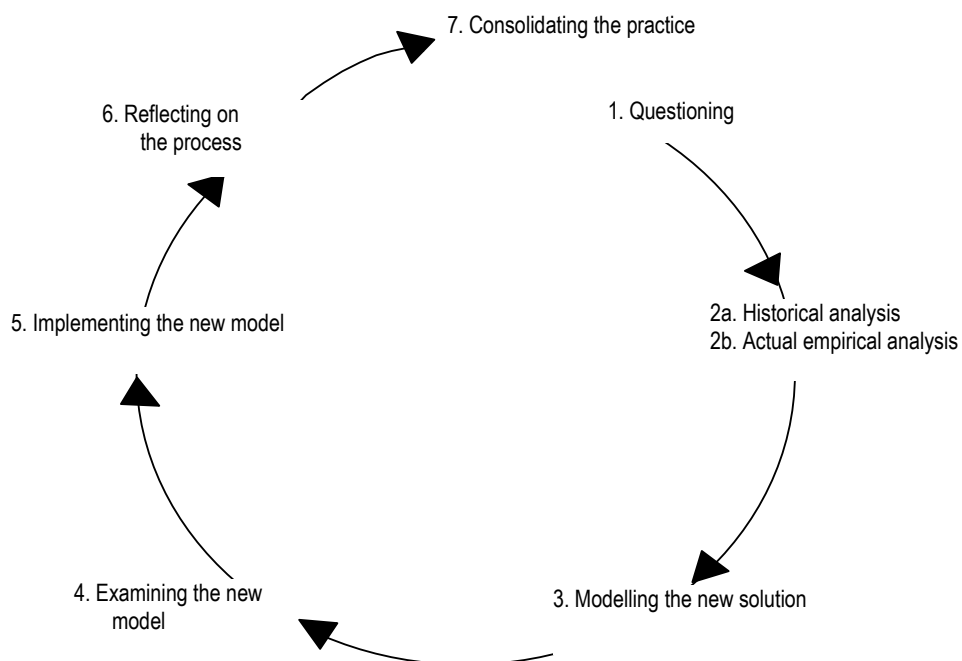


Figure 3-9: The expansive learning cycle

Engeström (1987) suggested that learning activity had a playful quality about it and referred to Bruner’s comment that the dissociation of means and ends permitted the exploration of their relation to each other. Engeström further elaborated this idea by describing learning as the “true development of instruments: ‘purification’ by elimination of secondary or accidental features, variation and enrichment, testing novel connections and disconnections” (p. 126). He referred to learning as transitional and expansive in character, and as allowing the learner to create new learning situations and to resolve the

contradictions embedded in those and others. A familiar example of one such contradiction between the exchange value and use value of a learning task can be found in the question from students to their teachers: “Why do I have to learn this? What use will this be?” as they investigate the exchange value (i.e. assessment marks) and use value (in the wider world of work) of some particular knowledge they are expected to master.

Engeström (1987) also noted Bruner’s suggestion that “the general estrangement of industrialized man from the contents of work” has resulted in “ ‘the young [becoming] more and more remote from the nature of the effort involved in running a society’ because ‘vocation, competence, skill, sense of place in the system ... become more and more difficult for the young to fathom’ ” (p. 134-5). There was the need in our cultural tradition for a place for “ ‘deep play’ ” (p. 135) where new forms of behaviour could be generated and modelled. This concept of a place for deep play proved particularly relevant in examining the role of a regular community event for the experts who participated in this research and has been explored in Chapter Six. In order to maintain their knowledge, experts demonstrated their use of this event for deep play when they explore and interact with the various aspects of and partial solutions to previously unsolved problems, explain the unexplained, and expand and reorganise their knowledge. A role for the element of exploration and the necessity of a private space to generate and model new behavioural models was also evident in Snowden’s work based on complex systems to be described in Section 3.4.

3.2.2.2 The zone of proximal development

Numerous researchers including Engeström (1987; 2000a), Lave and Wenger (1991), Daniels et al. (2005), Lave and Wenger (1991), Miettinen and Peisa (2002), Van der Veer and Valsiner (1991) and Zuckerman (2004) have explored the nature and utility of the concept of the zone of proximal development. Defined as the “distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers” (cited in Engeström, 1987, p. 169), Vygotsky regarded the zone of proximal development as also defining “those functions that will ‘mature tomorrow but are currently in an embryonic state’ ” (p. 169) and could be exploited by instruction. Zuckerman (2004) noted the associated corollary of multiple non-actualized potential for further individual accomplishments which could become manifest when supported by appropriate instruction (p. 10). Žorga (2003) stated that the

individual's inner developmental potentials could be "realised through the experience of imitation and in communication with others and through the interaction of the individual with his environment" (p. 272). Subsequent practice resulted in internalisation as an independent developmental achievement.

These descriptions relating to the zone of proximal development related it to being on the brink of learning something new, to learning that resulted from interacting with others who were more knowledgeable about that field. In their study of how patients learn about the disease with which they have been diagnosed in order to make life-affecting decisions, Daniels, James, Rahman et al. (2005) noted Wittgenstein's metaphor of knowledge-as-a-landscape and Greeno's notion of " 'learning the landscape' of a task or task environment" as an aspect of expertise in a particular field. Daniels et al. encapsulated these notions of knowing the landscape and what was contingent to reduce uncertainty in his reference to Vygotsky's belief that "for concept formation to take place everyday understanding needs to be brought into relation with appropriate scientific concepts" (p. 10). There was not just a need to know, but also an idea of what needed to be known in order to resolve current tensions.

Rather than adopt this focus on the individual and more knowledgeable others, Engeström (1987) expanded Vygotsky's original conception so that it could address the relationship between individual and societal development and the activities. To resolve the contradictions between the individual and collective models for the future and the past, Engeström reformulated of the zone of proximal development. He described it as "the distance between the present everyday actions of the individuals and the historically new form of the societal activity that [could] be collectively generated as a solution to the double bind potentially embedded in the everyday actions" (p. 174). This has been represented in Figure 3-10 (Engeström, 1999a, p. 67).

Engeström (1987) also proposed a phased, cyclic approach to crossing the zone of proximal development, shown in Figure 3-11 (Engeström, 1987, p. 189), and drew attention to the similarity between this cycle and the cycle of expansive learning in Figure 3-9 on page 38. This approach was incorporated into Engeström's expansive cycles of reorganization, shown earlier in Figure 3-7 on page 34.

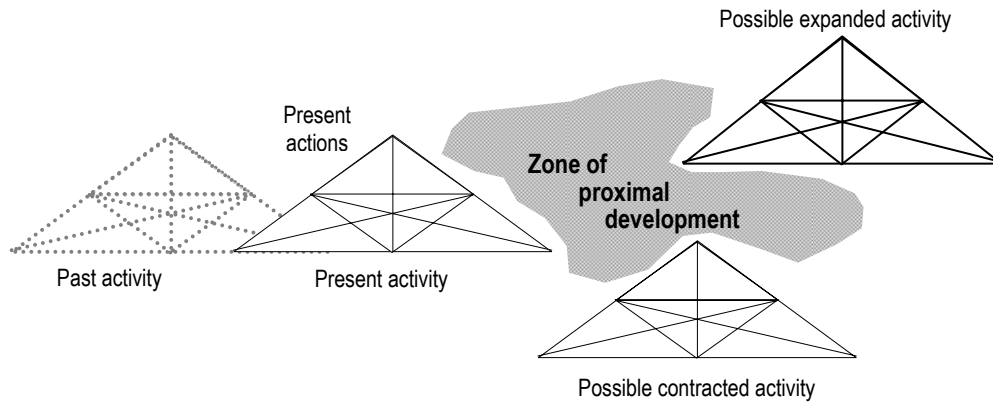


Figure 3-10: The zone of proximal development

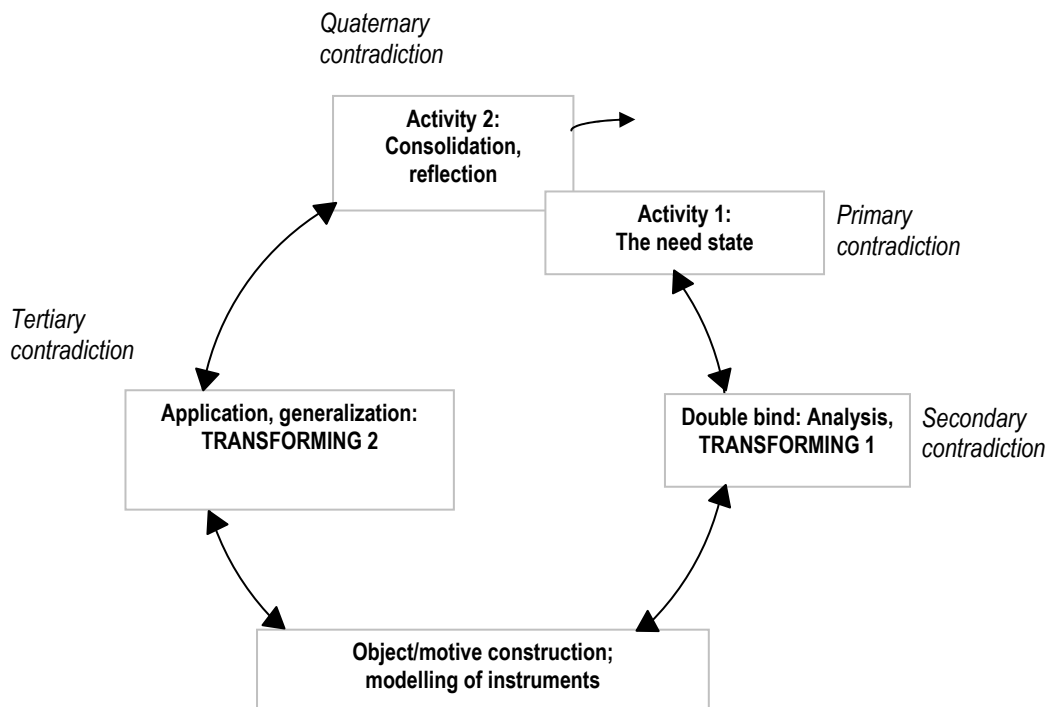


Figure 3-11: The phase structure of the zone of proximal development

Building on Engeström’s extended concept of the zone of proximal development, Lave and Wenger’s (1991) concept of legitimate peripheral participation regarded learning as involving the whole person and not just related to specific activities. Rather it was related to social communities (p. 53). Žorga (2003) noted that

through the mutual functioning of individuals with their biological potentials and the society with its symbols, tools and other cultural goods, learning

[could] become the driving force of human development. Therefore, changing cultural tools also [necessitated] a change in the course of human development. By creating culture and all its artificial products, people [accelerated] their own development. (Žorga, 2003, p. 272)

In their work on an activity theory inspired model of vocational education, Miettinen and Peisa (2002) described student development of a business plan for a hypothetical new firm. In their work on this project, students were supported by both their teachers and a real-life partner firm, external to the institution. Miettinen and Peisa suggested that the network thus formed between the students and the firm as a result of the student projects not only supported student learning but was also “a social arrangement that [could] help make the zone of proximal development visible in a firm” (p. 307).

The clarification of the nature of the zone of proximal development was important for those individuals, groups and organisations who dealt with developmental challenges associated with workplace change. The subjects of activity systems undergoing change strove to meet the constant stream of changing technologies, regulations and contexts. Against such a background, Engeström (1999a) described the zone of proximal development as “a terrain of constant ambivalence, struggle and surprise” (p. 90). As new goals were set and aspired to, associated activity systems were frequently strained by inner tensions and contradictions. Engeström stressed that if the zone of proximal development was not worked out then “specific goals [were] built on sand, or pinned onto thin air” (p. 66). In his earlier work, Engeström (1991) had warned that in the case of expert activity systems rather than attempt to “find relief by looking for established masters who could tell the practitioners what model to adopt for the future” when no such masters existed, subjects’ learning became “a question of joint creation of a zone of proximal development for the activity system ... a venture of designing, implementing and mastering the next developmental stage of the activity system itself” (Engeström, p. 271).

The work of Engeström, his colleagues and others has shown that the expansive learning cycle can be assisted by the developmental research method described in the below (Section 3.2.3.1) and through the expansive visibilization of the activity (see Section 3.2.3.2). Both are designed to make the zone of proximal development visible and have been discussed below.

3.2.3 Activity Theory and Work

Whilst some activity theorists concentrate on classroom based learning, activity theory has increasingly been used to study the complex evolving workplaces of the late 20th and early 21st centuries (Engeström, 1999a, 2000a, 2005c; Foot, 2002; Hasan, 1998; Hasu, 2001; Helle, 2000; Hill et al., 2005; Kerosuo & Engeström, 2003; Kontinen, 1999; R. Miettinen & Hasu, 2002; Nardi, Whittaker, & Schwarz, 2002; Toiviainen, 2003; Warmington et al., 2005) and the learning that occurs in those workplaces. Hasan (2005) wrote:

In the latter part of the [Twentieth] century, the personal computer brought the power of digital technologies into the lives of people everywhere so that in the Twenty-First century computer-based connectivity, systems and devices are indispensable tools for almost everything we do. This has resulted in a complex and ever-changing work-life environment for which the holistic and insightful nature of Activity Theory continues to provide an eminently suitable vehicle for understanding and analysis. (Hasan, 2005, pp. 29-30)

Hasan (2005) also noted that Engeström's cycle of expansive learning (see Figure 3-9 on page 38) reflected that the developmental nature of activities that flowed from a constantly changing workplace placed new demands on people. It also enabled reinterpretations of the objects of people's activities and the reinvention of communities of practice (p. 33).

Whilst the transformation of communities of practice has been discussed in Section 3.3.2, the use of the methodologies of developmental work research and expansive visibilization in the study of work have been described below.

3.2.3.1 Developmental Work Research

In this section, the theoretical underpinnings of developmental work research (DWR) have been described whilst the method of DWR has been presented in Section 4.5 as part of the Research Design.

DWR evolved as an activity theory based research method which supports a better understanding of the social processes of work and work-based learning. Stetsenko and Arievitch (1997) wrote about the methodological consequences of the work of Vygotsky and his followers including Leont'ev, Luria, Gal'perin, El'konin and Davydov. Stetsenko and Arievitch pointed to implications for the researchers when they stated that

it is only in the post-Vygotskian framework that the method of active co-construction has been granted a priority and a special epistemological status as being the most appropriate way to study psychological phenomena. Whereas the same basic proposition that the psychological phenomena are by essence

social constructions has led discourse-based constructivists to seek the solution in the study of the most clearly identifiable and observable forms of symbolic interaction (discourse and conversation), it has led the post-Vygotskian constructivists to a quite different conclusion. Namely, this latter form of constructivism contends that socially co-created (“socio-cultural” in the original Vygotskian terminology) phenomena such as self, agency, cognition, memory, and so on can be adequately studied by actively co-constructing them in the processes of a psychological inquiry. Importantly, a psychological inquiry ceases in this case to be merely an exploration, a study of phenomena; rather, it becomes a sort of an active enterprise, a human practice, a social process in which co-acting participants strive to achieve common goals. (Stetsenko & Arieviditch, 1997, p. 165)

In “Developmental work research: Reconstructing expertise through expansive learning”, Engeström (1991) formulated a research methodology which supported the expansive learning cycle experienced within work-based activity systems. DWR required analysis of work practices and interactions, and used the whole socially distributed activity system (Figure 3-6 on page 32) as its unit of analysis. This analysis took into account the “individual practitioner, the colleagues and co-workers of the workplace community, the conceptual and practical tools, and the shared objects as a unified dynamic whole” (p. 267) as well as the “less visible social mediators of activity – rules, community, and division of labour” (p. 267). The continuous transformations resulting from accommodation of the “individual and accidental disturbances, deviations and innovations occurring in the daily practice of workplaces” (p. 268) provided on the one hand, a source of compartmentalization and conflict, and on the other, a resource for collective achievement. The constant working through of tensions and contradictions with and between its elements resulted in the system’s constant reconstruction of itself. Whilst many changes were incremental and piecemeal, there were “also crises and qualitative reorganizations of the overall activity system – processes that lead to the solution of existing contradictions and to the emergence of new ones” (p. 269). This evolutionary change process, Engeström described as a cycle of expansive reorganization which could extend over several years. It involved the activity system moving

from ‘business as usual’ to an unarticulated ‘need state’ and then to a stage of increasingly aggravated inner tensions (double bind ...) which eventually threaten the very continuity of the activity. Parallel to the failures, conflicts and tensions, there are individual innovative attempts to overcome the limitations of the present organization. At some point, efforts are made to analyse the situation, which often further sharpens the double bind. In the midst of regressive and evasive attempts, there emerges a novel ‘germ cell’ idea for the reorganization of the activity in order to solve its aggravated inner contradictions. This idea gains momentum and is turned into a model. The

model is enriched by designing corresponding tools and patterns of interaction. The new model is implemented in practice, producing new conflicts between designed new ways and customary old ways of working. By working through these conflicts, the designed or *given new* model is replaced by the *created new* model, firmly grounded in practice. (Engeström, 1991, p. 269)

Engeström designed DWR as a longitudinal methodology which would fit in with this cycle, “pushing the process forward and sharpening its contradictions” (p. 271) through its interventionist nature. These interventions saw the researcher formulating hypotheses and conducting quasi experiments in strategic phases of the cycle through mirroring (see Section 3.4.10), a process that by presenting the workplace community with aspects of the current activity made visible the previously hidden tensions and contradictions within the system. The identification of these contradictions provided the opportunity for the participants to engage in creative problem solving and innovation which, in turn, facilitated the transformation of the activity as a result of the development of new improved or expanded models for the activity system. The adoption of the new activity system marked the end of one DWR process but also the beginning of another cycle of the process, as this changed activity system was then able to become the focus of another DWR undertaking.

Through its cyclical nature, DWR, as a model of organizational development, provided a framework for community or organizational transformation that paralleled Engeström’s (1991) model of expansive learning (see Figure 3-9 on page 38 whose ideal cyclic sequence is shown in Figure 3-12 (Engeström, p. 271). It is worth noting that Engeström regarded this representation as “not necessarily something done in every concrete project” (p. 271). As presented in Section 4.5, Engeström, his colleagues and other researchers set up a dedicated room which they referred to as the Change Laboratory and held 10 or so sessions with practitioners and participants (Engeström, 1999a, p. 70). Other researchers, including Edwards and Wiseman (2005), and Leadbetter and her colleagues (2005) have adapted the model to suit the contexts in which they were working. To gain the benefit of the understandings of the social processes of work and work-based learning from the use of the DWR method, the constraints of its use in the context of this research necessitated other adaptations to the DWR method. These have been described in Section 4.5.

As noted above, DWR aims to create a new model of work that is firmly grounded in practice through building on participants’ ideas for the reorganization of the activity. This process of the visibilization of a new activity during DWR has been described in the next section.

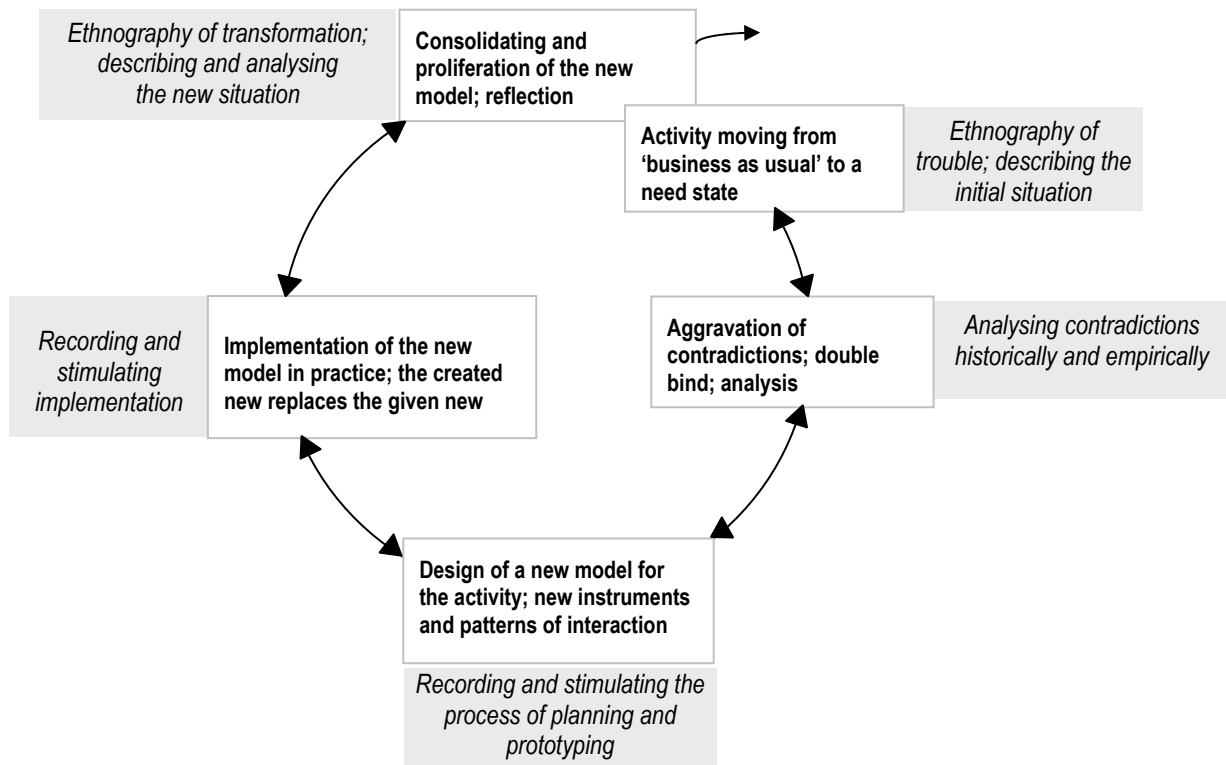


Figure 3-12: Steps of Developmental Work Research (DWR)

3.2.3.2 Expansive Visibilization of Work

More recently, Engeström focussed on that part of the DWR method known as the ‘expansive visibilization’ of work. Engeström (1999a) cited Margolis’s comment “ ‘when everyone in a community shares a habit, it ordinarily becomes invisible, for what everyone does no one easily recognizes’ ” (p. 63). The purpose of the four step process represented in Figure 3-13 was to make visible to the participants in an activity system the object or practice that had been previously taken for granted and subsequently invisible to or hidden from them; to allow the organization’s members to discover what was not currently visible to them, and to “learn what is not yet there” (Engeström, 1991, p. 270).

Engeström (1999a) described and represented expansive visibilization as a four-step process. The process began with making the “disturbances, ruptures and small unremarkable innovations in practitioners’ everyday work actions ... visible and analysable to practitioners and researchers” (p. 68) by such means as the collective viewing of a videotape and associated interview accounts (labelled as Visibilization 1 in Figure 3-13). This initial analysis of the current work situation provided practitioners and

researchers with an awareness of the temporal, linear, socio-spatial and developmental dimensions of their work and an awareness of problematic aspects, or ‘contradictions’ within their current work.

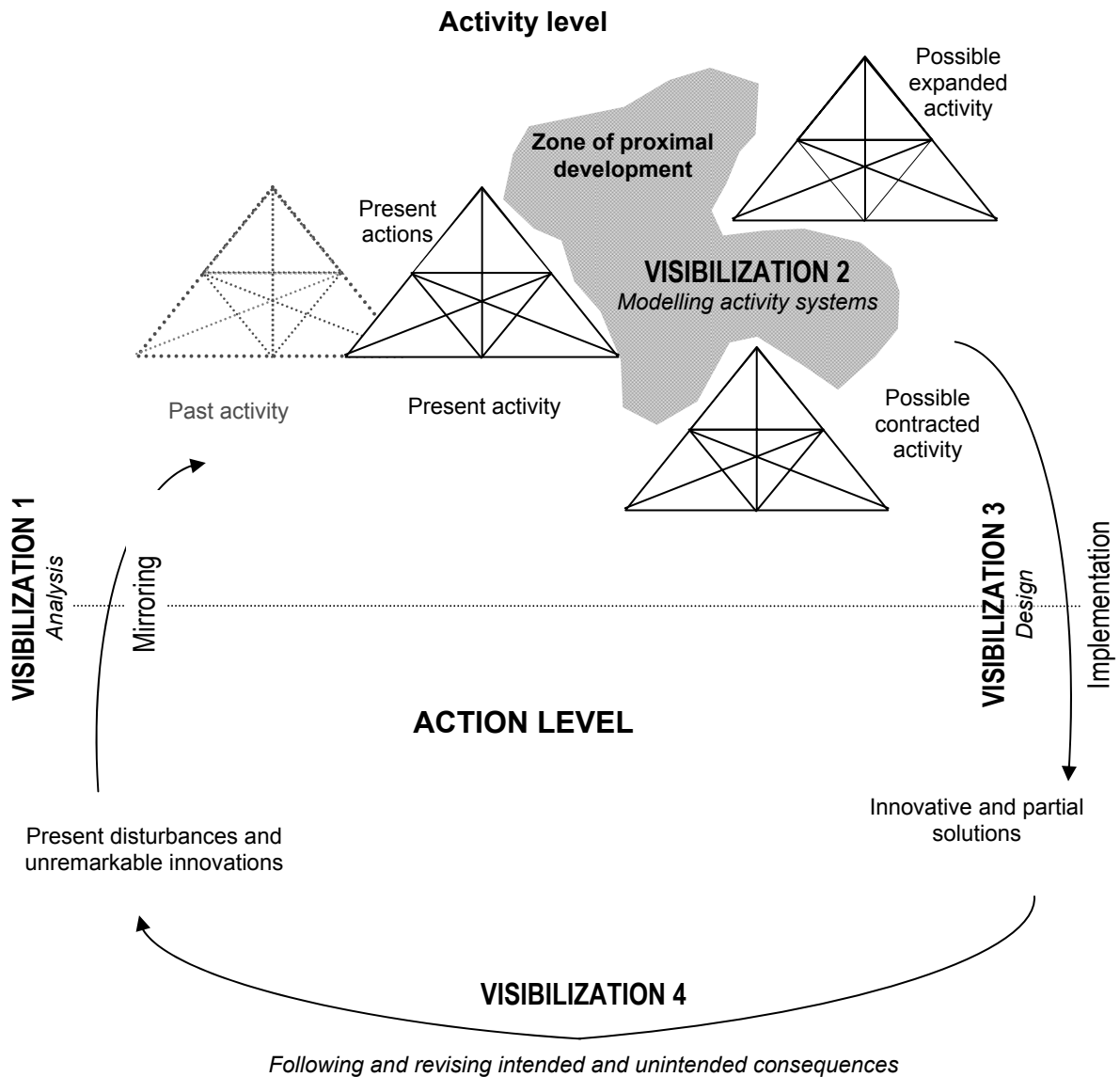


Figure 3-13: Visibilization of work as movement from actions to activity and back

The second step (labelled Visibilization 2 in Figure 3-13) engaged researchers and practitioners in further analyses aimed at examining the qualities of the past and present work practice, and when necessary the actions of which it was comprised, as well as opening up

a possibility to recognize recurring patterns and types of disturbances as manifestations of identifiable secondary contradictions in the present activity ... [leading] to tentative conceptualizations of both a possible worst-case future

[contracted activity] and a possible future in which the contradictions are resolved so as to open up new opportunities [expanded activity]. (Engeström, 1999a, p. 68)

This acted as the initial step towards resolving problems which the analysis had made apparent.

To cross the zone of proximal development that lies between the past, present and alternative future activity systems, Engeström (1999a) described activity as reverting to the level of goal-oriented actions in the third step (labelled Visibilization 3 in Figure 3-13). It was here that new kinds of actions would be designed and implemented: “Work actions and their representations and associated artefacts are re-examined and played with, with the intention of reorganizing them expansively to solve contradictions in the activity” (p. 68). The fourth step in the process (labelled Visibilization 4 in Figure 3-13) embedded the new actions within the new activity so that its consequences, both intended and unintended, were subject to monitoring through the feedback sessions that enabled analysis and further revisions of the overall model of the activity.

Engeström (1999a) claimed that the expansive visibilization process employed linear, socio-spatial and developmental dimensions to represent work and combined to “provide a robust, multi-layered reflective instrumentality for the workplace community” (p. 90). After a review of DWR interventions, Engeström warned that to be successful, researchers needed to focus on both the construction and appropriation of new strategic instruments and on the social-organizational re-mediation of the activity system, that is, those transformations relating to the division of labour, community and rules. He suggested that the robustness of his own work that had resulted in the development of a shared patient record at the Children’s Clinic of a Finnish Hospital, was the result of “a dialectical movement between activity-level visions and action-level concretizations” (Engeström, 1999a, p. 92). This dialectical movement and the subsequent implementation of newly created models for the activity system required negotiated ‘knotworking’ to cross the zone of proximal development. This process has been discussed in the next section.

3.2.3.3 *Knotworking*

Recently, Engeström (2000a) introduced the notion of ‘knotworking’ to better understand the processes of collaborative work and the construction of shared objects. Engeström described a ‘knot’ as a “rapidly pulsating, distributed and partially improvised

orchestration of collaborative performance between otherwise loosely connected actors and activity systems” (p. 972). Knotworking, he stated, was characterized by “a movement of tying, untying and retying together seemingly separate threads of activity” (p. 972). It could not be attributed to any specific individual or fixed organizational entity as the centre of control because the locus of initiative changed from moment to moment within a knotworking sequence (p. 972). Engeström, Engeström and Vahaaho’s (cited by Warmington et al., 2004) that the object-oriented, situationally directed, radically distributed nature of collaborative activity framed knotworking as

a temporal trajectory of successive, task-oriented combinations of people and artefacts ... fragile because they rely on fast accomplishment of intersubjective understanding, distributed control and coordinated action between actors who otherwise have relatively little to do with each other ... In knotworking, the combinations of people and the contents of tasks change constantly. (cited by Warmington et al., 2004, p. 42)

Engeström et al. (cited by Warmington et al., 2004) went on to suggest that “the unstable knot itself [needed] to be made the focus of analysis” (p. 42). This advice has been heeded in this research as demonstrated in Chapter Six where the activity of knowledge generation and mobilization within an expert community has been investigated.

Engeström, Engeström and Kerosuo (2003) studied professional discourse of meetings in their exploration of the potential for meetings to act as collective zones of proximal development (see Section 3.2.2.2). Engeström et al. were aware that meetings which focus simply on planning and /or brainstorming tended to be separated from practical actions, having “an inherent tendency of becoming glorified small talk” (p. 287). However, they also noted Iedema, Degeling and White’s finding that “when multiple professional groups or specialties were involved in a meeting, the discourse was ritualized and formal. Only meetings within a single profession or specialty tended to be more informal and negotiative” (p. 310).

For professional meetings to take on the ability to generate more general new patterns of activity, Engeström, Engeström and Kerosuo (2003) argued that meetings must become microcosms in which collective zones of proximal development could be articulated and enacted. Participants needed to be aware of their history-making potential for change so that the future-oriented experiments that provide innovation and partial solutions could be framed with this in mind. In their meetings Engeström et al. employed the developmental work research method (see Section 3.2.3.1) to allow practitioners to “look back on the

history of their activity and engage in the future-oriented framing experiments” (p. 286) as part of the expansive visibilization process.

Engeström et al’s. (2003) analysis of the meeting subsequently identified four types of discourse: co-narrating the nature of an activity, making joint decisions about intended actions, modelling the intended activity and gaining a voice (p. 294) through implementing the co-constructed activity. There was strong correspondence between these types of discourse and the phase structure of the zone of proximal development as shown in Figure 3-11 on page 41). These types of discourse and their relationship with the zone of proximal development have been summarised in Table 3-2 which draws on Engeström et al. (2003, p. 294-303).

Table 3-2: Types of professional discourse and their relationship to the zone of proximal development

Type of discourse	Description	Phase of the zone of proximal development
Co-narrating	The joint construction of successive pieces of narrative - not necessarily in chronological order.	Activity 1 Analysis
Making joint decisions	Characterised by explicit expressions of intended action No radical restructure of the whole pattern of activity although they gave a sense of coherence and integrity to the process	Analysis
Modelling	The search for an overview of and interconnections between multiple parallel threads. The socio-spatial and temporal elucidation and stabilization of the essential aspects of a complex and messy whole in order to identify the key parties / locations and timeframe.	Object / Motive Construction
Gaining a voice	Restatement of the initial history by the object / repositioning the object	Application, generalization Activity 2: consolidation

The various types of discourse demonstrated the non-linear nature of concept formation. They pointed to both vertical and horizontal movements as concepts formed and reformed until a (temporary) final concept was declared. That is, the conceptual ‘knots’ were tied, untied and retied during the process of knotworking. Drawing on Engeström (2000a, p. 972), this process has been represented in Figure 3-14. The knotworking process described

by Engeström et al. (2003) was consistent with the knowledge exchanges at the annual Manfred Donike Cologne Workshop on Doping Analyses described in Section 6.6. These exchanges maintained expertise within this expert community and have been examined through the lenses of the multiple theoretical frameworks of this research.

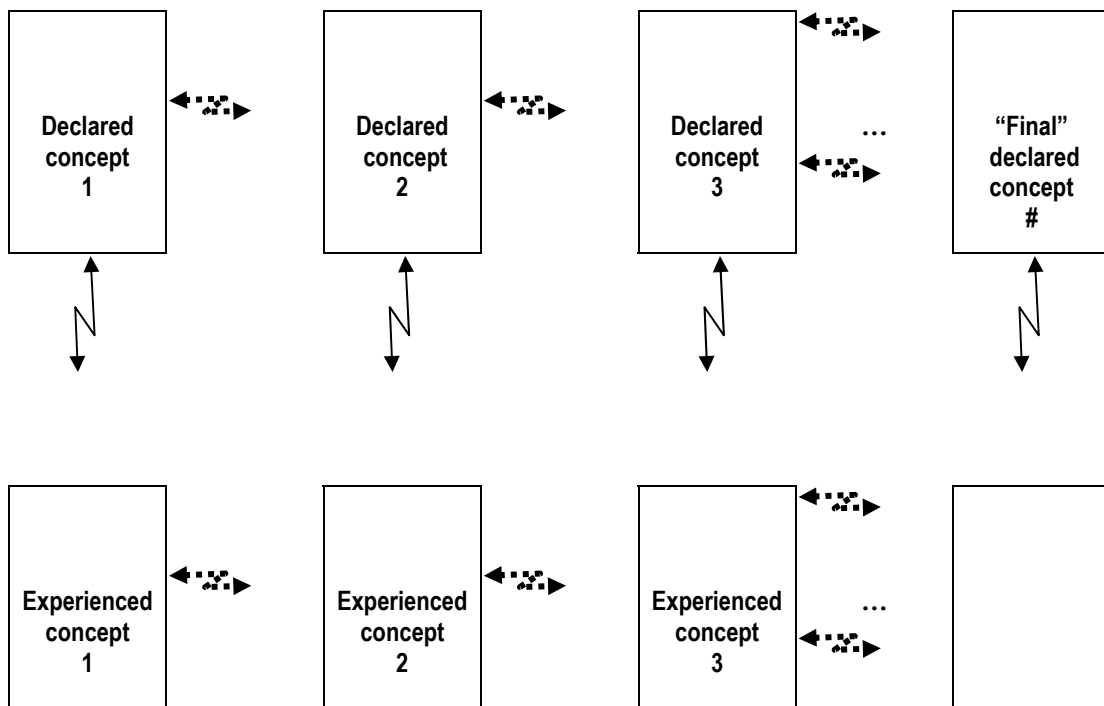


Figure 3-14: Knotworking - the horizontal and vertical movements in concept formation and learning

Engeström, Engeström and Kerosuo (2003) advised that to identify movements in the discourse, the object should be followed through its “various manifestations and metamorphoses” (p. 308), should be given a voice that allows the object to be seen from the perspectives of both the producer and the user and should be pushed “beyond its everyday boundaries, to make visible its developmental potentials” (p. 309). Engeström et al. described professional work and discourse as increasingly “socio-spatially distributed among multiple organizational units and forming long chains of interconnected practical and discursive actions” (p. 306). They went on to state that “the objects of expert work are changing toward relatively open-ended long-term entities... [and that] market pressures drive organizations toward strategic alliances and other forms of partnerships and interactive networks” (p. 306). The object’s trajectory, they said, presented a moving

horizon even though it was “specific and concrete, crystallized, embodied, and re-problematized” (p. 308) in every situation the expert faced.

Examples of knotworking have not proved hard to identify. Engeström (2000a, p. 273) suggested that another example of knotworking could be found in the work of the programmers of the Linux associated open source software movement whose “work [opened] up new possibilities for initiative and innovation.” In their work on the use of discussion databases in a multinational organization, Krogstie and Krogstie (2002) described a knot as a discussion which has a certain duration, frequent participation of various activity systems which do not normally interact and focuses on solving a problem. Warmington et al.’s (2004) review of interagency working for the Economic and Social Research Council in the United Kingdom also referred to knotworking. As stated above, the concept of knotworking has been revisited in Chapter Six as it has provided a theoretical lens for the examination of the maintenance of expertise.

Engeström (2000a; 2004a; 2005a) noted the similarity between the concepts of knotworking and Victor and Boynton’s (1998) co-configuration work (described in Section 2.3.1). Engeström, his many colleagues and Victor and Boynton pointed to the critical need for learning at work as the means to ensure flexible and adaptive responses to the changing nature of the workplace through pursuing the evolving object of work activity. Victor and Boynton also emphasised the critical role played by discourse. They regarded formal and informal, work-related conversations as the means by which knowledge infused an organisation and enabled the organisation to create, produce, transform and design both general purpose and unique goods and services for their clients. In much the same way, the knotworking discourse described by Engeström (2000a; 2004a; 2005a) and his colleagues (Engeström et al., 2003) enabled the crossing of collective zones of proximal development. As will be seen in Section 3.3.1.2 regular interaction to support the exchange of different points of view by the heterogeneous membership has been identified as a feature of a community of practice.

This section has explored the application of activity theory to the study of work. Both the activity theory based developmental work research method to support the expansive visibilization of work and the concept of discourse intensive knotworking for concept formation and learning have been presented. The use of these aspects of activity theory to

support theory building in this research has been flagged. Before leaving the discussion of activity theory, recent dialogue amongst activity theorists regarding the object of activity has been considered as elements of this dialogue have been incorporated into the building the model for the work of the scientific directors developed in Chapters Five through Seven.

3.2.4 The expanding object

Object-orientation is at the heart of activity theory. Nardi (2005) cited Leont'ev's statement that "it is exactly the object of an activity that gives it a determined direction" (p. 39) as well as Kuuti's comment that an object defines "a 'horizon of possible actions' " (p. 39). Yet, like others, Nardi found the concept of the object has not transferred easily into English and, with others, has recently pursued a clearer understanding of its nature.

Kaptelinin and Miettinen (2005) called for further clarification and development of the concept of the object because it was "one of the most fundamental notions" (p. 1) of activity theory, a concept which was "playing an increasingly important role in theoretical development and practical applications of activity theory ... as a powerful analytical tool that [helped] to reveal the fundamental aspects of social practice, and [to] support structured, meaningful interpretations of empirical data" (p. 1) as a consequence of both psychological and sociological interpretations.

Kaptelinin (2005) aimed to clarify the confusion resulting from the problematic transfer of the concept of the object from the Russian to English. Kaptelinin (2005) first explained that the subtle difference between the Russian words '*predmet*' and '*objekt*', both used by Leont'ev, had been lost in translation. As both '*predmet*' and '*objekt*' had been interpreted as the single English word 'object', confusion had arisen. Kaptelinin stated that the word *objekt* dealt "mostly with material things existing independently of the mind" (p. 6), that is, things that actually exist whereas the word *predmet* referred to "the target or content of a thought or an action" (p. 6). Kaptelinin also described the relevance of these two words for the two approaches to current activity theory-based research. The first approach, the one developed by Leont'ev, had as its analytical focus the "activities of individuals, carried out either collectively or 'eye to eye with the surrounding object world'" (p. 11). The second approach, developed by Engeström, defined the unit of analysis "as 'object-oriented, collective, and culturally mediated human activity, or activity system'" (p. 12). In this approach activities were carried out collectively and individuals could "only carry out actions within a larger-scale collective activity system" (p. 12). Kaptelinin noted that these

different perspectives on the object of activity were used by activity theory researchers in the fields of psychology and organizational change respectively. Importantly, Kaptelinin proposed that these approaches should be considered

complementary versions of activity theory, each of which is custom designed to deal successfully with practical and research issues in their respective domains, that is psychological and organizational change ... [their] different scopes ... can be fruitfully applied for solving different types of research and practical tasks". (p. 11)

In her study of a network of conflict monitors in the post-Soviet sphere, Foot (2002), explored the issues of object identification and formation. Having referred to Engeström's description of the role of the object as that of shaping and directing activity, and determining the horizon of possible actions, Foot suggested that the non-unreachable nature of any horizon implied that the object, as a horizon of possible actions, was "in principle uncatchable" (p. 132). Foot described her work as reporting "the analytical pursuit of an ever-evolving object that is simultaneously material and ideal, by 'catching' facets of the object as it is conceived of and engaged by the participants" (p. 132). Such facets were related to the formation of the object and its transformation over time by the multiple participants of the activity system. In the commentary on Foot's article on the Mind, Culture and Activity journal's mailing list (XCMA, 2003), Daniels wrote that Foot had "identified two object conceptions and their transformations through time: the monitoring of ethnic relations and the building of an epistemic community ... [a] task related object and an object concerned with social relations" (email dated Thu Jun 12 2003 - 01:55:56 PDT). Daniels subsequently questioned whether or not these represented two object conceptions or whether or not they represented the elements of a discourse on the object in which one element may be fore-grounded by subjects engaging from some positions and back-grounded by those in other positions. These questions resonated with Kaptelinin's comments about the complementary of the two perspectives on activity theory described above and with what Roth et al. (2005) referred to as the irreducible, dialectical and mutually presupposing relationship between the individual and the collective. Roth et al. stated that

In human practice, a collective object of consciousness emerges and develops through social interactions of individual subjects, of which the result is more than the sum of individual actions. ... the division of labour is not only conscious but also leads to the possibility to choose among different forms of participation to sustain society and, in exchange of material goods and labour, still achieve the benefits that stem from collective activity. ... collaborative

practice involves not only cooperative but also communicative actions toward a collective object. (Roth et al., 2005, p. 148)

These comments about the emergence of the evolving collective object through social interaction and different forms of participation highlighted the dynamic and developmental nature of activity with its “moving object” and supported the theory building undertaken in Chapters Five through Seven to model the dynamics of the work of the experts investigated in this study.

Nardi (2005) also focused on object construction and the human desires associated with its emergence. To further develop understanding of the object and its role in activity theory, Nardi proposed the use of the term *object formulation* to describe the process associated with “figuring out what [the object] should be” (p. 40) and the term *object instantiation* to refer to “the work that goes into realizing a particular object, to achieving an outcome” (p. 40). Object instantiation formed “the bulk of any activity – achieving some realization of the object, attaining an outcome” (p. 40). In the scientific research setting in which Nardi conducted her research, she described the work of object instantiation as “a lengthy, difficult, intellectually sweaty task” (p. 40), citing one of her informants’ rich description of it as a process that is “hard and slow, and not precise” (p. 40). Nardi noted that the multi-voicedness of an activity system resulted from its multiple actors, each with their own particular interests and motives. Nardi stressed that:

These motives were linked; they did not stand in isolation from one another. [They] were bound to each other through relations of conflict, power, resistance, and acquiescence. It was the struggles to align the motives – not merely the tasks ... that gave rise to a single activity system, rather than a set of individually coordinating systems. (Nardi, 2005, pp. 40-1)

Nardi (2005) suggested that the use of terms such as ‘negotiation’, ‘discourse’, and ‘collective reflection’ in the literature failed “to capture the passions that imbue human activity” (p. 41) Nardi proposed that it was the passionate interplay between motives, a “dynamic web of motives” (p. 49), that shaped and energized the construction of the collective object.

Miettinen (2005) emphasised the complex nature of the object. An object, he stated, was “realized and reproduced in actual projects involving the construction of artefacts in the form of a service, product, use-value or commodity” (p. 57) depending on the nature of the activity. From his research in the area of biotechnology he concluded that the complex and contradictory nature of the object of biotechnological activity arose from it being:

- d) simultaneously epistemic and practical;
- e) a commodity, that is, ... a contradictory unity of use-value and exchange value
- f) a heterogeneous or functionally complex system consisting of different material and social entities (R. Miettinen, 2005, p. 58)

Miettinen (2005) explained that the term ‘epistemic object’ referred to an “entity or effect that is largely unknown” (p. 59), citing Knorr-Cetina’s description of such objects of knowledge as “characteristically open, question generating and complex. They are processes, and projections rather than definitive things” (p. 59). Such epistemic objects were simultaneously required to apply the newly created knowledge and expertise in a practical manner to meet the demands of industrial processes or in areas such as health care and agriculture. Subsequently the interim results of an ongoing project would be given independent meaning and potentialities outside that originally envisioned (p. 62). Such activity implied “collaboration both with the relevant scientific communities and with industrial or other partners in metaphorical spaces that have been called transepistemic arenas of knowledge production” (p. 59). This notion of transepistemic arenas resonates with those of the zone of proximal development (see Section 3.2.2.2) and knotworking (see Section 3.2.3.3) as it is in the zone of proximal development that shared objects, albeit interim ones, are knotworked, that is negotiated, agreed upon and realized.

The functional complexity of the object, Miettinen observed, arose from the different functional expectations it embodied. These were related to the different kinds of expertise, resources and capabilities present in solution generated by the division of labour amongst those involved in the shared object’s formation. Echoing Nardi’s comments (see above) on the role of human desires in object construction, Miettinen remarked that functional complexity implied that “the participating organizations and individuals attach different desires, interests, and motives to the object” (p. 60). Miettinen commented that negotiations surrounding the shared object, “[concerned] the personal motives of the individuals and the diverging interests of the partners ... [regulated] the degree of involvement of the individual workers and the contribution of the partners to the joint creation of the object” (p. 64). Not surprisingly, Miettinen believed that “the very variety of individual motives, and capabilities makes the collective conceptualizing of the shared object of activity a key challenge in the development of an activity” (p. 64). The functional complexity of the object was consistent with the findings of this research into activity of the scientific directors.

3.2.5 Summary

Activity theory's emphasis on activity and the system within which it occurs has supported the application of the theory to work contexts which are dynamic and open to change. Elements of activity theory's analytic toolkit including the activity system of second generation of activity theory, interacting activity systems of the third generation of activity theory, DWR, expansive visibilization of work, and knotworking have been identified as having been incorporated into the research. The recent work of Foot (2005), Kaptelinin (2005), Miettinen (2005) and Nardi (2005, p. 65) has led to an expanded understanding of the object of activity. Miettinen's reporting of the application of interim results in the biotechnology industry, reinforced Foot's notion of the 'ever-evolving object' as one that is transformed over time by the multiple participants of an activity system. Nardi's and Miettinen's acknowledgement of the fundamental role of desire and recognition in object formation have underlined the benefit of ongoing empirical investigations that aim to elucidate further the rich dynamics of individual and collective activity. These concepts have been incorporated into Chapters Five through Eight as they support the construction of a model for the complex, dynamic activity of being an expert in a changing world.

As has been outlined in the research design set out in Chapter Four, observation of the 2003 Manfred Donike Cologne Workshop on Doping Analyses was undertaken early in this research and followed by attendance as a participant observer at the 2004 and 2005 workshops. The data from this aspect of the research have been presented in Chapter Six. The strong sense of community amongst the anti-doping scientists observed by the researcher at this event precipitated the use of communities of practice as another framework relevant to this study. The framework has been described in the following section.

3.3 COMMUNITIES OF PRACTICE: A THEORY OF SOCIAL LEARNING

The inseparability of the learning from workplace practice led to the development of communities of practice as a social theory of learning. As noted in Section 2.2.2.2, Wenger and his colleagues developed and extended Wenger's earlier work with Jean Lave into a social theory of learning based on communities of practice.

Wenger (1998) placed learning at the focus of his thinking stating his belief that “learning is so fundamental to the social order we live by that theorizing about one is tantamount to theorizing about the other” (p. 4). Wenger assumed that

- humankind are social beings;
- "knowledge is a matter of competence with respect to valued enterprises” (p. 4)
- "knowing is a matter of participating in the pursuit of such enterprises - of active engagement in the world" (p. 4)
- "meaning - our ability to experience the world and our engagement with it as meaningful - is ultimately what learning is to produce" (Wenger, 1998, p.5).

Subsequently, Wenger (1998) incorporated the following elements into the social theory of learning of communities of practice:

- *Meaning* - a way of talking about our (changing) ability - individually and collectively - to experience our life and the world as meaningful.
- *Practice* - a way of talking about the shared historical and social resources, frameworks, and perspectives that can sustain mutual engagement in action;
- *Community* - a way of talking about the social configurations in which our enterprises are defined as worth pursuing and our participation is recognizable as competence.
- *Identity*: a way of talking about how learning changes who we are and creates personal histories of becoming in the context of our communities.

These elements of social learning were illustrated by Wenger (1998, p. 5) as shown in Figure 3-15.

Wenger (1998) suggested that the concept of community of practice provided a "thinking tool" with which to achieve greater understanding of our world, and in particular the means by which knowledge is developed and shared. Wenger emphasised that participation had broad implications for understanding and supporting learning and for comprehending and supporting the development and stewardship of knowledge:

- For *individuals*, it meant that learning was an issue of engaging in and contributing to the practices of their communities.
- For *communities*, it meant that learning was an issue of refining their practice and ensuring new generations of members.

- For *organizations*, it meant that learning was an issue of sustaining the interconnected communities of practice through which an organization knew what it knew and thus became effective and valuable as an organization.

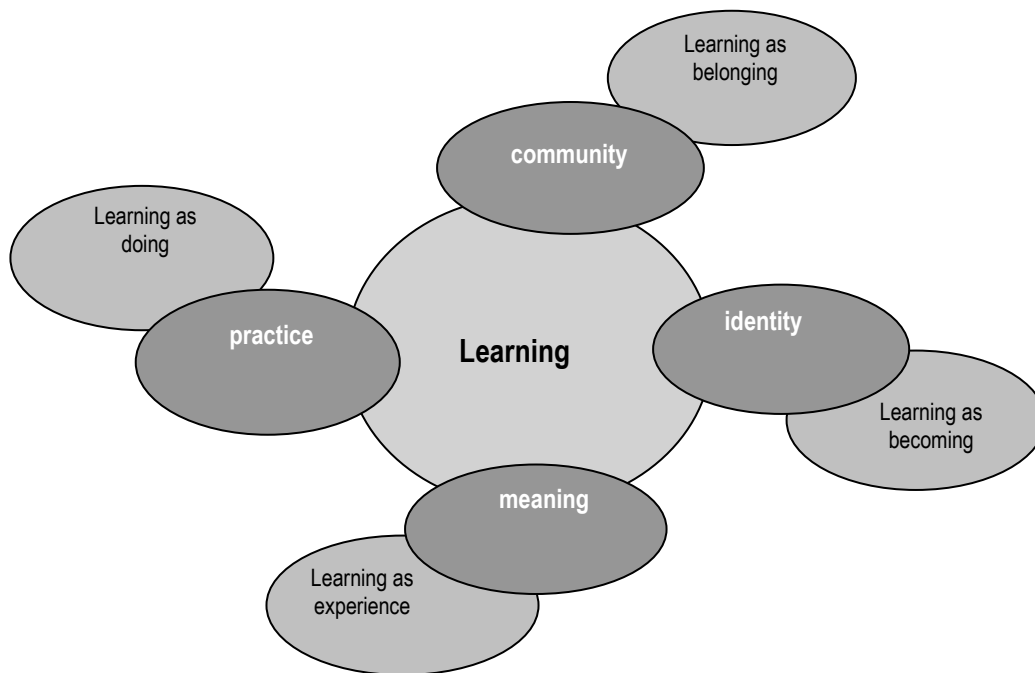


Figure 3-15: Components of a social theory of learning

Of importance to this research was the fact that the theoretical framework of communities of practice was far more accessible and more easily understood by practitioners themselves and was able to be incorporated into the research strategies (see Section 4.6.2) in the form of a survey administered to members of the anti-doping scientific community during their attendance at the Cologne Workshop.

Whilst acknowledging theories of social structure and situated experience, Wenger (1998) observed that theory of social learning also drew heavily on theories of collectivity and subjectivity, of practice and identity and of meaning and power, illustrating this (p. 14) as shown in Figure 3-16.

Wenger (1998) pointed out that "connecting the formation of collectivity and the experience of subjectivity on the same axis highlights the inseparable duality of the social and the individual" (p. 15). Placing power between identity and social structure, Wenger went on to describe power as a central question in social theory and put forward the view that the challenge was finding "conceptualizations of power that avoid simply conflictual perspectives (power as domination, oppression, or violence) as well as simply consensual

models (power as contractual alignment or as collective agreement conferring authority" (p. 15). Whilst subject to the beliefs and practices of their peer group, Wenger believed that individuals also developed their own interpretations of or meanings of the world around them and that "this notion of meaning production [had] to do with our ability to 'own' meanings, it [involved] issues of social participation and relations of power in fundamental ways" (p. 15). Engeström (2001a) summarised the motivation for situated learning theorists such as Lave and Wenger by stating that "motivation to learn stems from participation in culturally valued collaborative practices in which something useful is produced" (p. 141).

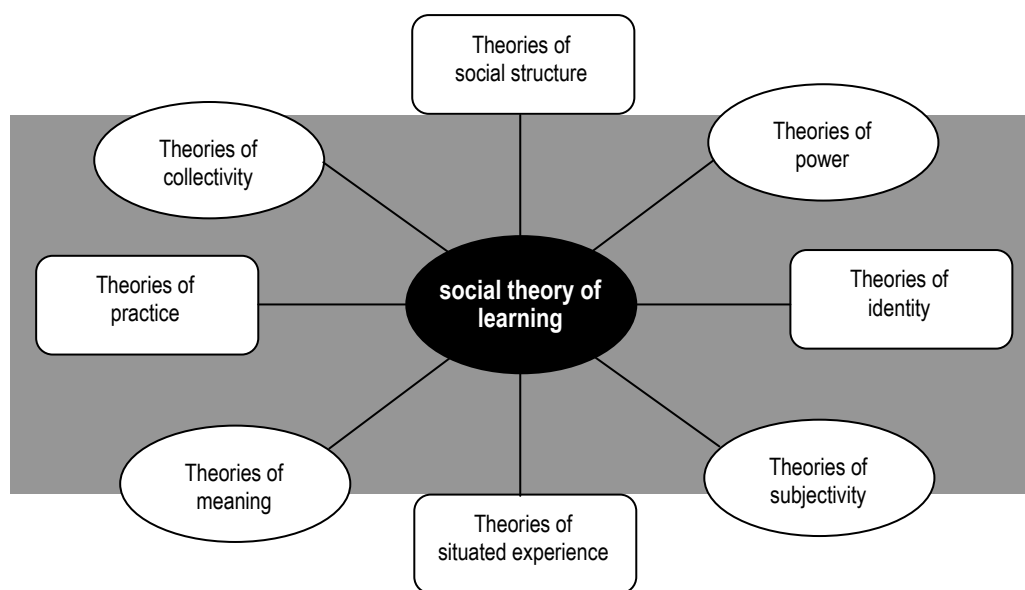


Figure 3-16: Intersection of intellectual traditions in the social theory of learning

Noting the increasing internationalisation of the workplace, Wenger, McDermott and Snyder (2002) stated that the globally based knowledge economy presented knowledge management challenges that many organisational managers were unable meet and in which communities of practice would be of use. The popular use of information technology had in many instances "created digital junkyards" (p. 24-6) rather than viable solutions to knowledge management problems. Wenger, McDermott and Snyder put forward their work on communities of practice as providing a sounder foundation on which organisations could build their knowledge strategies. Such strategies would be twofold. They would draw on an understanding of the nature of knowledge as individual and social, tacit and explicit, and dynamic and they would use social structures that supported learning, competency development and knowledge management. These strategies have

been explained further in the following sections as they were consistent with the researcher's observations of the role of the workshop attended annually by anti-doping scientists (see Chapter Six).

3.3.1 Communities of Practice: Structural Elements

Communities of practice vary from community to community yet they share a number of common structural elements. Wenger et al. (2002) contend that communities of practice can be small or big, long-lived or short-lived, collocated or distributed, homogeneous or heterogeneous, inside and/or across organizational boundaries, spontaneous or intentional, unrecognized or institutionalized. However, all communities of practice have: “a *domain* of knowledge, which defines a set of issues; a *community* of people who care about this domain; and the shared *practice* that they are developing to be effective in their domain” (p. 27-8). As each of these elements had been apparent during the researcher's observations of the 2003, 2004 and 2005 Manfred Donike Cologne Workshops on Doping Analyses (reported in Chapter Six), the nature of each element has been described in the sections below.

3.3.1.1 The Domain

As the set of issues on which a community focused, the *domain* provided “common ground and a sense of common identity ... [it] [legitimized] the community by affirming its purpose and value to members and other stakeholders ... [and inspired] members to contribute and participate, [guided] their learning, and [gave] meaning to their actions” (Wenger et al., 2002, p. 30). The community's domain was central to its existence, defining the community's identity, “its place in the world, and the value of its achievements to members and to others” (p. 31). Individuals participated in a community because they shared the issues or problems of its domain – passionately. This aspect of a community of practice echoed the comments of Nardi (2005) about the human desires associated with object construction (see Section 3.2.4) and was evident in the atmosphere observed at the workshops and in interviews with individual directors.

Wenger, McDermott & Snyder (2002) believed that the definition of the domain was critical to the functioning of the community. Wenger and his colleagues stated that, without clear knowledge of the key issues of their shared domain, community members would be unable to develop a “sense of accountability to a body of knowledge and

therefore to the development of a practice” (p. 32). They also suggested that it was the “intersection of personal meaning and strategic relevance [that was] a potent source of energy and value” (p. 32) A well-defined domain, they said, could become a statement of what knowledge the community would steward and a commitment by the community to take responsibility for a particular area of expertise. In so doing, the community committed itself to the provision of “the best knowledge and skills that can be found” (p. 32). The clear definition of a community of practice’s domain could “boost its visibility and influence” (p. 28). Not surprisingly, domains evolved as current problems were solved and new ones arose. This notion of evolving domains ultimately led to the development and finally the transformation of the community (see Section 3.3.2).

3.3.1.2 *The Community*

Wenger, McDermott & Snyder (2002) maintained that the *community* “[created] the social fabric of learning ... [fostered] interactions and relationships based on mutual respect and trust ... [encouraged] a willingness to share ideas, expose one’s ignorance, ask difficult questions, and listen carefully” (p. 34). Within a community of practice, people “[interacted], [learned] together, [built] relationships, and in the process [developed] a sense of belonging and mutual commitment” (p. 35). Wenger et al. asserted that the presentation of individual perspectives on shared issues and problems created a rich learning and problem solving environment. They regarded a community of practice as heterogeneous rather than homogeneous in nature. Whilst, the size of a community of practice could vary there had to be a sufficient number of people to maintain regular interaction and varying points of view. Not surprisingly, Wenger et al. noted that in very large groups, people found it difficult to build relationships with everyone else and those large groups tended to resolve into subgroups which were “nested” within the larger community. These subgroups focused on particular topics or a geographic location. Community of practice members could be located throughout a building, a country or distributed around the globe. Distributed communities would also have to contend with some or all of the additional challenges of distance, size, varying organizational affiliation and cultural differences. The lack of personal interaction because of distance could be addressed through a rhythm of activities such as face-to-face meetings, videoconferences, teleconferences, email, and web-based discussion boards. Such activities promoted the visibility of the community in the life of its members and facilitated “a sense of common history and identity” (Wenger et al., 2002, p. 57). As will be presented in Chapter Five, the

annual Manfred Donike Cologne Workshop on Doping Analyses was regarded by a number of the scientific directors as sufficiently important for them to commit time and money each year to support their regular attendance.

Wenger et al. (2002) contended that the success of a community of practice within an organization was dependent on its internal leadership, its external support, and the participation of its members. They stated that members' participation could vary, that individuals could belong to more than one community of practice and could participate in each community at various levels – as core, active, or peripheral members or as outsiders. They represented these degrees of participation diagrammatically (p. 80) as shown in Figure 3-17.

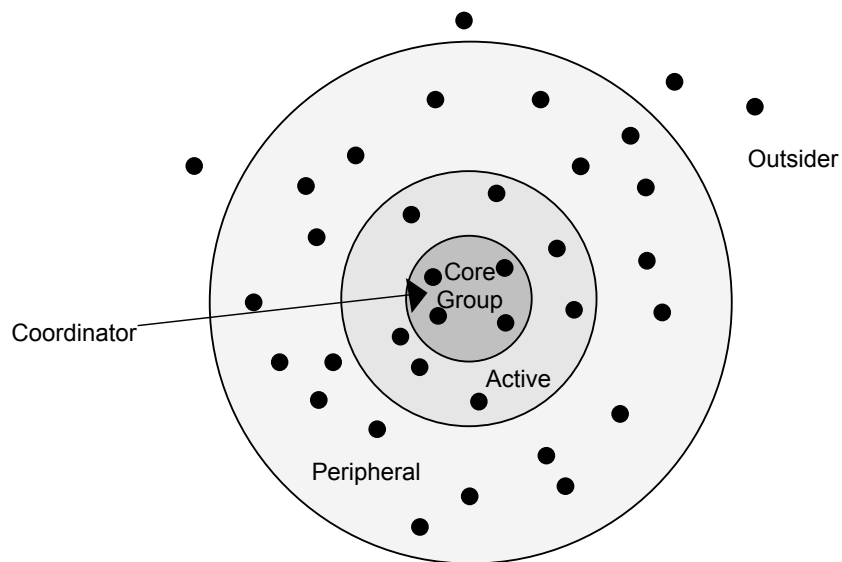


Figure 3-17: Degrees of participation in a community of practice

Wenger and his co-workers also pointed out that the internal leadership of a community of practice did not necessarily rest in the hands of a single person; rather it was shared by a group of people, about 10 to 15% of the community, who had internal legitimacy in the community. Whilst initially one member of this leadership or core group would take on a coordinating role, other key tasks would eventually be carried out by other active members. As well as identifying important issues in the domain, the coordinator's role was to monitor the "health" of the community by encouraging participation in regular community events, facilitating personal relationships between members, developing trust between members and increasing the community's social capital. The coordinator also supervised the boundary between community and the outside world, advancing the

standing of the community, particularly with management of relevant organizations in order to locate and maintain support and sponsorship. The members of this core group “actively [participated] in the discussions, even debates, in the public community forum. They often [took] on community projects, [identified] topics for the community to address, and [moved] the community along its learning agenda” (p. 56). Over time, the core group provided “much of the community’s leadership, its members becoming auxiliaries to the community coordinator” (p. 36). Other leadership roles from within this core group could include “organizers, experts and ‘thought leaders’, pioneers, administrators, and boundary spanners” (p. 56).

A second group of another 15% to 20% of the community membership, was *active* within the community. Whilst they were regular attendees of meetings and forum participants, their involvement did not match the regularity or intensity of the members of the core group (p. 56). According to Wenger and his co-workers

a large portion of community members [were] *peripheral* and rarely [participated] ... they [kept] to the sidelines, watching the interaction of the core and active members ... they [gained] their own insights from the discussions and put them to good use, ... they [were] learning a lot. (Wenger et al., 2002, p. 57)

Newcomers to a practice furthered their learning about the practice through legitimate peripheral participation in a community of practice. Communities of practice worked best when members of each of these groups “[felt] like full members” (p. 56).

Beyond these three main levels, were *outsiders* - people McDermott & Snyder (2002) described as having “an interest in the community, including customers, suppliers and ‘intellectual neighbours’ ” (p. 39). The nature of an individual’s community membership did not remain static, reflecting the individual’s changing involvement in the community. The boundaries between the levels of a community and between the community and its environment were not impermeable. Rather, they allowed individual involvement to vary according the current focus of the community and its need for particular expertise and interest.

The researcher’s early findings about the relevance of these concepts for anti-doping scientists were tested as part of the research design (see Chapter Four) through the administration of a survey that incorporated an item based on perceptions of community

membership to participants in the 2004 Manfred Donike Cologne Workshop on Doping Analyses. The outcomes of this survey have been presented in Chapter Six.

3.3.1.3 *The Practice*

A community's shared *practice* was built on the knowledge that the community needed to underpin its current and future exploration in its particular field of knowledge and skill. A practice was

a set of common approaches and shared standards that create a basis for action, communication, problem solving, performance, and accountability ... It also embodies a certain way of behaving, a perspective on problems and ideas, a thinking style, and even in many cases an ethical stance. In this sense, a practice is a sort of mini-culture that binds the community together. (Wenger et al., 2002, p. 38-9)

Wenger et al. (2002) went on to state that when an effective practice had resulted from the co-evolution of a community and its product, the community had been able to organise the knowledge resources related to its practice in a way that was beneficial to practitioners. These collective resources included narrative discourses related to the experiences of successes, best practices and lessons learned; heuristics, frameworks, principles, and models. The knowledge resources of a community ranged from the explicit and the tacit, from physical artefacts such as specialist tools and accumulated recorded knowledge such as that in conference proceedings through to the ability to assign meaning to small changes that might not be noticed by others unfamiliar with the practice. A successful practice balanced “joint activities, in which members explore ideas together, and the production of ‘things’ like documents or tools. ... the twin goals of interacting with peers and creating knowledge products complement each other” (p. 39-40). These functions of community building, knowledge sharing and creating were apparent during the annual workshop and have been described and discussed in Chapter Six.

Not surprisingly communities of practice do not simply appear. They develop over time. This development is described in the following section.

3.3.2 Communities of practice: Developmental stages

Wenger, McDermott and Snyder (2002) stressed that successful communities of practice took time to evolve and addressed many challenges during their evolution. They described a number of evolutionary stages through which communities of practice passed:

- **Identification** of community potential through definition of the community's scope to engage interests of prospective members and to meet organizational needs; identification of people who already network on the topic and persuading them to broaden their network, and identification of common knowledge needs.
- **Coalescence** into a community through the establishment of value of sharing domain relevant knowledge, the development of interpersonal relationships and sufficient trust to address "sticky" problems, the development of a deep insight into individual practice and thinking styles of group's members, development of a collective understanding of the community's practice, the initiation of events and spaces where community can share, and the identification of the nature of and means by which specific knowledge should be shared.
- **Maturation** of the community through the definition of community's role within the wider community and its relationship with other domains, the management of the membership of the community so that it remains engaged and focused on core issues, the identification of gaps in the community's existing knowledge and the nature of its "cutting edge", and the development of a need to organize its core knowledge and to take stewardship of that knowledge seriously.
- **Stewardship** of the community's knowledge through the maintenance of the domain's relevance; the establishment of a voice in the organization or broader community serviced by the community; the management of the membership of the community so that it remains actively engaged, including new members and new leadership, and finally concentration upon cutting edge issues.
- **Dissolution or transformation** into new communities as a result of the resolution of challenges that gave rise to the community, evolution of a new domain, the loss of members through lack of relevance or commitment to other communities, the routinisation of the practice or its evolution to something different.

Wenger et al.'s (2002) graphical representation (p. 69) of these stages has been presented in Figure 3-18 . In the figure, the jagged line represents the level of energy and visibility that the community typically generates over time.

An additional item on the survey referred to at the end of Section 3.3.1.3 tested the relevance of these concepts for anti-doping scientists. The outcomes of this survey have also been presented in Chapter Six.

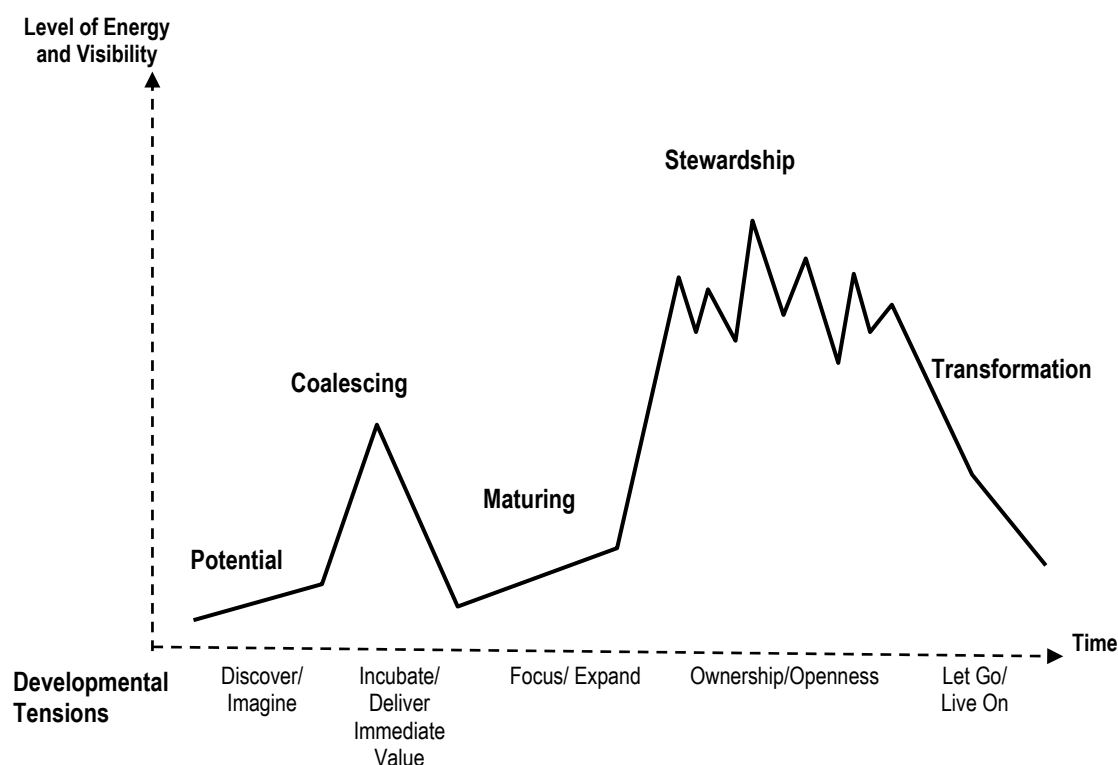


Figure 3-18: Stages of development of a community of practice

3.3.3 Summary

This research focused upon a group of scientific experts who shared a common practice of directing an accredited anti-doping laboratory. Pilot study, interview data and observational data collected during attendance at the 2003-5 annual Manfred Donike Workshops on Doping Analyses indicated that the nature and regularity of this event would be better understood through the use of the framework of communities of practice. As evident in this section, the communities of practice framework emphasized the situated context of work-based learning and the sharing of knowledge and understandings of interested individuals about a common practice. In Chapter Six, the development of personal and collective identity through membership of a meaningful community of practice as well as the role of the community in the creation and maintenance of knowledge and proficiency within the practice of anti-doping science have been presented.

The literature of both Activity Theory and Communities of Practice provided theoretical lenses that elucidated the theory building aspects of this research into the work of scientific experts who work in an international non-profit context. Both frameworks offered the language and concepts useful for developing insights into the issues uncovered by this

research. However, it became evident during the research that neither framework was an exact fit for the research context which was becoming increasingly multi-disciplinary as the research progressed. Even together activity theory and communities of practice did not provide all the tools to understand the research context. To address this gap, as noted earlier, a third set of lenses was drawn from the complexity theory based *Cynefin* framework developed by Snowden and his colleagues (Kurtz & Snowden, 2003; Snowden, 1999a, 1999b, 2002a, 2005; Snowden & Stanbridge, 2004). This framework provided a means of exploring issues relating to knowledge management in complex spaces. Coleman (1999) remarked that the “increasing interconnectedness of people across the globe [was] helping to accelerate change” (p. 33). The evolving internationalisation of public sector issues, such as doping in sport, resulted in the globalisation of efforts to address those issues, a brief overview of which has been provided in Chapter Eight. The evolving complexity of these contexts and the self-organizing tendencies of human systems, suggested that the social application of the theory of complex systems, which examined emergent order in large, interactive, adaptive networks, would offer insights into such spaces. As the *Cynefin* framework contributed to the theoretical understanding of the processes of knowledge mobilization presented in Chapter Six and the evolution of the globalisation of anti-doping work in Chapter Eight, it has been described in the following section.

3.4 THE COMPLEXITY OF KNOWLEDGE MANAGEMENT: THE *CYNEFIN* FRAMEWORK

Whilst the field of knowledge management is a relatively recent one, it has seen many attempts to work out ways to capture and structure the flow of information to an organisation’s decision makers. Many of these attempts have emphasised the computerisation of processes and paid little heed to the human elements of the complex context in which knowledge is being managed. Snowden (2002a) described the first age of knowledge management as focusing on “the appropriate structuring and flow of information to decision makers and the computerization of major business applications leading to a technology enabled revolution dominated by the perceived efficiencies of process reengineering” (p. 100). By the mid 1990s, recognition of the value of knowledge gained through experience and in community and the value of traditional knowledge transfer approaches such as apprenticeship schemes resulted in what Snowden referred to as the second age of knowledge management. Here the focus was on the transformation of

knowledge from tacit to explicit states through Nonaka and Takeuchi's (1995) popular SECI model (described in Section 2.2.2.1) which comprised the processes of socialization, externalization, combination and internalization. To combat moves to dissociate knowledge from those who know it, Nonaka and Konno (1998) restated their model and incorporated *Ba*, a shared space in which relationships could emerge. Challenges to concepts underpinning knowledge provided the basis for what Snowden described as the third generation of knowledge management. Snowden (2002a) cited Stacy's work on the complex responses to learning and knowledge creation in organizations, in which Stacy described knowledge as:

not a “thing”, or a system, but an ephemeral, active process of relating. ... no one, let alone a corporation, can own knowledge. Knowledge itself cannot be stored, nor can intellectual capital be measured, and certainly neither of them can be managed. (Snowden, 2002a, p. 101)

As mentioned in Section 2.2.2.1, Jackson (2003) stated that complexity theory offered management thinkers with a means of examining and dealing with the disorder, irregularity and randomness in organisational life. Based in the science of complex adaptive systems, Snowden stated that the ideas of Stacy and others resulted in knowledge being considered paradoxically as both a flow and a thing. They explored these ideas further through the use of the theory of complex adaptive systems, an introduction to which has been given in the following section.

3.4.1 The nature of complexity in organisations

The focus of the complexity sciences was originally on what Stacey (2003) described as “complex, apparently disorderly and sometimes turbulent systems in nature, for example, the weather, the human brain, ant colonies, convection in thermodynamics, urban evolution and the evolution of life itself” (p. 43). Waldrop (1992) described a complex adaptive system as

composed of many, many ‘agents’; [which] might be molecules or neurons or species or consumers or even corporations. But whatever their nature, the agents were constantly organising and reorganising themselves into larger structures through the clash of mutual accommodation and mutual rivalry”. (Waldrop, 1992, p. 88)

Stacey (2003) pointed out that in a complex adaptive system

no individual agent, or group of agents, [determined] the patterns of behaviour that the system as a whole [displayed], or how those patterns [evolved], and neither [did] anything outside of the system. ... Self-organization [meant] agents interacting locally according to their own principles, or 'intentions,' in the absence of an overall blueprint for the movement of the system. ... Adaptive systems ... [displayed] broad categories of dynamic that [included] stable equilibrium, random chaos, and a distinctive dynamic of stability and instability at the same time, known as 'the edge of chaos'. (Stacey, 2003, p. 49-50)

Complex adaptive systems exhibited the capacities to self-organise to more complex states, to adapt to their surrounding environment through learning, as well as to yield emergent outcomes which were richer than the sum of the individual parts. They were able to evolve into new forms through what Marion and Bacon summarized as "interactive, co-evolutionary processes" (1999, p. 77). These concepts of complexity science have been applied to the search for patterns which promote comprehension of unpredictable, dynamic, chaotic phenomena, scientific and social. The latter phenomena included organizational change, innovation, policy studies, learning and knowledge management.

When beginning to address the complexity of the human systems aspect of knowledge management, Senge (1990) noted two types of complexity: detail complexity and dynamic complexity. Detail complexity involved many variables whose behaviour was addressed by systems analysts' use of sophisticated though conventional tools of forecasting, planning and analysis methods to deal with cause and effect situations. Senge (1990) commented that such tools were ill-equipped to deal with most management situations where "the real leverage ... [lay] in understanding dynamic complexity, not detail complexity" (p. 72). Dynamic complexity, Senge wrote, occurred in situations where "cause and effect [were] subtle, where effects over time of interventions are not obvious" (p. 71). Senge remarked that for systems that exhibited dynamic complexity, there was a need to see "interrelationships rather than linear cause-effect chains, and ... processes of change rather than snapshots" (p. 73) through recognizing the recurrent structures. Thinking about systems was limited by our failure to recognise that "reality is made up of circles but we see straight lines" (p. 73). Senge went on to suggest that "a language made up of circles ... [was important] in facing dynamically complex issues and strategic choices, especially when individuals, teams and organizations [needed] to see beyond events and into the forces that [shaped] change" (p. 73-4).

The aggregate data of this research drawn from surveys, interviews, observations, and public documentation, painted a rich picture of the complex nature of the context of this research. The context ranged from the activity of individuals, through a community of individuals to the involvement of multiple groups of stakeholders from diverse cultural and organisational backgrounds. In the light (or perhaps the theoretical fog) of this complexity, the researcher adopted Snowden and Kurtz's complexity based *Cynefin* framework for sense-making within organisations, as it provided both a language and the concepts with which to explore and interpret this canvas. This framework has been described in the following section.

3.4.2 Sense-making in dynamic contexts: The *Cynefin* framework

The *Cynefin* framework represented the response of Snowden and his colleagues (Kurtz & Snowden, 2003; Snowden, 1999a, 2000, 2002a) to their questioning of three pervasive assumptions upon which the sense-making processes evident in organisational decision-making (Kurtz & Snowden, p. 462-3). These assumptions assumed:

- Order: Prescriptive and predictive models of human behaviour can be produced and interventions into human behaviour can be designed because of underlying cause and effect linkages between human interactions and also in markets. Such linkages imply a correct way of doing things, that is, best practice could be defined.
- Rational choice: Individual and collective behaviour can be managed by the manipulation of pleasure and pain because humans made rational decisions based on their preference to maximize pleasure and minimise discomfort or pain.
- Intentional capability: The possession of the capability to carry out an action implies the intention to carry out that action; that is the actions of others are deliberate.

Snowden and Kurtz asserted that these assumptions about human behaviour were true only in some contexts. Their approach was based on complex adaptive systems. They stressed that humans were not limited to a single identity; rather humans demonstrate both individual and collective identities regularly. Nor were humans bound to acting in accordance with predetermined rules, rather they structured or re-structured their actions as a result of collective agreement or their own free choice, and were capable of imposing order on chaos. Humans were also able to participate in real time well beyond their own immediate locality as a result of their ability to communicate abstract concepts through language and disseminate them widely and instantaneously using social and technological infrastructure. The *Cynefin* framework addressed the lack of decision-making tools and

techniques available to support effective sense-making in contexts where the assumptions of order, rational choice and intentional capability did not hold true. These contexts included global contexts that were evolving and subject to change. It provided what Snowden referred to as an organic or ecological approach to sense making and learning in formal and informal communities by generating models “designed to force communities of practitioners to recognize the need to introduce requisite levels of variety into their thinking, and avoid single models of practice and strategy” (1999a, par.1). More recently Snowden and Stanbridge (2004) have developed a multi-ontological sense-making model, a landscape of management, for decision making and intervention design in organisations. This model responded to the varying degrees of visibility of order, or the nature of unorder, either complex or chaotic.

To accommodate these new understandings of knowledge, the human context and human behaviour, Snowden and his colleagues constructed the *Cynefin* sense-making framework, relating it to notions to knowledge creation, knowledge management, knowledge mobilization and decision-making within complex socio-technical systems. Snowden (1999a) commented that the Welsh word *Cynefin* translated poorly to something like ‘a familiar habitat’. In this there was something akin to Nonaka’s concept of *Ba*, for providing a common space for relationships to develop and for advancing knowledge, both individual and collective (see Section 2.2.2.1). Snowden drew attention to the difference between the two concepts, describing the *Cynefin* model as a phenomenological framework, in which emphasis has been placed on “how people perceive and make sense of situations in order to make decisions” (Kurtz & Snowden, 2003, p. 470). The *Cynefin* framework allowed “shared understandings to emerge through the multiple discourses of the decision-making group” (Kurtz & Snowden, 2003, p. 468), it

[linked] a community into its shared history – or histories – in a way that paradoxically both [limited] the perception of that community while enabling an instinctive and intuitive ability to adapt to conditions of profound uncertainty. ... Critically it [emphasized] that we never start from a zero base when we design a knowledge system, all players in that system come with the baggage, positive and negative derived from multiple histories. (Snowden, 2002a, p. 104).

The *Cynefin* framework’s acknowledgement of the natural presence of diversity, ambiguity and paradox within human communities was represented by four open spaces or knowledge domains and a fifth central domain. These have been described in the following paragraph and represented diagrammatically in Figure 3-19 which draws on

representations of this framework published by Snowden (1999a, p. 2; 2002a, p. 104). Each of the four knowledge domains of the *Cynefin* framework focused on a particular set of situational dynamics, each of which impacted on how consensus for making sense of and making decisions in certain and uncertain conditions could be reached (Kurtz & Snowden, 2003, p. 468). The two lower domains were in public view, whereas the two upper domains were situated in the comparatively invisible, private space inhabited by expert workers in a particular field.

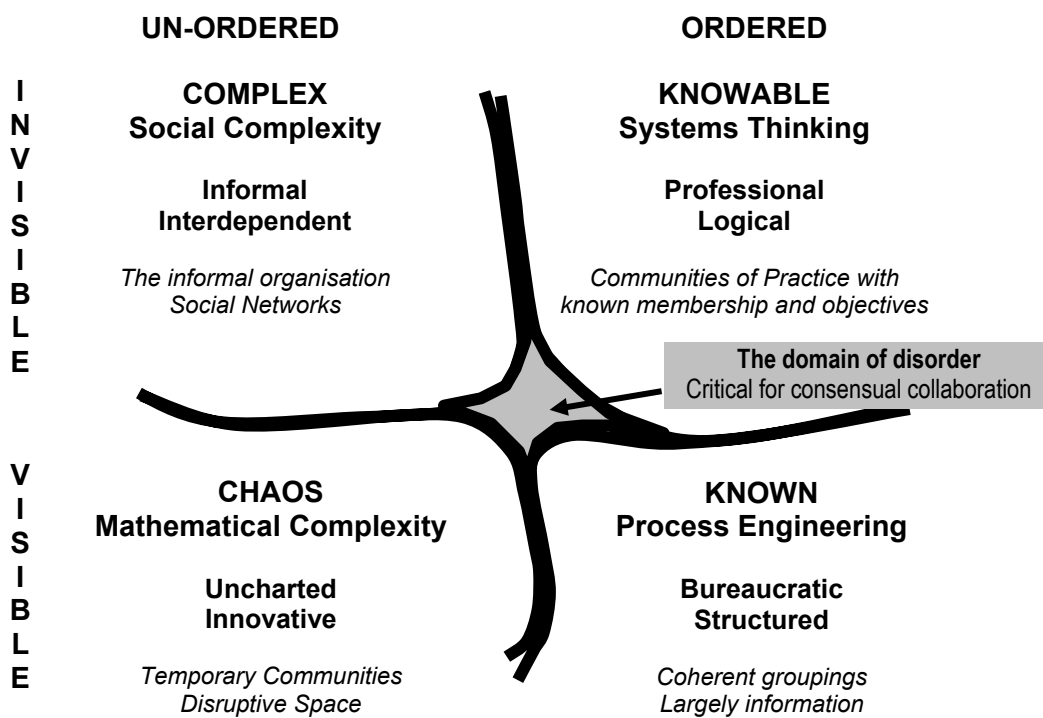


Figure 3-19: The Cynefin framework of knowledge domains for common sense-making

The two domains on the right hand side of Figure 3-19 possessed directed order, that is, starting from the current situation, there were series of steps existed that could be followed in order to reach a desired outcome or endstate (Snowden & Stanbridge, 2004, p. 143). Cause and effect relationships were either knowable or known in these ordered domains. The two other domains, on the left hand side of Figure 3-19, exhibited emergent order, that is, order that was neither controlled nor directed. Kurtz and Snowden (2003, p. 465) used the term ‘un-ordered’ to describe the emergent ordered domains where the presence of patterns was often detected retrospectively . They pointed out that in this way things could

be “both ordered and un-ordered at once, because in reality order and un-order intertwine and interact” (p. 466). As in all models, the separation between order and un-order was artificial but served to assist understanding the dynamics of each of the four domains and promote understanding of the contexts in which sensible decisions had to be made.

Subsequently, the framework’s purpose was

to enable sense-making by increasing the awareness of borders and triggering with a border transition a different model of decision making, leadership or community. [The framework] argued strongly against single or idealised models, instead focusing on diversity as the key to adaptability. (Snowden, 2002a, p. 107)

The focus of the *Cynefin* framework was not on the unmanageability of unordered contexts and their lack of predictable order, but on what had to be managed: on managing the movement from current to desired situations via a series of steps in the ordered domain; on identifying starting conditions for desirable patterns in un-ordered domains (Snowden & Stanbridge, 2004, pp. 143-4). In short, sense-making and decision making depended on the nature of the domain in which the decision maker was working.

Snowden noted that understanding the role of a fifth central domain, the domain of disorder, was critical for achieving consensual collaboration between decision-makers who are working in a rapidly and constantly changing world. The writings of Snowden (Snowden, 1999a, 1999b, 2000, 2002a, 2002b; 2005), Kurtz and Snowden (2003), and Snowden and Stanbridge (2004) have been drawn on to provide the further details of the *Cynefin* domains in the following sections because of the use of the *Cynefin* framework in the interpretation and theory building in Chapters Six and Eight.

3.4.2.1 The ordered domains of the Cynefin framework

Thinking based on the assumption of order in a system presupposed that there were empirically verifiable general rules or hypotheses to generate a growing body of reliable knowledge in which the whole was the sum of its parts. Cause and effect relationships had been or could be discovered. Such order allowed a focus on efficiency and the use of a reductionist approach to problem solving. In the ordered domains, linear cause and effect relationships were either known or knowable to the collective, e.g. a society or organisation, not just an individual person. There were strong connections between a central director and others who worked in these domains; such connections could take the form of structures, procedures, forms, or expectations.

In the ‘known’ domain, a repeatable linearity and the robustness of production meant that predictive models could be created and the constraints of best practice reasonably accepted as a means of ensuring consistency and efficiency. In such structured contexts, decision makers examined and categorised a situation before responding in accordance with the predetermined practice set out by policies, procedures and controls. The context was structured and bureaucratic. Connections between those working in this domain were weak. Clarity of communication depended on language which was explicit and understood by all. Transfer of existing knowledge was through training.

In the ‘knowable’ domain, stable but complicated chains of cause and effect relationships were difficult but not impossible to understand. Given time and resources, all such relationships could be transferred from the knowable to the known but, until they were, a community of expert advisors and decision makers had a trusted role in making decisions. It was they who experimented, investigated, identified and stabilised cause-effect relationships through their research. It was experts who examined and analysed a situation to develop a response based simultaneously on the extent and limitations of their expert knowledge. As connections between the experts working in this domain were strong, the context was that of a community of practising experts who had acquired specialist, often abstract, knowledge over a considerable period of time. Such knowledge was discussed in the specialised language of the area and was not easily comprehended by the non-expert. Systems thinking was an appropriate way of making sense of the relatively stable systems of this context.

3.4.2.2 The un-ordered domains of the Cynefin framework

Kurtz and Snowden (2003) described the acknowledged reliance on elements such as ‘inspired leadership’ and ‘gut feel’ as indicators of the existence of un-order and the need for a different, more appropriate way of dealing such un-order. In the un-ordered domains, there was no central direction; connections to a centre were weak and lacked structure. Kurtz and Snowden noted that interventions in problem situations in the un-ordered domains were diagnostic, primarily directed towards gauging a response and searching for an inherent pattern which might enable sense to be made of the un-order; the whole was never the sum of its parts. The ‘un-ordered’ domains were either chaotic in which there was no perceivable organisation of knowledge or behaviour, or complex in which “patterns [emerged] through the interaction of many agents” (p. 469).

The 'chaos' domain was turbulent with no perceivable cause and effect relations. In this domain, there was no time to investigate; rather there was a need for immediate action to reduce the turbulence, a sense of urgency. Careful monitoring of the reaction to those actions enabled detection of the response and decisions to be made regarding further intervention. Connections between those working in this domain were weak. Actions could be single and authoritarian, an attempt to control the chaos and transform the context to that of the 'known' through the imposition of order on chaos. Alternatively, intervention could take the form of multiple interventions that were directed towards creating and identifying new patterns, thereby moving the context from the chaotic to the complex. Whilst uncomfortable, chaos was a source of new possibilities and innovation.

The 'complex' domain was where the multitude of relationships between numerous interacting agents defied categorisation using analytical techniques. Rather, as elements of complex adaptive systems, the patterns of the relationships between interacting agents became visible in hindsight, a phenomenon which Kurtz and Snowden (2003) called "retrospective coherence" (p. 469). Patterns emerged, seemed to stabilize and head towards predictability but then slipped away as different patterns surfaced and (almost) established themselves. An analogy could be found in the image of waves rolling onto a beach where the exact values for the wave height and frequency are never quite predictable. Kurtz and Snowden suggested that the best approach to this complex context was for decision makers from multiple perspectives to "create probes to make the patterns or potential patterns more visible before [taking] any action. ... [to] then sense those patterns and respond" (p. 469). Desirable patterns could be stabilized, undesirable ones destabilized and more probes used to seed the space encourage the emergence of new patterns. Patience supported by time and resources, was required because "this [was] the time to 'stand still' (but pay attention) and gain new perspective on the situation rather than 'run for your life'" (p. 469). Strong connections between those working in the complex domain emerged as a result of repeated interaction, mutual goals and experiences. Such connections could also resist change. The notions of pattern finding and stabilisation, the movement from a private, exploratory space to a public one was consistent with the research data and has been incorporated in the discussion of the expanding expertise of anti-doping scientists in Chapter Six (see Section 6.5.2) and to the discussion of the complex evolving context of international anti-doping work in Chapter Eight. As noted previously, these notions also resonated with those of the concept of knotworking in

activity theory (see Section 3.2.3.3) and the sharing of ideas within a community of practice (see Section 3.3.1.2).

3.4.2.3 *The domain of disorder*

Kurtz and Snowden (2003) believed that the domain of disorder, the central domain in the *Cynefin* framework, is “critical to understanding conflict among decision makers looking at the same situation from different points of view” (p. 469). Based on their experience, they observed that users of the *Cynefin* framework found it easy to agree on the meaning of the extremes of the four open domains in their particular organisational setting, but disagreed on the meaning of the central space. Kurtz and Snowden commented that

individuals [competed] to interpret the central space on the basis of their preference for action. Those most comfortable with stable order [sought] to create or enforce rules; experts [sought] to conduct research and accumulate data; politicians [sought] to increase the number and range of their contacts; and finally, the dictators, eager to take advantage of a chaotic situation, [sought] absolute control. The stronger the importance of the issue, the more people [seemed] to pull it towards the domain where they [felt] most empowered by their individual capabilities and perspectives. (Kurtz & Snowden, 2003, p. 470)

Kurtz and Snowden (2003) found that effective decision-making based on sense-making required the resolution of conflict resulting from these differences. They stated that the reduction in size of the domain of disorder was dependent on the achievement of consensus amongst decision makers as to the nature of the situation and the most appropriate response for such a context. Kurtz and Snowden described a number of methods aimed at achieving such consensus amongst decision makers regarding contextualisation including the use of the narrative database, convergence methods, and the generation of alternative histories. Such consensus reaching was also reminiscent of the development of a shared object through the discourse of the negotiated knotworking of third generation activity theory described in Section 3.2.3.3. The methods described by Kurtz and Snowden provided avenues through which decision makers could recognise and respect the different perspectives of multiple stakeholders and acknowledge the contradictions between the diverse interpretations of the multiple objects of different activity systems.

Kurtz and Snowden (2003) described the forces of the past as leading to the emergence, stabilization and ordering of ideas until those ideas become part of the everyday ritual. At

the same time, the forces of the future countered those of the past through obsolescence and forgetfulness, through the curiosity and energy of new generations, the questioning of the current order of things and the arrival of a new challenge. The pressure of the past and the demands of the future collide in the complexity of the present. Dealing with these clashes is part of the rhythm of existence. However, describing and managing that rhythm demanded an ability to “take a bird’s eye view” of events. An example of the way in which the *Cynefin* framework provided this view is presented in the next section.

3.4.3 An example of the application of the *Cynefin* framework

The 2003 outbreak of Sudden Acute Respiratory Syndrome (SARS), a highly contagious, bird influenza virus which had transferred to humans, presented an urgent and complex global threat. When the *Cynefin* framework is applied to this context, a deeper understanding of the World Health Organization’s response can be reached. The following paragraphs present such an analysis based on data from the internet and popular media

Faced with the prospect of a global SARS pandemic, the World Health Organization tackled the chaotic situation apparent in the outbreak of this new and highly contagious disease decisively through its Global Outbreak Alert and Response Network (GOARN) (World Health Organization, 2006). GOARN’s immediate visible efforts were directed towards assisting countries with their contagious disease control efforts by ensuring rapid and appropriate technical support in affected areas. In spite of an initial resistance due to lack of cooperation by bureaucratic elements of the Chinese government, order was imposed on the chaotic situation surrounding the new disease of SARS and the situation moved directly from the chaotic domain of unknown disease outbreak to the known domain of disease control with its standardized, well-established procedures and practices. At the same time, experts with relevant expertise set to work in the complex domain to learn about the disease and how to deal with it on a long term basis. These experts were given the resources to address the less visible technical aspects of the disease itself by carrying out research in which they explored the consequences of particular interventions in the hope of identifying patterns which would lead to long-term solutions such as a SARS vaccine that could lead to disease control through the implementation of an immunisation programme. Such research and development was carried out away from the public gaze and would take much longer than the implementation of known strategies for the containment of contagious diseases. As experts gradually deciphered the emergent

patterns, sense could be made of the chaotic context that SARS had presented. There would be movement towards the knowable. As more patterns emerged and were stabilised, experts would develop an understanding of the linear linkages surrounding the virus. This would allow further movement to the knowable and finally to the known domain of cause and effect relationships where standard solutions to deal with SARS would routinely be implemented. This process is represented in Figure 3-20.

Whilst lessons learnt from this experience can be transferred by GOARN to future contexts by health workers, there is also room for learning by the use of the *Cynefin* framework to understand other contexts such as that of this research.

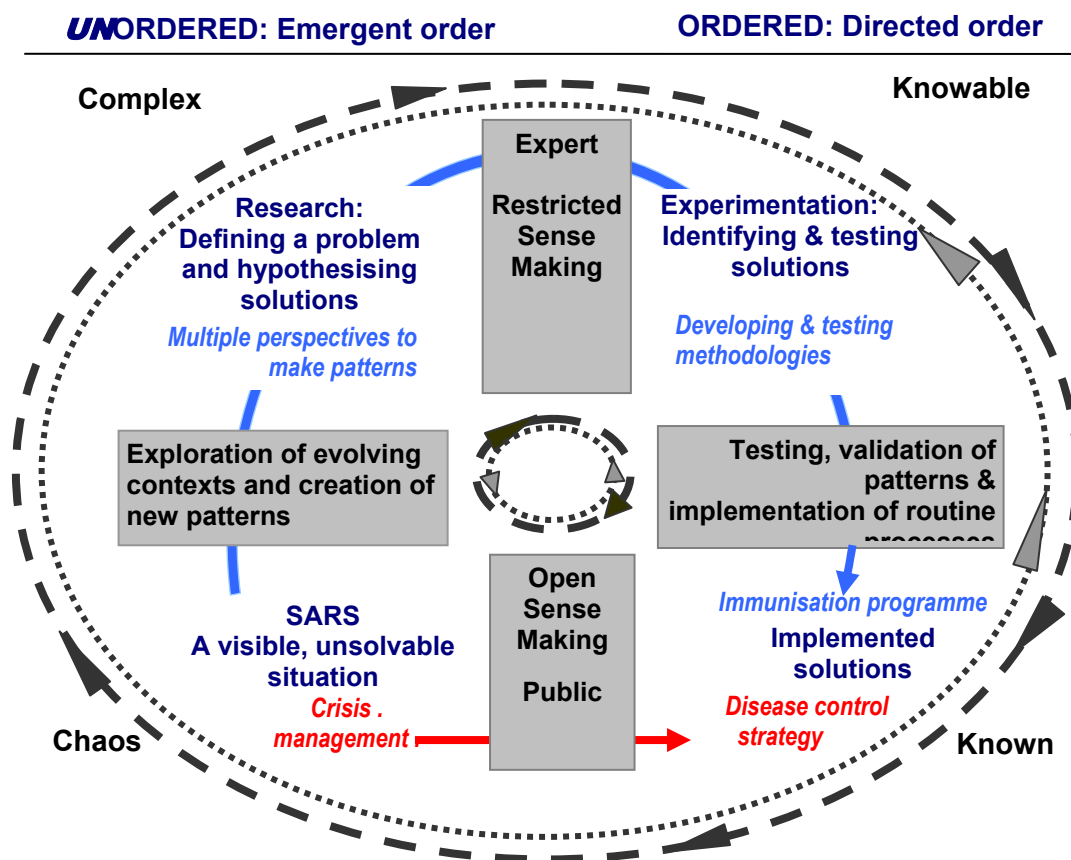


Figure 3-20: The World Health Organisation's Epidemic and Pandemic Alert and Response to SARS represented using the *Cynefin* framework

3.5 SUMMARY

The theoretical frameworks described in the previous sections provided a variety of lenses with which to examine, and the language with which to discuss, the work of anti-doping scientific experts and how those experts maintain their expertise in the global public sector. Additionally, these frameworks proved useful in understanding the evolving complex

context in which the work of these experts takes place. As noted throughout this chapter, the contribution of each framework in understanding the dynamics of expert work will become apparent as the research results are presented in Chapters Five through Eight. It is worth noting that the accessibility of the communities of practice framework recommended its use by the researcher as a research tool to provoke deeper reflection by attendees at the 2004 Cologne Workshop on the nature of their own community. At this stage, an overview of the role of the frameworks in the analysis and interpretation of data to answer the questions posed by this research has been provided in Table 3-3.

Before answering the research questions, the design of the research has been described in the following chapter.

Table 3-3: Role of the theoretical frameworks in analysis and interpretation

Broad research question	Activity Theory	Communities of Practice	<i>Cynefin</i> framework
What are the dynamics of expert work?	<p>Consideration of expert activity as involving an individual / collective subject;</p> <p>the tools experts use to achieve an evolving, multi-faceted object;</p> <p>the community to which experts belong</p> <p>the rules experts abide by as they work within community</p> <p>the division of labour within a community set in a complex evolving context</p> <p>the nature of the object of activity</p>	<p>Consideration of becoming as expert as being a peripheral member of a group whose members' expertise matches that desired by the individual</p> <p>being an expert as participating personally and professionally in developing a common complex practice</p> <p>a community that was developing its practice, particularly through access to a trusted, shared space</p> <p>a community that was managing its external boundary to meet its clients' needs</p> <p>a professional association in terms of degrees of involvement in a community of practice</p>	<p>Consideration of experts as working in between the invisible complex and complicated domains where specialist knowledge enables the generation of cause-effect relationships from patterns identified retrospectively in the complex domain</p> <p>sense-making in visible and invisible contexts and in the domain of disorder</p>
How do experts maintain their expertise?	<p>Consideration of a community event as an activity system</p> <p>resolutions of tensions in an activity through expansion to a new form of activity</p> <p>knotworking for crossing a collective zone of proximal development to co-construct a new (shared) object</p>	<p>Consideration of these experts as</p> <p>Bettering their expertise through participating in a with others in the development and stewarding of a common practice</p>	<p>Seeding and retrospectively identifying previously unrecognised emergent patterns in complex contexts to create new, though at times tentative, knowledge</p>
How do stakeholders perceive the work of experts?	<p>Consideration of the need to expansively visibilise the activity to better meet the needs of the community through adjusting the elements of the activity.</p>	<p>Consideration of the need to transform the practice to ensure its continued relevance for the broader community</p>	<p>Supporting sense-making in diverse contexts</p>

Chapter 4 THE RESEARCH DESIGN

“The hardest thing to see is what is in front of your eyes.”

Goethe in Janesick (1994, p. 217)

4.1 INTRODUCTION

As the means by which individuals answer questions about “the form and nature of reality ... the relationship between the ... would-be knower and what can be known...” (Guba & Lincoln, 1994, p. 108) and about how the would-be knower “can go about finding out whatever he or she believes can be known” (p. 108), research is a powerful means of seeing what is in front of your eyes. The research design is a key aspect of this power. This research aimed to make visible the dynamics of the work of experts through finding out how both the experts and their stakeholders perceived that work. It also aimed to find out how those experts maintained their expertise and to build a model of expert work grounded in the evolving international context of the early 21st century.

In this chapter, the design of the qualitative study conducted over the years 2002-2006 and directed towards these aims has been presented. The feasibility of the research and the design of the subsequent research were facilitated by the conduct of the pilot study reported early in this chapter. To better meet the demands of the research context, the design for the major part of the research integrated three qualitative research methods, namely the case study (Eisenhardt, 1989), grounded theory (Fernández, 2004b; B. Glaser, with the assistance of Judith Holton, 2004; Strauss & Corbin, 1994) and the activity-theory based developmental work research method (Engeström, 1991; Y. Engeström, 2005a). Drawing on Fernández’s approach to grounded theory research, explained in Section 4.5, the theoretical frameworks described in the previous chapter (activity theory, communities of practice and complex systems) were used for theory building throughout the study. Their incorporation into the research supported what Strauss and Corbin (1998) described as the probing, theoretical questioning of data and the discovery of concepts and their relationships.

The chapter about the design of this research begins with a section framing the research in the context of the researcher’s cultural history, leading to the refinement of the research questions. Subsequent sections contain a description of the pilot study, the research

methods integrated into the research, the overall plan of the research and its timeline, as well as details of the methodologies used to collect, analyse and interpret the research data. The prospect of publication of the study's findings contributed to the need for establishing and honouring a trusted relationship between the study participants and the researcher. As has been described in later chapters, this relationship enabled the co-construction of an understanding by the participants and the researcher about the context in which the experts worked as well as a grounded model for the dynamics of the work of these experts. The manner in which this relationship was built has been included in this chapter.

4.2 DISCOVERING THE RESEARCH

The personal nature of the genesis of this research has been reflected by the use of the first person in much of this section which sets out the process that led to the statement of the research questions, as well as in later sections of this chapter.

Research is an engaging activity, one in which a researcher's motivation facilitates commitment to finding an answer to a question that has evolved from the researcher's own interests, that is from her/his own socio-cultural perspective. The design of this research followed from my belief that individuals live in complex social worlds and have unique worldviews that are shaped by the ongoing development of their individual social and cultural histories.

In Chapter Two, the three questions that were the kernel of this research were posed:

1. What are the dynamics of the work of experts?
2. How do experts maintain their expertise?
3. How do stakeholders perceive the work of experts?

These questions evolved from my own socio-cultural history as a Science graduate, as an experienced educator interested in learning and as a supervisor of practicum periods that promoted the professional development of university undergraduates, and as the wife of a scientist who had worked in a number of specialist research areas and as a citizen of an increasingly global society. The questions also grew from my recognition that new forms of work incorporating technology were evolving as both living and work places become increasingly global and fast-paced. Accompanying this rapid change were internationally shared issues that called for the combined efforts of international scientific and technical experts and general workers (those without such scientific and/or technical expertise but

with other knowledge and skills) if they were to be resolved – the example of the SARS epidemic of early 2003 was presented in Section 3.4.3. The time was also right for me to articulate and commit to answering a research question as my life circumstances had changed to afford both the energy and time for higher degree research study. Such study demanded a research topic – one that was personally engaging.

My broad interest in professional development and transition to work of undergraduate students led to my original choice of topic. Initial reading (Boud & Walker, 1991; Michael Cole, 1996; Denzin & Lincoln, 1994; Engeström, 1987; Gaines, 1995; Lave & Wenger, 1991), questioning and reflection led to broad questions about how established professionals become and stay experts in their specific field, particularly when knowledge is constantly growing. These questions captured my interest. As further investigation of the literature located few relevant writings about experts and what they do, I had identified another area for my doctoral research: investigating about how people become and stay experts in a particular field. To carry out this research I would need to access amenable “groups, settings, and individuals where (and for whom) the processes being studied are most likely to occur” (Denzin & Lincoln, 1994, p. 202). I therefore flagged the use of a case study approach in this research and began thinking about the case as well as the need for a pilot study in that field to establish the feasibility of the research.

My own interests in science, in the education of aspiring professionals, in scientific knowledge and its relevance for the general population, assisted the process of narrowing down the field to a scientific one. In some early reading I had discovered that UNESCO was concerned about the interaction of science and society and had convened the 1999 World Conference on Science as a platform for

extensive discussion leading to a new ‘social contract’ for science as we enter the twenty-first century. The participants analysed where the natural sciences stand today and where they are heading, what their social impact has been and what society expects from them. They also established what efforts should be invested to make science advance in response to both these expectations and the challenges posed by human and social development. (UNESCO, 2000, Overview / Outcome, par. 2)

Further reading about social science studies of other scientific communities (Charlesworth, Farrall, Stokes, & Turnbull, 1989; Lach et al., 2003; Merton, 1968; Steel, Lach, List, & Shindler, 2001) also served to whet my interest in carrying out qualitative social research into the dynamics of the work of a high profile group of scientists involved in meeting one

of our global society's challenges. This was reinforced by the steady stream of science related items of the radio and television. I decided that in an increasingly global society, I would find it interesting if the experts participating in my study worked in a single field at both national and international levels.

These considerations led to the reframing of my research questions in the context of the work of internationally recognised scientists who were regarded as experts in their field:

1. What perceptions do scientific experts hold about their work?
2. How do scientific experts in a field maintain their expertise?
3. What perceptions do stakeholders hold about the work of the scientific experts with whom they share an endeavour?

Further reflection led to concerns about the possible restricted access to research data as a result of the confines of commercial confidentiality. These concerns guided my decision to investigate the work of scientists who were involved in the visible non-for-profit sector rather than those working in commercial or invisible government contexts. As experts in their particular field, the scientists in my study would work in an evolving context, one that was obviously undergoing transformation. As established professionals in their field, these scientists would have developed techniques for maintaining their expertise. Such techniques would be part of the dynamics of their work. Their work would be subject to scrutiny by the broader community including other scientists, to general workers in the other organisations working in their area and to interested members of the public.

As my research project was the basis of my doctoral work, the case had to suit the expectations of, and timeframes set out for, doctoral research. To facilitate my research, the expert group which I chose to investigate had to be of a manageable size, and have members who were identified publicly and hence could be contacted easily. The pilot study would give an indication of whether or not the chosen group of scientific experts would agree to participate in the research in sufficient numbers for the research to be viable. The next step was to identify a group of scientists who, as the internationally recognised as the experts in their field, could be asked the questions listed above in the context of their own field: a case study (Eisenhardt, 1989; Yin, 1994).

My interest in forensic science had been contributed to by my reading of fictional books by authors such as Patricia Cornwell (1990; 1991; 2004) and television shows such as CBS's 'Crime Scene Investigation' and the British Broadcasting Corporation's 'Silent Witness'.

The high profile media status of doping in sport made visible the work of the 25 globally dispersed, sports doping control laboratories accredited by the International Olympic Committee. This small group of specialised forensic laboratories suited the needs of my research and were my first choice as the case. The directors were accredited experts in their field. Information about each of the laboratories including the contact details for each of the laboratory directors was listed on the International Olympic Committee's website making it easy to identify and contact each director to seek their participant in the research (Appendix A-1). Before undertaking pilot study with a subset of the 25 directors to establish the feasibility of the research, or lack thereof, I reframed my research questions in the light of the context of the scientific directors of accredited sports doping control laboratories:

1. What perceptions do the scientific directors of accredited doping control laboratories hold about their work?
2. How do the scientific directors maintain their expertise?
3. What perceptions do other stakeholders involved in anti-doping work in sport hold about the work of the scientific directors of accredited doping control laboratories?

Not only would the pilot study ascertain the amenability of a small group of the directors towards the research, it would support the design of the main study and the development of suitable instruments for research in the global context in which the directors worked.

The use of the qualitative case method to answer the research questions stated above, would allow me to develop an understanding of the work of this particular group of experts. My desire to generate substantive theory about the work of scientific experts who labour in this and other socio-technical contexts demanded the use of an additional research method, namely that of grounded theory (B. Glaser, 2002; Strauss & Corbin, 1994, 1998).

Building trust between the researcher and the study participants would be an important aspect of research in such a high-profile context. To support this aim, I decided to build into the research a mechanism whereby participants would be provided with the opportunity to comment upon and where appropriate to make amendments to my research notes and interpretation of the research data. This would also result in a co-constructed understanding of the dynamics of the work of these experts. I found that the activity theory based developmental work research (DWR) method incorporated this double stimulation approach, referring to it as mirroring. Given the globally dispersed context for this research, no physical change laboratory existed and alternative approaches were found

to enable mirroring. These have been discussed in Section 4.6.7. Use of the grounded theory method would ensure that the findings and subsequent model were based firmly on understandings shared by the participants and myself as researcher. The case, grounded theory and developmental work research methods as well as a discussion of their integration in this research have been presented Section 4.5.

Before launching into the research, I applied for and obtained ethics approval for my research into the dynamics of the high-profile work of expert scientists in sports doping control. Recognising the probable concerns of the directors about the need for anonymity and confidentiality, I reflected on the means by which the confidentiality of participants and bias would be addressed conscientiously and consistently. At all times throughout the research, I would ensure that I maintained the confidentiality of the participants in my study. Data would be stored under lock and key or on a password protected computer. Documentation relating to the ethics approval for the research is contained in Appendix B.

My research proposal was accepted by the Faculty of Arts and Sciences late in 2002 and as is the manner of all doctoral research, I enthusiastically and somewhat naively set about the research that would answer my questions. The reality of how I did this is described in the following sections, beginning with a description of the pilot study. In the context of this research, this study was indeed a means of making visible to researcher, participants and the wider community what seemed invisible but was in fact before their eyes. Like other qualitative researchers including Schwandt (1994), I watched, listened, asked, recorded and examined and then reported upon the everyday life world I investigated. In doing so, the emerging co-constructions of the participants and myself as researcher provided windows for reflection, improved understanding, evaluation and judgement not only of the work of experts but also of my own practice as a researcher, an educator and a learner. Perhaps, as Kincheloe and McLaren (1994) suggested, the research process has also provided such opportunities for participants.

4.3 STUDY SETTING, POPULATION AND PARTICIPATION

As stated in the previous section, subject to the establishment of its feasibility in a pilot study, the work of the scientific directors of the 25 laboratories accredited by the International Olympic Committee (IOC) for doping control work had been identified as the context for this research. For the purposes of this research, the accreditation process

identified the directors of each of these laboratories as experts in the specialist area of forensic science that dealt with the detection of performance enhancing substances whose use by athletes was banned. Each of the laboratories was assessed annually to determine whether or not their work remained of an adequate standard to maintain their accreditation for a further twelve months. As experts in the field, the directors of these accredited laboratories were expected to oversee both the routine and research work of the accredited laboratories. In the course of their work, these expert scientists also interacted with many stakeholders in other professions.

Recruiting people to participate in research can be difficult at the best of times but more critical when the population for a research project is small, its members are located around the world, often speak languages other than English as their first language and the researcher's only language. However, as English is the language of international cooperation it was the sole language used in this research. Nonetheless, the language of the research may have restricted participation in the research.

The small number (25) of scientific directors of accredited laboratories limited the population size and meant that all scientific directors would be asked to participate in the study although, as was expected, not all scientific directors agreed to participate. Email requests were sent to approximately one third (8) of the scientific directors requesting their participation in the pilot study described below in Section 4.3. The remaining 17 directors, were contacted a number of months later to seek their participation in the main study, as were representatives of the stakeholder groups identified by directors who had participated in the pilot study.

The laboratories and hence the scientific directors were dispersed around the world with 5 scientific directors in Asia (Bangkok, Beijing, Penang, Seoul, Tokyo), 2 in northern America (Los Angeles, Montreal), 1 in Australia (Sydney), 1 in Africa (Bloemfontein) and the remainder in Europe. Four of the 25 scientific directors were female. As stated previously, the contact details on the IOC's website indicated that organizational contexts of the laboratories differed. Some laboratories were part of a university; some were part of a hospital whilst others were part of a government institution or a government institution in their own right.

Stakeholder participation in the research was drawn from groups that were identified in the pilot study as groups that interacted with the scientific directors about anti-doping matters.

Consequently, stakeholders were drawn from a number of professions including general anti-doping practitioners who worked in anti-doping agencies, from representatives of sporting organizations, sports physicians, sports lawyers, interested members of the public and journalists, as well as coaches and athletes. Once again, contact details for prospective participants were obtained from the internet and the request for participation made by email. Where possible, contacts were made with both Australian and overseas representatives of each stakeholder group. Athletes proved to be the only stakeholder group from which there was no response, either positive or negative. In this instance, indirect contact through an athletes' representative was also attempted but to no avail. Perhaps it may have had something to do with 2004 being a year in which the Summer Olympics were held.

Twenty eight (28) stakeholders from diverse locations and with diverse roles in anti-doping work participated in the research. (See Table 4-1 and Table 4-2). Some participants reported that they carried out multiple roles. For example, a stakeholder might be both a sports physician and a medical officer advising a sporting organisation on doping control matters.

Table 4-1: Study participant role experiences and affiliations

Participant affiliation / role	Number of Study Participants (Some participants had multiple affiliations)
Scientific Directors	15
Pilot only: 2	
Pilot and Interview: 2	
Interview only: 8	
Survey only: 2	
Survey and Interview: 1	
Anti-doping agency employees (National & international)	13
Sporting organization officer including national and international Olympic committees	15
Sports physicians	5
Lawyers	3
Interested members of the public	7
Coaches or athletes	7
External scientists	6
Internal scientists	5

In all, 43 directors and stakeholders from various parts of the world participated in the research, demonstrating that both the context and the research were truly international in their scope.

Table 4-2: Geographical dispersion of study participants

Region	Number of Participants
Northern Europe	8
Southern Europe and Africa	7
Americas	9
Asia and Oceania	19
Total	43

As stated above, the feasibility of the study was explored through a pilot study conducted late in 2002 – early 2003. This pilot study and its outcomes have been described in the next section.

4.4 THE PILOT STUDY

Janesick (1994) wrote that a pilot study enabled a researcher to consider issues related to the research design “before devoting oneself to the arduous and significant time commitment of a qualitative study” (p. 213). In this research, a pilot study was the means used to assess the feasibility of an investigation that needed to engage expert scientists in the high-profile context of anti-doping work as participants. Later sections have reported the use of the pilot study to assist the development of effective communication patterns and to design the interview schedule for use in the main study.

As noted previously, a pilot study was conducted in late 2002 – early 2003. This undertaking established the feasibility of this research by succeeding in recruiting a viable number of participants and generating data that led to the identification of the initial conceptual categories. The pilot study also supported decision-making about the design of the remainder of the research study. A description of the pilot study has been given in the following sub-sections, beginning with an overview of the data collection.

4.4.1 Data collection

The pilot study took the form of a survey whose data was analysed to identify common elements for investigation in the main research. Eight of the 25 scientific directors of accredited doping control laboratories from a selection English-speaking and non-English speaking nations were contacted by email and asked to participate in the study by completing a short survey, delivered as an MS-Word document attached to an email. Four

of the eight directors agreed to participate. The experience of encouraging both participation and the return of completed surveys from those directors who agreed to participate in the study led to the design of a protocol eliciting participation in the main study. Samples of correspondence relating to the pilot study have been presented in Appendix C.

The pilot study survey consisted of closed demographic and open ended questions. The two demographic questions related to the length of time the director had been working in the area and the institutional environment in which their laboratory was located. Open ended questions sought data about the enjoyable, unenjoyable and problematic aspects of their work. The survey also collected data about the groups with which these scientific directors communicated as well as how they maintained their laboratory's expertise and shared their research outcomes. Pilot study participants were also asked to comment on any other aspect of their work and to suggest other questions which could be asked of future participants. A copy of the pilot study survey has been placed in Appendix D.

4.4.2 Data analysis

Participants in the pilot study returned their completed surveys as attachments to an email. The data from the pilot study survey was analysed using the processes described in Section 4.6.2 (p. 114) and Figure 4-5 (p. 107), namely data display, reflection on and subsequent coding of data into conceptual categories described below. The responses to the open-ended questions in the pilot study survey data were collated in a table to facilitate the recognition, ordering, comparison and contrasting of descriptive elements in the text. This assisted the identification of conceptual categories within the data. These categories were also used to design the data collection instruments in the main study (see Section 4.6.3 on p. 116 and Section 4.6.2 on p. 114).

The pilot study data indicated that the work of the scientific directors of accredited doping control laboratories focussed on three main areas:

- doing the technical routine forensic analyses to produce results for doping control programs
- maintaining technical expertise through keeping up with current and generating new knowledge, and
- being involved in anti-doping decision-making and policy development.

This initial analysis of the pilot study data about the work of the directors indicated that it occurred in an evolving complex socio-technical context. To develop theory about this context, content analysis would need the support of suitable theoretical frameworks to ensure the asking of “probing questions that stimulated the discovery of the properties, dimensions, conditions, and consequences of this context” (Strauss & Corbin, 1998, p. 66). With the goal of a sophisticated interrogation of the pilot data in mind, activity theory was used to interpretation of the findings of the pilot study. Activity theory was thus the first framework to be incorporated into the research. It informed the coding and the generation of the overarching themes identified in the pilot study. As indicated in Chapters Two and Three, the frameworks of communities of practice and the complexity theory based *Cynefin* framework also became part of this theoretical data stream and were used later in the research. The incorporation of the literature as a data stream into the grounded theory method has been further discussed in Section 4.5.2 on page.98.

This additional cycle of theoretically informed analysis resulted in the initial modelling of the work of the scientific directors as an activity system. This interpretation has been explained in the next section.

4.4.3 Findings: The activity of being a scientific director

As stated in the previous section, the analysis of the pilot study data identified technical and social aspects of the directors’ work. In carrying out their duties, the directors referred to their reliance on their own and other laboratory-based scientific knowledge, the sophisticated laboratory instruments they used, as well as the information and communication technologies that facilitated their access to the external knowledge which helped them keep abreast of the changing field within which they worked. The data also provided information about the organisational context within which each of the accredited doping control laboratories operated. The directors who participated in the pilot study provided some particulars of the conventions and rules that govern their work, the stakeholders with whom they come in contact in the course of their work and how the various aspects of anti-doping work are carried out. The data also pointed to the complexity of the socio-technical context within which the directors worked. Drawing on Engeström’s (1987) triangular representation of an activity system described in Section 3.2.1, Figure 4-1 highlights various aspects of the directors’ work by representing it as an activity system. These aspects have been explained in the following paragraphs.

In Figure 4-1 the scientific directors collectively have been identified as the subject of the activity system. The object of their activity is doing the work of a scientific director in order to bring about outcomes that provide reliable, high-quality analytical results as well as to that practice through the conduct of research. As well as these technical aspects, the directors regarded it as part of their role to provide sound advice to anti-doping program administrators, policy makers and other members of the community that constitutes this complex work context. As was described the next chapter, Chapter Three, where activity theory has been discussed at length, the object of individual activity can become a shared object as a result of interactions with a broader community. Amongst the directors of accredited anti-doping laboratories, the existence of a shared object made them the collective subject of this activity system.

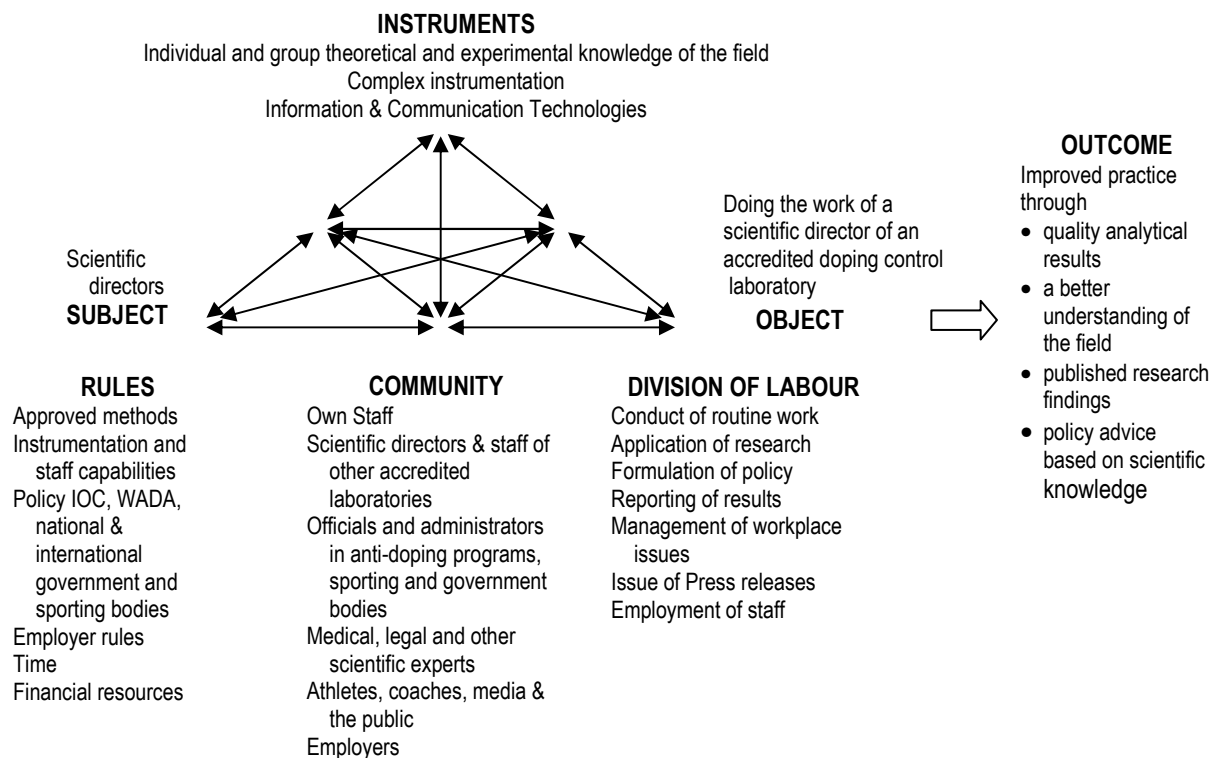


Figure 4-1: The work of the scientific directors as an activity system

The tools or instruments the scientific directors used to do their work were technical, intellectual, and social. The directors used the sophisticated scientific instrumentation in their laboratories, their own knowledge and experience together with the knowledge and experience of others in their scientific community. This knowledge may have been exchanged formally in the literature or at a conference or workshop, or informally via a casual face-to-face or telephone conversation or email correspondence. In particular, the

Manfred Donike Workshop on Doping Analyses held annually in Cologne, Germany seemed to play a role in the maintenance of the expertise – a role that would be investigated in the main study (see Section 4.6.2, p.114).

Within the context of the scientific directors' work there were many rules that had to be taken into account. These rules were concerned with the optimal usage of the equipment which was used to do the scientific work, rules that concerned the work of the staff within the laboratory, rules that external bodies such as accrediting bodies or government anti-doping agencies placed on the laboratory work, rules relating to the publication of scientific research as well as the pressure of time and limited financial resources. As the general work of combating drug abuse by athletes was multifaceted, the various members of the anti-doping community divided this labour between the different roles they performed. The scientists' role was to improve anti-doping practice through the conduct of routine testing, research into anti-doping science and at times, advising other anti-doping workers. According to the pilot study data, the directors' also communicated with groups that carried out non-scientific, or general roles in anti-doping work including those working in:

- testing authorities such as the International and National Olympic Committees, the World and National Anti-Doping Agencies, International and National Sports organizations, major sporting event organizers that were responsible for the sample collection and transport and for the management of the test results
- policy making bodies such as national governments, International and National Olympic Committees, the World and National Anti-Doping Agencies, International and National Sports organizations that developed policies regarding the abuse of performance enhancing substances by athletes
- employing bodies such as governments, universities or companies that had an accredited doping control laboratory as part of their organization and thus interacted with the laboratory on workplace issues such as staffing and equipment
- the media who informed the public about issues relating to doping in sport
- sports law who carried out work associated with the legal aspects of doping in sport
- sports medicine practitioners who cared for athletes and were often involved in sporting organisations.

All these groups were connected in some way to the work of the laboratories and their scientific directors and together with the staff of the accredited laboratories formed the broader anti-doping community.

Analysis of the pilot study data had indicated that this context was an interesting one for this research into the dynamics of expert work. However, the processes of the pilot study provided some valuable insights for design of the main study. These implications have been described in the next section.

4.4.4 Implications of the pilot study

As well as demonstrating the feasibility of this research into the dynamics of the work of the scientific directors of accredited anti-doping laboratories, the outcomes from the pilot study impacted on

- the process of recruitment of participants for the study
- the use of email in the mirroring process of developmental work research
- the identification of conceptual categories in the data through the use of theoretical frameworks to facilitate analysis of the research data and theory building
- the overall research design as the integration of case, grounded theory and developmental work research methods
- the selection of data collection techniques, including interviews, participant observation and public documentation.

The rate of participation in the pilot study - 50% of those asked to participate did so, suggested the feasibility of the expansion of the pilot into a larger research undertaking. The continuation of a participation rate of 50% of those approached to participate in the research would result in the participation of another 8 directors, resulting in the overall participation of 12 directors. Given the small population size, this combination of participants in the pilot and the main studies provided a suitable sample size for this research. With a similar participation rate, the recruitment of at least 24 stakeholders whose contact details would be obtained from the World Wide Web would not prove too onerous.

One aspect of the pilot study that proved to be a valuable lesson for the design of the main research related to the process of recruitment of participants for the research. The success of the pilot study had indicated that the use of information and communication technologies to conduct long-distance social research was feasible although not without its challenges for the researcher. One such challenge related to the lack of a response from some prospective participants. Uncertainty as to whether or not a participating director had actually received the email to which the survey had been attached highlighted the need to establish effective communication patterns by giving an indication of the return date in all

emails requiring action on the part of the participants. The experience of the pilot study also resulted in the planned use of two, polite reminder emails when participants failed to respond to an initial email. Another problem resulted when the email servers of some organisations stripped emails of MS-Word attachments to reduce the risk of computer viruses invading an institution's system. This problem was solved through the use of rich text format (rtf) files for both the survey and the Letter to Participants (see Appendix B) which set out information about the study.

The pilot study also demonstrated that email provided an effective means of first distancing participants from their data and later provoking further reflection on an emailed document which represented the researcher's visualization of their activity as part of the mirroring process of the developmental work research method.

Additionally, the pilot study pointed to the need to develop a research design that would be able to function effectively in a complex changing context. The integration of the grounded theory method with the case method had been used suggested by Eisenhardt (1989) and Fernández (2004a; 2004b). However, to deal with the apparent complexity of the changing workplace being investigated in this research, developmental work research, an activity theory based method was incorporated into the research design. These three methods and their integration have been discussed more fully in the next section.

On a more practical level, the pilot study also enabled the researcher to reflect upon the global nature of the research space, the high pressure work of those who inhabited it and on how best to elicit data for the research. Lessons learnt from the pilot study extended beyond those relating to the recruitment process to data collection techniques. Firstly, the pilot study outcomes helped with the design of the interview schedules used in the main study to elicit data about the work of the directors from both the directors and their stakeholders. The details of the data collection interview instruments have been described in Section. 4.6.3 on page 116.

The pilot study also pointed to the advantages of the researcher becoming a participant observer at the annual Manfred Donike Workshop on Doping Analyses. The researcher realized that attendance at the week long workshop would provide an opportunity to be immersed in the anti-doping scientific community and to make observations about the interactions between these scientists. Participation in the workshop would build trust between the research and the subjects of this research. It would also provide a way of

interacting with the anti-doping scientific community that could, through discussions with other workshop attendees and a presentation at the workshop, promote the co-construction of the research outcomes by both the participants and the researcher. For example, the researcher presented the preliminary, pilot study based understanding of their work to the directors as part of a “progress report” at the Manfred Donike Workshop on Doping Analyses in 2004 (Kazlauskas & Crawford, 2004c) and invited workshop participants to make comments about the presentation during the remainder of the week-long workshop.

The next section demonstrates how these pilot study outcomes, and other requirements were taken into consideration prior to and during the development of the research design for the main study.

4.5 DESIGNING THE MAIN STUDY

The aim of qualitative studies, stated Huberman and Miles (1994) was “to describe and explain (at some level) a pattern of relationships, which [could] be done only with a set of conceptually specified analytic categories” (p. 431). Subsequently, the ongoing use of the constant comparison techniques associated with analytic induction meshed well with the cyclic nature of qualitative research (repetitive data collection, reduction and analysis) because it supported the derivation of theory based on regularities uncovered by the iterative question-and answer approach of qualitative research. A number of qualitative research methods have been identified as providing particular benefits for this research namely the case, grounded theory and developmental work research methods. Combined, these methods supported the design of this research into the complex, evolving research context of international anti-doping efforts in sport. Prior to the presentation of the research design, each of the research methods integrated into this section has been provided, beginning with the case method.

4.5.1 The Case Method

As described earlier when discussing the origins of the research questions, the first design decision had been to use a case study for the research because it would support in-depth investigation of a dynamic, real-world situation, the work of the scientific directors of accredited anti-doping laboratories.

Eisenhardt (1989) described the case method as “a research strategy which [focused] on understanding the dynamics present within single settings” (p. 534). Burns (2000) asserted that

the case study [was] the preferred strategy when ‘how’, ‘who’, ‘why’ or ‘what’ questions [were] being asked, or when the investigator [had] little control over events, or when the focus [was] on a contemporary phenomenon within a real life context. (p. 460)

Burns (2000) also stated that case studies “generate rich subjective data [that could] bring to light variables, phenomena, and relationships that [deserved] more intensive investigation” (p. 460). Case studies had this ability because they provided researchers with flexibility in their choice of the research instruments they deemed most appropriate for the context under investigation. These instruments included the standard qualitative interview and participant observation methodologies.

To develop a research design that went beyond the descriptive capacity of the case method to the one with the ability to build theory in contexts undergoing change, the research required additional capabilities. Consequently, two other research methods – grounded theory and the developmental work research methods, were integrated into the research. The first of these, the grounded theory method has been described in the next section.

4.5.2 Grounded Theory Method

Dick (2001) stated that grounded theory begins with a research situation, comprehension of which the researcher develops through gathering data. Strauss and Corbin (1998) used the term ‘grounded theory’ to mean “theory that was derived from data, systematically gathered and analysed through the research process” (p.12). Analysis, they emphasised, as

the interplay between researchers and data. It is both science and art. It is science in the sense of maintaining a certain degree of rigor and by grounding analysis in data. Creativity manifests itself in the ability of researchers to aptly name categories, ask stimulating questions, make comparisons, and extract an innovative, integrated, realistic scheme from masses of unorganized raw data. ... There are procedures to help provide some standardization and rigor to the process. However, these procedures were designed not to be followed dogmatically but rather to be used creatively and flexibly by researchers as they deem appropriate. (Strauss & Corbin, , p. 13) [*Authors’ emphasis*]

Glaser (2004), with the assistance of Holton, described the product of grounded theory as

a set of carefully grounded concepts organized around a core category and integrated into hypotheses. The generated theory explains the preponderance of behaviour in a substantive area with the prime mover of this behaviour surfacing as the main concern of the primary participants. (B. Glaser, with the assistance of Judith Holton, 2004, par 41)

Glaser (2004) went on to describe the elements of grounded theory methodology as theoretical sensitivity, ongoing data collection, coding and analysis, constant comparison, theoretical sampling, treatment of the literature as another literature source, memoing, sorting and writing up. Glaser, with Holton's assistance, indicated that the essence of theoretical sensitivity was

the ability to generate concepts from data and to relate them according to normal models of theory in general, and theory development in sociology in particular ... [and that] the first step in gaining theoretical sensitivity is to enter the research setting with as few predetermined ideas as possible. (B. Glaser, with the assistance of Judith Holton, 2004, par 41)

Data collection in grounded theory research starts at the commencement of the project "with regular daily data collecting, coding and analysis" (B. Glaser, with the assistance of Judith Holton, 2004, par 44). Reinforcing Strauss and Corbin's earlier call for researcher creativity, Glaser encouraged researchers to remain "open to what is actually happening" (par 44), and to see "what will emerge conceptually by constant comparative analysis" (par 44). Glaser (2004) stated that the constant comparative method enabled "the generation of theory through systematic and explicit coding and analytic procedures" (par 53). When using this method, the researcher initially compared some incidents to other incidents in order to "establish underlying uniformity and its varying conditions" (par 53) and to generate concepts and hypotheses. Secondly, concepts were compared to other incidents "to generate new theoretical properties of the concept and more hypotheses" (par 53) leading to "theoretical elaboration, saturation and verification of concepts, densification of concepts by developing their properties and generation of further concepts" (par 53). Finally, the constant comparison of concepts established "the best fit of many choices of concepts to a set of indicators, the conceptual levels between the concepts ... and the integration into hypotheses ... which becomes the theory" (par 53).

Whilst the case study method provided a tool to study a carefully delineated real world context, and the grounded theory method supported the generation of theory, the complexity of this research would benefit from more strategies than those provided by these two methods. Furthermore, the changing nature of the context necessitated the use of

a research method that had proven ability to operate in such changing conditions. Both these needs were met by the activity theory based, developmental work research method (DWR). Whilst the theoretical underpinnings of DWR have been presented in Section 3.2.3, the practicalities of DWR and the manner in which it was adapted for this research have been described in the next section.

4.5.3 The Developmental Work Research Method

In the manner of other qualitative researchers, activity theorists have made use of standard ethnographic methods of interviews, participant observation and public documentation for their research into newly evolved and increasingly complex workspaces. In the relatively recent field of human-computer interaction, Kuutti (1996) stated that “research [was] not ahead of practice – on the contrary. In fact, a considerable number of researchers [had] been studying successful solutions in order to understand why they [were] working” (p. 17-8). Kuutti went on to suggest a tri-level approach to research in this complex field through the combination of technical, conceptual and work process levels. He described activity theory as “a philosophical and cross-disciplinary framework for studying different forms of human practices as development processes, with both individual and social levels interlinked at the same time” (p. 25). As such it suited the study of the dynamics of work of the scientific directors of anti-doping laboratories whose work had been found in the pilot study to involve both individual, social and technical aspects.

Whilst the research of early research of activity theorists afforded some insights into the nature of expertise in the workplace, the use of activity theory in problematic workplaces had led to the formulation of DWR (Engeström, 1991) as a more powerful means of understanding transformations associated with human activity systems. Engeström (2005a) commented that when carrying out DWR

researchers [entered] actual activity systems undergoing ... transformations and ... put [the ideas of activity theory] into the acid test of practical validity and relevance in interventions which [aimed] at the construction of new models of activity jointly with the local participants. (Y. Engeström, 2005a, p. 36)

DWR rested on three theoretical principles. Firstly the situated socially distributed activity system provided the unit of analysis. Secondly, an activity system interacted with other activity systems: it did not exist in a vacuum. Lastly, activity systems evolved over time through a process that could be regarded as cycles of expansive reorganisation in which

practitioners [asked] what they [were] doing and why... [leading to] a movement ... that [involved] the entire community and eventually [affected] several related activity systems ... [and] [implied] diversification of the initial model into various applications and modifications”. (Engeström, 1991, p. 269)

The use of DWR by Engeström and other Finnish researchers (Engeström, 2000b, 2004a; Y. Engeström, 2005a; Engeström, Engeström, & Vahaaho, 1999; M. Hasu, 2000) in problematic work contexts led to a dialogic relationship with participants and the resolution of tensions through the joint production of a new activity through the process of expansive visibilization (see Section 3.2.3). To do this, the researchers and participants in these studies took advantage of their close geographical proximity to meet in a Change Laboratory, a setting that was “complex and multi-layered both semiotically and instrumentally” (Y. Engeström, 2005a, p. 298). The Change Laboratory provided a physical environment in which participants came together to examine and reflect upon their past and current work practices in order to identify problematic tensions or contradictions and then, through sharing ideas and negotiation, visualize a future activity in which these difficulties are resolved. This was achieved through a semi-circular arrangement of furniture and video equipment that allowed the 12 or so participants to be recorded during meetings as well as to review critical excerpts selected for playback by the researchers. Engeström represented the Change Laboratory diagrammatically (p. 293) as shown in Figure 4-2.

Through their involvement in the Change Laboratory, participants engaged in a variety of socio-cognitive processes as they examined their own activity through a process which involved them in confronting, debating, disconnecting from and modelling and re-engaging with current and future ways of acting. Engeström (2005a) represented this process (p. 299) as shown in Figure 4-3. By providing participants with a model of their activity system including its inherent tensions, DWR enabled participants to identify and to “make sense of the built-in contradictions generating the troubles and disturbances depicted in the mirror ... [and, over time] construct a **vision** of the past and the future of the activity system” (Engeström, 2005a, p. 298). They did this through sharing their ideas orally, or in writing or as drawings with each other and the researchers/interventionists. The mirror contained “challenging examples of problems and disturbances” (p. 298) that had been recorded and played back to participants.

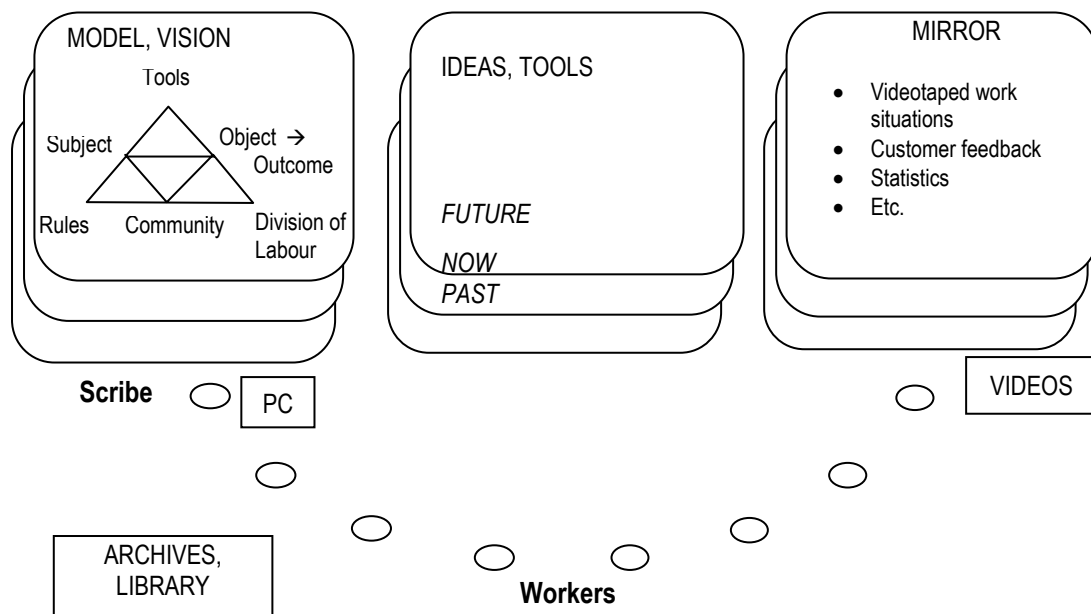


Figure 4-2: Prototypical layout of the Change Laboratory

The Change Laboratory also allowed participants to negotiate and to debate various aspects of their future as they went about expansively visualizing and co-constructing their future activity. Not surprisingly, the process challenged participants both intellectually and emotionally.

The Change Laboratory has been used successfully by both the Finnish researchers listed above and other developmental work researchers (Bodrozic, 2005; Helle & Engeström, 2005b; Hill et al., 2005; Hong & Cheng, 2005) who worked with various organisations in educational, health and industrial contexts. Representatives of various worker groups in an organisation met regularly in the Change Laboratory to examine existing problematic work practices and to bring about new improved ones. Daniels and Leadbetter (2005) and Warmington et al. (2005) found the demands of the Change Laboratory as formulated by Engeström and his colleagues too heavy. To cater for the dispersed geographical locations of groups of children's services professionals in the United Kingdom, Daniels and Leadbetter and Warmington adapted the Change Laboratory to promote collaboration between the participants in their DWR projects. Daniels and Leadbetter did this by reducing the number of face-to-face meetings, promoting participation and lowering costs in terms of both the time and money.

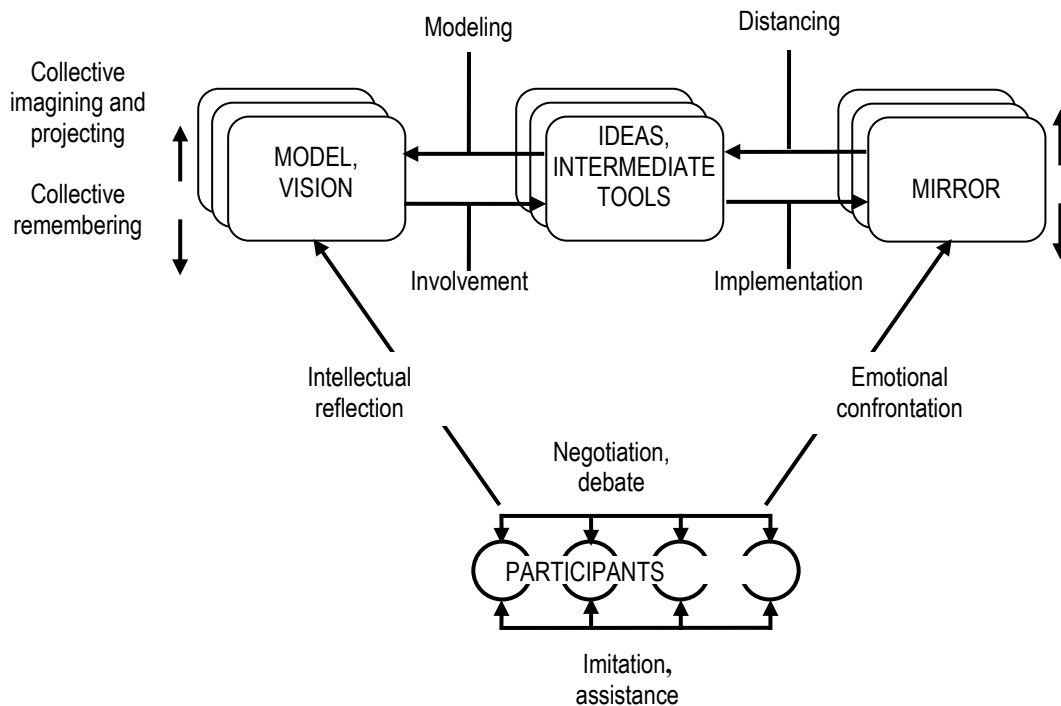


Figure 4-3: Central socio-cognitive processes of the Change Laboratory

In choosing to integrate the DWR approach with its associated socio-cognitive processes (see Figure 4-3) in this project, the research design faced two major differences from the context of previous DWR studies. Firstly, the research had not been called for by the study's participants or the organisational superiors to carry out a transformational project as had been sought in each of the studies mentioned. Thus, the change that ensued from this research would, from the participants' point of view, be accidental and/or incidental and may well go unnoticed and unacknowledged. Secondly, the widespread geographical locations of the potential participants made it impossible to organize the regular meetings in a physical Change Laboratory. In order to deal with these issues, the research did not have workplace change as its goal. That is, the researcher did not go into the field and state her intention to change the way these expert scientists did their work and maintained their expertise. Such an approach may well have shut the project down before it even started. Rather, the researcher's intention, both stated and actual, was to enable

- individual and collective reflection upon these experts' current practice through the double stimulation of the mirroring processes described below and in Section 4.6.7

- study participants and the research to build a joint understanding of the dynamics of the work of expert practitioners
- visualisation of possible solutions of problems that had given rise to current tensions within the activity of being the director of an accredited anti-doping laboratory

Any change that occurred in the research context would be a result of the participants' decisions and not seen as a result of a research intervention. Subsequent theorising on by the research would expand the relevance of the research findings to other contexts. The diverse geographical locations of the study's participants had a bigger impact on the study's design.

Without the geographical proximity of study participants, there was no possibility of access to a physical Change Laboratory by the study participants. Subsequently, alternate approaches to some forms of data collection and to the facilitation of the socio-cognitive processes had to be developed. Further, the use of DWR necessitated mechanisms whereby the researcher would mirror back to participants their own and the researcher's perceptions of their activity as well as involve participants in discourse relating to and reflecting on the research and its findings. Rather than a meeting, the mirror that provided participants with the opportunity to confront, and reflect on tensions within current practice was provided by the researcher's request for an individual participant to comment upon their interview notes or a paper that had been prepared for publication. Similarly, presentations relating to the research at 2003, 2004 and 2005 annual Manfred Donike Workshop on Doping Analyses in Cologne, Germany acted as mirrors for the research by providing participants and their broader community with opportunities for individual and collective remembering, reflection and projection, the socio-cognitive processes at the heart of the Change Laboratory experience (see Figure 4-3). The incorporation of these adaptations of the physical Change Laboratory of DWR, used by Engeström and others, into this research, enabled participants and the researcher to co-construct an understanding of what it meant to be and stay a scientific expert in the complex international context of anti-doping work.

Three research methods have been described above. The strength of the case method was to be found in its ability to understand the dynamics of contemporary phenomena in a real life context. Grounded theories, according to Strauss and Corbin (1998), were "likely to offer insight, enhance understanding, and provide a meaningful guide to action" (p. 12).

The developmental work research method provided a research method for suited to understanding activity that was undergoing transformation. Given that the aim of this research was to create a theoretically based understanding of the dynamics of the work of scientists in a complex, evolving context, the design of this research aimed to bring the strengths of each of these research methods to the research by integrating DWR with the grounded theory method and case methods. This integration is described in the following section.

4.5.4 An integrated research design

Research is a purposeful activity conducted within a chosen setting using carefully selected research tools. As such, the design of successful research demonstrates the appropriateness of the process for its purpose. The integration of the case study and grounded theory methods with DWR provided the basis for a research design whose purpose was to generate theory from rich subjective data about a complex, evolving contemporary activity. The process of integrating these three research methods described in the previous section in the design of this research was made easier by Fernández's (2004b) integration of case and grounded theory methods in his research into project management in the field of business-related information systems. Fernández (2004b) drew on Eisenhardt's (1989) earlier discussion of theory building from case study research to develop a diagrammatic representation of the theory building process of the grounded theory method within the case study. Fernández remarked that the entering the field included "defining the research problem and ... ensuring theoretical flexibility and relevance of careful selection of cases" (p. 85).

Fernández's diagram (2004b, p. 85), shown in Figure 4-4 emphasised the longitudinal, iterative nature of the grounded theory method and the importance of memoing. Importantly, Fernández's approach differed from the traditional understanding of grounded theory in which, to ensure that there are no preconceptions, the literature was not incorporated into the research until after the results were established. Rather, Fernández enunciated an ongoing role for the extant literature as a data stream throughout his study. In this role, the literature was a powerful means of informing and refining the coding of data and generation of the overarching themes on which theory was built. The context of the case together with the ongoing coding process, continuously guided the literature review, which in turn supported a deeper level of data interrogation. In the same way, the

role assigned to the literature in this research into the dynamics of the work of experts in the global public sector, has been to support the building of substantive theory. The literature of activity theory, communities of practice and the complexity based *Cynefin* model, already described in Chapter Three, informed and refined the coding of data and the generation of themes for theory building aspects of this research through stimulating abstract questioning of the data.

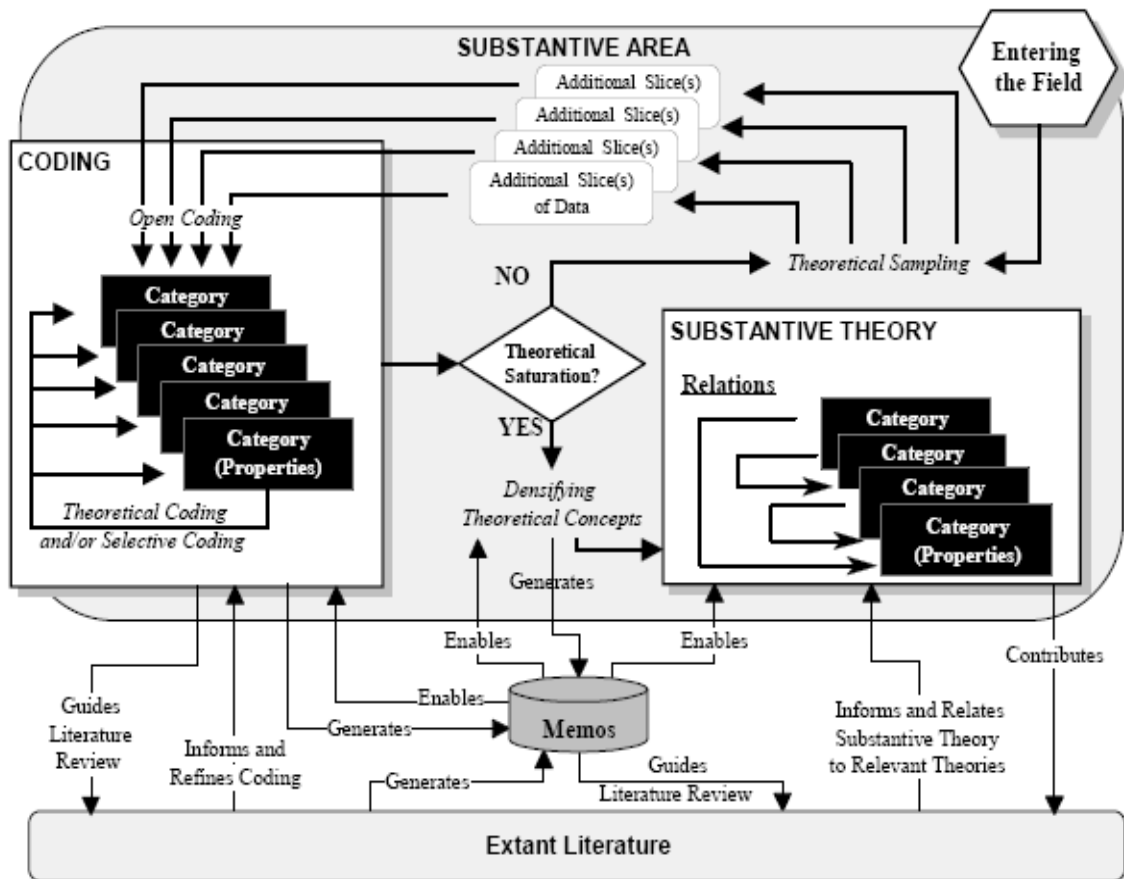


Figure 4-4: The grounded theory building process within the case study

The inclusion of the DWR method in the research method necessitated building into the research design the opportunities for participants, as well as the researcher, to examine, consider and comment on the interim models proposed by the research and other material generated by the research process. Participants’ comments provided additional data for the researcher to incorporate into the iterative processes of data collection, analysis and interpretation. These processes have been described below and have been represented diagrammatically in Figure 4-5 which draws on both Fernandez (2004b) and McLaughlin (2006). In the figure, the single-headed arrows in the centre of the diagram

indicate the linearity of the processes whereas the double-headed arrows at the sides of the diagram emphasise the cyclical / iterative nature of the processes. Preceding presentation of details of the research strategies in Section 4.6, an overview of the research process has been presented to emphasise its dual linear and iterative nature.

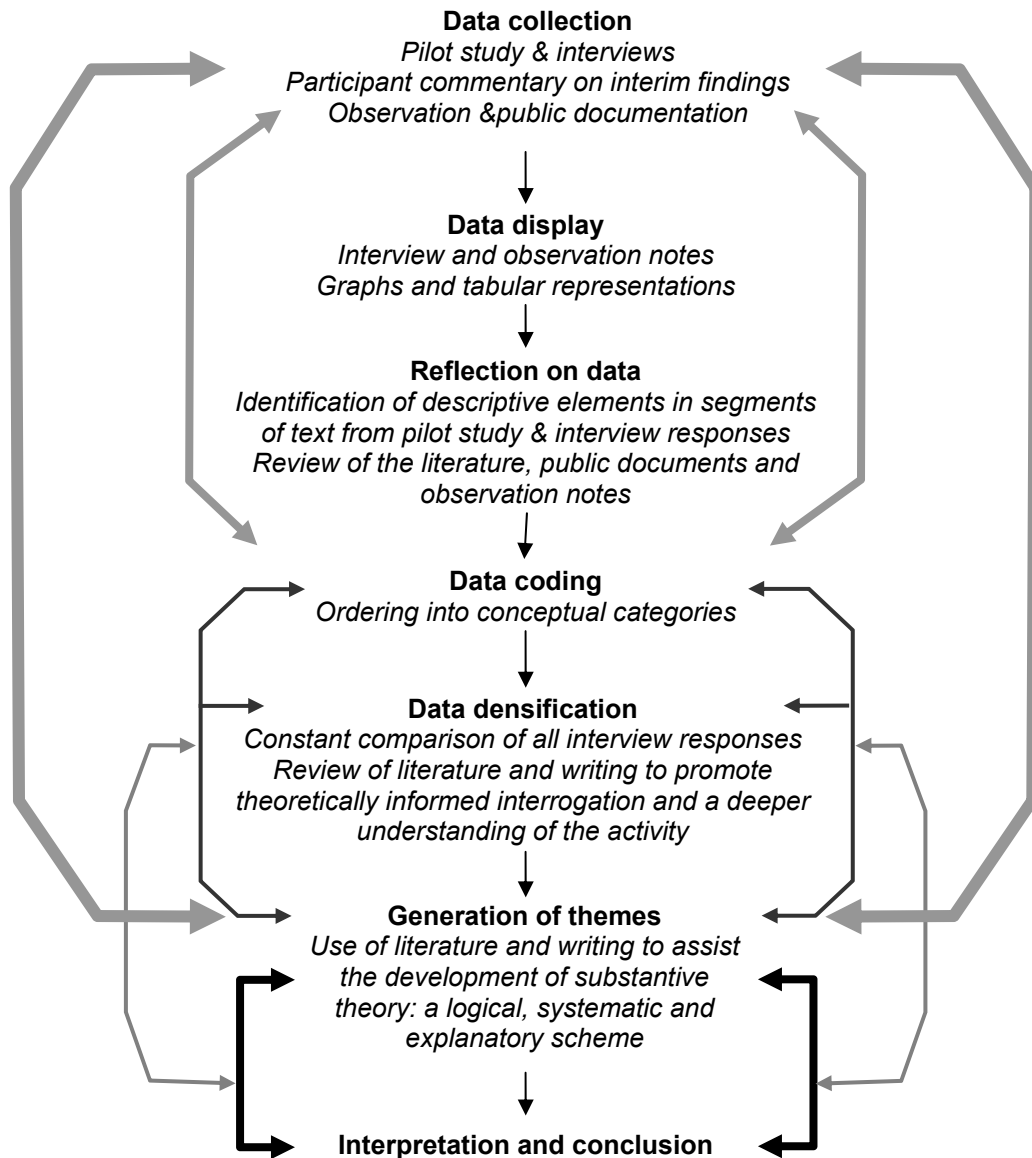


Figure 4-5: The grounded, iterative, participative theory building research approach

The first major phase of data collection in the pilot study (see Section 4.4) initiated the process represented in Figure 4-5. Participants' survey responses were displayed in a table and then investigated in order to identify descriptive elements in the text. Coding of these elements resulted in conceptual categories and a summary of the pilot data which was disseminated to participants as part of the mirroring process. Comments made by

participants were new data for the research process. As reported in section 4.4.3, the theoretically informed interrogation of the pilot study data resulted in an initial modelling of the work of the scientific directors as an activity system with associated inherent tensions. The categories identified in the pilot study data were used to design the data collection tools for the main study: interviews of both the scientific directors and stakeholders, described in Section 4.6.3. The pilot study also identified those groups that were stakeholders in the work of the scientific directors.

The second major data collection phase took the form of participant observation at the Manfred Donike Cologne Workshop on Doping Analyses in March 2003. As well as providing an opportunity for the researcher to be immersed in one aspect of the culture of the anti-doping scientists, the researcher gave a presentation and submitted a paper about the planned research (Kazlauskas & Crawford, 2003) thereby provoking workshop attendees to reflect on their work in the manner of the Change Laboratory process of previous developmental work research. Analysis of and interpretation of this data led to a survey of the 2004 workshop attendees' perceptions of themselves as a community together with theory building relating to the contribution of the annual workshop to the maintenance of anti-doping expertise by members of the community. This role, together with the perceptions of stakeholders about the work of the scientific directors, were presented at and submitted as a paper for the 2005 workshop proceedings (Kazlauskas & Crawford, 2005). Both presentation and paper emulated the socio-cognitive process of developmental work research's Change Laboratory and aimed to elicit additional data from members of the anti-doping scientific community.

The third major phase comprised interviews of willing scientific directors and stakeholders. As stated above and described in Section 4.6.3, the results of the analysis of pilot study data underpinned the design of these interview schedules. Prior to coding, each interviewee received a copy of the researcher's summary notes from their interview. Once again this mirroring process aimed to emotionally confront interviewees and provoke their reflection on the work of the directors. Densification of the data through constant comparison, reflection and theoretically informed interrogation of the data resulted in the generation of themes and the construction of models for the work of these scientific experts. Once again, the presentation of this interpretation of the data to participants and their communities (Kazlauskas & Crawford, 2005b, 2006a, 2006b) aimed to elicit additional data for subsequent integration into the research.

The fourth major source of data was from publicly available sources such as the academic literature, the media and the World Wide Web. Ongoing examination of the writings about the theoretical frameworks of activity theory, communities of practice and the complexity based *Cynefin* framework, promoted a more abstract, higher level of interrogation of the data leading to a deeper understanding of the activity of the directors and the role of the workshop. The high profile nature of the doping in sport led to a steady stream of items in the media. These together with material posted on websites by anti-doping and sports organisations provided additional data for inclusion, when relevant, into the research.

Writing about the research while it was being carried out and writing up the research after the researcher had left the field promoted data densification and the development of substantive theory about the research.

As represented in Figure 4-5, this steady movement of the research towards its interpretation and conclusions was an ongoing process that involved the iterative co-construction of the findings by both the research and the study participants. Further details of the research methodologies have been described in the next section.

In summary, the implementation of this integrated research method combining the case, grounded theory and developmental work research methods led to the use a variety of qualitative data collection strategies including a pilot study, participant observation, interviews, examination of publicly available, anti-doping related documentation and the literature and the mirroring process of the developmental work research method. The traditional iterative approach of the grounded theory method to data collection, analysis and interpretation were extended through the incorporation of the literature as a data stream and the mirroring process of developmental work research. Data analysis operated at various levels. Initial examination of pilot study survey, observation and main study interview notes enabled recognition, ordering, comparison and contrasting of descriptive elements to support data coding leading to the development of conceptual categories. Constant comparison of fresh data with existing categories resulted in either the rejection of the category or its confirmation and enrichment. Review of the literature informed a higher level interrogation of the data through the asking of abstract theoretical questions. Writing to construct answers to the research questions and the mirroring process supported reflection, sometimes elicited further data from participants, and led to further

development of the themes associated substantive theory. An overview of the research and its use of these strategies have been given in Table 4-3, displayed over this and the next page. A timeline for the use of the research methodologies has been given in Table 4-4.

Table 4-3: An overview of the research plan

Research Strategies	Associated actions
<i>Pilot Study</i>	<p>Background reading to develop an understanding of the history of the anti-doping context and techniques for studying scientists and their work</p> <p>Selection of 8 scientific directors from around the world for pilot study participation.</p> <p>The use of a voluntary short survey to frame pilot study's participants' perceptions of</p> <ul style="list-style-type: none"> • their work and its context • their aspirations, achievements and challenges • the interaction of scientists in this area of expertise • the growth and application of knowledge in this area <p>Data collection: Administration of pilot survey to the 4 participating scientific directors</p> <p>Data analysis: Examination of survey data to identify categories relating to these scientists' work.</p> <p>Mirroring: general feedback material to participating scientific directors.</p> <p>Theory building: The work of these scientists as an activity system (as reported in Section 4.4.3 on p. 92)</p> <p>Outcomes</p> <p>Integration of case, grounded theory and developmental work research methods</p> <p>Refinement of the participant recruitment process</p> <p>Identification of stakeholder groups for participation in main study</p> <p>Selection of interview, participant observation, mirroring and public documentation as data collection techniques</p> <p>Use of the theoretical frameworks of activity theory, communities of practice and the <i>Cynefin</i> model of sense-making</p> <p>Development of the main study interview schedules for directors and stakeholders.</p>
<i>Participant observation</i>	<p>Attendance at Manfred Donike Workshops in Cologne in March 2003 - 2005 provided</p> <ul style="list-style-type: none"> • a period of immersion in the international context of anti-doping laboratory work. • opportunities to present aspects of the research to the anti-doping scientific community <ul style="list-style-type: none"> ○ 2003: introduction to the research ○ 2004: mirroring of interim findings from the pilot study and early interviews about anti-doping scientists' perceptions of their work; survey of workshop attendees' understandings of themselves as a community of practice; informal interactions with community during the workshop ○ 2005: mirroring of findings about the role of the Cologne workshop as a means of maintaining expertise and stakeholders' perceptions of the past and future work of the scientific directors <p>Data collection: Field notes from observations of and conversations with the workshop attendees; survey data which elicited attendees' perceptions of anti-doping scientists as a community of practice</p> <p>Data analysis and interpretation: Examination of observation notes to identify and confirm conceptual categories about the workshop and to generate themes relating to the nature of this community event and the work of these scientists</p> <p>Mirroring: presentation of interim findings into the 2004 and 2005 Cologne workshop, discussion of findings with workshop attendees and forwarding published papers to interested participants.</p> <p>Theory building: The participants of the workshop as members of a community of practice; the workshop as a regular event for a community of practice, the workshop as an activity system; the ongoing discourse relating to maintaining expertise as knotworking and co-configuration work that occurred in a trusted, private, shared space; knowledge generation and mobilization as moving from chaos to the known(as reported in Chapter Six)</p>

Table 4-3: An overview of the research ctd.

<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Main Study interviews with scientific directors and stakeholders</p>	<p>Recruitment of and interviews with participating scientific directors and stakeholders about their perspectives on the work of the scientific directors of accredited doping control laboratories throughout 2003 and 2004. The conduct of these interviews over a long period provided opportunities for reflection, data coding, data densification and the generation of themes as well as the mirroring of the notes from interviews with individuals.</p> <p>Data collection: use of email surveys and/or semi-structured telephone or face-to-face interviews with willing scientific directors and stakeholders to extend and clarify issues pertaining to the work of the scientific directors raised by the pilot study.</p> <p>Data Analysis and interpretation: use of the iterative approach represented in Figure 4-5 to identify and confirm conceptual categories and generate themes in interview data relating to the work of these scientists</p> <p>Mirroring: researcher's interview notes sent to participating individuals for comment and presentations of the researcher's overall understandings of the directors' and stakeholders' perspectives at the Cologne Workshop</p> <p>Theory building: The work of the directors as a complex activity system with multiple objects (as reported in Chapter Five); communication roles stakeholders expect ed of the directors (as reported in Chapter Seven); the evolving context of anti-doping work as interacting activity systems (as reported in Chapter Eight) and as a complex adaptive system moving between chaos and order (as reported in Chapter Eight)</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Literature and public documentation</p>	<p>Continuing review of the academic literature and the popular media.</p> <p>Data Collection: examination of newspapers, radio, television and the web to locate articles in the public domain about doping in sport; websites belonging to doping control organisations such as the World Anti-Doping Agency (WADA), the Australian Sports Anti-Doping Agency (ASADA) and sporting organisations such as the Federation of International Football Associations (FIFA) or the International Olympic Committee (IOC); academic literature, particularly the literature relating to activity theory, communities of practice and the complexity based <i>Cynefin</i> framework</p> <p>Data Analysis and interpretation: use of the iterative approach represented in Figure 4-5 to identify and confirm conceptual categories and generate themes in interview data relating to the work of these scientists</p> <p>Mirroring: opportunities for participants to reflect and comment on research findings through theoretically informed presentations and papers at workshops, symposia and in journals.</p> <p>Theory building: the work of the directors as a complex evolving activity represented through the integration of activity theory, communities of practice and the <i>Cynefin</i> framework into the model finalised in Chapter Seven</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Writing</p>	<p>Preparation of papers and presentations to colleagues and the anti-doping community.</p> <p>Data collection: Ongoing perusal of the academic and popular literation</p> <p>Data analysis and interpretation: iterative examination of and reflection on the data to promote the densification of theoretical concepts needed to develop a substantive theory based on the emergent concepts from a theoretically informed data analysis</p> <p>Mirroring: opportunities for participants to reflect and comment on research findings through presentations and papers at anti-doping related workshops, symposia and proceedings.</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">Writing up</p>	<p>Withdrawal from the field Preparation and production of thesis and other publications</p> <p>Data analysis and interpretation: Densification of theoretical concepts through further reflection and writing; further interpretation and conclusions about the findings of the research</p> <p>Theory Building: the work of the directors as a complex activity with multiple objects whose existence was related to the routing work of the directors; the role of a trusted, private, shared space for the maintenance of expertise in an evolving context; the visualisation of the complexity context</p>

Table 4-4: Research activities over time

Year	2002		2003					2004					2005					2006							
Month	11	1	3	5	7	9	11	1	3	5	7	9	11	1	3	5	7	9	11	1	3	5	7	9	11
Pilot Study																									
Attendance at the Cologne Workshop																									
Main Study Surveys & Interviews																									
Literature & Public Documentation																									
Analysis																									
Mirroring processes of DWR																									
Writing																									
Writing up																									

4.6 RESEARCH STRATEGIES

The effective use of multiple research strategies in this international study was made possible by modern transport and information and communication technologies. These technologies also made it possible to develop alternate strategies to those of the physical Change Laboratory venue used by other DWR workers for mirroring interim findings back to study participants. As has been described in the next section, email acted as a conduit between the researcher and participants. Participation in and presentations to the 2003, 2004 and 2005 Cologne Workshops facilitated both data collection and the DWR process of mirroring. Over 2003 and 2004, interviews were conducted face to face but also ear-to-ear - by telephone, at times in the middle of the researcher’s night. Review of the literature, media and other publicly available documentation persisted throughout the study. Similarly, analysis through the joint construction of understandings of the work of the directors and how they maintained their expertise, deeper reflection and analysis through the writing process occurred throughout the research.

Further details of the research methodologies, beginning with the critical role of effective communication by email, have been presented in the following sections.

4.6.1 Communication with participants: “You’ve got mail!”

As critical aspects of this qualitative research were conducted over long-distances, the important processes of recruitment of participants, organisation of data collection and establishment of rapport were frequently conducted electronically. Subsequently, email could be best described as the workhorse for this study with the researcher negotiating extra space on the university’s email server to ensure that there was sufficient room during the study for participants’ emails with their attachments. As stated previously, one of the outcomes of the pilot study was the development of an effective protocol for the recruitment of participants by email. One advantage of the high-profile nature of doping control work in sport was that the contact details, including email addresses, for many members of the study’s population were available from the websites of various sporting and government organisations. Email provided a speedy, cost-effective means with which contact, recruit and interact with far-flung participants.

As stated in Section 4.4.4, the researcher had experienced uncertainty as to whether or not a participating director had received and forgotten, or received and chosen to ignore, or not received an email about the research. The researcher’s personal experience of managing large volumes of email, resulted in the development of a series of three polite emails requesting participation and the inclusion of a return date in all emails requiring action on the part of the participants. Appendices C and E contain examples of the correspondence requesting participation in the pilot study and the main study.

Email also provided the means through which the research could establish rapport with participants, clarify any questions they had about the research, send and receive surveys, and organise interviews. It also provided one of the mechanisms for the non face-to-face mirroring process associated with DWR. For example, to mirror the outcomes of the pilot study to participants, a summary of the pilot study survey data was emailed to pilot study participants for their comment. Similarly, in the main study, interview notes were emailed to interviewees for them to confront, reflect and comment upon the researcher’s construction of their views. Participants’ responses resulted in the incorporation of this new data into a joint construction of an understanding of the work of anti-doping scientists.

4.6.2 Participant Observation

Janesick (1994) commented that the qualitative researcher became the “research instrument ... [with] the ability to observe behaviour” (p. 212) They must “stay in the setting over time ... [and] develop a model of what occurred in the social setting” (p. 212). Participant observation is one of the strategies that allows qualitative researchers to do this. Burns (2000) stated that participant observation provided qualitative researchers with the opportunity to “take part in the daily activities of people, reconstructing their interactions and activities in fieldnotes taken on the spot or as soon as possible after their occurrence” (p. 405) Burns went on to describe it as “a process of waiting to be impressed by recurrent themes that [reappeared] in various contexts” (p. 405). There were two options for participant observation in this research. The first option was for the researcher to request permission to spend time in one or more of the accredited laboratories to observe the daily work of one or more directors. The second option was to request permission to attend the week-long annual Manfred Donike Cologne Workshop on Dope Analyses (hereafter referred to as the Cologne workshop). This event was attended by representatives of almost all accredited anti-doping laboratories. The pilot study data and background reading had suggested that the Cologne workshop played a role in the maintenance of expertise within this community. The possibility of focussing on an activity which would contribute to answering the second research question (namely ‘How do scientific directors maintain their expertise?’), led to the researcher’s decision to request permission to attend the 2003 Cologne Workshop. In 2006, the researchers attended two other international meetings related to general anti-doping work. In this section, a brief overview of these meetings, including an explanation of the researcher’s gaining access to the Cologne workshop, have been given. Extended description and discussion of the Cologne workshop have been presented in Chapter Six.

As an outsider, the researcher negotiated her presence at and participation in the Cologne workshop as attendance was by invitation only. An email was sent to the workshop’s organisers seeking permission for the researcher to attend the 2003 Workshop to make observations for and to inform anti-doping scientists about this research. Permission was given to attend and make a presentation in 2003, moving the researcher’s status to one of a privileged observer of as well as an active participant in the Workshop. As well as listening to lectures and also giving one, the researcher joined other participants for meal and coffee breaks and at the evening social gatherings which will be described in Chapter

Six. This provided what Burns (2000) describes as most important: “the collection of stories, anecdotes and myths ... with which a sense of the dominant themes of concern ... can be developed” (p. 406). Although the researcher made a presentation (Kazlauskas & Crawford, 2003) and took part in conversations during the workshop, the researcher’s role at the workshop was mainly that of observer as there was no way that the researcher was able to understand most of the high-level science that was discussed even though the language of the workshop was English. However, attendance at the Cologne workshop led to a deeper understanding of this group’s culture. Attendance and presentations at the 2004 and 2005 workshops (Kazlauskas & Crawford, 2004b, 2005) provided opportunities for the researcher to extend the participant observer role and to carry out the mirroring process of developmental work research. During the workshops, the researcher kept detailed notes about the day-to-day activities of the workshop and interactions between participants, both scientific and social. Analysis of these notes and observations of the communal nature of the 2003 workshop, reading of the literature of communities of practice, and the prospect of participation in the 2004 workshop resulted in the development and conduct of a short survey about attendees’ perceptions of community at the end of the researcher’s presentation in 2004 as noted in Section 3.3. A copy of the survey has been included in Appendix G. Additional data collected during the 2004 and 2005 Cologne workshops, affirmed the researcher’s initial hypothesis that the workshop played a key role in knowledge mobilization within this community and enabled a deeper understanding of the role of the workshop in the identity formation of anti-doping scientists. An in-depth analysis of the role of the Cologne workshop has been presented in Chapter Six.

Towards the end of the research in 2006, the researcher attended and presented posters at general meetings (i.e. not only for anti-doping scientists) held to discuss anti-doping work. In April, the Cyprus National Anti-Doping Committee, the Council of Europe, and the World Anti-Doping Agency (WADA) organised the first Conference on Ethics and Social Science Research in Anti-Doping and in September-October, the International Association of Athletics Federations (IAAF) organised a World Anti-Doping Symposium: “Effectiveness of the Anti-Doping Fight”. As well as providing insights into the broader anti-doping community, these events provided further opportunities to mirror the findings of the research to the broader anti-doping community including some stakeholders who had participated in the research. The researcher’s attendance at these meetings broadened her understanding of the complexity of the context of sports anti-doping work (see Chapter Eight).

4.6.3 The Main Study Interviews

As a social science research tool, interviews take a variety of forms, ranging from completely open and unstructured through semi-structured forms and to completely structured. Whilst interviews can also solicit data from many individuals simultaneously when conducted as a focus group, in this research semi-structured, one-to-one, live interviews were used to elicit data from individual scientific directors and their stakeholders. Whilst the word ‘interview’ was most often associated with the live, face-to-face dynamic of questions and answers as seen on the television or heard on the radio, in social research ‘interview’ had a broader understanding. Minichiello, Aroni, Tuckwell and Alexander (1995) noted that the survey could also be regarded as an interview as it too asked questions of the research participant and captured their responses. In this research, the schedule for the face-to-face interview and the survey interview of the directors were developed simultaneously and aimed to elicit the same information. In the case of the stakeholders, only a schedule for live interviews was designed. The use of the semi-structured interview with both the directors and stakeholders provided data that led to a focused, deeper understanding of the directors’ work from the insider perspective of the directors themselves and from the outsider perspective of representatives of a number of their stakeholder groups. The director and stakeholder interview schedules shared a similar format. Closed-ended demographic questions were asked at the beginning of the interview, followed by open-ended questions after respondents had become more comfortable talking about the content of the interview. Some interviewees also took advantage of the opportunity to comment freely on other aspects of anti-doping work in sport. Before describing each interview schedule, two other matters relating to the conduct of the interviews have been reported.

The invitations to the scientific directors to participate in the research were distributed prior to those to stakeholders. This first group of invitations presented prospective participants with two ways to participate: to respond in writing to a series of questions using their word processor, or to take part in a live interview that would be conducted face-to-face at a mutually convenient location, or ear-to-ear by telephone, depending on the geographical locations of the researcher and the participant. As stated previously, this decision had led to the development of the interview in both text-based and oral formats. However, the invitation resulted in some confusion as a few directors, whose first language was not English, opted to both complete the survey and to participate in an interview. The

researcher took advantage of these directors' willingness to participate in research by using their written responses as a basis for deeper probing in the interview. To avoid such confusion about modes of participation, stakeholders were simply asked if they would participate in a face-to-face or ear-to-ear interview.

The second matter related to a request prior to a live interview by one early interviewee for information about what sorts of areas the interview would cover. The ease with which rapport was established in this interview resulted in all subsequent interviewees being sent a one-page pre-interview information page that covered both the demographic questions and a list of broad topics that would be covered by questions in the second part of the interview. This practice also assisted the interview process by allowing interviewees to work out numerical answers such as how long they had been involved in the area and gave them an idea of how the interview was proceeding. It may also have acted as scaffolding for those interviewees whose first language was not English in much the same way as the pre-lecture distribution to students of lecture notes or a PowerPoint file can provide students, particularly students whose first language is not English, with a roadmap of a lecture and so supports students' learning.

Particular details of the scientific director and stakeholder interviews and how they were conducted have been described in the following sections.

4.6.3.1 The scientific director interview

As indicated in Section 4.4, the pilot study had identified three major categories for the work of the director: routine analytical work, maintaining expertise and providing advice to anti-doping workers. To ascertain whether or not these categories were common to all scientific directors participating in the research, the focus of the semi-structured interview schedule posed questions about

- their perceptions of the challenges in anti-doping work
- communication networks, and
- how they maintained their expertise.

Additionally, directors were asked to recall a significant incident related to anti-doping in order to throw up other aspects of their work which the directors regarded as outstanding. The interview comprised two sections. The first consisted of a number of demographic questions whilst in the second section, questions were open-ended.

The demographic questions elicited data about the nature of anti-doping work in the director's country, about the number of times her/his laboratory had carried out the testing for a major event, about how many samples their laboratory analysed annually. Directors were also asked how often they contacted another director outside organised meetings and the means they used for such contact (eg email, phone etc.) Going through the demographic questions helped to establish rapport between the interviewee and researcher, creating a secure and trusted environment for the open-ended questions which elicited longer responses.

The open-ended questions in the second part of the interview drew out information about each interviewee's career background and achievements, as well as those of the laboratory for which they were responsible. Once comfortable with the interview, participants were asked to describe the challenges that they perceived as associated with anti-doping work, the changes they would like to see in the area over the following three years. They were also questioned about communication and about the impact of language and cultural backgrounds and communication between those involved in anti-doping work as well as the sharing of anti-doping scientific expertise in a rapidly changing context. Directors were asked about how they maintained their expertise, the conduct of anti-doping research and about the qualities and attributes necessary for their role. Documentation related to the scientific directors' interview schedule has been included in Appendix E.

There were two main differences between live and written interview - the survey. One difference related to the open-ended questions in the latter part of the schedule. In the survey, the open-ended questions were followed by sub-questions to provide greater clarity and/or guidance for the interviewee. In the live interview, the interviewer had been able to provide clarification and/or guidance as required. The second difference related to the inclusion in the live interview of a question which enhanced the researcher's ability to explore the directors' understanding of the challenges of their work. This question had evolved after the dissemination of the call for participation in order to encourage participants to reflect more deeply on the nature of their work. Its inclusion in the interview demonstrated the researcher's preparedness to enhance the research tools during the study. Janesick (1994) encouraged researchers to act in this way thus:

Being totally immersed in the immediate and local actions and statements of belief of participants, the researcher must be ready to deal with the substantive focus of the study and with the researcher's own suppositions. ... In a sense,

while in the field, the researcher is constantly immersed in a combination of deliberate decisions about hypotheses generated and tested on the one hand and intuitive reactions on the other” (Janesick, 1994, p. 213)

In this instance the researcher decided to ask the directors an additional question about the skills and knowledge needed by someone who hoped to become the scientific director of an accredited laboratory. Some directors commented that they found this an interesting even challenging question to answer. Analysis of the data elicited by this question made a valuable contribution to understanding the directors’ perceptions of challenges they faced.

As stated previously, only stakeholders were interviewed either face-to-face or ear-to-ear, i.e. by telephone. In the following section, the semi-structured schedule for the stakeholder interviews has been described. It was both similar to and different from the schedule developed for the interviews of the scientific directors.

4.6.3.2 The Stakeholder Interview

The focus of the semi-structured interview with stakeholders was on their perceptions of the work of anti-doping scientists and on their own perceptions of the complex socio-technical context of doping control in sport. Unlike the scientific directors and anti-doping scientists who had been made aware of this research through a presentation about the research at the 2003 Cologne Workshop (Kazlauskas & Crawford, 2003) before being requested to participate, stakeholders from around the world and in Australia were first informed about the research in an email or letter that asked them to participate in an interview. They had no prior awareness of or information about the research. As a consequence the interview structure, as described in the next paragraph, anticipated stakeholder questioning about the nature of the research by inviting questions about the research at the commencement of the interview.

Aspects of the schedule for the stakeholder interview were similar to the schedule developed for the directors’ interviews. The initial demographic questions provided a clear description of the stakeholder’s background and facilitated the development of rapport. The first four of the open-ended questions continued this process by asking the interviewee how they came to be involved with this aspect of sport, their perceptions of doping issues and how they thought these issues could be and were being addressed. An early question asked about the role of communication, particularly cross-cultural communication, in anti-

doping work and how the interviewee maintained their knowledge of doping in sport issues. Following these topics, the stakeholder was asked about their perceptions of the work of the directors. These included the stakeholders' understandings of the past contributions of the directors to anti-doping work, the skills and knowledge they regarded as essential and desirable for someone who worked as the scientific director of an accredited laboratory, and the role that the directors should play in policy development and decision-making. This last aspect had been included because of the concerns expressed by directors about the degree of their involvement in policy development and decision-making. As in the interview schedule for the directors, the final question asked the stakeholder to recall a doping-related event that stood out in their memory. As had been the case in the interview with scientific directors, this question often prompted further comment about anti-doping work and issues. Once more, interviewees were given the opportunity to ask about the nature of the research. Documentation related to the stakeholder interview schedule has been included in Appendix F.

Analysis of stakeholders' responses to these questions would enable the comparison of stakeholders' conceptual categories relating to the directors' work with those generated by data elicited from the directors themselves.

These interview schedules provided the principle means through which individual data was elicited from individual participants throughout the rest of the study. As will be seen in Chapters Five and Seven, the interview data supported the co-construction of an understanding of scientific expert work of the scientific directors of accredited doping control laboratories, by the researcher, the stakeholders and the directors themselves.

4.6.3.3 Conduct of the Interviews

As outlined in Table 4-4, interviews with of the scientific directors occurred over the fifteen month period between March 2003 and June 2004. Stakeholder interviews took place between May 2003 and July 2004, after most of the interviews with the directors had been conducted. When possible, face-to-face interviews had been conducted with participants from Australia and other countries. Interviews with other Australian and overseas participants were conducted by telephone. The researcher requested (and was always given) permission to record each interview. Unfortunately some early telephone

interviews were unusable as a result of interference between the recording and the telephone equipment. Once the techniques of setting up recording equipment to avoid interference were mastered, the telephone interview process worked well. However, an equipment malfunction in the last interview also rendered the recording unusable. On these occasions, extensive notes taken by the researcher preserved data.

Interviews lasted from 20 minutes to more than an hour and a half, depending upon the talkativeness of the interviewee. Telephone interviews also allowed extensive quality note-taking during the interview – a luxury not afforded by face-to-face interviews. The Meeting Planner on the website <http://www.timeanddate.com/worldclock/meeting.html> proved invaluable when setting up interview times with overseas participants.

In all thirty eight interviews were conducted, 11 with scientific directors and 27 with stakeholders. The broad affiliations of interviewees are listed in Table 4-1 on page 89. Twenty two of these interviews were by telephone. As stated above, all participants gave permission for their interview to be recorded, although one participant made additional “off-the-record” comments. Following each interview, the recording was copied to digital media and the original stored in a secure location. The digital copy was “played” on a computer to facilitate note-taking and data analysis. In accordance with the method of developmental work research, the researcher’s personal interpretations of data in the form of interview notes were checked against the views, beliefs and opinions of the participants by emailing the interviewee a copy of the researcher’s notes and inviting correction, clarification and/or further comment. Whilst the original recordings were kept in locked cabinets in the researcher’s office, digital copies were encrypted and stored in password protected folders on a password protected computer.

As indicated above, interviews and participant observation were major data sources for this research. Additionally data was collected from publicly available sources, including the media. The use of material from the media represented the views of another group of stakeholders – the journalists whose work served to inform the public about doping in sport and anti-doping efforts. The use of this data source has been described in the next section, followed by a brief review of the role of the academic literature as data.

4.6.4 Review and analysis of public documentation

Doping in sport is a high profile issue and subject to frequent media attention. A positive dope test by an elite athlete can be headline news, both nationally and internationally. During the course of this study, numerous events drew media coverage on doping issues including the suspension of popular Australian cricketer Shane Warne for diuretic use, the exposure of elite athletes' use of the designer steroid THG in the United States, the exclusion of two elite Greek athletes from the Athens Olympic Games for avoiding a doping test and more recently the furore surrounding the positive test results for the winner of the 2006 Tour de France, Floyd Landis. Such doping cases draw attention to and at times bring the role of science and scientists and their relationship to doping in sport into the spotlight, causing much to be written and/or said. In the case of Floyd Landis, the athlete and his defence have chosen to post the Laboratory Documentation Package on the World Wide Web. Journalist Carlton Reid (2006) commented that the availability of this 370-page document from the French doping control laboratory on Floydlandis.com would see it "dissected by interested experts from around the world ... [leading to a] so-called Wikipedia-defence". The content of the steady stream of articles about doping in sport in both print and online newspapers, on radio and television underlined both the high-profile status of issue and the evolving, scientific, organizational, legal, global nature of the research context.

Other publicly available data sources used in this study included the policies and other information posted on the internet by anti-doping agencies and sporting bodies. For example, the International Standard for Testing (WADA, 2004c) and the World Anti-Doping Code (WADA, 2003b) which have been referred to frequently in later chapters.

4.6.5 Review of the academic literature

As noted in Chapter Two and in Section 4.6, the academic literature played an ongoing role in this research. Not only did it support the framing of the research questions by establishing the context as researchable, it contributed to the theory building processes of this grounded research. Whilst a detailed discussion of the theoretical framework provided by the literature of activity theory, communities of practice and the complexity-based *Cynefin* model of sense-making has been provided in Chapter Three in this section, some brief examples have been given of how the literature was used to support theory building in this research.

- Participant observation of the Cologne Workshop in 2003 resulted in the identification of ‘feelings of community’ and the ‘ongoing refinement of the scientific practice’ as it related to doping control work as categories. Subsequently, review of the literature about communities of practice (Krogstie & Krogstie, 2002; Lave & Wenger, 1991; Waruszynski, 2001; Wenger et al., 2002; Wenger & Snyder, 2000) obtained what Fernández described as an ‘additional slice of data’ (2004a; 2004b). As described above, the researcher’s presentation at the 2004 Workshop further explored this aspect the anti-doping scientific community by incorporating the conduct of a theoretically informed one-page survey (Appendix G) about attendees’ perceptions of themselves as a community of practice.
- As the researcher heard about the various pathways by which the directors and stakeholders had become involved in doping control in sport and about their diverse current roles, a sense of the complex, evolving nature of doping control efforts emerged. This led to reading about wicked problems (Lach et al., 2003; *The Insider*, 2002) and complex adaptive systems and the *Cynefin* model of sense-making (For example Kurtz & Snowden, 2003; Markovsky, 1998; McMillan, 2004; Snowden, 2002a; Stacey, 2003; Waldrop, 1992). As part of the mirroring process, the researcher’s presentation at the 2005 Cologne workshop invited workshop attendees to consider and comment on a complexity informed diagrammatic representation of the nature of the socio-technical context within which they worked.
- The researcher’s observations at the Cologne workshop, interview data and the academic literature in anti-doping science led to recognition of the ongoing refinement of scientific aspects of doping control work as the means through which these experts maintained their expertise. The various challenges, scientific and non-scientific, inherent in this work lead to modelling the workshop as an activity system and triggered wider reading about activity theory and its associated concepts such as expansive visibilisation and knotworking (Blackler & Crump, 2000; M Cole, 1983; Engeström, 1987, 1996, 1999a, 2000a, 2000b; Gregory, 2000a; Mervi Hasu, 2001; Kontinen, 1999; Miettinen, 1999; Toiviainen, 2003 to name but a few). These concepts have been described in Section 3.2.3.

The ‘additional slices’ of data from the academic literature enabled a deeper, more abstract level of questioning of the data. The formation of answers to these questions supported the modelling and theory building aspects of this research. Additional support for these processes related to the use of writing as a research strategy.

4.6.6 Writing

Whilst doctoral students are frequently exhorted to write, such exhortations are rarely accompanied by an explanation. In the course of this research, the researcher came to understand the reason for such advice and the critical importance of writing for data analysis.

Richardson (1994) described writing more than a mopping-up activity at the end of a research project, portraying it as a way of knowing. In short Richardson expressed a belief

that writing was itself “a method of discovery and analysis. By writing in different ways, we discover new aspects of our topic and our relationship to it.” (p. 516). Huberman and Miles (1994) concurred with this view, adding that data display that allowed the viewing of a complete data set helped the writer to

see patterns; the first text makes sense of the display and suggests new analytic moves in the displayed data; a revised or extended display points to new relationships and explanations, leading to more differentiated and integrated text, and so on. Displays beget analyses, which then beget more powerful, suggestive displays. (Huberman & Miles, 1994, p. 433)

Throughout this research the preparation of numerous papers and presentations supported cycles of data display, reflection on the data, coding, densification, generation of themes and interpretation. The construction and re-construction of diagrammatic interim models, be they formally prepared for a presentation or scribbled on a piece of paper during a “Eureka!” experience during a journey, were all part of the iterative analytical process described in Section 4.5 and represented diagrammatically in Figure 4-5 on page 107.

These various forms of data collection and analysis led to the development of substantive theory presented in Chapters Five through Eight. The writing process described in this section formed the basis of the developmental work research’s mirroring process that had been incorporated into the design of this research. While the mirroring process has been discussed a number of times already, a summary of this aspect of the research has been given in the next section.

4.6.7 Mirroring

The ‘mirror’ (see Figure 4-2 and Figure 4-3) in developmental work research provided participants with a means to examine their practical work experiences, particularly problematic ones, and to theorize about them with a view to developing novel innovative solutions (Y. Engeström, 2005a, p. 292). It also provided researchers with a means to validate their interpretation of the object of the participants’ activity, making adjustments when needed. The regular meetings over a three to six month period that formed part the standard Change Laboratory were not possible in this research because of the diverse locations of participants. Subsequently, the research design adopted an alternative

approach to stimulating the socio-cognitive processes associated the Change Laboratory.

These included giving

- pilot study participants the opportunity to comment on the aggregated pilot study data
- individual participants with notes of her/his interview to review
- presentations made regularly at the annual Cologne Workshop and poster sessions at other symposia to keep participants and the wider anti-doping scientific community informed about the nature and progress of the research
- invited presentations to staff of two of the accredited laboratories.

As well as validating the researcher's interpretation of the participants' activity, each of the above provided opportunities for eliciting further data and for engaging participants in the co-construction of an understanding of the work of the scientific directors and the manner in which they maintained their expertise. Questions, answers and comments indicated that these strategies had provoked further reflection by both the participants and the researcher. The implementation of these processes has been summarised in Table 4-5.

Towards the end of the research, copies of papers for publication in the academic literature were sent to those participants who had requested them. The feedback indicated that the process had proved interesting reading and hopefully the basis of further reflection.

Comments about the papers included:

“Thank you for providing me with this interesting reading - a very unique study indeed, full of interesting information. I would appreciate receiving a copy of your longer paper whenever possible” (ID: S024)

“Thanks for getting me to read a copy of your 2 articles. You have struck a rich vein.” (ID: S014)

Whilst this approach did not provide the opportunity for the intense face-to-face emotional confrontation of the physical Change Laboratory, it did achieve its goal of providing participants with the opportunity to examine their work experiences, to negotiate the representation of them and to visualize improved future ones. At the time of writing, arrangements are being made for the anti-doping scientific community with the final outcomes of the research in a presentation at the 2007 Cologne Workshop.

The previous three sections have provided a description of the origins of the questions to be addressed by this research, the pre-design considerations and the integration of the case, grounded theory and developmental work research methods in the research design. The various data collection techniques, an overview of their use have been presented and the

frameworks selected to support theory building flagged for further description in the next chapter. Before concluding this chapter, two more important issues have been addressed. The first of these relates to the need for trust between the researcher and individuals whom they are researching and the second relates to the strategies integrated into this research to ensure its validity and reliability.

Table 4-5: Mirroring activities

Research activity	Mirror
Proposed Study	Presentation at Cologne Workshop, March 2003
Pilot study	Participant review of aggregated pilot study survey data in early 2003
Analysis of aggregate pilot study data and early interview data; identification of sources of tensions within the work; preparation of paper and presentation	Paper in the 2003 workshop proceedings relating to presentation at Cologne workshop (Kazlauskas & Crawford, 2003) Presentation at Cologne workshop, March 2004
Individual interviews	Review of interview notes by individual interviewees (2003 – 2004)
Analysis of observations notes from 2003-4 Cologne Workshops	Review of paper for an external journal by Workshop organisers prior to publication (Kazlauskas & Crawford, 2004b) Paper in the 2004 workshop proceedings relating to presentation at Cologne workshop (Kazlauskas & Crawford, 2004c)
Analysis of stakeholder perceptions of the work of the directors and knowledge mobilization within the anti-doping scientific community	Presentation at Cologne workshop, March 2005 Paper in the 2005 workshop proceedings relating to presentation at Cologne workshop (Kazlauskas & Crawford, 2005)
Models of work of directors of anti-doping laboratories	Copies of publications to interested participants Presentation at Conference on Ethics and Social Science Research in Anti-Doping, Cyprus, April, 2006 (Kazlauskas & Crawford, 2006b) Presentation at IAAF World Anti-Doping Symposium, Lausanne, Switzerland, September-October, 2006 (Kazlauskas & Crawford, 2006a) Planned presentation at 2007 Cologne Workshop

4.7 ESTABLISHING TRUST

Trust in qualitative research into a context such as the very public one of this research, related to ensuring the privacy of the participants, building confidence in the research and establishing rapport between the participants and the researcher. Research participants are often highly sensitive to exposing their inner thoughts and beliefs to public scrutiny. Their vulnerability in this regard means that before opening up to a researcher, trust must be established between the participants and the researcher. Many of means through which

trust was established in this research have been referred to previously. However, in this section, they have been revisited in order to highlight the strategies taken throughout this research to build and maintain confidence in the research and between the researcher and the participants.

For a number of years, all university based research has been required to formally address the issue of participant privacy through the procedures associated with obtaining ethics approval. As stated previously, this research had obtained ethics approval from the university. However, in a high-profile public context such as that for this research, the researcher recognised that the measures which ensured the confidentiality and anonymity of participants were critical to building trust between the researcher and participants. Other researchers had written about similar dilemmas. In their study of collaboration and competition between medical scientists, Atkinson, Batchelor, and Parsons (1998) had dealt with the matter in the following way:

It [was] not possible to disguise the setting in which the research was conducted, nor [could] the identities of all the scientists be hidden. The specificity of the scientific discovery claim and its appearance in publications [rendered] secrecy impossible. Strategies to disguise the research setting would [have robbed] the account of concrete detail and render the analysis jejune. We have, however, sought to avoid identifying individual actors too closely. Selected quotes from the interviews [were] not ... attributed to named actors. (Atkinson, Batchelor, & Parsons, 1998, p.264-5)

Following Atkinson et al.'s lead, to avoid the identification of individual participants and their organizations in the small study context of this study, each participant was allocated an identification code which began with a letter and is followed by three digits. The need to identify whether a comment was made by a director or stakeholder led to the development of a coded identity for each participant. Consequently, to identify a participating scientific director, the coding process meant that a director's code began with a 'D'. A stakeholder's code began with an 'S'. Thus D001 and S001 were chosen to represent a director and stakeholder respectively. This convention also allowed the researcher to identify the source of any particular comment used in the text of this document or any other publication emanating from this research but did not make public more information about the participants than would be necessary. The organisational background of participants was referred to in general terms. For example, a participant from the anti-doping agency of a particular country was, when necessary, simply referred to as S--- from a national anti-doping agency.

Both the interviews and my participation in the Cologne Workshop also highlighted the critical nature of trust in qualitative research. The development of rapport and confidence through the negotiation of participation via email, as well as the carefully designed interview schedule and protocol had both been important aspects of eliciting data from individual participants. It had also been important to establish trust with the broader community which the researcher observed during each of the Cologne workshops she attended. The presentations at the workshops were an important part of this process of building trust and openness between the community and herself as a social researcher. The initial presentation at the 2003 workshop about the research ensured that the workshop attendees knew why the researcher was there and the nature of my participation at the workshop. Following the presentation, two incidents indicated to the researcher that the research was viable, boosting the researcher's confidence considerably. Firstly, a question from the floor about the expected outcomes of the research suggested an interest by the questioner in those outcomes. Secondly, the session chair's polite request at the end of the presentation in 2003 to return the following year to give a 'progress report' suggested an acceptance of the research and an '*entréz*' for the researcher's attendance at the 2004 and 2005 workshops. Importantly, the researcher realised that attendance at these workshops would facilitate the mirroring process that was a central part of the developmental work research method that would be integrated into this research. As a non-scientific participant of an anti-doping science workshop, the researcher had felt awkward during the 2003 workshop, particularly as her presentation about the research, and hence the reason for her attendance at the workshop, was the final session on the last day of the workshop in the 'Miscellaneous' section.

The success of interviews conducted during 2003 enhanced the participants' and the researcher's confidence in the research. The acceptance of the researcher by the anti-doping scientific community was also apparent when she was greeted warmly by numerous participants during the second and third years of her attendance at the workshop. One attendee stated that the researcher had become "one of the family now".

Invitations to talk about the research to staff of two of the accredited anti-doping laboratories also indicated the community's engagement with the research and the researcher. Since participation in the 2003-5 Cologne Workshops, the researcher had further indications of the community's trust. First was an invitation to participate in the 2006 workshop (Gotzmann, 2006). Previously, attendance at the workshop had to be

negotiated in writing between the organisers and the researcher. Secondly, the researcher received an unsolicited communication from one of the study participants alerting her to the availability of funding for research into social aspects of anti-doping work with encouragement to apply for such funding to further her research interests in this area.

The final matter addressed in this chapter deals with the strategies incorporated into the research to ensure the reliability and validity of its outcomes.

4.8 VERIFICATION STRATEGIES WITHIN THE RESEARCH

Morse, Barrett, Mayan Olson and Spiers (2002) argued that reliability and validity in qualitative research could be achieved through the implementation of integrated, self-correcting verification strategies during the conduct of the research. Such procedures, they contended, promoted reliability and validity. In this research, such procedures went beyond the triangulation achieved through interviews with numerous scientific directors and stakeholders, and the researcher's observations at the Cologne Workshop.

In developing a model for the dynamics of the work of the directors, the iterative, critical analysis of data resulted in a model which best fit the data elicited by the research. This model had, in a sense, won its struggle for existence as a result of the use of the constant comparative method to inspect and compare data fragments, to identify the patterns of "action and interaction between and among various types of social units... [and to discover the process of] reciprocal changes in patterns of actions/interaction" (Strauss & Corbin, 1994, p. 278). Even so, this model, like all knowledge, should be regarded as "provisional, subject to a subsequent study which [could] come up with disconfirming evidence" (Silverman, 2000, p. 178).

The comprehensiveness of the treatment of the research data was supported by the use of a set of categories generated from the pilot study data. These categories were tested and refined through the design and the analysis and theoretically informed questioning of the interview and other data in the later part of the research. The tabulation of public data relating to

- the location of the accredited doping control laboratories and the numbers of samples analysed by the accredited doping control laboratories in 2003

- attendance at and presentations to the Cologne Workshop
- research publications by the accredited doping control laboratories in the academic literature
- supported the building of sound theory about the activity of being the director of a doping control laboratory and about the role of the Cologne Workshop.

Respondent validation of the data and its interpretation occurred through the mirroring process of the developmental work research method integrated into the research. This mirroring process has been described previously and included in Table 4-3 on page 110.

To sum up, the approaches built into the design of this research ensured the reliability and validity of the research in that they ensured verification of the data by respondents, the generation of a model of best fit through the mirroring process and theoretically informed interrogation of the data, and the subsequent co-construction by both participants and researcher of the answers to the questions asked by this research.

4.9 SUMMARY

This chapter has set out the design for a qualitative research project that has answered three research questions:

4. What perceptions do the scientific directors of accredited doping control laboratories hold about their work?
5. How do the scientific directors maintain their expertise?
6. What perceptions do other stakeholders involved in anti-doping work in sport hold about the work of the scientific directors of accredited doping control laboratories?

The chapter has described how the case, grounded theory and developmental work research methods have been integrated into the research design.

The use of a variety of research strategies including a pilot study, participant observation, semi-structured interviews and examination of the extant literature and public documentation have been explained. The incorporation into the design of the mirroring process of developmental work research enabled study participants and the researcher to successfully co-construct an understanding of and theoretical model for the dynamics of their work, the answer to the first and third research questions about the directors' and their stakeholders' perceptions of the dynamics of the work of the directors. The incremental development of this model has been presented in Chapters Five through Seven. Similarly,

the research design has set out how the data to answer to the second question about the manner in which the directors go about maintaining their expertise has been collected and analysed. The answer to this question has been presented in Chapter Six.

While later chapters have made visible how that design adopted for this research enabled the researcher and anti-doping scientists and their stakeholders to “see what [was] in front of their eyes” (Janesick, 1994), Table 4-6 provides a summary of how the research questions were answered by the research design. It is worth noting that the use of the theoretical frameworks has not been even between and within the processes of answering each of the research questions. Rather they have been used when and where appropriate. Table 4-6 also prefaces the implementation of the research design presented in later chapters as it presents the elements of the research design, with reference to data collection and analysis strategies and the theoretical frameworks that informed a higher level of interrogation and theory building. Beginning with the scientific directors’ perceptions of their own work in Chapter Five, the results’ chapters report how the research design was implemented, and situate the strategies of data collection, analysis and theory building in the context of the relevant research question.

Table 4-6: Answering the research questions by design

Research Questions	Research Design		
	Data Collection	Data Analysis	Theoretical Frameworks
<p>What perceptions do the scientific directors of accredited doping control laboratories hold about their work?</p> <p>(Addressed principally in Chapter Five)</p>	<p>Pilot study survey</p> <p>Main study surveys and interviews</p> <p>Observations at the Cologne Workshop</p> <p>Public Documentation and academic literature</p> <p>Mirroring interim findings</p>	<p>Open and selective coding as part of the constant comparison technique</p>	<p>Activity Theory</p> <p>Communities of Practice</p> <p><i>Cynefin</i> framework</p>
<p>How do the scientific directors maintain their expertise?</p> <p>(Addressed principally in Chapter Six)</p>	<p>Pilot study survey</p> <p>Main study surveys and interviews</p> <p>Observations at the Cologne Workshop</p> <p>Academic literature</p> <p>Mirroring interim findings</p>	<p>↑</p> <p> </p> <p> </p> <p>↓</p>	<p>Activity Theory</p> <p>Communities of Practice</p> <p><i>Cynefin</i> framework</p>
<p>What perceptions do other stakeholders involved in anti-doping work in sport hold about the work of the scientific directors of accredited doping control laboratories?</p> <p>(Addressed principally in Chapter Seven)</p>	<p>Stakeholder interviews</p> <p>Public Documentation</p> <p>Mirroring interim findings</p>	<p>Data densification through reflection and writing</p>	<p>Activity Theory</p> <p><i>Cynefin</i> framework</p>

Chapter 5 INSIDERS' VIEWS OF SCIENTIFIC EXPERT WORK

5.1 INTRODUCTION

In Chapter Two, the initial research questions about the dynamics of the work of experts and the means by which specialist professionals maintain their expertise background were raised in light of previous research into experts and expert learning and the need to revisit these questions in the context of the changing demands of work in the early 21st century. Chapters Three and Four respectively described the theoretical and practical tools used to gather analyse and interpret the research data. In Chapter Three, descriptions of activity theory, communities of practice and the complexity based *Cynefin* framework were presented. The purpose of these theoretical frameworks within the study was to promote abstract questioning and a deeper understanding of the data to support the construction of theory. The positioning of this investigation in the narrow forensic specialisation of sports doping control work early in Chapter Four, resulted in the refinement of the research questions and a focus on the work of experts who were the scientific directors of those laboratories accredited for sport's doping control work in 2002 by the International Olympic Committee. Chapter Four also described the design of this grounded, case research, a design that also incorporated the developmental work research method. The results of the research into the work of the directors, based on the use of the research strategies described in Chapter Four, and their integration into theoretical models of the work of these experts and the context in which they work have been described in Chapters Five through Eight.

As the first of the chapters reporting the results of the research, this chapter addresses the first research question about the perceptions that the scientific directors have of their own work, positioned as it is in a non-profit, but high profile, global context. To situate the work of the directors culturally and historically, the chapter begins with a brief overview of doping control efforts in sport. This is followed by an explanation of how the research design set out in Table 4-3 and 4-4 was implemented in this part of the study. Section 5.4 draws on data elicited from the scientific directors and from other publicly sources to present a rich description of the work of the directors. Using the research process described in Section 4.5, the theoretical perspectives that supported informed abstract questioning of the data have been integrated into each results section of this chapter. In the

remainder of the chapter, a deeper understanding of the results, based on iterative cycles of theoretically informed questioning and interpretation of the data, has been presented. The outcome of this process, presented in Section 5.5.3, has been the construction of an initial model for work of the directors based on the views of participating directors. The process draws heavily on Activity Theory which holds that every activity system results from its own unique history and is oriented towards a collective, artefact-mediated object: “a constantly reproduced purpose that motivates and defines the horizon of possible goals and actions” (Engeström, 2005a, p. 143). This conception of Activity Theory is central to analysis and interpretation of the results, however it requires the inclusion of the concept of multiple objects of activity to better capture the dynamic complexity of the activity investigated by this research.

5.2 BRIEF OVERVIEW OF DOPING CONTROL EFFORTS IN SPORT

In terms of the number of scientists, the field of doping control science was a small one when compared with other scientific areas such as biotechnology or environmental marine science. When this research began, there were 25 doping control laboratories accredited by the International Olympic Committee (IOC). The formation of the World Anti-Doping Agency (WADA) in November 1999 (WADA, n.d.-b) resulted in a marked increase in anti-doping efforts internationally. By September 2006, an additional eight doping control laboratories had been accredited, making 33 laboratories in all. However, the geographical dispersion of the laboratories, the different organisational contexts within which they are now located, the scientific and legal challenges their work addresses and the slow but steady increase in their number indicated that the context of anti-doping work has changed. The continued efforts of these multiple stakeholders has ensured that the context continues to change. The evolution of the anti-doping efforts has been examined in some detail from a complexity perspective in Chapter Eight, but at this stage a brief overview of anti-doping efforts has been given to provide a preliminary basis for the readers’ understanding of the research context and the discussion in this and following chapters.

Doping in sport goes back to ancient times (Houlihan, 2002; Todd & Todd, 2001; WADA, n.d.-a; Wadler, 1999). The deaths of athletes in the late 1800s and 1900s and the widespread knowledge that athletes were using amphetamines to enhance their performance led to the formulation of rules that banned doping. These rules were virtually unenforceable and amphetamine abuse by athletes remained widespread until the 1960s

when scientists developed analytical methods to detect amphetamine use and processes to carry out analyses began to be put in place. Use of other types of drugs including beta-blockers, diuretics and steroids has required further scientific research to enable analyses for these types of compounds. Scientific research into doping detection techniques continues and now includes research into new areas such as blood doping and gene doping which require those scientists working in the area to acquire new knowledge and skills.

From the mid 1960s and through the 1970s most international sporting federations introduced some form of scientific drug testing of athletes. The Mexico Olympics in 1968 were the first Olympic Games in which drug testing was carried out and the IOC continued to conduct drug testing at all subsequent Olympic Games. To ensure that the standard of testing was exceptionally high and trustworthy, in 1981 the International Association of Athletics Federations (IAAF) introduced a laboratory accreditation process. This was taken over by the IOC and by 1983 seven laboratories were accredited. This increased to 18 by 1986, to 25 by 2002 and to 33 by 2006. WADA became responsible for the accreditation of doping control laboratories in 2004. Whilst scientific techniques have developed over time, funding was not forthcoming from the organisations who used the results of the testing (Charbonneau, 2000). The first formal funding program for anti-doping research was not developed until the early 2000s by WADA.

During the 1990s, more sporting organisations and governments developed effective anti-doping programs so that elite athletes would be tested both in-competition when they participated in major national and international sporting events, and out-of-competition when a doping control officer visited an athlete when they were not competing and requires them to provide a sample for testing. Doping tests increased from just over 106000 in 1996 to almost 170000 in 2004 (<http://www.wada-ama.org/en/dynamic.ch2?pageCategory.id=335>, accessed 25th February, 2006).

The consequences of a positive drug test, that is one which indicates that the athlete has used a banned substance, can mean a ban from competition sport for up to two years or for life. Faced with this prospect, some athletes have challenged their positive doping results in court, bringing in non-accredited laboratory scientific experts to challenge either the analytical result, the interpretation of the result or the science underlying the analytical methods. The increased global effort to address the issue of drugs in sport since the late 1980s has led to anti-doping programs in both individual sports and nations. As well as

overseeing athlete education and sample collection for the testing programs of anti-doping work, some nations, such as Australia, have legislated expansion of these anti-doping agency operations. The Australian Sports Anti-Doping Authority now focuses on deterrence, detection and enforcement through “testing, education, investigation, presentation of case hearings, sanction recommendations and the development, approval and monitoring of sporting organisations' anti-doping policies” (<http://www.asada.gov.au/>, accessed 6th September, 2006), with the motto “Pure performance: The most important sporting record is a clean one.”

5.3 PUTTING THE RESEARCH DESIGN INTO ACTION

As stated in Chapter Four, the contact details for each of the scientific directors of the accredited laboratories were listed on the IOC’s website. This made it a simple matter to email the directors in 2002 and ask them to participate in the research. Following the pilot study, a presentation at the Cologne Workshop on Dope Analyses in March 2003 (to be described in Chapter Six) had introduced both the research and the researcher to the wider anti-doping scientific community and established the relationship base upon which the research was to be built. The pilot study had resulted in an initial understanding of the work of the directors and assisted the development of a survey and interview guides that was used in the main study to gather further data from other scientific directors and from representatives of groups of stakeholders which had been identified by pilot study participants. Data were collected, analysed and theory built using the iterative grounded process described in Section 4.5.4.

Overall, 18 of the 28 directors responded to the request to participate in the research in some way and 15 actually contributed, just over 53% of the total population of directors at that time. The overall pattern of the directors’ participation is given below in Table 5-1. Just over 36% of the directors were interviewed.

Table 5-1: Patterns of Directors’ participation

	Pilot surveys	Surveys	Interviews	Agreed to participate but did not respond to follow up
Number	4	3**	10	2

** One respondent provided only demographic data

As stated in Chapter Four, in both the survey and the semi-structured interview schedule, a number of demographic questions were followed by open-ended questions that encouraged the directors to talk about their own career history and the background to the establishment of their laboratory. Directors were asked about those aspects of their work that they liked and disliked; the challenges experienced by scientists working in the area, the skills and knowledge necessary for their role; about communication and the maintenance of their expertise; the place of research and routine work in the laboratory, and finally a personally significant event related to anti-doping work. Participants were invited to make further comment if they so wished. All interviews were longer than 30 minutes with some lasting more than an hour. Five of the interviews were conducted by telephone, often at strange hours of the day and night to compensate for time differences between Sydney and the directors' locations. The other five interviews were conducted face-to-face on occasions when the researcher was able to be in the same geographical location as the director. In this and other results chapters, italics have been used to indicate that the text quoted was sourced from an interview with either a director or stakeholder.

As stated in Section 4.5.4, iterative cycles of display, analysis, coding and densification of data collected from interviews, surveys notes, public documentation, and observation notes supported the interpretative and theory building aspects of this research. Directors were asked to review and comment on their own data, as well as being given the opportunity to reflect upon and critique preliminary interpretations of aggregate data as part of the mirroring process of the developmental work research method that had been integrated into this research. The illumination and interpretation of the major aspects of the directors' work using the theoretical frameworks described in Chapter Three supported the development of the initial stages of a dynamic model for the work of the directors. Further aspects of the model will be developed in Chapters Six and Seven which respectively address the maintenance of expertise within this scientific field and stakeholders' perceptions of the work of the directors. The evolving complexity of the global context of anti-doping work has been explored in Chapter Eight.

5.4 BEING THE SCIENTIFIC DIRECTOR OF AN ACCREDITED ANTI-DOPING LABORATORY

There are no formal courses about either the science of dope analysis or about being the director of a doping control laboratory. Would-be directors require extensive knowledge

and experience in an appropriate scientific field such as biochemistry, toxicology, pharmaceutical or analytical chemistry in order to begin to understand the nature of their future work. In the past the IOC provided guidelines about the requirements for accredited doping control laboratories, including a list of substances whose use laboratories would be able to detect through their analyses and an accreditation assessment each year. Additionally, would-be directors were expected to have either a doctorate or hold extensive experience in the field. Since the World Anti-Doping Agency (WADA) became responsible for laboratory accreditations, would-be directors can learn about the nature of their future role more formally through a study of the detailed International Standard for Laboratories (ISL) (WADA, 2004a) and the Prohibited List (WADA, 2006d), “an International Standard identifying Substances and Methods prohibited in-competition, out-of-competition, and in particular sports”. As will be seen from the following sections, the day-to-day practice of being the director of a doping control laboratory requires much more than a thorough knowledge and understanding of these documents.

All the directors described themselves as being personally and professionally challenged, excited and satisfied by their work. Analysis of data from the pilot study described in Section 4.4, and data from the main study interviews, generated numerous codes that were later subsumed into three broad categories of description for the perceptions of the scientific directors about their work. These broad categories focused on the efforts needed by the directors to

- sustain routine dope control testing in their laboratory
- advance anti-doping science through knowledge creation and mobilization
- promote the participation of the directors in the governance of global anti-doping practices.

However, not all directors reported concerns about all these categories. An examination of the number of routine doping control analyses conducted by the laboratories in 2003 (WADA, 2004d) and the research presentations of the laboratories at the 2003 and 2004 Cologne workshops supported an experiential basis for these categories. The categories and their attributes have been summarised in Table 5-2. Prior to a detailed account of these categories, a description of the directors’ sense of personal commitment to their work has been given.

5.4.1 A personal response

The personal commitment of the directors to their role is evident in their relative stability as a group of workers in times when professionals frequently change jobs. During the period of this research only three of the 28 laboratories accredited at the outset of the research had a change of director: (Russia, Portugal, and Korea). An attendance list from the first Cologne Workshop held in 1982 showed that some of the directors had worked in anti-doping for more than 20 years. Other directors had been involved for more than 10 years. The comments reported below also indicate a personal commitment and response to the role.

Table 5-2: Routine and research work of the accredited anti-doping laboratories

Routine and selected research output Perspectives about the work of the scientific directors	Number of directors Number of samples in 2003	Average number of presentations by participating directors' laboratories at 2003-4 Cologne workshops	Average number of presentations by all laboratories of this size at 2003-4 Cologne workshops
Sustaining routine testing Managing the laboratory Maintaining forensic proficiency Keeping up with new scientific techniques Acknowledging a shared responsibility	3 Less than 2500	0.0	1.2
Advancing anti-doping science AND sustaining routine testing The nature of anti-doping scientific research Keeping up with doping practices Mobilizing new knowledge within the community Deepening relationships	3 Between 2500 and 4500	4.7	3.4
Participating in anti-doping governance AND advancing anti-doping science AND sustaining routine testing Critiquing anti-doping administration Canvassing involvement Formalising community involvement	8 More than 4500	8.9	7.6

Whilst holding the different perceptions about their day-to-day work described below, all the directors stated that their work in this field had allowed them to combine their interests in a variety of areas, to do research and routine work that was exciting and challenging as well as of benefit to society at large. As highly qualified and experienced scientists, becoming the director of a doping control laboratory had represented a change of career

course for the directors. The field offered one director the opportunity to “*use chemistry on real life*” (ID: D010). Another stated that

The decision for me to proceed in the anti-doping field ... has so many shades and personal impressions. Good experiences with colleagues on one side and on the other side, of course, an interesting field of work. And the third thing for me was that it was very challenging because you produce results and you immediately have an effect through these results if it's a positive result.
(ID: D003)

For some it was important that the nature of their work had enabled them to promote the profile of science in their particular nation: “*We have facilities to help (other labs in the country) ... facilities that might speed up their research*” (ID: D002).

One director stated their belief that by working in the area, a director took an ethical stance on the issue of doping in sport because “*because the motive of doping control is mainly supported by ... ethical considerations*” (ID: D015). Another director stayed in the field because “*there is a need for this work*” (ID: D006).

The work was personally demanding. During my attendance at a Cologne Doping Analysis Workshop, one director asked that a comment be published about the directors’ having to deal with the stress of waiting before the start of a second analysis to confirm the presence of a prohibited substance in an athlete’s urine sample, the conduct of which would be observed by the athlete’s representative. The director described the stress related with the tense situation where he / she was “*looking out the window to see who’s turning up; for example the big American lawyer.*” However, there was also acknowledgement of the formative role of such experiences. The director of the Canadian accredited laboratory, Professor Ayotte (2004) stated that “*assisting the sport authorities and responding to the allegations made during the dispute takes time but we have used that experience to target research work to improve our methods, correcting the more fragile aspects and incorporating various checks*” (p. 239). In spite of such stress and challenges to their work, another director commented on the low staff turn-over remarking with a wry smile that the directors and staff of anti-doping laboratories “*don’t leave - they don’t change jobs*” (ID: D005) attributing this to the fact that it was “*exciting work.*” This next comment from about the work of a director epitomised the thoughts of a number of the other directors:

It’s fun. It can get extremely stressful. [You’re] always discovering things; interacting with people. I’ve made some very good friendships. ... It’s been

stimulating the interactions that we've had in terms of both socially and also the work that we do and I think that we're still learning. (ID: D001)

The comments above indicated that the directors were personally engaged in and challenged by their work. They were buoyed by the intellectual stimulation and their belief that what they do is good for society. Their work satisfied both the curious and altruistic aspects of their natures. They also appreciated the collegiality of their peers in this small field. Their comments made it clear that their role was not without the emotion and passion described by Nardi (2005) as being associated with the formulation of the objects of collaborative activity (see Section 3.2.1). In activity theory terms, the personal motives for the directors' activity originated in their personal need to apply their scientific knowledge and skills to the active solution of a recognised problem, to satisfy their intellectual curiosity, to heighten the profile of science in their country and to be part of a scientific community. Addressing the scientific aspects of sports anti-doping work had provided a suitable context for giving a sense of meaning to - an underlying motive for, their scientific work, individually and collectively.

As well as the various ways in which being the director of an accredited laboratory provided a meaningful identity for these scientists, the scientists' perceptions of their roles also varied. The ways in which their comments emphasised the need to sustain routine testing, to conduct research and development work, and to participate in governance activities has been presented in the following sections.

5.4.2 Managing routine operations

Analysis of the survey and interview data indicated that sustaining routine operations in an accredited doping control laboratory was a complex task comprising both scientific and general duties. The data showed that establishing an accredited laboratory required considerable time and effort on the part of the would-be director and that after attaining accreditation, the director then dealt with ongoing demands of maintaining the physical, intellectual and professional standards of their laboratory and its staff. The data in the following sections provided insights into the various facets of this aspect of the directors' work, beginning with comments about how these scientists came to be directors of accredited anti-doping laboratories. The data also indicated that the directors of laboratories with low numbers of analyses, that is, directors with less experience, were

focused solely on these aspects of their work. Those directors with more experience described additional dimensions to their work to be described later in this chapter.

5.4.2.1 Learning to do anti-doping science

In the absence of a formal course in anti-doping science, scientists interviewed for this research began their journey towards being the director of an accredited laboratory with considerable scientific knowledge and expertise in a field appropriate for, but not in, anti-doping science. They learnt what was needed in an informal way - through reading the literature, and interaction with the directors of and scientists in laboratories that were already accredited.

Interview and survey data showed that the directors' entry to the field had various triggers. Some directors had instigated their entry into the field by contacting the appropriate national authorities and proposing that a national doping control laboratory be set up. Others had been approached by or responded to advertisements published by their national governments or representatives of organizations that were planning a major sporting event such as an Olympic Games that required a doping control laboratory in the city or country where the games were to be held. Few directors had any formal knowledge of, and experience in, the field of anti-doping science before taking on the role of director. Rather they had acquired their knowledge over a period of years prior to their laboratories' being accredited by the IOC.

Demographic data, as well as publicly available documentation on organisational websites, indicated that the directors' backgrounds were not homogenous, rather they had a variety of educational and professional experiences including chemical, biochemical, medical and biomedical sciences. Preceding their entry into the doping control area, the directors worked in academia, industry and government institutions for varying numbers of years. To gain the necessary knowledge about anti-doping science and managing a doping control laboratory, many directors stated that, as well as reading the literature, they had interacted with other anti-doping scientists. Often these interactions included attendance at the annual week-long Cologne Workshop on Doping Analyses in Germany and visits to established doping control laboratories. In some instances, these visits were quite extensive, lasting far longer than just a few hours or days. In this way, the would-be director gained practical experience through actually carrying out the analyses of athlete samples. Such encounters enabled would-be directors to learn about the various ways in

which other accredited laboratories conducted their analyses and carried out the routine work of doping control. A would-be director was then able to return to their own laboratory and to develop their staff's capabilities required to carry out the analyses with the equipment available in their own laboratory. One director described their own experience:

[I] visited laboratories and went to the workshop in Cologne. ... talked to the people in all those laboratories and the people in Cologne, [I] found out what was needed so that when I [went] back I knew what procedures other people were using and ... could develop our own procedures. (ID: D001)

At times, the relationship between would-be directors and current directors provided ongoing support as such interactions of “*setting up laboratories ... [led] to casual rather than formal cooperation*” (ID: D006).

The lenses of the three theoretical frameworks described in Chapter Three, provided a deeper understanding of the process of learning to be the scientific director of an accredited laboratory. Firstly, these processes were reminiscent of the concept of legitimate peripheral participation (see Section 3.3.1) whereby new members of a community of practice observed and learnt about their new practice from more experienced and more active members of an existing community of practice (Lave & Wenger, 1991; Wenger, 1998). This approach to the establishment of a doping control laboratory through hearing, seeing and participating in what others in the field were doing, followed by doing it themselves, had a number of consequences. On the one hand, it meant that the would-be directors developed strong relationships with other laboratories and their staff. On the other, the directors gained practical knowledge of the analytical methods that they would need to implement successfully in their own new laboratory. It also meant that a would-be director's first hand experience ensured that he/she was able to interpret the results of the analyses regarding the presence or absence of performance enhancing substances used by athletes for doping. The would-be director's observations of and discussions with the staff of other laboratories also assisted their learning about the development and management of the routine processes which they needed to put in place so that their laboratory would be able to carry out the practice of larger scale routine dope control testing. Further, the would-be director learns a great deal about their future role, about what it meant to work in anti-doping science, and to be the director of an accredited laboratory. In effect, learning to be the director of an accredited laboratory took place by participating, albeit peripherally, in an existing community of practice.

Secondly, activity theory concepts provided a means for better understanding the process of becoming a director. As the would-be director observed and heard about anti-doping activities in other laboratories, he/she visualized an expanded state for their own laboratory's activity (see Section 3.2.3). To achieve this, the would-be director and his/her staff carried out the required learning as they crossed a zone of proximal development (see Section 3.2.2) and subsequently implemented their expanded activity. Finally, would-be directors needed to be able to routinely deal with non-routine events as they were embarking on a career path which demanded considerably more than the ability to carry out the science of a doping control test. In short, they were entering a field that “[involved] several fields working together. ... [It was] more than just theory” (ID: D015). It was work in which “it [was] usual that unusual things [happened]” (ID: D004).

This last aspect of learning to do anti-doping science suggested that the would-be director needed to be able to make sense of situations in which there was a lack of certainty. According to the *Cynefin* model, (Kurtz & Snowden, 2003; Snowden, 1999a, 2005) described in Section 3.4.2 the complex nature of work in such dynamic chaotic and complex required not only expert knowledge but also the ability to explore these evolving contexts and to retrospectively recognise patterns they had seeded through experimentation.

After learning about and becoming accredited to carry out anti-doping work, directors reported that the routine management of their laboratories presented ongoing concerns.

5.4.2.2 *Managing the laboratory*

The everyday work of routine testing in an accredited laboratory requires the management of skilled, committed staff and the acquisition and maintenance of the sophisticated instrumentation necessary to meet the high analytical standards for the work. It also involves interacting with superiors in the greater organizational context within which the laboratory is located, a role which is not always easy. The role is not without its challenges as can be seen from the directors' comments that follow.

Many directors expressed feelings of ongoing frustration arising from the difficulties they experienced in raising sufficient income to cover changing day-to-day needs. One director

commented on the annoyance that comes from working in a field where a government “[wanted] to do dope testing but they [didn’t] really want to pay for it” (ID: D005).

Another director felt that funding problems arose because “higher authorities” (ID: D002) did not adequately understand the context of doping control work, which a different director regarded as leading to “political issues rather than scientific ones” (ID: D001).

Other directors’ comments related to the ongoing financial situation of the laboratories and the requirements of making enough money to keep within budget, to support the work and to avoid the need for a constant search for funding:

[The low prices associated with doping control analyses made it] very difficult to break even and, even more, to make profit for the purchase of new instruments required in the field. (ID: D009)

Changing the technology frequently and demanding new instruments in the market that [cost] a lot. (ID: D010)

My biggest challenge [was] to find support, money, subsidy, because as time [moved] on ... you [had] to improve the lab ... We [had] to survive by doing other analyses for customers so that we [could] actually draw income. (ID: D002)

One director pointed out that the laboratory comprising its skilled staff and expensive instrumentation had to be maintained “whether it [was] for one sample or for twelve samples” (ID: D006). This director also commented that if there was an increase in the number of accredited laboratories, there would have to be an increase in the number of samples to be tested in order for all accredited laboratories to have sufficient work to support their operations. Another director expressed the opinion that there was a need for “proper independent financing of the anti-doping organizations, including the labs” (ID: D011) in order to avoid the grind of ongoing financial difficulties.

Another area of comment was that of staffing. One director alluded to the importance of good laboratory staff when describing laboratory staff as a “like a team on a sailing boat” (ID: D008). Another director commented that managing a laboratory required constant interaction with staff and with keeping experienced staff to avoid constantly having to train up new personnel (ID: D001). The frequent introduction of new techniques and research outcomes, led other directors to describe problems they had experienced with “finding the right people, the people who [had] a keen interest in the changing science” (ID: D002) and

with obtaining appropriately “*trained personnel*” (ID: D010) who would be able to apply new research outcomes and techniques in their laboratory with proficiency.

Sport that was free of doping by athletes was considered an important ideal by the majority of governments, sporting federations and health practitioners. Yet these comments from directors in different countries in various regions of the world indicated an underlying problem for the accredited doping control laboratories. Dope testing was a highly-specialised and expensive practice that relied on the commitment of highly skilled staff. Yet neither governmental nor sporting bodies, nor even commercial sporting interests, had universally committed the funds that the directors who carried out the technical aspects that underpinned anti-doping work, regarded as necessary for the smooth conduct of routine practices associated with their work. In activity theory terms, these difficulties in obtaining funding for the work of the laboratories point to a difference between the use value and exchange value of the results of doping analyses and give rise to considerable tension between the directors and their institutions. The directors were also concerned about the funding of scientific research in this area.

5.4.2.3 Keeping up with new scientific techniques

Doping in sport is an evolving field and has come a long way since ancient Greeks used “extracts of mushrooms and plant seeds” (Observer, 2004) to enhance their performance. Whilst most recent efforts towards better detection of performance enhancing substances have concentrated on improving analytical techniques to identify the presence of a banned substance or its metabolite in urine, the approaches to artificial performance enhancement continue to change with new techniques being developed for the detection of erythropoietin (EPO), human growth hormone, and blood doping. At the very first “Ethics and Social Science Research in Anti-Doping” Conference, Nikolay Durmanov (2006) spoke at length of the role to be played by scientific knowledge in meeting the challenge of techniques such as gene doping.

The directors were well aware of the changing nature of anti-doping scientific work:

More and more of the methodologies are tending to be biochemical (rather than analytical). (ID: D009)

It’s a very interesting, a fast moving field with a lot of developments. (ID: D005)

As the person responsible for an accredited laboratory, the director had to ensure that he / she as well as his / her laboratory's staff were well informed about the latest developments in doping and anti-doping science. They recognised the need to:

[Keep] both yourself and your staff up-to-date with the dynamic state of the science. (ID: D002)

Keep up internationally or you'll fall behind. (ID: D005).

There was a fear of not keeping up because “*there's too much information out there*” (ID: D002).

At the end of 2003, the responsibility for accrediting international sports doping control laboratories was transferred from the International Olympic Committee (IOC) to the World Anti-Doping Agency (WADA). The transfer occurred during the period of this research. As a result of the transfer, the accredited laboratories were being required to respond to changes in the requirements relating to the operation of accredited laboratories:

Quite often the rules change. ... WADA will develop new rules and the laboratories will have to work with [them], modify methods to be in line with their procedures within a fairly short time; they'll change the way the accreditation is run. So constantly you're on your toes because there's a lot of change in the area. (ID: D001)

Such changes were not always easy or welcomed by the directors. In a paper presented at the 22nd Manfred Donike Workshop on Dope Analysis, the director of the Rome laboratory described:

the drastic reorganization of the structure of the screening methods consequent to the last upgrade of the list of prohibited substances and methods, focusing on the possibility to reorganize the internal workload of the laboratory keeping the overall number of internal procedures at a minimum. (Botré, Amendola, Borrelli, Colamonici, & Garribba, 2005, p. 15)

Other directors commented in their interviews that:

Having to adapt the laboratory for the (ISO17025 laboratory standards and WADA's International Standard for Laboratories) regulations [was] a challenge (ID: D009)

[The] new regulations being promoted by WADA ... [took] a serious amount of time for questionable benefits. (ID: D012)

Changes such as these in the context of the work of a laboratory originated both from the shifting nature of doping and from alterations to the governance of the area. Whatever the

origin of the changes, the laboratories were obliged to react and individual directors had to determine and execute an appropriate response for his / her laboratory. The subsequent tensions between the directors and other members of the anti-doping doping community centred on the changing rules associated with their activity. These changes were associated with moving to a new version of the activity of the laboratories. Not only did these comments indicate that the changes had little positive response from the directors, they also suggested that a new version of the activity had been imposed on the directors rather than jointly visibilized and constructed as in the third generation of activity theory (see Section 3.2.1). In terms of the complexity based *Cynefin* model, the changes suggested that the recently-formed World Anti-Doping Agency (WADA) had sensed that doping in sport presented a chaotic situation and that the appropriate management technique was to impose order through the structured control provided by the implementation of standard process based on publicly accessible information (see Section 3.4.2). From a community of practice perspective, the community was being expected to transform its practice to meet a new set of external needs (see Section 3.3.2).

Regardless of the changing nature of their activity, all directors were aware of the need for their laboratories to produce analytical results of the highest standard.

5.4.2.4 Maintaining forensic proficiency

Frequent reports in the media are testimony to the fact that this area of scientific endeavour was subject to intense scientific, legal and public scrutiny. The standards that a laboratory director had to ensure that laboratory staff, resources and procedures were able to routinely meet covered analytical, technical, quality management and support requirements set by the accrediting body - the IOC until the end of 2003, and since then WADA. Professor Jordi Segura, director of the Barcelona Laboratory, spoke to the European Parliament's Committee on Culture and Education about the laboratory experts' recognition of the need to meet such requirements:

the result must be fully reliable, especially when reporting adverse analytical findings. Luckily, the high level of confidence demanded both by the athletes and by the society has been long recognized by the laboratory experts.
(Segura, 2004, par. 4)

In an interview with a journalist, Professor Franz Delbeke had spoken of the nature of these demands when he described the analytical precision levels thus:

In the days of amphetamines we could detect micrograms per millilitre, by now we're about a 1000 times more precise. For anabolic steroids we're at a nanogram per millilitre, we're even below that for corticosteroids. To give you a idea what a nanogram per millilitre is: that's one particle that can be spotted in one billion particles of urine. A colleague of mine once compared it to tracking down one person in the entire population of India. ("Interview with Doping Hunter Professor Frank Delbeke," 2005)

When contributing to this research, one director reinforced this comment by stating that “*in this field of science [a director was] required to have much more clarity than in any other section of science*” (ID: D008). One director aimed to oversee “*a reliable laboratory which [provided] correct analytical results that [would] allow a proper fair judgement of doping cases*” (ID: D009). Other directors commented about the prospect of legal challenges to positive analytical results:

When you have a positive and you are challenged ... it's very hard. (ID: D005)

If you have a person that is paid to say 'Look, if this laboratory result can be wrong', and you pay this person (a great deal of money) he will find a flaw in your laboratory procedures that will not be relevant at all to the solidity of the results. (ID: D008)

One director highlighted the effort needed to maintain the required standards and stated a belief that the doping control laboratories were “*unique because the science [was] top-level but [the] very huge workload ... mainly [relied] on humans not on machines*” (ID: D008). Another director was aware of the pressure that ensued from the need to “*maintain the [laboratory's] reputation all the time – ... the most difficult part.*” (ID: D002). This director also stressed the critical importance of staff and research activity in achieving such proficiency:

The most important thing [was] how to manage the lab in terms of maintaining quality and ... keeping staff interest and commitment ... because without them, the lab [didn't] work. ... I think that's the most important thing for a lab director. (ID: D002)

You [had] to include some form of research so that people doing the routine work [were] thinking about their work and [didn't] become just robots just doing things automatically without thinking about it very much. (ID: D002)

Other directors agreed with the inter-connectedness of research and routine work. Doing both routine and research work ensured that staff knew all the problems associated with

their work (ID: D011) and thus had the depth of knowledge necessary to evaluate routine results (ID: D009). The juxtaposition of routine and research activities contributed to upgrading the staff's knowledge and promoted laboratory's proficiency - proficiency that would stand up to legal scrutiny. However, an investigation of the English language publications relating to anti-doping research indicated that not all anti-doping laboratories had published papers in recent times suggesting that active research programmes exist to varying degrees in the accredited laboratories. A discussion of this data has been presented in Chapter Six.

The above comments from the directors underscored their recognition of the paramount need for accredited laboratories to sustain a level of day-to-day performance that would withstand intense legal and external expert examination. As well as recognising the link between reliable testing processes and sound scientific research, the directors found it difficult at times to deal with the anxiety that could accompany challenges associated with some positive doping cases. In activity theory terms, routine anti-doping work was divided in such a way that the labour of generating reliable scientific results had been assigned to the accredited laboratories. Tensions arose between the laboratories and the community when there was a perception that this was not the case and that the laboratories were not producing reliable results. From the perspective of the *Cynefin* model, the public need to rely on standardised, validated processes related to the work of experts whose private task it was to identify possible, and develop and test actual, solutions to problems. The problems in the context of doping control in sport were concerned with the detection of the use of prohibited performance enhancement techniques by athletes. The tension between the visible public domain of an athlete accused of doping and the normally invisible domains of expert scientists could be caused by a lack of understanding between the open sense making of the public domain and the restricted sense making of the domains in which experts did their work.

5.4.2.5 *A shared responsibility*

The individual accountability of each of the directors for the standards of their own laboratory as described in the previous section was common to all directors. It gave rise to a shared responsibility. One director commented that all laboratories “*work towards the same goal. We work as a group*” (ID: D008). There was a belief that the laboratory

directors could “*only do our analyses following the rules and being very strict in our evaluations and explanations and ...then we have done our duty*” (ID: D015). There were common needs for “*continued improvement in quality control*” and “*improved knowledge of procedures as a result of better understanding of uncertainty*” (ID: D003) and some optimism that because of

the formation of WADA and the money that they have to spend for research and also for control, education and everything, a new stage in anti-doping control and much better harmonisation (could) at least be expected for the coming years on the basis of the anti-doping code and of the other methods WADA has elaborated. (ID: D015)

The use of ‘we’ and ‘our’ in the above comments demonstrated that the directors recognised a shared purpose and responsibility with respect to producing correct analytical outcomes. The comments also indicated that the directors were aware of the need for ongoing efforts to ensure that they and others felt continued confidence in the results of the analyses conducted by the accredited doping control laboratories. The dialectical relationship between the individual and collective subject of anti-doping scientific activity was palpable in comments such as those presented above. The directors were ‘in this together’. The shared responsibility also suggested a preparedness to work with non-scientific workers in the broader anti-doping order community to address the issue of doping in sport in the international context, to create what in the third generation of activity theory is described as a shared object for their joint but distinct effort. The feeling that this community of scientists shared responsibility for and commitment to a joint practice was also tangible during the annual Manfred Donike Cologne Workshop on Dope Analyses, an event which has been discussed in Chapter Six. Rather than being a short-lived, contained goal, this object of doing routine doping control analyses encapsulated a persistent ‘horizon of possible goals and actions’ (Engestrom, 2005a, p. 143) for all directors and was central to the activity of being a director.

In this section many of the day-to-day responsibilities and concerns associated with routine testing in an accredited doping control laboratory have been described. All directors who participated in this research, regardless of the amount of experience in the field or the number of samples analysed annually, made comments on this aspect of their work. In activity theory terms, it was a shared object of the activity of being a director. Importantly, in three cases, these were the only types of comments made by the directors. These

directors were responsible for laboratories with comparatively small annual sample loads of fewer than 2500 analyses annually (WADA, 2004d). In activity theory terms, this suggested that the directors of laboratories with comparatively small numbers of doping samples had a single object for their activity, namely doing routine analysis at the required level of proficiency. The directors constantly needed to alter their activity to meet the changing approaches to doping adopted by athletes, as well as the additional scientific, organisational and legal demands of this evolving context. The dynamic nature of this work had been reflected in the scientific directors' comments reported above. The directors' comments also indicated that there were tensions within the community relating to the financial, knowledge and proficiency related demands associated with sustaining routine testing in an accredited laboratory. These tensions will be further discussed towards the end of this chapter in Section 5.5.2. As noted at the beginning of Section 5.4 and in Table 5-2 a second category of directors' comments related to the advancement of anti-doping science through research and development. These directors were responsible for laboratories that had analysed more than 2500 samples annually. This second category has been described and their theoretical implications discussed in the next section.

5.4.3 Advancing anti-doping science

More experienced directors whose laboratories analysed more than 2500 samples annually, formed a sub-group who described their work as involving **both** sustaining a routine testing laboratory as set out in the previous section AND* as conducting research and development. This research and development would contribute to the ability of anti-doping science to detect the use of new performance enhancing techniques by routine testing. As will be seen from their comments, these directors believed that the nature of research in this area differed from that in other areas. These directors referred to research as being triggered by unusual occurrences in routine testing and by 'cases' – legal action brought about by athletes who had returned a positive result for the presence of a banned substance and wished to challenge that result. They regarded the research process as complete only when it resulted in a robust, validated method that could be applied routinely by testing laboratories and stand up legal scrutiny. In short, research was complete only when the knowledge it generated was mobilised by accredited doping control laboratories. The directors questioned the ability of external scientists to fully

* Here and subsequently, AND has been used as a Boolean operator to indicate both the previous and subsequent referents.

appreciate this distinction between doping control research and that in other scientific fields. Newly generated knowledge was distributed between the laboratories through publication in the academic literature and by presentations at the annual Cologne Workshop. Their research contributions also led to stronger relationships with other members of the scientific anti-doping community. The results below set out comments made about this aspect of their work by these more experienced directors, beginning with the importance of research for anti-doping work.

5.4.3.1 *The nature of anti-doping research*

A sub-group of the directors commented that the nature of research in the anti-doping context differed from that of research in other fields. One director pointed out that “*Good research ... understands the need and problems of the research topic*” (ID: D003). Another director stated that routine work provided “*a continuum of cases to challenge the established knowledge and foster new R&D work*” (ID: D007). A third director (ID: D009) agreed that doing research in anti-doping work was dependent upon the knowledge and experience that came from doing routine work. Another director stated that, unlike researchers in other fields, researchers in anti-doping laboratories believed that “*when the test is fine, that’s when the research is complete*” (ID: D006). This director concluded that those scientists working in the accredited laboratories, who had a better understanding of testing, had a better understanding of what was needed for anti-doping research. A different director explained:

every time you do research, you have to [be] prepared that that research will lead to a methodology that your laboratory will use. ... A couple of things have to be kept in mind depending on the nature of the substance. Firstly, you have to ask ... ‘Can I work this into any of the routine tests I already do?’ If the answer is ‘yes’, that’s a very big win. That means you can assimilate it and there’s very little extra work, maybe some minor modifications and validations, but it just becomes part of an existing methodology. If the answer is ‘no’, then you have a huge problem. That means you have to develop a new test. That costs money and my calculation is that for every new test that can’t be run in with the others, it’s about [the equivalent of \$AU200000] for something simple because you have to put someone on it to run the samples separately to the other screens. (ID: D001)

In the light of these extra considerations, it was not surprising that some directors expressed reservations about the involvement of external scientists in doping control research. One director (ID: D003) expressed disquiet that some external researchers may be directing their research capabilities towards doping research in the prospect of obtaining

funds that would enable technology spin offs for their other research areas. Another director (ID: D009) referred to long term benefit to be gained from the ongoing use of instrumentation originally purchased for research in improved routine dope control testing once the research was completed rather than, as the previous director (ID: D003) had speculated, being put to work in another field. A different director (ID: D012) doubted the ability of scientists from other fields to act as the assessors of applications for anti-doping research funds because of their lack of understanding of anti-doping scientific work.

The researcher's presentation at the 2005 Cologne Workshop in which the researcher discussed the research output of laboratories, one director from a laboratory which did conduct research, thought-provokingly wrote:

day to day routine leads you to focus on routine problems. Therefore there's no time to fly high. ... [laboratories] tackle similar problems. ... Our niche of work suffers from the lack of fertilizing character coming from an ample scientific research. ... It is common knowledge that ultra focused research usually is a waste of money. Breakthroughs often come from other related (or even unrelated) fields. Challenge is to find common goals on medical /food chemistry research and anti-doping needs. (ID: D007)

Many of the research projects in analytical science had been triggered by day-to-day problematical or interesting experiences in routine testing. In terms of the *Cynefin* framework, it seemed that many research projects in anti-doping represented efforts to untangle the complex science of their field in order to make knowable its intricacies and subsequently render more aspects of the practice of anti-doping science known (see Section 3.4.2). From a communities of practice perspective (see Section 3.3), the overseeing of the development and dissemination of the solutions to the ongoing challenges of routine doping control work, suggested that these anti-doping scientists acted as stewards of their practice to ensure that the knowledge and skills of both themselves and other members of the anti-doping scientific community maintain a practice which was professionally adequate to meet the needs of the broader community. Not all research was triggered by day-to-day events. From an activity theory perspective, engagement in research that would advance anti-doping science presented a second object, an additional horizon of possible actions and goals for the activity of these directors. Whilst linked to the actions and goals associated with the first object, effecting the day-to-day actions and goals associated with a functioning research distinguished this as a second object.

In recent times, many new pharmaceuticals have been developed that have been or could be used by athletes to enhance their performance. The perceived prospects of blood and gene doping have also given rise to the need to expand anti-doping science and to work with researchers from other disciplines. As will be seen in the next section, the directors are well aware of these challenges.

5.4.3.2 *Keeping up with changing doping practices*

Like other scientists, doping control scientists carry out research in order to generate the new knowledge needed to keep up with the growing complexity and diversity of doping practices amongst athletes. As scientists researching in the area of doping in sport, these more experienced directors in this sub-group acknowledged their need to develop “*new analytical tools for the detection of new drugs challenging the field*” (ID: D009) to catch up with the athletes and their advisors who were “*continuously trying to develop new things that they can use to fool the laboratory*” (ID: D005) and by the need for the accredited laboratories to “*guarantee [the] appropriate monitoring*” (ID: D007) ability of these tools. Because anti-doping scientists saw themselves as playing “*an active role in fighting doping in sport*” (ID: D011), their research was the means through which they were “*really at the margin of development*” (ID: D015) in their field of endeavour.

The desire to keep up with new approaches to performance enhancement created what one director described as a “*feeling of urgency and the obligation to act all the time*” (ID: D011). Another director referred to the ongoing research and development in the pharmaceutical industry as presenting a continuing challenge to doping control laboratories:

As the pharmaceutical companies develop drugs, athletes see the potential of these drugs as doping agents. We try to second guess, or first guess them even, so that when a new drug's coming out we'll look at its potential for use as a doping agent. If it is, we'll look at ways of testing for it. (ID: D001)

The directors also recognised that as doping control became more complicated they would “*sail into many gaps [and need] to come up with the scientific needs and different techniques of testing*” (ID: D003). There was growing recognition of the need for multi-disciplinary research into some of the undetectable performance enhancement approaches which are outside their current expertise. Such research would require “*involving a lot of people in other labs with various expertise as the laboratory itself [would not] have the expertise to actually cover all bases*” (ID: D001).

Regardless of whether an accredited laboratory was university based or located in a commercial or public context, this sub-group of directors were vocal about the need for funding to support research that aims to advance anti-doping science. Some directors commented that one of the main problems confronting expert scientists working in doping control was “*getting the money for [their research] ideas*” (ID: D003). They commented that there were “*not enough financial resources to support your research groups*” (ID: D013). One director expressed their concern that doping control work was not considered highly amongst the wider scientific community. One consequence of this was that there were comparatively few scientists working in the field and thus limited scientific interchange. The director suggested that “*programs [needed] to be developed that would attract the very best scientists to doping control science*” (ID: D012). As an attractor for bright young scientists, research could be expected to play a key role in such programs.

Research Laboratories accommodated by other types of institutions may not normally have supported or encouraged research. Frustration resulted from working in a situation where a laboratory was caught between a national government that did not necessarily want to pay for dope testing and a university that “*[didn't] have the money and internationally universities are scaling down monies for research*” (ID: D005).

Laboratories located organisationally within or that had links with a university were expected to conduct research in order to “*be in tune with academic aims*” (ID: D006). These laboratories were part of institutions in which there was an expectation that the outcomes of research would be open to scrutiny by the wider academic community through publication in the academic literature.

In light of the location of a number of the laboratories within universities or the relationship between a laboratory and a university, it was not surprising that a number of directors referred to the valuable research contributions made to anti-doping science by research students working within the laboratories (IDs: D007, D011, D013). During attendances at the Cologne Workshop, the researcher noted that numerous presentations given at the workshop were based on the work of research students. These presentations often dealt with both theoretical and the applied nature of the outcomes of the students' research in anti-doping science, reinforcing the belief that that research in this area was not complete until it had been incorporated into a usable testing process (see Section 5.4.3). An example of a university research student project undertaken within a doping control

laboratory was presented at the 2004 Cologne Workshop by Adam Cawley (2004) who presented his work on the pure and applied aspects of carbon isotope ratio analysis in doping control. Over the years, such student research has provided a comparatively inexpensive means of advancing the anti-doping science.

In activity theory terms, research to expand their practice was, for some directors, a second object within the activity being the scientific director of an accredited doping control laboratory. The comments presented in this section indicated that this sub-group of more experienced directors saw themselves and their staff as being at the cutting edge of their field. To paraphrase the words of activity theorist Yrjö Engeström, these directors worked to learn what was not yet there (1991, p. 270). For the directors, research was not just about the creation of knowledge related to whether or not a test to detect an athlete's use of a banned substance could be developed, rather research also involved implementing such knowledge in legally defensible, valid, reliable forensic testing procedures. They saw this aspect of their research as distinguishing it from that of researchers in many other fields. It also led to tensions between the directors and researchers from other disciplines. Yet the directors were vocal about the need for funding to sustain research including collaborative research that gave the laboratories access to the knowledge and skills of scientists in other disciplines.

As a community of practice some directors noted that research outcomes at an annual community event were shared prior to publication in the academic literature for the good of the practice. There was an indication that the scientists in other fields were regarded by the scientific directors as outsiders, who whilst interested in the community but did not share the long-term commitment to anti-doping work that they themselves had (see Section 5.4.1). Nor did the directors perceive these external scientists as sharing the same sense of accountability to the routine practice harboured by the scientific directors and outlined in Section 5.4.2. In view of the fact that athletes sometimes employed highly qualified scientists to cast doubt on the analytic results of a positive doping finding, the directors felt tentative about their relationships with scientists from beyond the doors of their (accredited) laboratories.

From a *Cynefin* perspective, under the supervision of the directors, anti-doping scientific researchers worked away from public view in the private spaces of their laboratories in order to unravel the unsolved problems their field. Gradually researchers from various

laboratories loosened the knots of these scientific problems and succeeded in transforming their status from complex to complicated where practical, defensible solutions could be developed, refined, validated and implemented. This process of knowledge mobilisation will be discussed in considerable detail in Chapter Six. In contrast, the research efforts of scientists from other disciplines, including those working outside the accredited laboratory system, have not yet been able to identify and stabilize any of the patterns inherent in the complex performance enhanced human systems and move them to a knowable status from which validated, reliable tests have been implemented.

As stated above, the directors emphasised the importance of disseminating the results of anti-doping research to all doping control laboratories in order to enhance their practice. This issue has been discussed in the next section.

5.4.3.3 Mobilizing new knowledge within the community

The comments of the sub-group of directors whose laboratories analysed more than 2500 samples per year indicated their belief that the new knowledge generated by research needed to be shared between all laboratories and mobilised rapidly in the form of robust testing processes. One director observed:

There is no way that you can do [anti-doping science] by yourself ... there must be interaction between the laboratories discussing the problems and discussing the solutions of the problems. (ID: D005)

This director went on to state that they thought “*it would be wrong if one laboratory [kept] information to [itself] without telling ... the others*” (ID: D005). However, the directors differed in their beliefs as to how research outcomes should be distributed.

Traditionally the outcomes of anti-doping scientific research, as with the outcomes of most scientific research, had been distributed through publication in the peer reviewed scientific literature. Searches for each of the directors of the accredited laboratories using the PubMed database (<http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?DB=pubmed>) showed that over the years, most directors had published outcomes of their research in the peer-reviewed academic scientific literature. For the years 2003 and 2004, directors of 19 of the 33 laboratories accredited in 2004 (just over 57%) were listed as co-authors of papers. Some directors stated that they regarded publication in the peer-reviewed literature as the

most appropriate means for new knowledge to be scrutinised and shared between laboratories (IDs: D006, D012). Others acknowledged the vital role of personal interaction between the directors in meetings and particularly during the annual Cologne Workshop (IDs: D001, D002, D003, D004, D005, D008, D013). 23 of the 31 laboratories accredited in 2004 (about 72%) presented talks or posters at the 2003 and 2004 Cologne Workshops. One director stated:

When one laboratory discovers a new method, the scientists have the right to publish and have their names on it, even if ... from the following instant, all the laboratories use the same method. ... Everything works perfectly when the circulation of information still gives enough credit to the person that made the discovery. (ID: D008)

Another director pointed out that

the interaction [at Cologne] is usually on an annual basis, so you've got plenty of time to do your research work and then share it with the others and publish almost simultaneously [with the publication of the workshop proceedings the following year]. (ID: D005)

The laboratories' accrediting body, WADA, not only expected that the accredited laboratories would "develop a program of research and development to support the scientific foundation of Doping Control" (WADA, 2004a, Annex B, 2.1, p. 54) but stipulated that information about new banned substances and methods for their detection would be rapidly disseminated between laboratories within sixty (60) days of discovery. WADA stated that the dissemination of information could occur by, stating:

participation in scientific meetings, publication of results of research, sharing of specific details of methodology necessary for detection, and working with WADA to distribute information by preparation of a reference substance or biological excretion study or information regarding the chromatographic retention behaviour and mass spectra of the substance or its metabolites. (WADA, 2004a, Annex B, 3.5.2, p. 56)

Differences of opinion amongst the directors regarding the best way for new knowledge in the area of anti-doping science to be distributed amongst, reviewed and put to work by the laboratories have been borne out by the use of two different approaches to the dissemination of knowledge about the recent detection of new 'designer steroids', that is steroids specifically synthesised by chemists for use by athletes to enhance their performance. During 2003/4 scientists at the accredited laboratory in Los Angeles discovered the designer steroid tetrahydrogestrinone (THG) and shortly after published a paper about its discovery, synthesis and detection in urine (Catlin et al., 2004). The

scandal caused by the use of this compound by elite athletes and the role of the Bay Area Laboratory Co-operative (BALCO) scientists who manufactured the compound made news headlines around the world. The following year another designer steroid was discovered almost simultaneously by two accredited laboratory groups working independently. One group was from Montreal and the other from Los Angeles. The Montreal group referred to the compound as desoxymethyltestosterone (DMT) and disseminated their discovery by informing WADA who announced the discovery to the press in a conference call on February 1, 2005 (Ritter, 2005). The Los Angeles based group chose to disseminate the information through publication in the academic literature, referring to the same steroid as methylandrostenol (madol) in an article published on February 11, 2005 (see Sekera, Ahrens, Chang, Georgakopoulos, & Catlin, 2005).

This data provides evidence of the desire of both the scientific directors and WADA to mobilise the knowledge generated by scientific research in a relatively short time-frame. It also suggests that there is variation as to the preferred manner in which this should be done in order to ensure that the knowledge transferred to testing procedures is sound and able to withstand public scrutiny. The work of various laboratories in the same comparatively small area has the potential to lead to competition and tension between research groups, especially between those that are university based where there are career and funding rewards associated with publication in the peer reviewed literature.

In activity theory terms, this data suggests that there were tensions arising from the differing use and exchange values of the information in the anti-doping and scientific communities. Unless addressed, these tensions could increase as scientists working in other fields and employed by other public and private organisations engage in anti-doping research with a view to building a career upon or commercialising the outcomes of their anti-doping related research. According to activity theory, tensions signal the opportunity for the expansive reorganisation of the activity (see Figure 3-7 on page 34). Resolution of this tension for anti-doping scientific researchers and their communities will need to address the issues of intellectual property and the requirements placed by universities on their staff for academic publications as a prerequisite for professional advancement.

From a community of practice perspective, the current practice of the community has been found to be inadequate for the needs of the broader community. As a consequence, the community is no longer in sole possession of all the expert knowledge needed by the

broader community. It is faced with a challenge to its continuing relevance. The community can resolve the dilemma through taking on the new skills and new members necessary to support the evolution of a new practice (see Section 3.3.2). Alternatively, the community could accept a steady decrease in relevance or share that its relevance with other groups.

Through the lens of the *Cynefin* model, the visibly unsolvable problems currently facing anti-doping scientists, the need to involve scientists from other disciplines where there is little understanding of the final outcome of research in anti-doping context, the lack of comprehension of anti-doping administrators of the complicated nature of anti-doping science and the complex issues that anti-doping scientific research is addressing, situates this issue in the domain of disorder. As stated in Section 3.4.2 making sense in this domain necessitates the resolution of the differences between the parties and the achievement of consensus about the most appropriate way of responding to the situation.

In Section 5.4.1, the analysis of directors' comments indicated that the directors were committed to anti-doping work as individuals. In section 5.4.3, it was apparent that the directors had a sense of responsibility to their peers through their shared routine laboratory practice. As will be seen in the next section, research work also impacted on inter-personal relationships.

5.4.3.4 Deepening relationships

Building inter-personal relationships takes time. Collegiality amongst anti-doping scientists had resulted from the shared responsibility of maintaining a high routine standard. The researcher's observations of the discussions between scientists during the Cologne Workshop, noted that the presentation of research outcomes also encouraged deeper relationships between participants.

In the global context of anti-doping science, opportunities for face-to-face interaction between the directors of the anti-doping laboratories and their staff occurred infrequently. In the absence of a common workplace with a common room over which to share a cup of tea or coffee and so build an interpersonal relationship, the discussion of research projects and the informal dissemination of research outcomes at the workshop took on an added dimension. The conversations, formal and informal, at the Cologne workshop assisted researchers to enhance the relationships they have with other members of the anti-doping

scientific community. The researcher observed that a research presentation at the Workshop could support extended discourse, beginning with an expression of appreciation of or question about the researcher's work and subsequently opening the door to an expanded discussion about the research and of other aspects of anti-doping work. Research presentations that withstood the scrutiny of the anti-doping scientific community and the associated conversations between the presenter and other scientists encouraged the formation and deepening of relationships between peers:

If you're a reasonable person and your laboratory does some research, if you run the laboratory well and with quality and people respect that laboratory, ... then you'll become reasonably accepted in a couple of years. (ID: D001)

One director's comment seemed to suggest that such exchanges also provide personal encouragement, supporting their perceptions of meaning and identity:

If you're doing really good anti-doping work, then no one, except the scientific community [wants] to hear it. (ID: D003)

These directors' comments also indicated that they perceived their work as involving both routine analytical testing AND research work. Examination of WADA's statistics (2004d) indicated that all the directors in this sub-group managed laboratories which had carried out more than 2500 analyses during 2003. The effect of this limited day-to-day experience was not surprising as some of the directors' comments indicated that research and development projects were frequently prompted by anomalies in routine work and the court cases in which the work of the laboratories was challenged. Whilst research outcomes had been disseminated through the literature and meetings, they were principally disseminated through presentations at the Cologne Workshop, an annual event which was attended by staff from almost all accredited laboratories. In activity theory terms, the activity of the directors in this sub-group had a second object for their activity – improving anti-doping scientific practice through research. This object had not been apparent in the responses of the less-experienced directors of laboratories where fewer than 2500 samples had been analysed annually.

From a community of practice perspective, this represented recognition of the need to steward the community's practice and ensure the community's continued relevance. The aim of research activity aimed to improve their own and other laboratories' capabilities to not only detect the use of banned substances by athletes but also to robustly defend

laboratory results in the courts and so inspire the high level of confidence in the accredited laboratory system alluded to earlier.

In terms of the *Cynefin* model, the research work aimed to improve the capability of anti-doping workers to detect performance enhancement had been carried out by scientific experts working in and out of accredited laboratories, but always in private behind laboratory doors. To a large extent much of the work is only been understood by the expert community as it occurs in the expert domains shown in the top half of Figure 3-19. As noted above, the changing nature of both doping and the anti-doping movement together with the desire for a rapid response to new doping techniques resulted in the dissemination of information within the anti-doping scientific community prior to publication. The aim of such secrecy was that its unannounced implementation in testing procedures would identify athletes who had been doping. An examination of the *Cynefin* model identified clearly the inherent dangers from the speedy implementation of new knowledge in standardised processes before the complex and complicated aspects of a problem are fully understood through sense-making work carried out away from public view in a space occupied by experts.

Whilst comments about their work as a combination of routine AND research activities were made by eleven of the directors, eight of these eleven made comments about a third aspect of their work. This left three directors in a middle group. Their comments about both routine AND research work indicated that they focused on these two areas as the objects of their activity. Again size counted. The laboratories, from which this middle group of directors came, analysed fewer samples than the final group of directors, whose laboratories conducted more than 4500 tests during 2003. The third category of comments about the work of the directors, was associated the governance aspects of doping control in sport and the directors' involvement in them.

5.4.4 Participation in governance

A third group of directors concerned themselves with more than ensuring the day-to-day routine viability of their laboratories AND conducting research which would lead to the creation and mobilization of new anti-doping knowledge. These directors, whose laboratories all analysed more than 4500 samples annually, were critical of the governance

of anti-doping work and regarded participation in the governance of global harmonization of anti-doping practices as a further aspect of the work of the directors. They were critical of anti-doping administrators and the impact of anti-doping related committee decisions on the laboratories in matters such as changes to the list of banned substances. These directors saw themselves as more than just the technical experts in this field and promoted a broader role for the directors as a consequence of the considerable knowledge and wisdom that the directors had built up as a result of extensive experience in the field. They advocated the involvement of directors in decision-making and policy development processes associated with the governance of anti-doping practice in sport in order to improve that practice by having decision makers take the laboratory experience and perspective into account. These directors felt qualified to comment on the state of international anti-doping activities, both scientific and general by critiquing the efforts of and decisions made by other workers and policy makers in the field.

5.4.4.1 *Critiquing the administrators*

This highly experienced sub-group of directors remarked upon the role of anti-doping administration and the impact on the laboratories of administrative decisions in areas such as research funding and changes to the list of banned substances and changes in sample collection protocols. In light of the transformation of anti-doping work internationally, one director commented optimistically:

a new stage in anti-doping control and much better harmonisation can at least be expected for the coming years on the basis of the anti-doping code and of the other methods WADA has elaborated. (ID: D015)

Other directors' comments about anti-doping work were not so positive. One director (ID: D011) complained of the constant search for funding and "*politics, politics*". This director saw a need for "*international real concerted actions*" through the honest, consistent implementation of the international code and the "*proper independent financing of the anti-doping organizations, including the labs*" (ID: D011). Another director was concerned by the focus of anti-doping organisations on elite athletes and perceived a "*missing real concern with a universal coverage of doping control*" (ID: D007). A different director was of the opinion that at that time anti-doping education efforts were "*not yet very effective*" (ID: D015).

Other directors expressed concern about the impact of WADA's requirements on the laboratories:

having to adapt the laboratory for (ISO17025 and WADA's ISL) regulations is a challenge. (ID: D009)

new regulations being promoted by WADA. This takes serious amount of time for questionable benefits. (ID: D012)

One director commented that some administrators seemed to regard the laboratories as “*service providers ... the push is to make us: bottle in – results out*” (ID: D006). Another director was concerned by WADA's approach to the laboratories which seemed to put emphasis on shortcomings and sanctions rather than on acknowledging the quality of the laboratories. This director stated:

There are more or less 250 drugs or metabolites that are searched in urine. The list is about 255 ... but still from the press, from the public opinion, sometimes you get the impression that the laboratory tests is powerless because it is not able to detect all the substances that are on the list. (ID: D008)

The director remarked that being able to test for 250 out of 255 drugs or metabolites was “*not bad*” (ID: D008).

Echoing a comment by D011, another director (ID: D012) referred to deficiencies in the knowledge of funding committees who did not always have the qualifications and experience in anti-doping science accurately to evaluate research proposals in the area. Additionally, this director found little satisfaction in working with “*sports administrators who [did] not understand the details of doping analysis ... [or were] still learning the basic tenants*” (ID: D012).

These directors' comments indicated that the most experienced directors were not content with a number of aspects of the changing administrative context within which they work. There was a sense that the directors saw little appreciation on the part of administrators of what the laboratories had voluntarily achieved over the years. Nor did the director perceive that governing bodies had an understanding of their decisions impact on the laboratories.

In activity theory terms, there was an underlying tension that relates to the working relationship between anti-doping administrative and scientific workers. Resolution of such tension would require that the varying bodies of anti-doping workers engage in the

knotworking associated with the co-configuration of a common object in inter-agency working of third generation activity theory (see Section 3.2.3). From a community of practice perspective, the community was at a stage of its life cycle where it needed to steward its practice carefully to ensure that its practice continued to be regarded as relevant by the broader anti-doping community.

5.4.4.2 *Canvassing director involvement*

In the light of the directors' criticism of anti-doping administrators and policy makers, it was not surprising that one director called for

more laboratory people in all ... commissions where you have to take technical decisions. Not only on the commission to evaluate the laboratories. But ... on the commission to write doping agents in the list, also in the commission to write the procedures for sample collection. (ID: D008)

This director did not see this involvement in decision making solely as a matter of representation. Rather, when a committee made decisions that directly related to the work of the laboratories, this director believed that he /she and his / her colleagues should be allowed to participate in the discussion and to give advice about the impact of proposed plans of action on the work of the laboratories.

Other comments expanded on this proposal for the directors' participation in decision making. Some directors (IDs: D006, D008) were of the opinion that whilst the directors through the laboratories played a technical role in supporting anti-doping programs around the world, they could also make further contributions that would promote the development of programs that were proactive rather than reactive. One director recalled that on previous occasions when the laboratories identified a problem, it had not always been easy to convince the decision-makers that there was a problem that needed to be solved. This director noted a lack of focus on many issues leading to the need for the directors of the accredited laboratories to find opportunities to “*stand up and say ‘Hey! We’re here! We’ve got a role to play!’ And ‘We’ve got some points to make!’*” (ID: D006)

As stated previously, WADA's International Standard for Laboratories (2004a) requires laboratories to keep their colleagues and WADA informed of scientific advances.

However, there is no reference to the broader involvement of the laboratories in anti-doping work. Observations during the Cologne Workshop indicated that some directors do belong to some of WADA's committees but the above comments and others made during

the workshop indicate that this representation is not as extensive as the directors would like. In particular, the directors of the larger laboratories in this sub-group are frustrated by their limited ability to contribute to increasing the effectiveness of anti-doping practice through greater participation of the directors in its governance and subsequently canvass the increased involvement of the directors.

Examination of this issue from a theoretical perspective highlighted tensions relating to the rules to which the activity of the laboratory directors is subject. These tensions related to the lack of a satisfactory shared object between the scientists and their international accrediting body, a concern by the scientific community about the practice of its accrediting body and a sense of disorder in the sense-making surrounding international decision-making in anti-doping work.

5.4.4.3 *Formalising community links*

The shared practice and concerns of anti-doping scientists were formalised in 2001 with the foundation of the World Association of Anti-Doping Scientists (WAADS).

Membership of this professional association was limited to anti-doping scientists, and was seen by some directors as a body that would be of benefit to anti-doping science and scientists. Since its formation, WAADS has held annual meetings, set up a website which supports discussion forums for its members. WAADS also instigated a quality assurance program which has helped the laboratories maintain their shared responsibility for high quality routine analyses. One director spoke of the quality assurance program thus:

With ... the WAADS [quality assurance program], we get a report on which you have the methods of all the test laboratories. So you can really improve. You can say 'Look here! They are making this extra extraction or they are not using solid phase. They use a different instrument. So you can verify what is going on in your lab and you can improve. I think this is the best achievement we have had in the last year. (ID: D008)

One director (ID: D006) alluded to a broader role for WAADS, a role in which the interests of anti-doping scientists were represented and public comments made on anti-doping issues. Another director (ID: D009) suggested that it would be useful for WAADS to have closer ties with other organisations working in the area of doping control. Whilst one director did not think that WAADS was developing its role in these areas at a satisfactory rate, the researcher's observations of the Cologne Workshops 2003-2005 noted

a change in the community's attitudes to WAADS. One significant indicator of this was the move from a late afternoon meeting for an hour prior to an evening activity annually to the scheduling of the WAADS Annual General Meeting on the only (previously) free evening of the workshop and the provision of a hearty supper to sustain members during their meeting in 2004 and 2005. It was evident that the WAADS meeting had become a regular part of the Cologne Workshop program and, as apparent from observations of the meetings, had provided a forum for the vigorous discussion of a variety of issues that affect the accredited laboratories.

As a professional association, WAADS formalised and extended some of the previously casual links between those laboratories whose directors and scientists had become members of WAADS. In providing a forum for debate amongst anti-doping scientists, the WAADS meeting had expanded the possibilities for interaction between the accredited laboratory directors. During my attendance at the WAADS meeting during the 2004 Cologne Workshop, Dr. Olivier Rabin, WADA's Scientific Director, spoke of his desire for WAADS to act as the communication channel between WADA and the laboratories. Whether or not WAADS adopted this role or developed a different role remains to be seen.

When examined through lenses provided by the theoretical frameworks of activity theory, communities of practice and the *Cynefin* framework, the data could be interpreted in various ways. In activity theory terms, this formalisation of professional relationships within the anti-doping scientific community through the creation of a professional association, pointed to the development of an artefact appropriate for achieving, what was for some directors, a third object of activity. This object was being involved in the governance of anti-doping and the artefact was a professional association. Such involvement would help resolve the tensions scientists were experiencing as a result of the changes in anti-doping work. From a community of practice perspective, the formation of WAADS represented the presence of a group of anti-doping scientists who were sufficiently involved in their practice that they were prepared to play an active role at the core of this community of practice (see Section 3.3.1). Using the *Cynefin* framework, anti-doping scientists could be regarded as seeing their association as a means of gaining a voice in the domain of disorder resulting from the initial stages of the globalisation of anti-doping efforts. Such a voice would allow them to continue to contribute to the sense-making of this evolving domain.

The comments in this section indicated that the most experienced of the directors who had participated in this study, believed that they had a valuable broader role to play in international efforts to combat drug abuse in sport. Their previous and current experiences had provided an understanding of anti-doping efforts from which they critiqued the actions of administrators, particularly those involving decisions which impacted on the accredited laboratories. They wanted to be more involved in the governance of the area. The formation of a professional association, WAADS, had represented the first formal effort toward the achievement of this aim. During the 2005 WAADS general meeting, the researcher was unable to ascertain whether or not this professional association had actively taken on the role of promoting the views of anti-doping scientists beyond laboratory doors and in the wider corridors of anti-doping organisations. However, the presentation of a report about the quality assurance program indicated that WAADS had taken on a role of promoting professional development of its members and their laboratories.

These results and theoretical commentary presented in this section about ‘Being the scientific director of an accredited anti-doping laboratory’ are interesting in their own right and provide an empirical base for the development of the objects of the directors’ activity. However, further theoretical analysis of the data provided additional insights. These have been presented in the next section.

5.5 THEORETICAL INSIGHTS INTO THE DYNAMICS OF BEING A DIRECTOR

In Chapter Three, three theoretical frameworks of relevance to this study of the work of experts were presented. In this section the framework of activity theory has been used to support a deeper interrogation and analysis of the work of the directors with a view to initiating the theory building associated with this research. Drawing on the data presented above, in this section the work of the directors has been represented using the well-known format of Engeström’s famous triangular depiction of an activity system (see Section 3.2.1.2). In section 5.5.1, the elements of this activity system have been explained. In section 5.5.2 the tensions within the directors’ activity have been described. Finally in section 5.5.3 the evolution of the objects of the directors’ activity has been considered. This examination of the directors’ work has been used to develop an initial model for the work of this group of experts.

5.5.1 The work of the directors as an activity system

As described previously in sections 5.2 and 0, the scientific directors of accredited laboratories aimed to produce and interpret high quality analytical data to support publicly administered doping control programs in sport. The second generation of activity theory, as described in Section 3.2.1, provided researchers with a tool to better understand human activity based on its socio-cultural history and acknowledging the social context of human activity. A diagrammatic representation of the activity of the scientific directors of accredited anti-doping laboratories within the international anti-doping context has been given in Figure 5-1. This diagram acted as the focus for the general overview of the elements of the work of the directors discussed in this section.



Figure 5-1: The Activity of being the scientific director of an accredited anti-doping laboratory

The research data indicated that the directors, the subjects of this activity system, came from various historical and socio-cultural backgrounds. Their laboratories varied in geographical location, number of years in the field and volume of analyses conducted

annually. The community, with whom the directors communicated about anti-doping matters, was made up of many different groups. These included laboratory staff with whom the directors came into contact on a daily basis, colleagues in other anti-doping laboratories, with whom the directors have less frequent contact, as well as non-scientific workers in anti-doping - representatives of government bodies and sporting federations, experts in related scientific and medical fields, and legal experts. In the course of their work in anti-doping the directors had also reported occasional contact with journalists, coaches, athletes and the interested public. They also interacted with their institutional superiors and employers about organizational and business matters.

It was apparent from the data that the work of the directors was affected by the various rules within the context of their activity. These rules impacted upon what the directors did and how they did it. For example, the financial situation of the laboratory affected the number of staff, the amount of instrumentation that a laboratory had and the ability of the laboratory to conduct research and the need to do additional work in another area to generate income. National laws and anti-doping policy as well as the presence or absence of a national anti-doping organization also affected the work of the director. The accreditation requirements imposed by the IOC and now WADA and by other international standards also affected the work of the directors. The organizational context within which the laboratory was situated was also influential. For example a fee-for-service laboratory situated in a university may be regarded negatively by other academics beyond the laboratory's walls. In addition, the actual scientific equipment available in a laboratory affected the scientific research and routine work of the laboratory, its staff and the director.

The labour of anti-doping work was divided between various members of the broader anti-doping community. Whilst the routine work and much of the scientific research and the application of that research had been left to the laboratories, over time other organisations took on non-scientific roles in anti-doping work such as sample collection, education programs, prosecution of cases against athletes, formulation of policy and so on. This general anti-doping work occurred within and across sports at both national and international levels. As no laboratory was a completely independent entity, the work of running a laboratory, regardless of the laboratory's nature, was carried out within the larger organisation to which the laboratory belonged. Subsequently the directors carried out other tasks required by their organisations. For example, directors of laboratories situated

within a university often had academic duties which might involve teaching and supervision of research students.

The tools used by directors in their work in doping control were both physical and intellectual. The methodology of experimental and theoretical chemistry together with highly sophisticated analytical instrumentation facilitated the routine analysis of thousands of samples. An unusual analytical outcome could lead to follow-up work that was not so routine in its nature. The interpretation of unusual analytical outcomes also relied on the director's knowledge base. Analytical outcomes which indicated the presence of banned substances could result in the director's involvement in a legal case against an athlete and required the preparation of extensive documentation for use in the case. This aspect of a director's work also called for considerable knowledge about the broader context of doping in sport as well as an extended knowledge base developed from experience, the literature and the shared experiences of the scientific anti-doping community.

According to activity theory, the activity of the subjects moves towards its outcome by pursuing an object, that is, through directed activity. The desired outcome of the complex activity of being a director of an accredited doping control laboratory system was the successful resolution of the problem of doping in sport. However, the identification of the object of such a complex activity itself represents a complex undertaking. Prior to a discussion of the multiple objects of the activity of the directors in section 5.5.3, the tensions within the directors' activity have been discussed.

5.5.2 Tensions within the activity of being a scientific director

As with all activity systems, contradictions exist but are not directly manifest, rather they become apparent "through disturbances, ruptures and small unremarkable innovations in practitioners' everyday work actions" (Engeström, 1999a, p. 68). Such disturbances give rise to tensions between the activity system's members. Three tensions identified within the directors' activity will be described and discussed in this section. They relate to

- Obtaining the resources needed to sustain a doping control laboratory
- Enabling a tactical response to doping control through rapid knowledge mobilization
- Gaining a voice in anti-doping governance

5.5.2.1 *Obtaining the resources to sustain a doping control laboratory*

This first tension related to the object shared by all directors of accredited anti-doping laboratories, namely that of sustaining their laboratory's practice. As noted previously, the directors' comments indicated that they found it difficult to access the ongoing funding for the necessary staff and equipment to ensure that the laboratory could continually perform at the standard required for accredited doping control laboratories. This tension is at the heart of the following comments:

[There is a perception that the laboratory already has] high-end facilities and [does] not need any more support ... the way I am now my biggest challenge is to find support, money, subsidy, because as time moves on because you have to improve the lab, you have to let them see ... the change over time. (ID: D002)

[It is] very difficult to break even and even more to make profit for the purchase of new instruments required in the field. (ID: D009)

These concerns were also evident in a report in the New Straits Times, published in Penang, Malaysia on January 18, 2005 reported that "Universiti Sains Malaysia's Doping Control Centre (DCC) [risked] losing its accreditation with the World Anti-Doping Agency due to a lack of resources to maintain the agency's standards" ("USM's Doping Control Centre risks losing accreditation," 2005). From this newspaper report, it seemed that the financial circumstances of the Malaysian laboratory were such that the laboratory financial difficulties and their impact on routine testing had become public knowledge.

In a revision of their initial International Standard for Laboratories (ISL), WADA's International Standard for Laboratories (2004a, Section 4.2.3) demonstrated its recognition of this tension and the problems laboratories experienced when they lacked adequate resources. The revised ISL set out the requirements of the public authorities responsible for the national anti-doping programs towards their accredited laboratory for both the initial accreditation and the ongoing maintenance of that accreditation. The revised ISL required that a laboratory seeking WADA accreditation provide:

an official letter of support from the relevant national public authority responsible for the national anti-doping program, if any, or a similar letter of support from the National Olympic Committee or National Anti-Doping Organization. The letter of support shall contain as a minimum:

Guarantee of sufficient financial support annually for a minimum of 3 years

Guarantee of sufficient numbers of Samples annually for 3 years

Guarantee of provision of necessary analytical facilities and instrumentation, where applicable

In addition, any explanation of exceptional circumstances shall be given due consideration by WADA. The three year letter of support does not in any way require exclusive support for only one laboratory.

If the laboratory as an organization is linked to host organizations, (e.g. universities, hospitals...) an official letter of support from the host organizations shall be provided which should include the following information:

- Documentation of the administrative support for the laboratory
- Financial support for the laboratory, if relevant
- Support for the research and development activities
- Guarantee of provision of necessary analytical facilities and instrumentation.

(WADA, 2004a, Section 4.2.3, p. 12)

The revised ISL also addressed the issue of ongoing support in established laboratories. Section 6.4 of the ISL required that laboratories wishing to maintain their WADA and ISO† accreditation must provide a new letter of support and report the annual number of tests the laboratory conducted. Supporting authorities and laboratories were warned that “if the number of Samples falls below 1500 per year, WADA Laboratory accreditation will be suspended or revoked” (Section 6.4.2, p. 40).

These revised requirements were aimed at ensuring that the laboratories have both financial support and the sample numbers needed to maintain proficiency. They presented an expanded visualisation of the activity of the accrediting body through its determination of this broader set of conditions. From a community of practice perspective, community outsiders with a vested interest in the practice of the laboratories, initiated changes aimed at ensuring better support for the accredited laboratories by their clients. In terms of the *Cynefin* framework, WADA’s ISL represented an imposition of order on the haphazard context of accredited laboratory resourcing - scientific, financial and practical. An analysis of WADA’s Laboratory statistics for 2003, 2004 and 2005 (WADA, 2004d, 2005a, 2006a) showed that the ISL’s requirements had an immediate impact on the laboratories with low sample numbers as is evident in the statistics for the Malaysian, Thai and Turkish laboratories presented in Table 5-3.

† ‘ISO’ is the acronym for the International Standards Organisation; ISO/IEC 17025 is the number of the ISO standard defining the criteria which laboratories must meet. The URL for this organisation is <http://www.iso.org>

Table 5-3: Increase in Laboratory samples numbers in low volume laboratories 2003 - 2005

Number of Samples	2003	2004 (% change against 2003)	2005 (%age change against 2003)
Laboratory			
Korea	1424	1,688 (+19%)	2,527 (+77%)
Malaysia	717	1,371 (+91%)	1,807 (+152%)
Thailand	863	1,555 (+80%)	2,416 (+180%)
Turkey	678	1,508 (+122%)	2,416 (+256%)

Given that the data collection for this research occurred prior to the implementation of WADA’s revised ISL and that the comments about paucity of resources came from directors of laboratories of varying sizes, two conclusions can be drawn. Firstly, the comments of the directors regarding the difficulty associated with maintaining proficient routine testing have been vindicated by the resource requirements described in WADA’s revised ISL. Secondly, further research is necessary to ascertain whether this regulated response has been sufficient to resolve this particular tension within the directors’ activity.

5.5.2.2 Tactical response through rapid knowledge mobilization

The second tension related to the desire for rapid mobilization of relevant, newly created scientific knowledge in order to keep abreast of the changing approaches to doping and anti-doping science. The data indicated that a number of factors that contributed to this tension.

Firstly, the directors varied in what they viewed as the best means of disseminating research outcomes. One director stated:

Although there are faults in the peer-review system nobody has found a better way. A repeated criticism of doping control is that it operates in ... semi-secret and that many policies are not openly declared. ... the peer review system is the only way. (ID: D012)

This contrasted with that of another who regarded the laboratory system as “a fair and cooperative competition ... [where] everything [worked] perfectly when the circulation of information still [gave] enough credit to the person that made the discovery” (ID: D008).

This latter description suggests that the laboratory system is a ‘cooperative’ one (Tsai, 2002, p. 180). That is, cooperation and competition exist beneficially alongside each other supporting both formal and informal knowledge sharing between members.

Secondly, the broader anti-doping community also recognised the importance of knowledge sharing by anti-doping scientists. The Code of Ethics' annexure to WADA's ISL required that "the Laboratory director or staff shall participate in developing standards for best practice and enhancing uniformity of testing in the WADA-accredited Laboratory system" (WADA, 2004a, Annex B, 3.5.2, p. 56). It also stipulated that that information about new banned substances and methods for their detection was to be disseminated between laboratories within sixty (60) days of discovery (WADA, 2004a, Annex B, 3.5.2, p. 56). These requirements added another facet to the tensions associated with this problem of responding rapidly to the scientific aspects of doping in sport.

Thirdly, the nature of anti-doping scientific research required both the exploration and exploitation of new and existing knowledge linked to an understanding of the context. The development of validated robust defensible tests required for the forensic context of doping control took time and effort. WADA's ISL (2004a) addressed the need for contextually aware, ongoing anti-doping research when it stated that a laboratory seeking accreditation

shall demonstrate in its budget an allocation to research and development activities in the field of Doping Control of at least 7% of the annual budget for the initial 3-year period. The research activities can either be conducted by the laboratory or in cooperation with other WADA-accredited Laboratories or other research organizations. (Section 4.1.5, p. 13)

WADA also expected that the laboratory "demonstrate during the probationary period its willingness and ability to share knowledge with other WADA Accredited Laboratories" (Section 4.1.6, p. 13) and set out a description of that sharing in its Laboratory Code of Ethics. From established laboratories, WADA required "an annual progress report to WADA documenting research and development results in the field of Doping Control and dissemination of the results. The Laboratory should also relate research and development plans for the next year" (Section 6.4.5, p. 40) and "an annual report sharing of knowledge with all other WADA-accredited Laboratories" (Section 6.4.6, p. 40).

Additionally, there was a need to address the prospect of new methods of doping and performance enhancement. These techniques were expected to originate from highly specialized fields such as biotechnology and genetics, beyond the current expertise of anti-doping laboratories. Together with the advent of designer steroids such as tetrahydrogestrinone (THG) in 2003 ("The battle for the soul of sport," 2004), scientists within and beyond the accredited laboratories were being challenged to develop and to put in place robust new techniques to detect these new modes of performance enhancement.

As will be reported in Chapter Seven, stakeholders expressed their desire for anti-doping scientists to take a more pro-active role in the identification of new doping techniques. The directors recognised that such advances in anti-doping techniques would require the involvement of external scientists from commercial and/or private research groups as well as public research organisations. From a third generation activity theory perspective, the involvement of external scientists with different cultural histories and objects of activity could be expected to introduce additional tensions as they worked alongside the anti-doping scientific community to generate, disseminate and mobilise the outcomes of new types of anti-doping research. This tension could become particularly evident if some of those external researchers were subject to the constraints of confidentiality imposed by the commercial organisations in which they worked.

Whatever the means used to generate, disseminate and implement knowledge and new testing procedures, there has been evidence that care needs to be taken in order to ensure that all concerned, including athletes and the public at large, trust the results produced by the laboratories. That this trust can be easily undermined has been exemplified in the recent situation surrounding the urine test for erythropoietin (EPO). This test had been developed and patented by French scientists and approved by the IOC prior to the 2000 Olympic Games.

In August, 2005 the Flemish civil courts ruled that the scientific evidence could not support the finding that the triathlete Rutger Beke had taken EPO. As a result Beke and his supporters were

filing suit and asking total damages of \$221,000 from the World Anti-Doping Agency (WADA) and WADA-approved labs in Ghent, Belgium and Cologne, Germany. The two labs handled Beke's post race samples that yielded false positives for the banned drug EPO. (Carlson, October 20, 2005)

At the end of September 29, 2005, WADA (2005b) released the statement:

The detection method for EPO is valid and reliable. It has undergone an extensive scientific validation process and has been used successfully for many years by many anti-doping laboratories around the world. It is a well-established procedure widely accepted by the scientific community, as demonstrated by publication in a number of international scientific journals. Further, in all its decisions relating to EPO, the Court of Arbitration for Sport (CAS) has supported the validity of the EPO detection method. At (its) meeting of September 26-27, 2005, the WADA Laboratory Committee reiterated its strong support to the method when properly applied. (WADA, 2005b)

The statement went on to describe a phenomenon relating to the EPO test that had been reported to WADA in the northern spring of 2005 as a result of the ongoing research into all detection methods. According to the statement accredited laboratories had been informed of the phenomenon in July 2005 and directed to integrate the new information into their testing protocols. WADA stated that ongoing research would ensure that the phenomenon was understood and more easily predictable. A few weeks later the Washington Post reported

The directors of the more than 30 labs that do analysis for WADA were summoned to Paris on Wednesday for an emergency three-day meeting to discuss the test for EPO, also known as erythropoietin, a banned blood-boosting drug useful to athletes in endurance sports. But even as criticism of the test mounted, WADA officials said they had not lost confidence in it.

...

WADA doesn't want to address any deficiencies in any of its tests, but if they don't change the test, given the way it's done currently . . . I think it's going to be an issue in probably every EPO case that comes up from now on," said Los Angeles attorney Howard Jacobs, who is appealing EPO bans for two U.S. distance runners.

...

Of course WADA can't back down," said one European sport official, who requested anonymity. "How can they back down on a test they've used to ban people for years? If they come out and say, 'Our test has got flaws,' how many millions are people going to sue for?"

(Shipley, 4th November, 2005)

Such an article failed to engender the confidence in the EPO test, particularly when WADA had also stated:

When WADA contacted the laboratories in July 2005, the Agency asked laboratory directors whether they had previously noticed similar profiles.

Several laboratories were aware of this phenomenon and had already incorporated it in their routine procedure for the reading of EPO results. Others undertook to review cases they may have had in the past six months. This therefore gives the Agency full confidence that there have been no sanctions of athletes due to such profile.

(WADA, 2005b)

This incident highlighted the need for making very well considered haste in the development and mobilization of new approaches to doping control.

The demand to move from judicious knowledge management through the peer review system of the academic journals and/or the annual Cologne Workshop to the tactical approach of rapid knowledge mobilization of newly created knowledge has confronted anti-doping scientists and funding bodies with a need to carefully reassess, enhance and extend the processes and channels by which scientific knowledge and practice has been traditionally generated and verified if the anti-doping movement is to reap the rewards of the research in which it has invested so many resources, effort and hope. In terms of third generation activity theory, this requires the joint visibilization of a new activity of doing anti-doping research by both anti-doping scientists and external scientists (see Section 3.2.1). From a community of practice perspective, this reassessment may indicate that the community is at a point in its development where it needs to transform its practice (see Section 3.3.2). Through the lens of the *Cynefin* framework, there is a need for external scientists and stakeholders to have a better understanding of sense-making in the publicly invisible space in which anti-doping science has been conducted (see Figure 3-19).

5.5.2.3 *Gaining a voice in governance*

Both national and international anti-doping decisions and policy necessarily impacted upon the work of the anti-doping laboratories. The third tension indicated by this research related to the frustration ensuing from the directors' perception that anti-doping decision- and policy-makers lacked awareness of the impact of their decisions on the laboratories. The historical involvement of scientists in anti-doping work has been described earlier in section 5.2. Based on this history Donovan, Egger, Kapernick, and Mendoza (2002) concluded that "the main focus on controlling the use of banned substances [had] been on testing athletes and the development of tests to detect usage" (ibid., p. 269). Recently national anti-doping efforts had focussed on compliance with the WADA code, on the development of effective sample collection and education programs. Some nations had also given their anti-doping agencies the authority to investigate and prosecute 'non-analytic positives'. The prosecution in the United States of those connected with the designer steroid THG is an example of the new powers of anti-doping workers. In this changing anti-doping environment, the directors expressed frustration about their lack of voice in current decision-making and a strong desire to have their input on anti-doping matters considered by the decision-making committees.

Dissatisfaction was apparent during the 2004 Cologne Workshop. During the impromptu discussion after the presentation of a paper by Dr. Francesco Botré (2005), in which he

described the changes to analytical procedures that the Rome laboratory had made in order to accommodate recent additions to the WADA list of substances prohibited for use by athletes. The presentation, on March 7, 2004, pointed out that incorporating tests for newly listed substance into laboratory practice required time and money, effort that could be wasted if the substances were later removed from the list. During the discussion that followed, another director stated: “*We are all disappointed about the list ... We should try to get influence on the list committee ... one person is not enough!*” The comment of another director during an interview provided a possible basis for the directors’ beliefs about the advantages of their involvement in such committees: “*A laboratory expert has valuable experience to all aspects of the fight against doping: control, legislation, education.*” (ID: D004).

The concerns of the directors about their lack of voice have been borne out by the membership of scientific committees comprising representatives of governments and anti-doping organisations, scientists from other areas, and doctors but low levels of participation of the anti-doping laboratory directors. For example, the List Committee (<http://www.wada-ama.org/en/dynamic.ch2?pageCategory.id=314>, accessed 3rd January, 2006) comprised eleven members, only one of whom was the director of a laboratory; none of the twelve members of the Health, Medical and Research Committee (<http://www.wada-ama.org/en/dynamic.ch2?pageCategory.id=294>, accessed 3rd January, 2006) was a laboratory director. The frustration with this lack of involvement in such governance activities gave rise to one director’s terse comment that the laboratories were more than just ‘*service providers*’ (ID: D006).

Lawson (2004) commented that in other fields of endeavour, professional associations had often been formed to take on the role of publicly representing their members’ interests. For example, the Australian Medical Association (AMA) released media announcements relating to health and medical issues (<http://www.ama.com.au/web.nsf/topic/media-releases>, accessed 2nd January, 2007). Whether or not the future activities of the World Association of Anti-Doping Scientists (WAADS) takes on this role of formally voicing their members’ concerns on the issue of participation in anti-doping governance committees has yet to be seen.

5.5.3 The multiple objects of a complex activity

The role of perspectives in constructing an object of activity provided the starting point for the following discussion of the multiple objects of this activity system. The data presented previously described up to three perspectives that the directors' have of their day-to-day role. These perspectives encompass routine testing AND, simultaneously, possibly one or both of anti-doping scientific research and involvement in the governance of anti-doping work, in that order. The possibility of three objects for a single activity system goes beyond much of the activity theory literature.

Bødker and Andersen (2005) reminded us that many activity theorists saw activity as

directed to satisfy a need through a material or ideal Object. ... Human activity [was] carried out through actions, realizing objective results. These actions [were] governed by the conscious goals of the subject. ,, . Actions [were] realized through series of operations, each triggered by the conditions and structure of the action. They [were] performed without conscious thinking. (p. 359)

These objective results were observable whereas the Object, as the organising principle of the activity, may be invisible.

More than 10 years ago, Kaptelinin (1996) noted that difficulties could be associated with the identification of a system's object and that such difficulties were associated with the possible presence of multiple objects, suggesting that the presence of multiple objects indicated one of the following "(a) an activity is just beginning to coalesce; (b) that one activity is about to decompose into multiple activities; or (c) two or more objects are "temporarily merged" (p. 138). Hasu (2000) wrote about the connection between perspectives and an object of activity stating that:

the object [was] to be understood as a project under construction, moving from potential 'raw material' to a meaningful shape and outcome. ... Separate historical layers and perspectives [met] and interact[ed] in object construction. (Hasu, p. 370-1)

When examining the Network for Ethnological Monitoring and Early Warning (EAWARN) in the former Soviet Union during the 1990s, Foot (2002) analysed the discourse of multiple participants in the complex EARWARN activity system in search of the object of the activity system. Foot proposed that the varying perspectives of the participants resulted in different object conceptions and that these different object

conceptions had numerous distinct manifestations (2002, p. 139). Foot (2002) suggested that

the object that is embedded in activity [could] be understood as a complex, multifaceted, organizing principle of an activity that evolve[d] over time. An object [was] conceptualized, engaged, and enacted by participants in the activity in diverse ways, resulting in differing object concepts within the same activity system. (p. 139)

As in Foot's study, the data in this study identified multiple perspectives and associated different object conceptions. In contrast to the approximately five year old EARWARN community investigated by Foot (p. 133), the community of scientific directors investigated in this research had been in existence for more than 20 years and over that extended period of time had established a shared body of knowledge, agreed practices and community routines. In this community, as in the EARWARN community, participants not only held different object conceptions, they also carried out their activity in the different ways described previously. Miettinen and Hasu (2005) stated that "orienting towards an explicit object [was] a complex process presupposing analysis of the environment, the present activity and its critical problems" (p. 136). Reflecting the reality of such a situation, Lemke wrote:

theorists and researchers recognize that in the study of human activity 'pure' or single-purpose, single-object activities are idealizations or relatively rare kinds of occurrences and that for the most part we live with mixed or multi-purpose activities. We are always carrying out multiple agendas on multiple timescales, and activities afford us resources and opportunities for all sorts of things we want to do, individually and collectively. (XCMA, 2003, email dated Friday June 20 2003 - 019:42:45)

Bødker and Andersen (2005) commented on the limited support provided by a single object when "a much richer and more precise analysis of situations that are much less artificial ...[and] much more confusing" (p. 395-396) is required. Most recently, Hyppönen (2007) outlined the need for "a better understanding of development as the parallel shaping of multiple objects" (p. 188) to better manage the complex processes of co-development. Coupland and Crawford (2002) also noted the possibility of multiple objects in the complex system of activity of mathematics learning at university. It seems then that these recent research efforts into complex contexts also resulted in an expansion of activity

theory itself in order to better interpret the realities of the world the theory was being used to investigate.

This analysis of the work of the directors' activity supported Foot's view of the multifaceted nature of the object, but additionally it supported the claims of more recent research by Bødker and Andersen (2005), Coupland and Crawford (2002), and Hyppönen (2007) by identifying more than one object. As shown by the analysis of the directors' data, some directors viewed their work as involving the pursuit of more than one object. It was this simultaneous, contiguous work on the different agendas relating to various aspects their work, that gave rise to the multiple perspectives. In this context these multiple objects formed a complex cluster of identifiable objects, subordinated to the overarching, integrating activity of being a director. These multiple objects arose from the various situations that determined the immediate focus of the directors' activity.

As stated previously, the first of the multiple objects of the directors' activity related to sustaining routine doping control testing. Whereas this object was common to the activity of all the directors, the other objects were confined to directors of larger laboratories. Analysis of the data (Table 5-2 on p. 139) indicated that the directors of laboratories which conducted more than 2500 analyses annually had an expanded perception of their role, one that included both sustaining high quality routine testing AND carrying out research that contributed to the advancement of anti-doping science. These directors had incorporated a second object into their activity, namely instigating, organising and overseeing the research projects underway within their laboratories. They pursued this object in addition to their pursuance of the first object, that of sustaining routine testing. Finally, the directors of the largest laboratories, which analysed more than 4500 samples annually and in a sense the most experienced directors, perceived their role as maintaining routine testing AND contributing to the scientific advancement of the area AND positioning anti-doping science in the socio-technical context of anti-doping work. The data presented in the previous section indicated the complex multifaceted nature of each of these objects of anti-doping scientific work. Each required its own set of management strategies. Participating directors of the largest laboratories with more than 4500 samples annually directed their activity towards all three objects associated. Laboratories which analysed between 2500 and 4500 samples annually aimed to carrying out anti-doping routine and research work. The sub-group of smallest laboratories directed their activity towards the successful maintenance of proficient analytical work within the changing and demanding context of

anti-doping work. Figure 5-2 provides a diagrammatic summary of these multiple objects of the directors' activity. The nature of, and, the relationship between, these objects is explored further in the following sections.

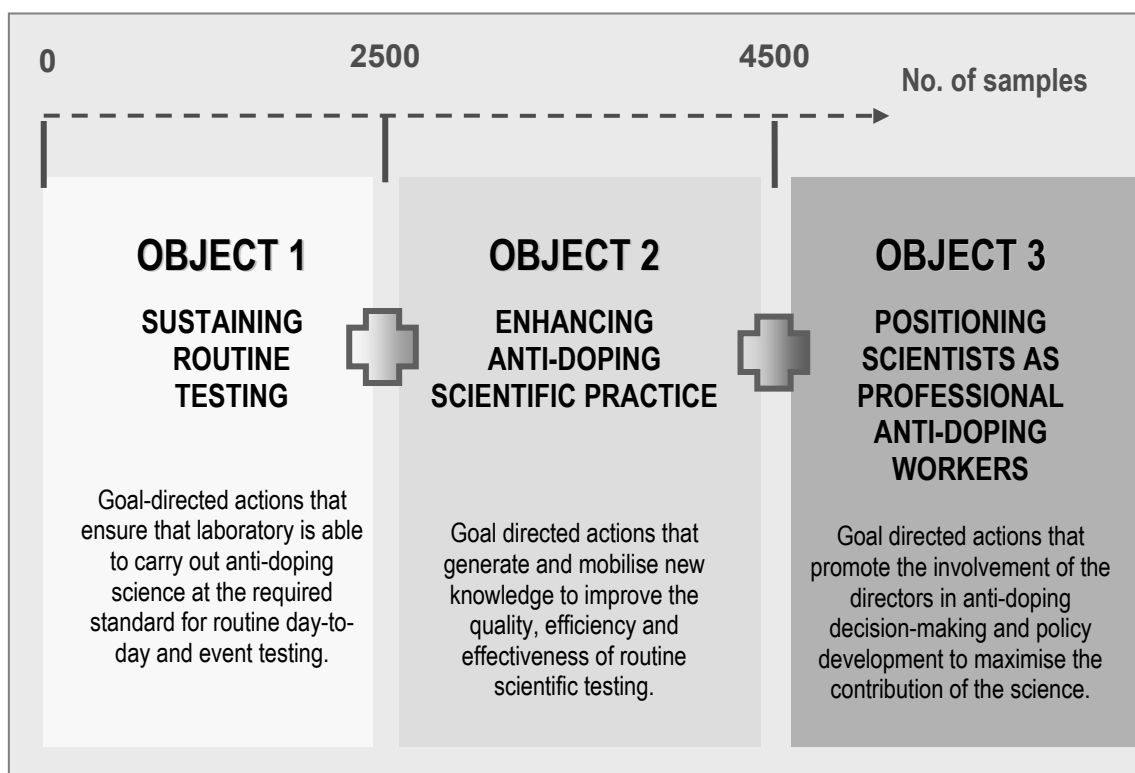


Figure 5-2: The multiple objects of the work of the scientific directors

5.5.3.1 The First Object: Sustaining Routine Testing

As indicated above, the common perspective of sustaining routine testing resulted in the identification of the first object of the activity of a director's work. Having accumulated the necessary knowledge, skills, staff and resources to attain accreditation, a director directed his/her activity towards the object of ensuring that his/her laboratory was able to routinely analyse large numbers of samples in a way that met the requirements for IOC/WADA accreditation as well as those of the International Standards Organization's management and laboratory technical requirements, the ISO9000 and ISO17025 standards respectively.

As well as carrying out routine testing on a day-to-day basis, at times a laboratory radically transformed its operations in order to carry out the testing for a major sporting competition. Most of the work of the laboratories consisted of routine analyses distributed throughout the year with comparatively long timeframes of around 14-days for the reporting of results.

However, this timeframe changed dramatically when the laboratories conducted the testing for a major event such as the World Swimming Championships, the Tour de France or an Olympic Games. At such times, the laboratory was required to analyse a very large number of samples with the normal quality requirements and report the results within a 48-hour time frame. For example, for the Sydney Olympics in 2000, the Australian doping control laboratory which had conducted around 6000 analyses in the year prior to the Olympics, increased its staff from around 15 to almost 100, as well as dramatically increased the available instrumentation and laboratory space in order to conduct the 2000 analyses it was required to do in the three week period (Trout & Kazlauskas, 2004). Over the years, reports about such alterations of a laboratory's practice proved of ongoing interest to the directors. For instance the 1994 proceedings of the invitation-only Cologne Workshop on Dope Analyses contained a report on the 1992 Barcelona Olympic Games by Segura, de la Torre, Pascual, Ventura, Farré, Ewin and Cami (1994a; 1994b) and the 2003 proceedings contained a report by Damasceno, Bento, Gomes, Marques, Ramos, Souza and Aquino Neto (2003) on the South American Games in 2002.

In maintaining the proficiency of routine testing of day-to-day, out-of-competition testing, and rapid turnaround in-competition, the directors drew on the knowledge and skills learnt from their own experience setting up and maintaining a routine testing laboratory and from the knowledge learnt from the shared stories of other directors in their community of practice. These stories were one of the tools of their activity system. The directors used what Victor and Boynton (1998) described as articulated knowledge: that knowledge which was documented, codified, precise and for which the laboratory's training needs were known. As in other communities of practice, the shared stories within the anti-doping scientific community, such as those referred to in the previous paragraph, contributed to the director's identity and ability to make sense of the needs surrounding the adaptation of a laboratory's work to novel situations. These stories transported the directors "into the situations [the stories] relate[ed] and involve[d] [the readers] in producing the meanings of those events as though [the readers] were participants" (Wenger, 1998, p. 203). In terms of the *Cynefin* model, these repeated interactions, the mutual goals, the shared experiences between the members of an informal network or a community of practice in a space away from the public eye, enabled experts to transform what might initially seem a complex context task into a complicated one (see Section 3.4.2) that could be validated for routine use.

Although this object of doing routine scientific work was nominally the same for all the laboratories, the manner of its actual achievement varied considerably between laboratories as a result of contextual differences such as the degree of community and organisational support for anti-doping work and their expectations of the director and the laboratory. These factors impacted on funding, staffing, equipment, ability to maintain an up-to-date knowledge base and transfer new knowledge to the laboratory's scientific practice through in-house research, and the number of samples sent to a laboratory for analysis. For example, WADA's laboratory statistics for 2004 (2005a, p. 3) indicate that of the 169,187 samples tested by the laboratories accredited for all of 2004, the number of samples conducted by an individual laboratory ranged from 1371 (Malaysia) to 37047 (USA) whilst the number of adverse findings that a laboratory had to deal with ranged from 8 (Japan) to 462 (France). Such differences impacted not only on the number of staff required to do the work of the laboratory, but also on the skills of those staff because of their exposure and response to data generated by the analysis of samples: more samples led to greater variety and broader experience, experience that laid the foundation for expansion to the second object.

5.5.3.2 Expanding to a second object

As noted previously, the research data indicated that only those laboratories with relatively small annual sample numbers were focussed on the single object of sustaining routine testing. Larger laboratories were able to develop and expand their work to incorporate a second object by leveraging the knowledge and experience already acquired. To understand how this occurred, the work of Victor and Boynton (1998), Engeström (1987; 1999a; 2005a), Lave and Wenger (1991) and Wenger (1998) provided valuable concepts that have been presented in this section.

Victor and Boynton (1998) commented that the conduct of routine work leads to learning about what works and what doesn't work, and a practical knowledge of the numerous aspects of a routine process (p. 68). Victor and Boynton described craftwork as "the basis from which all organizational knowledge is created" (p. 24). Craft-based knowledge produced individual and/or novel but not necessarily consistent solutions to local problems. As a member of a community of workers, the well educated and increasingly experienced craftworker was able to learn more and more clearly how they did their work and eventually to articulate and share their knowledge based on "an understanding and a deep knowledge of the confusing, demanding world of their work" (p. 30).

Lave and Wenger (1991) and later Wenger (1998) stated their belief that learning occurs through engagement with a community of practice which provided a space, not necessarily a physical one, for interacting with others who worked in the field and therefore shared an understanding of what it meant to do this work on a day-to-day basis (Wenger, p. 72-85). Enhancement of routine processes came about through leveraging the practical knowledge generated by routine work, through linking co-workers' and colleagues' insights and suggestions with experimentation that further analysed current processes and explored possible improvements to those processes. For Victor and Boynton such workers were knowledge workers (p. 164) who were able to both think AND do as well as to constantly look for ways in which improvements could be made (p. 79).

Once the directors developed a deep knowledge and understanding of their craft through the extensive experience gained by the routine analysis of large numbers of samples, they were able to articulate the knowledge and understanding thus gained, and to interact with other anti-doping scientists as their fellow craft-workers. They were also able to visualise and then make real a role beyond routine only work, a role that had expanded to include enhancing anti-doping practice through making needed improvements to existing processes and through developing new research based approaches that were firmly linked to the existing routine practice of the doping control testing laboratory. The movement involved in transforming the work of a director and his/her laboratory from routine practice to routine practice AND research to enhance the community practice exemplified the process of expansive transformation of an activity system (Engeström, 1999a, 2005a).

Engeström (2005a) described the developmental transformation of an activity system as an attempt to “to reorganize, or re-mediate, the activity system in order to resolve its pressing inner contradictions” (p. 180). These contradictions manifested themselves through “disturbances, ruptures and small innovations in practitioners' everyday work actions” (p. 181). A transformation was expansive “when the object and motive of the activity are reconceptualized to embrace a radically wider horizon of possibilities than the previous mode of the activity” (p. 64).

In the evolving context of doping control science, the usual stream of the unusual that accompanied routine analysis of samples (ID: D004) provided the scientific problems, breakdowns and disturbances symptomatic of contradictions within the activity system. When a director and his/her staff became sufficiently aware of such symptoms that they

visualized and then brought to fruition the research projects that resolved such contradictions, their own activity had undergone an expansive transformation. The regular sharing of these experiences with their colleagues in other anti-doping laboratories indicated the presence of a second object, the enhancement of anti-doping scientific practice in all anti-doping laboratories, that existed alongside the object of sustaining routine doping control testing.

5.5.3.3 The second object: enhancing anti-doping scientific practice through research

As stated previously in section 5.4.3, the second perspective from which the scientific directors regarded their work was that of advancing anti-doping science. This perspective pointed towards the second object, enhancing the practice of anti-doping science through research. Analysis of the data in Table 5-2 on p. 139 suggested that a laboratory workload of at least 2500 samples per year provided a suitable experiential base for such expansion into a research program which has as its object the improved scientific practice of all doping control laboratories. Achievement of this object required both the generation and mobilization of new knowledge. The generation of new knowledge could be achieved by the design and implementation of a suitable research program. The mobilisation of that knowledge required sharing that knowledge with other accredited laboratories.

Over the years, the research programs within and amongst doping control laboratories enhanced the practice of anti-doping science through improving detection levels, simplifying analytical processes, and developing scientific techniques which reduced the costs of testing whilst meeting the quality requirements. As described in section 5.5.2.3, the research undertaken by the Rome laboratory (Botré et al., 2005) and presented at the 2004 Cologne Workshop had resulted in the ability to test for recent additions to the list of prohibited substances within the limitations of the financial resources of the laboratory. Disseminating the nature of such changes with other laboratories provided ideas which other directors could consider for use in their own laboratory. The financial benefits from research such as Botré et al.'s and other accredited laboratories have been noted by others working in doping control. Staffan Sahlstrom, the president of International Doping Tests and Management described the reduction in costs associated with testing "from 700 US dollars per test in 1994 to approximately 500-550 US dollars per test in 1998" (Sahlstrom, date unknown).

This second object had emerged from the context of, and the successful and ongoing achievement of, the previous object: sustaining routine testing. The empirical data indicated that the incorporation of this second object into a director's activity required that the director's laboratory analyse more than 2500 samples annually. Such a sample load provided the base on which a director was able to observe and to investigate sufficient variety of unusual events, that is analyses whose results that did not mesh smoothly with current knowledge, to trigger the expansion of their laboratory's activity to incorporate a research program whose outcomes were of relevance to and shared with other anti-doping laboratories. As will be the subject of a detailed discussion in Chapter Six, this sharing of research outcomes engaged the directors and staff of research active laboratories in the co-configuration of new knowledge and associated analytical processes for adoption within the accredited laboratory system. At times, anti-doping researchers had accessed the knowledge and skills of scientists and expertise from other disciplines but the successful mobilization of such interactions relied upon the configuration of and its validated and reliable implementation within the broader accredited laboratory system.

5.5.3.4 Expanding to a third object

A second expansive transformation of the work activity of the directors occurred when the directors not only supervised a laboratory that conducted both routine practice AND anti-doping research, but acted upon a need to participate in anti-doping governance in order to better position the contribution of anti-doping scientists in the socio-technical context of anti-doping. This need took the directors beyond their laboratory doors and aimed to ensure that policy and decision makers were cognisant of the impact of their decisions upon anti-doping science and the work of the laboratories, and that the benefits of the work of doping control laboratories to anti-doping efforts were maximised.

At this level, the directors described their need to engage in what Victor and Boynton (1998) would describe as the co-configuration of anti-doping work. In doing this, the directors drew on tacit, articulated, practical, architectural knowledge built upon their extensive experience in the field to expansively visibilize a third object for their activity, engaging in anti-doping governance. The additional object of the directors' activity also led to greater interaction and collaboration with other non-scientific anti-doping stakeholders to construct the shared object of third generation activity theory (see Section 3.2.1). As noted in Section 3.2.3, such efforts have been termed interagency working by Warmington and his colleagues (2004; 2005; 2004). From a community of practice

perspective, such actions reflect the efforts of the community to manage its boundary with the outside world (see Section 3.3.1).

5.5.3.5 The third object: Positioning anti-doping scientists in anti-doping governance

The third perspective on their work resulted from the directors' recognition of tensions in their work ensuing from externally made decisions. To resolve these tensions, the eight most experience directors who participated in this research, indicated their vision of a broader role for the anti-doping scientists, that of participation in the governance of anti-doping. They regarded the establishment of the World Association of Anti-Doping Scientists (WAADS) in 2001 as a part of achieving this object. Lawson (2004) stated that such association was "an expression of group consciousness and unity borne of members' common vocational experiences, interests, and aims" (p. 30). Lawson went on to describe the broader purpose of such societies as being:

to strengthen and elevate the profession's status, which they do through defining professional issues and priorities, maintaining standards of performance, and controlling access to the group. Associations seek to serve the internal needs of their professional members while also offering a united front to the various external interests and public entities that interface with the profession. (Lawson, 2004, p.30)

Observational data collected during the 2004 and 2005 Cologne Workshops indicated that WAADS did in fact possess a number of these attributes. It was apparent that WAADS restricted its membership to current and aspiring anti-doping scientists and also had levels of membership based on experience in the field. Additionally, WAADS conducted the quality assurance program described previously which promoted achievement of the high levels of proficiency expected of doping control laboratories.

These directors had also expressed their concerns about the lack of an accredited laboratory voice on anti-doping decision making committees. As reported in Section 5.4.4, the comments of WADA's Scientific Director, Dr. Olivier Rabin had suggested that WAADS might take on a more formal role in communications between the accredited laboratories and WADA. One director had commented that WAADS needed to be recognised in the area as formally representing the interests of working anti-doping scientists and as having the authority to comment on public statements that were ill-founded or nonsense (ID: D006). The lack of such public comments at the time of writing and the composition of WADA's committees as listed on the WADA website

(<http://www.wada-ama.org/en/dynamic.ch2?pageCategory.id=258>, accessed 2nd January, 2006) suggested that WAADS has not yet taken on nor been recognised as having this more public role.

This third object of the activity of the most experienced directors emerged from the context of routine testing AND anti-doping research. The data indicated that this sub-group of directors that had incorporated this third object into their activity were responsible for laboratories which processed more than 4500 samples annually. This considerable sample load provided an experience in routine and research work which gave the director with the opportunity to make observations about the conduct of anti-doping science and to form views about and comment upon the community's interactions with other non-scientific stakeholders. To negotiate this boundary between scientific and general anti-doping work, the *Cynefin* model has suggested that sense making in contexts which involve multiple stakeholders required decision makers with the ability to work in the domain of disorder, a domain where individual stakeholders often competed and attempted to impose their own preferences on others. (see Section 3.4.2). Kurtz and Snowden (2003) believed that effective decision making in this domain hinged on the resolution of the conflict that had arisen as a result of the differences between the various stakeholder perspectives. They suggested ways of achieving such consensus amongst decision makers regarding contextualisation including the use of the narrative database, convergence methods, the generation of alternative histories, all of which resonate with the previously described activity theory concept of knotworking (see Sections 3.2.3 and 4.5.3) and Victor and Boynton's (1998) notion of co-configuration work (see Sections 2.3.1, 3.2.3.3). The emphasis on the ability to engage in effective discourse resonated with van de Ven's (2005) assertion (reported in Section 2.2.2) that innovators require political savviness (p. 365) in order to negotiate successfully the intertwined and divergent needs of multiple stakeholders.

From the analysis presented above, it seems that becoming and continuing as a director of a laboratory accredited for anti-doping work is a complex activity that can comprise multiple, multifaceted objects. With time and experience, directors are able to not only to understand anti-doping science but also to apply that science at a high standard for both routine and high-volume competition testing. They are able to work out ways in which

they can not only develop and expand their and their laboratory's own expertise but make contributions to the evolving knowledge base and scientific practice of anti-doping science through sharing the outcomes of their research either in peer-reviewed journals, conferences or at the Cologne Workshop. They are able to respond to changes to WADA's requirements or to the demands of a major sporting event. The data also indicates that the directors' work takes them beyond their laboratory doors and requires interaction with other scientists, general anti-doping practitioners and the wider community. The directors develop considerable knowledge about anti-doping matters and the many facets of anti-doping work. This awareness of both scientific and general aspects of anti-doping prompts the directors to articulate and pursue their participation in the general decision-making processes associated with anti-doping work. These scientists pursue these multiple objects in the course of the complex activity of being the director of an accredited laboratory.

In this light the diagram presented previously (see Figure 5-2) showing the evolution of the multiple objects of the director's activity, has been adjusted in order to incorporate the additional elements that resulted in the expansive transformation of a director's activity and the formation of the second and third objects. This revised model has been presented in Figure 5-3. The number line at the top of the diagram indicated that the formulation of multiple objects was linked to the volume of samples analysed annually by the laboratory:

- All laboratories pursued the first object of sustaining routine testing
- Laboratories that carried out more than 2500 analyses also pursued the object of enhancing anti-doping scientific practice.
- The largest laboratories also pursued the third object of positioning anti-doping scientists in governance aspects of anti-doping work.

The large plus (+) signs represented the expansion in the number of objects pursued by a director as the volume of work done by their laboratory increased. The arrowed vertical bars between the objects indicate the use of the knowledge gained through pursuing one object in the expansive formulation of the adjacent objects. It is worth noting that this model concurred with Engeström's (2005a) comment that experts were engaged "in multiple simultaneous tasks and task-specific participation frameworks within one and the same activity" (p. 219). Engeström's assertion that the coordination of these multiple tasks within a set of distributed participation frameworks, or polycontextuality, represented a challenge in the environment of larger collaborative activity systems, concurred with the previously described that existed within the activity of the directors.

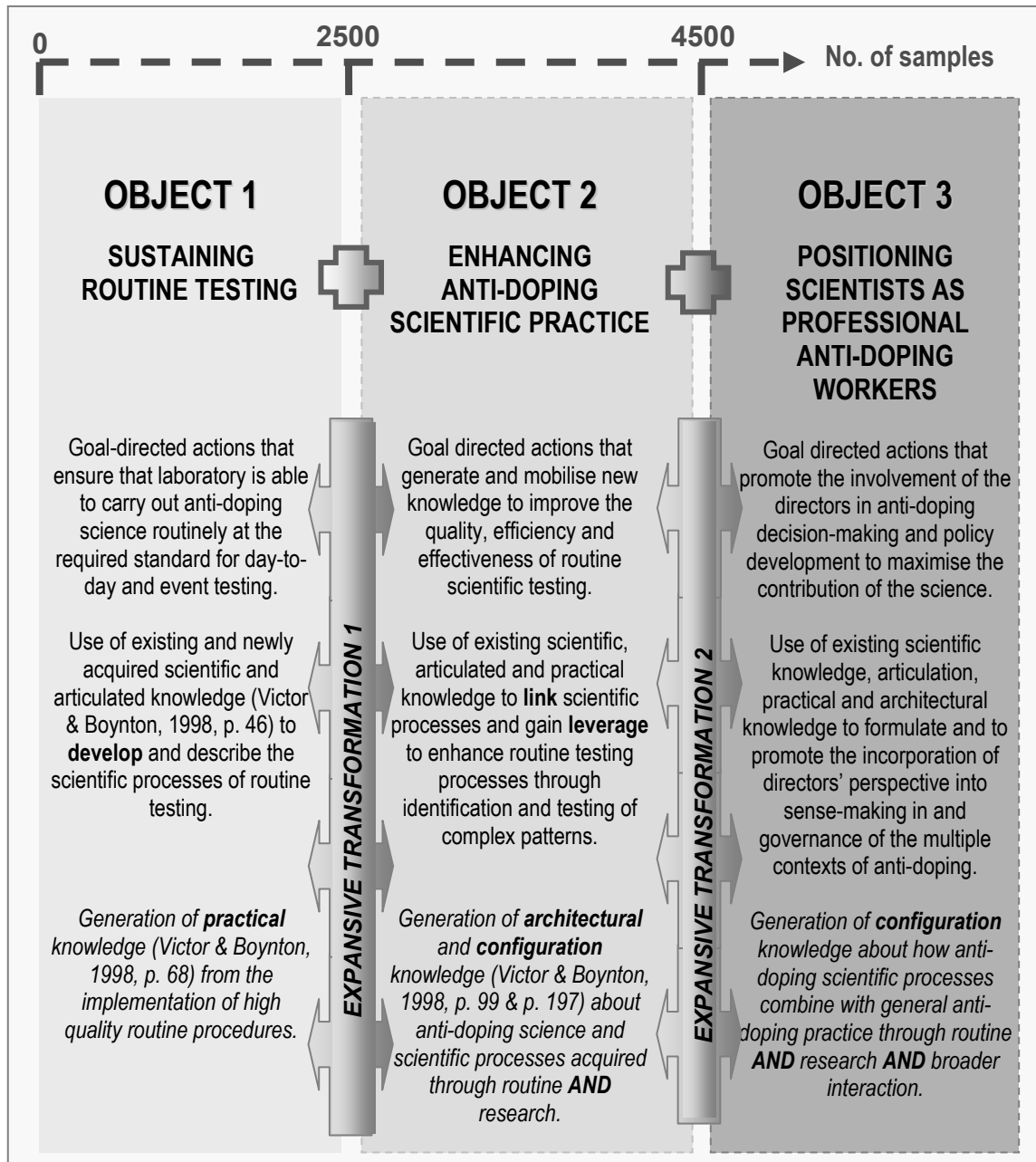


Figure 5-3: A revised model for the directors' activity

5.5.3.6 The role of a shared space in a complex activity

The previous discussion of the activity of the work of the directors also flagged the importance of interactions between members of the community of anti-doping scientists and pointed to the existence of a trusted, shared space for these interactions. The data showed that throughout their professional journey, many anti-doping scientists had appreciated their access to and the contributions of the accumulated knowledge of their peers in the anti-doping scientific community. Whilst the peer reviewed scientific literature provided indirect interactions between scientists and provided the opportunity to

formally assess the substance of anti-doping research work, it contributed little to the sense of community amongst anti-doping scientists. The data indicated that personal interactions were more highly valued. Such interactions occurred during visits to accredited laboratories, through email or phone, or when attending conferences. In particular, attendance at the invitation-only Cologne Workshop provided a regular opportunity for interaction between anti-doping scientists. Whilst this event will be discussed in detail in Chapter Six, a short description of the workshop's role in the work of the directors has been given at this point to promote understanding of its role in the model of the work of the directors.

From a community of practice perspective, the annual workshop represented a trusted space where community members regularly had the opportunity to engage with each other to

exchange tips, solve problems, or explore new ideas, tools and techniques ... to tangibly experience being part of the community ... [to] appreciate the level of sophistication the community brings to a technical discussion, [to see] how it rallies around key principles, and the influence it has in the organization".
(Wenger, McDermott, & Snyder, 2002, p. 58)

In this, as in other areas of human endeavour, awareness, identity, capabilities and goals evolved through interaction in social contexts.

As a regular event in the annual calendar of anti-doping scientific work, the Cologne Workshop provided a confidential, private arena in which anti-doping scientists could share and rework existing and new knowledge in order to develop their joint practice, to identify, solve and verify solutions to common problems and to construct their individual and collective cultural histories as they expansively address the objects of their activity. This trusted space had been incorporated into the model of the dynamics of the work of the scientific directors presented in Figure 5-4. The positioning of this space beneath the three objects underlines its role as a place where all members of this community can engage with each other about their shared practice. Because of the importance of this private space in the maintenance of expertise within this community, it has been discussed in depth in Chapter Six.

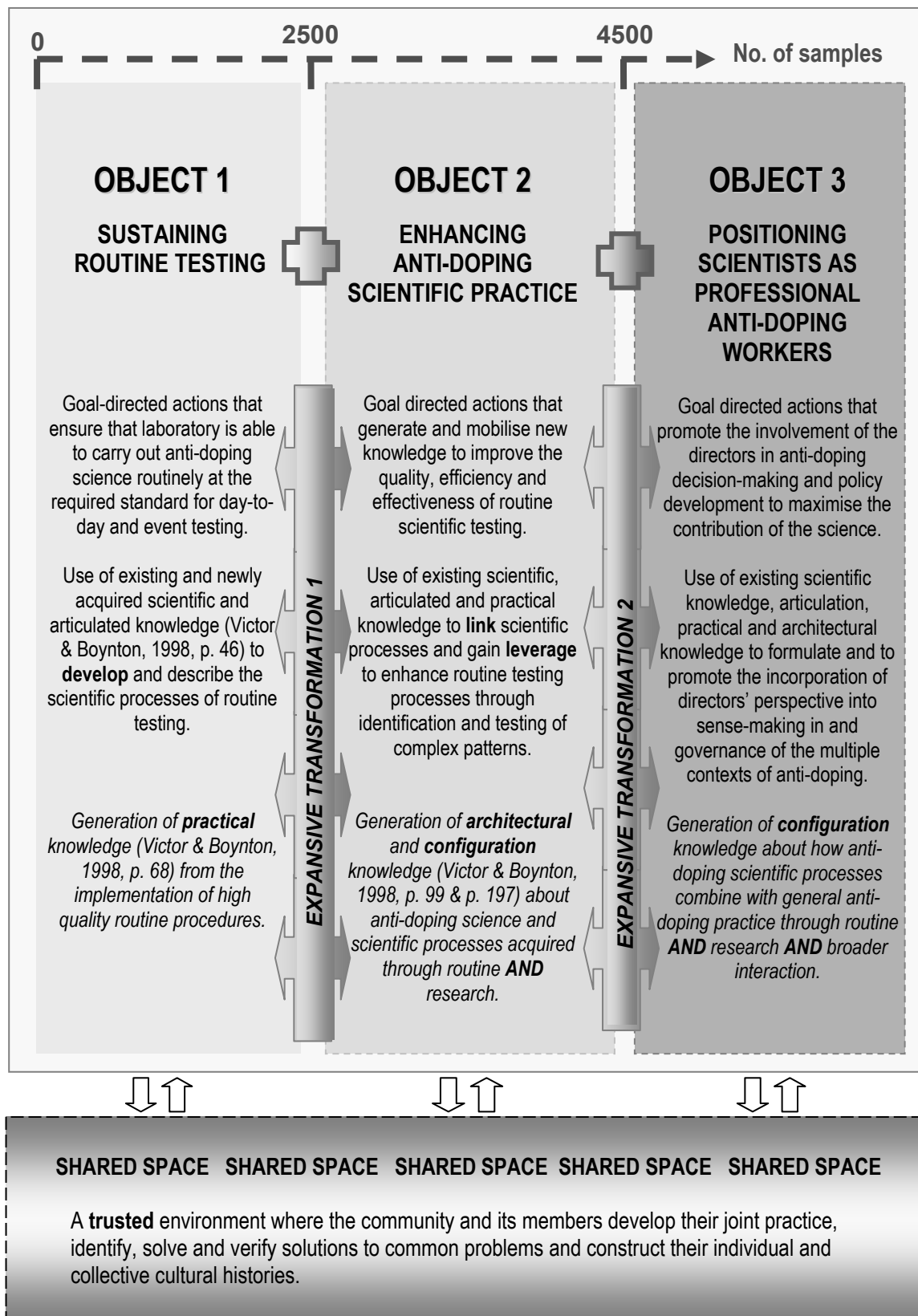


Figure 5-4: A model for the dynamics of the scientific work of the scientific directors

5.6 CONCLUSION

In this chapter, the perceptions held by the directors of anti-doping laboratories about their work and the tensions within this activity have been described, analysed and interpreted through the lenses provided by the frameworks of activity theory, communities of practice and the *Cynefin* model of organic knowledge management. A model, grounded on the directors' perspectives on their work, incorporated these theoretically informed insights into the directors' activity.

The use of activity theory elucidated the complexity of the directors' activity resulting in a model that comprised an identifiable cluster of up to three objects for the overarching activity. These objects related to the conduct of high quality routine analyses, to research aimed at enhancing the capabilities of anti-doping science, and to gaining a voice in the governance of anti-doping efforts in order to ensure that decision makers were cognisant of the laboratory perspective. Starting from the single object of conducting high quality routine analyses, an increase in routine experience provided a director with a firm basis for the incorporation of the additional object of anti-doping research into their activity through the expansive transformation of their activity. Even higher numbers of routine analyses supported expansion to the third object relating to the governance of anti-doping efforts.

From a community of practice perspective, the access to the trusted shared space of the annual Cologne workshop supported the ongoing development of the joint practice and its practitioners. The members of this scientific community were aware of the scientific and resource challenges they faced and the need for the scientific and broader anti-doping community to meet these challenges successfully through transforming their practice. Though they were outsiders to this community of scientific practice, as stakeholders in the work of the laboratory, the broader anti-doping community had, through WADA, regulated an increased level of support to be provided by a host organisation for its accredited laboratory. This increased support aimed to ensure that a laboratory had the necessary equipment and sufficient samples to maintain their expertise.

The application of the *Cynefin* framework enhanced understanding of the complexity and uncertainty inherent in anti-doping scientific work. Over time, anti-doping scientists addressed the complex scientific problems of their work. According to the directors, the ways in which they did this were not understood by their stakeholders. This implied that stakeholders found it difficult to make sense of the difficulties surrounding the generation

of new scientific knowledge and its transformation into a standardised practice whose use stakeholders could incorporate into their practice.

The integration of the theoretical frameworks as additional analytical tools indicated that aspects of the tensions within the directors' activity, particularly those relating to resources, research and governance, were located within what the various frameworks refer to as the zone of proximal development, the stage of transformational development or the domain of disorder.

As stated in Chapter Three and has been reiterated in Chapters Six through to Eight, the successful resolution of the tensions in this space requires effective discourse between members of the broader anti-doping community. Such discourse would act as a precursor to the expansive transformation of current activities and the crossing of zones of proximal development by the various groups of anti-doping workers who share this complex, global space as they co-construct solutions to their shared problems.

Data contributed by the scientific directors and their stakeholders indicated that both the directors and their stakeholders regard the advancement of anti-doping science as a critical element of anti-doping work. The stakeholders' perspective on the work of the directors is presented in Chapter 7, whereas the next chapter considers how the scientific directors together with their colleagues maintain their expertise by describing and analysing the nature of the Cologne workshop as a regular community event.

Chapter 6 EXPANDING EXPERTISE

Some of the best lessons we ever learn are learned from past mistakes. The error of the past is the wisdom and success of the future.

Dale Turner (n.d.)

6.1 INTRODUCTION

In Chapter Two, the broad question was raised as to how experts maintain their expertise when they have been acknowledged as having achieved mastery of their field. The significance of this answering this question was reinforced by Engeström's (1991) comment that the dominant traditions of the study of experts had said "practically nothing about the factors that make experts learn and perform their discrete tasks in the first place" (p. 267). In Chapter Four, it was noted that in interviews, scientific directors were asked how they maintain their expertise. As reported in Chapter Five, the accredited experts in their field, the scientific directors of accredited doping control laboratories described research and the dissemination of research results as a key element of maintaining the necessary expertise they required to keep abreast of new approaches to doping in sport.

Alvesson and Kärreman (2001) described knowledge as "an ambiguous, unspecific and dynamic phenomenon, intrinsically related to meaning, understanding and process" (p. 995). In this chapter, this question of maintenance of expertise by a group of professionals who are already at the cutting edge of their field has been further investigated. As stated in Chapter Four, data about how anti-doping scientists obtain and mobilise the knowledge they need to maintain their expertise and improve their ability to detect doping in sport was collected

- using the pilot study survey and interviews with willing scientific directors
- by observing the Manfred Donike Cologne Workshops on Doping Analyses (2003 – 2005)
- from publicly available peer-reviewed literature on anti-doping science.

After presenting the data, the concepts of activity theory, communities of practice and the *Cynefin* framework were used to inform a deeper level of interrogation of this data and to reach a more abstract interpretation of the data than otherwise possible. The processes used by anti-doping scientists to mobilise the knowledge needed to maintain and expand

both individual and collective expertise in this constantly changing field of science have been explored and represented. Subsequently, a revised version of the model for the work of the directors has been put forward.

The chapter begins with consideration of the motivation for and manner in which knowledge sharing takes place in this context.

6.2 THE IMPERATIVE TO MAINTAIN EXPERTISE

As described in the brief overview of the history of anti-doping work in sport in Section 5.2, doping in sport has been an evolving practice that placed pressures on doping control workers to maintain their awareness of new substances and techniques used by athletes to enhance their performances. It also meant that anti-doping scientists have to develop procedures to detect these new approaches. The data elicited from the directors and their stakeholders indicated that all members of the wider anti-doping community regarded it as vital that the scientists in the accredited doping control laboratories generate and share such new scientific knowledge so that all anti-doping scientists could keep up with the latest scientific developments in both doping and doping control techniques.

The directors have long known the critical role of knowledge sharing in their work. Over the years, this knowledge exchange between anti-doping scientists has been achieved through the steady but small stream of publications in the peer reviewed literature and the exchange of knowledge at the Manfred Donike Workshop on Dope Analyses held annually in Cologne, Germany. Hereafter, this event has been referred to simply as the Cologne workshop. This regular event for anti-doping scientists was first organised in 1983 by Professor Manfred Donike for the particular purpose of disseminating and mobilizing scientific knowledge so that it could be used to detect drug abuse by athletes. The value of the workshop to anti-doping scientists has been indicated by the fact that it has become a regular annual commitment for the vast majority of accredited anti-doping laboratories. Having referred to her/his commitment to annual workshop attendance, one director additionally inferred a moral imperative on the part of anti-doping scientists to share new knowledge with their scientific colleagues: *“I think it would be wrong if one laboratory kept information to [itself] without telling it to the others when you are playing catch up”*

(ID: D005). As part of an activity theory informed examination of the Cologne workshop, the cultural history of the workshop has been presented in Section 6.3.

General anti-doping workers also regarded knowledge sharing amongst anti-doping scientists as the key element to ensuring individual and collective expertise. Stakeholders interviewed for this research recognised the knowledge sharing amongst the directors whom the stakeholder described as possessing “a set of knowledge that only they have ... there’s a lot of sharing of knowledge” (ID: S021).

WADA enunciated the following knowledge sharing related condition for a laboratory’s accreditation and linked it to the Laboratory Code of Ethics:

The Laboratory shall demonstrate their willingness and ability to share knowledge with other WADA Accredited Laboratories. A description of this sharing is provided in the Code of Ethics. (WADA, 2004a, Section 4.2.8, p. 15)

As stated in Section 4.4.2.2, WADA also stipulated a timeframe of 60 days together with the avenues through which knowledge can be shared: scientific meetings, research publications, laboratory-to-laboratory communications and via WADA itself (WADA, 2004a, Annex B - Laboratory Code of Ethics, Section 3.5.2, p. 56).

In summary, all anti-doping workers, whether they are scientists, stakeholders or organisations such as WADA, place great import upon the dissemination of new knowledge as a means of keeping up with new approaches to doping in sport. In the previous chapter, the preparedness of the laboratories to support such processes for rapid dissemination was reported. These included a description of the almost simultaneous announcement in early 2005 of a new designer steroid methylandrostenol (madol) / desoxymethyltestosterone (DMT) by the accredited laboratories in Los Angeles and Montreal respectively (see Section 4.3.3.3). The tensions that can surround the intellectual ownership of such scientific discoveries need to be addressed by the anti-doping community, particularly as knowledge contributions increasingly come from researchers outside the anti-doping community in either public or commercially oriented institutions. In the shadow of such likely tensions, those means anti-doping scientists have used to maintain their expertise over the years have been described and examined using the theoretical frameworks described in Chapter Three.

6.2.1 Avenues for maintaining expertise

All professionals are expected to keep abreast with changes in their profession. Interview data indicated that the directors of accredited laboratories recognised the need to keep up with recent developments in and relevant to their area and did so in various ways.

However, finding the time to do so was not always easy because of “*free time constraints due to the everyday heavy routine work*” (ID: D004).

When asked about the means by which they maintained their knowledge, the directors mentioned a number of ways both individual and communal. Interaction with other anti-doping scientists, at either scientific meetings or in one-to-one conversations with colleagues, was described as the most common means through which the directors maintained their expertise. Many directors spoke of the importance of interacting with other scientists working in the anti-doping area either at scientific meetings such as conferences or the workshop or by direct communication (such as face-to-face, phone or email) with other anti-doping scientists. One director stated: “*It is not a field where you can work alone*” (ID: D005). Research within and between laboratories and research based on routine work was a means of identifying solutions to new problems or new solutions to current situations and hence to keep up with their changing field. Directors also referred to informal interactions with colleagues working in this and other fields, the peer reviewed literature, direct communication about a particular matter, and committee work, as means through which they maintained their expertise. These avenues have been represented graphically in Figure 6-1. Each of these avenues has been discussed below.

Seventy seven percent (77%) of those interviewed regarded attendance at scientific meetings as a means by which they maintained their expertise and 69% reported that conversations with other anti-doping colleagues promoted their learning. One director described anti-doping scientists as: “*experts in doping control or residue analysis in biological matrices, having a tremendous knowledge to share, as well as willingness to do so*” (ID: D007). Whilst many of the directors mentioned meetings in general as a way of keeping up, the annual workshop was specifically mentioned by 7 (54%) of respondents as a means of keeping with advances in anti-doping science. One director described the role of the workshop thus:

You have to keep up internationally or you'll fall behind. That is why we must attend the drug testing workshops in Cologne every year where you can get your new knowledge but also you meet the other persons that are interested in

this field and you can discuss it with them. I think it's more worth talking with the persons and discussing your problems and their problems ... [having] good contacts with other laboratories around the world. So that is how we are keeping up. (ID: D005)

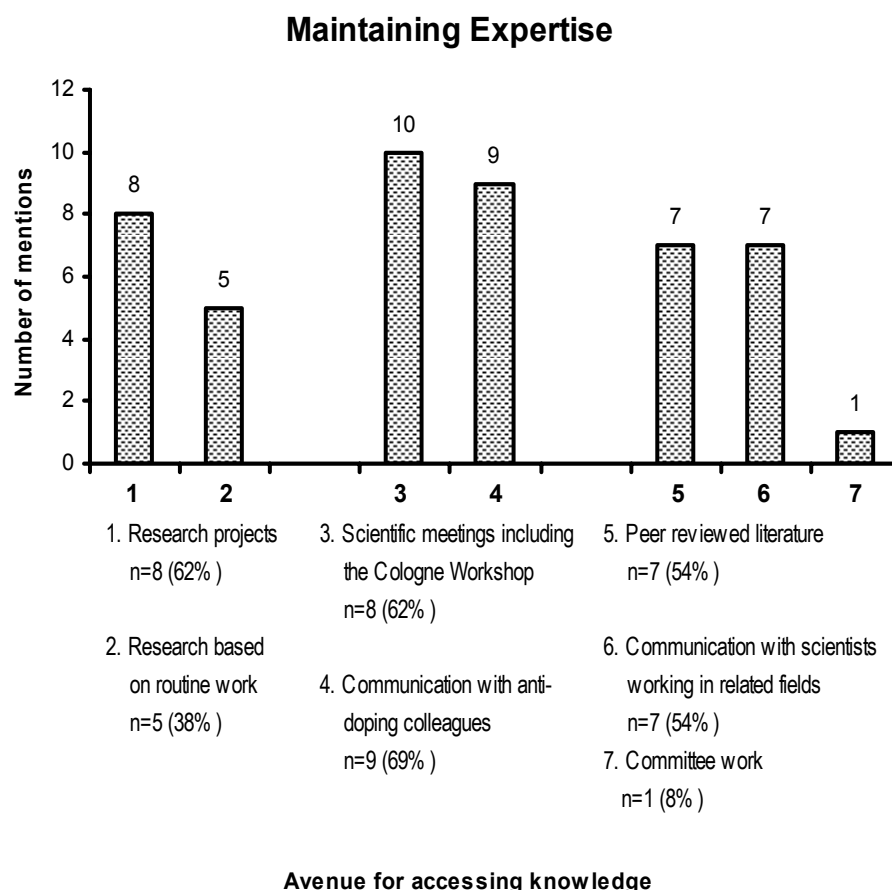


Figure 6-1: Avenues through which directors maintain their expertise

The high rate of attendance by the directors and/or accredited laboratories at the workshop also pointed to the importance placed on this event by anti-doping scientists. Workshop attendance has been examined more closely in Section 6.3.2

Whilst inter-collegial communication was also noted as an avenue for maintaining expertise, some directors (15%) mentioned the recently formed World Association of Anti-Doping Scientists (WAADS) as playing a role in maintaining expertise. As stated in Section 5.4.4, one director (ID: D008) had described the WAADS quality assurance program as an exercise that helped both directors and laboratories to compare and contrast their work with those of the other laboratories. As such the program provided a practical means of sharing knowledge between the laboratories.

One director (8%) mentioned the contribution to the development of personal expertise that results from committee work.

Just over half (54%) of the directors interviewed for this research referred to the literature as one of the means they used to keep abreast of this area. D012 regarded the peer reviewed literature as the best way to share new knowledge, commenting that:

Although there are faults in the peer-review system nobody has found a better way. A repeated criticism of doping control is that it operates in the semi-secret and that many policies are not openly declared. Again the peer review system is the only way. (ID: D012)

Another director did not regard the peer-reviewed literature as the sole means through which knowledge could be shared between laboratories but acknowledged the literature's role in ensuring that the discoverers received due credit for their work:

When one laboratory discovers a new method, the scientists have the right to publish and have their names on it. Even if ... from the following instant all the laboratories use the same method e.g. blood method for EPO. ... Everything works perfectly when the circulation of information still gives enough credit to the person that made the discovery. (ID: D008)

There was comment upon the limited extent of the available literature in the anti-doping scientific field because only “*a relatively small number of scientists are attracted to this field*” (ID: D012).

The conduct of research was also seen as a means through which a director and laboratory staff could both maintain and expand their knowledge about, interest in and proficiency with respect to anti-doping work. One director stated that the combination of routine and research created a dynamic context for the work (ID: D003). Another underscored the role of research in ensuring that staff were intellectually engaged with their work, commenting that “*You have to include some form of research so that people doing the routine work are thinking about their work and don't become just robots just doing things automatically without thinking about it very much*” (ID: D002). Routine work was seen as providing “*a continuum of cases to challenge the established knowledge and foster new [research and development] work*” (ID: D007). A research project might be initiated by a particular situation arising from routine analytical work or an investigation aimed at the refinement or development of a new technique. Such projects might be conducted by permanent staff as part of their work or by higher degree research students working in the laboratory. This research-based approach to generating new knowledge resonated with Victor and

Boynton's (1998) examination of innovative firms. Victor and Boynton described the accumulation of knowledge resulting from improving the various aspects of an organisation's work as the source of renewal that directed the process of invention and led to expanded capabilities (see Section 2.2.2.1). Victor and Boynton also noted the role of frequent informal interactions with trusted peers in the dissemination of ideas, concepts and information through an organisation.

The physical location of colleagues has a major effect on the knowledge disseminating interactions described by Victor and Boynton in the previous paragraph. In the absence of a shared physical location for their work, the new knowledge generated by research undertaken at the cutting edge of anti-doping science has been disseminated through other means. To better understand the role of the Cologne workshop, the next section examines more closely the channels chosen by anti-doping scientists to share their research outcomes with their colleagues.

6.2.2 Channels for disseminating new knowledge

As described in the research design (see Section 4.6), surveys and interviews as well as observations of the workshop and literature provided data about how anti-doping scientists disseminate the outcomes of their research and so expand their expertise. An appraisal of scientific publications related to doping in sport showed that anti-doping research was carried out by scientists in a single accredited laboratory or through collaboration between scientists working in different accredited laboratories. At times scientists from accredited laboratories worked with external researchers or external researchers independently carried out research that had implications for anti-doping science. Whilst interview and survey data had indicated that the directors and their staff maintained their expertise through a variety of means, it had not identified the degree to which scientists used these channels to disseminate their research outcomes. To learn about anti-doping scientists preferences for knowledge dissemination, the agenda for the workshop and its associated proceedings for a particular year were examined as well as peer-reviewed scientific publications sourced using the publicly available PUBMED online database (available at <http://www.ncbi.nlm.nih.gov/entrez/query.fcgi>). The results of this investigation have been discussed below, beginning with the use of the peer reviewed literature.

6.2.2.1 *The peer reviewed literature*

The peer-reviewed literature has long-been regarded as the principal means by which scholars in all disciplines including the small field of anti-doping science have presented their research outcomes to their peers and established themselves as scholars in their particular field. Gaines (1995) stated that “journals are the major medium for discourse in the scholarly community and, as such, are intrinsically part of the social processes in that community” (par. 1). The process of publishing in the peer reviewed literature has been the principle means by which researchers have contributed to the advance of their discipline as it provides usable knowledge “that is reliable in application and whose source can be trusted” (Section 3.1). Further “the refereeing processes of current journals have been developed to apply standards of 'truth' and 'justification' to the material submitted so that certain minimal levels can be relied on as applying to all material in those journals” (Section 3.1). Well-published and cited authors held a respected status in their field, and have been regarded as having exemplary expertise in their field as their work has been able to withstand the scrutiny of their peers for an extended period. In more recent times, universities and funding bodies have come to both expect researchers to publish frequently in the peer-reviewed literature as a means of demonstrating their status as a knowledgeable expert, and to reward those who do so more frequently (Merton, 1968, 1988).

In the absence of a peer-reviewed scientific journal dedicated solely to anti-doping science, anti-doping scientists have published in a wide variety of journals. This has led to a broad-based public discourse about the research of anti-doping scientists involving scientists working in many different areas. Over the years, this discourse in the peer-reviewed literature has helped to generate trust in the analytical processes of the accredited laboratory systems through providing an accepted venue in which anti-doping science has been subjected to scrutiny by qualified peers.

Papers published in the academic literature that have reported the outcomes of research from accredited anti-doping laboratories have been a rich source of new knowledge for anti-doping scientists - knowledge that can be incorporated into routine laboratory practice. Searches of the PUBMED database for papers related to anti-doping science AND authored or co-authored by the directors of the accredited laboratories (summarised in Appendix H), found that in 2002, 40 papers had been published, 37 were published in 2003 and 40 in 2004, making a total of 117 papers over the years 2002-2004. When laboratory size was taken into account during a further analysis of the publication rates of laboratories

were consistent with the pattern of increasing diversity of the nature of work carried out accredited laboratories with increasing size. This pattern was first described in Section 5.4 and has been incorporated into the model for the dynamics of the work of the scientific directors represented most recently in Figure 5-4. PUBMED data indicated that those laboratories which analysed fewer than 2500 samples in 2003, on average published 1.5 papers over the three year period 2002-2004. The middle group of laboratories which analysed between 2500 and 4500 samples during 2003, on average published 3 papers in the peer-reviewed literature sourced by PUBMED during that period. Finally the largest laboratories generated the highest average number of publications or 5.8 during the 3 year period 2002-2004. As will be seen in the next section, analysis of data about the numbers of Cologne workshop presentations and proceedings told a different story.

6.2.2.2 The annual Manfred Donike Workshop on Doping Analyses in Cologne

As stated above, the study data indicated that whilst both publication in peer-reviewed journals and the annual workshop had been used as channels through which to disseminate research outcomes amongst the anti-doping scientific community, presentation at the workshop was the preferred avenue for knowledge dissemination. Analysis of data about publications by both those directors who participated in the study and by the entire population of directors supported the existence of a relationship between the volume of samples analysed by the laboratories in 2003 and the number of publications and workshop presentations connected with each laboratory. Those laboratories which analysed fewer than 2500 samples on average published least papers. Over the years 2003-5, the smaller laboratories whose directors had participated in the study had made on average 1.25 presentations at the workshop, wrote up on average 0.7 (around 56%) of these presentations as publications in the peer-reviewed Cologne proceedings and published an average of 1 paper in the peer-reviewed professional literature (around 80% of the number of their presentations at the workshop). The corresponding statistics for **all** small laboratories are a little higher: 2.3 presentations, 1.1 papers in the proceedings and 1.5 papers in professional literature. The research output from larger laboratories is higher. The middle group of laboratories whose directors participated in the study (2500 – 4500 samples in 2003) gave an average of 5.6 presentations at workshop over the years 2003-2005, published 4.7 (84%) of those presentations as papers in the proceedings and had an average of 3 papers (54% of the number of workshop presentations) published in the academic literature. A similar pattern was observed for the largest laboratories with

averages of 12, 11 (92%) and 5.8 (48%). This is in keeping with the findings in Section 5.4. This comparison of the usage of various channels for knowledge dissemination has presented graphically in Figure 6-2, which has been based on the data contained in Appendix H.

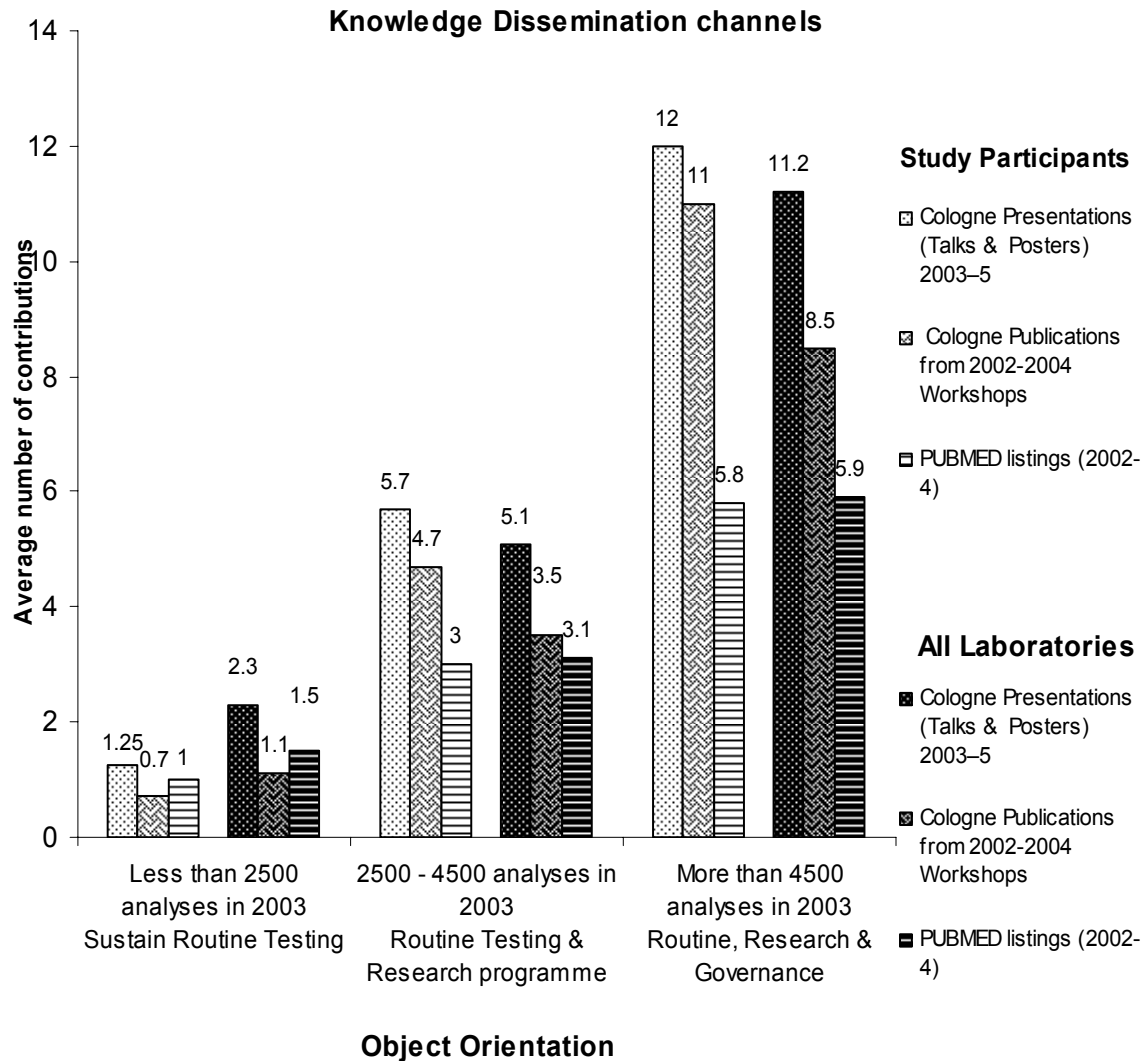


Figure 6-2: Use of knowledge dissemination channels by anti-doping scientists

Two other conclusions have been drawn from Figure 6-2. Firstly, that there was no marked difference between the knowledge dissemination preferences of each group of research participants and the overall population from which they were drawn. Secondly the graph highlighted the preference that the directors have for the workshop as the venue for disseminating research findings. In all groups, talks and posters at the workshop are

preferred to publications in the proceedings or in the academic literature. This may occur for a variety of reasons. Possibly, discussions about the presentation at the workshop may suggest that further experimental work is necessary before publication. Alternatively, the nature of the communication may be unsuitable for publication, or there may not be the time required or effort available to transform a presentation into a paper or article. Additionally, the workshop provides an opportunity for young anti-doping scientists to present their work as a means of promoting their entrée into the community. Figure 6-2 also makes apparent the generally lower but persistent use of the peer-reviewed literature for knowledge dissemination by anti-doping scientists.

Whilst there was some indication in the interview data that in the past the issue of intellectual property may have been a problem for workshop presenters, the increasing number of contributions to the workshop seems to suggest that such difficulties are in the past. D005 stated that “*in the past it may have happened that someone else did the work also (before presentation) but that doesn't happen now*”. The current organisation of the publication of the workshop's proceedings ensured that the sharing of anti-doping scientific knowledge via the medium of the workshop, its proceedings and/or peer-reviewed journals proceeded in a smooth manner: “*The interaction [at Cologne] is usually on an annual basis, so you've got plenty of time to do your research work and then share it with the others and publish [in the peer reviewed literature] almost simultaneously*” (ID: D005).

Examination of the programme for and proceedings of the 2003 and 2004 workshops indicated that the majority of workshop presentations were published and it may be that this is an increasing trend. Data contained in Table 6-1, 38 (or 69%) of the 55 presentations given at the 2003 workshop were written up and published. In 2004, not only was there an increase in the number of presentations from 55 (or 16.4%) to 64, the rate of publication in the proceedings also increased to 57 (or 89%) of the 64 of the presentations. Table 6-1 also shows that in 2003 and 2004, there were respectively 37 and 40 articles listed by PUBMED as (co)authored by directors of anti-doping laboratories. Whereas the 2003 Cologne workshop proceedings contained a similar number of contributions to that made in the broader scientific literature, namely 38 compared with PUBMED's 37, in 2004, 57 papers were published in the peer-reviewed workshop proceedings whereas a search of PUBMED located only 40 articles published in the academic literature.

Both interview and publication data suggested the workshop has a particular role in this community in that it facilitates the formal and informal dissemination of both new and current knowledge about anti-doping practice amongst experienced and inexperienced anti-doping scientists. This role in the evolution of individual and group expertise in the anti-doping scientific community is considered in greater depth in the following section.

Table 6-1: Usage of various knowledge dissemination channels by anti-doping scientists for the years 2003 & 2004 *

Medium	Workshop agenda '03		Workshop agenda '04		Cologne Workshop Peer-Reviewed Proceedings		PUBMED Listings	
	Talks	Posters	Talks	Posters	2003	2004	2003	2004
Number of items	33	22	34	30	38 (69%)	57 (89%)	37	40
Total contributions	55		64		95		77	

* Non-attendance at the 2006 workshop meant that the researcher did not receive a copy of the 2005 Workshop's Proceedings and so was unable to extend the comparison to 2005.)

6.3 AN OVERVIEW OF THE COLOGNE WORKSHOP

As noted above, in Chapter Five and elsewhere (Kazlauskas & Crawford, 2004b), the workshop has long played a major role in the knowledge exchanges which occur between anti-doping scientists. To better understand the role of the annual workshop, this section contains an overview of demographic data relating to the anti-doping scientific community and the sub-group who attended the 2004 workshop as well a history of the workshop. The researcher's observations of the 2003 – 2005 workshops and their participants have also been presented. The section provides a backdrop for the three theoretically informed analyses of the nature and role of this annual event for anti-doping scientists from the perspectives of community of practice, activity theory and the *Cynefin* framework offered later in the chapter.

6.3.1 The international nature of anti-doping scientific work

An examination of the geographic location and volume of analyses conducted by each of the laboratories listed in WADA's (2005a) 'Adverse Analytical Findings for 2004' (represented graphically in Figure 6-3) highlighted the international nature of anti-doping

scientific work. These figures made it quite clear that most of the world's anti-doping scientific activity in 2004 occurred in Europe which had more doping control laboratories and carried out more doping control analyses than the rest of the world. The pie charts in Figure 6-3, indicated that Europe, with just under 60% (18) of the accredited laboratories, conducted more than half of all 169, 025 doping control analyses in 2004. These statistics indicated that anti-doping efforts, both scientific and organisational were well established in Europe.

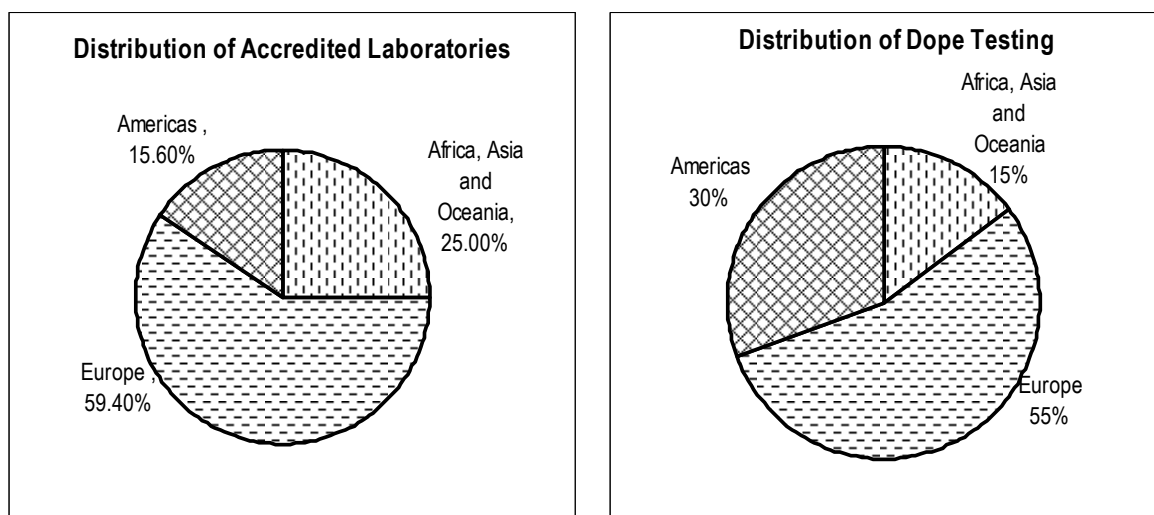


Figure 6-3: Regional distribution of Accredited Laboratories and Sports Dope Tests in 2004

The statistics for Africa Asia and Oceania reflected a different situation. 25% (8) of the laboratories were located in this region but only 15% of the world's doping control analyses were carried out there. The lack of organised testing programs in the vast majority of countries in those areas of the world reflected in the lower percentage of analyses for this region. WADA has addressed this situation through the formation of regional anti-doping agencies (RADOs) aimed at reducing the financial commitment needed by individual countries to support such programs. Only 16% (5) of the laboratories accredited in 2004 were situated in the Americas, South, Central and North. However, the region conducted approximately 30% of the analyses. In particular, the Los Angeles laboratory conducted considerably more analyses than any other laboratory (almost 22% of **all** analyses), skewing the data for this region. This high number of analyses carried out by the Los Angeles laboratory is a result of the implementation of organised anti-doping testing in many professional sports in the United States, a country with a much larger

population than that of many other countries with an accredited laboratory. As has been discussed in the next section, representatives of each of these regions and the majority of laboratories go to Cologne for the workshop. However, the distribution of both attendance at and contribution to the workshop differed from the percentages of accredited laboratories and analyses.

6.3.2 Diversity of participation in the 2004 Cologne Workshop

The international nature of the anti-doping scientific community was apparent at all Cologne workshops attended by the researcher. The List of Participants provided by the workshop's organisers provided institutional affiliations and contact details for each workshop attendee. The workshop program provided a list of presentations, both talks and posters, presenters and their affiliations. Together these documents provided data about attendance and contribution for the 2004 workshop. This data has been summarised in Appendix I. Examination of this data indicated that attendees of the 2004 workshop had travelled from around the world, as they had in the workshops of other years and inferred diversity of attendees' cultural histories.

Attendance at the workshop by staff from accredited laboratories situated in the regions outside Europe was comparatively under-represented: 29% of the attendees from outside Europe compared with 41% of laboratories and 45% of testing. This was not surprising given the cost of travelling to and staying in Europe for the week-long workshop and given that so many laboratories had reported difficulties with covering the routine costs of day-to-day analytical work (see Section 5.4.2). In such circumstances, a scientific director would be unlikely to fund the participation of large numbers of staff in the workshop. The corresponding high percentage of European attendees (71%) and the high percentage of their contributions to the workshop (64%), shown in Figure 6-4 could have been influenced by the lower costs of attendance at the workshop both financially and in terms of time for European based anti-doping scientists. In particular, the workshop was easily attended by all staff of the Cologne laboratory.

The contributions to the Cologne Workshop were calculated using the 2004 Workshop program which listed both the names and affiliations of the contributors. From this data it was apparent that whilst the Americas, North, Central and South, conducted around 30% of the doping control analyses in 2004, and represented 16% of the world's accredited laboratories in 2004, they provided only 7% of the workshop contributions and sent only

10% of the attendees. This under-representation of input may suggest a regional focus on the processes of doping control rather than on anti-doping scientific practice and research. In contrast to the low level of attendance and contributions from the Americas, the level of attendance by staff of laboratories situated in Africa, Asia and Oceania (i.e. 25% of the world's accredited laboratories), was 19% and lower level of doping control testing (15%). These laboratories contributed strongly (29%) to formal knowledge exchanges at the workshop. This may suggest that anti-doping programs in this region are generally not as well established as those in Europe but that there is a regional interest in the development of a strong scientific base for anti-doping activity.

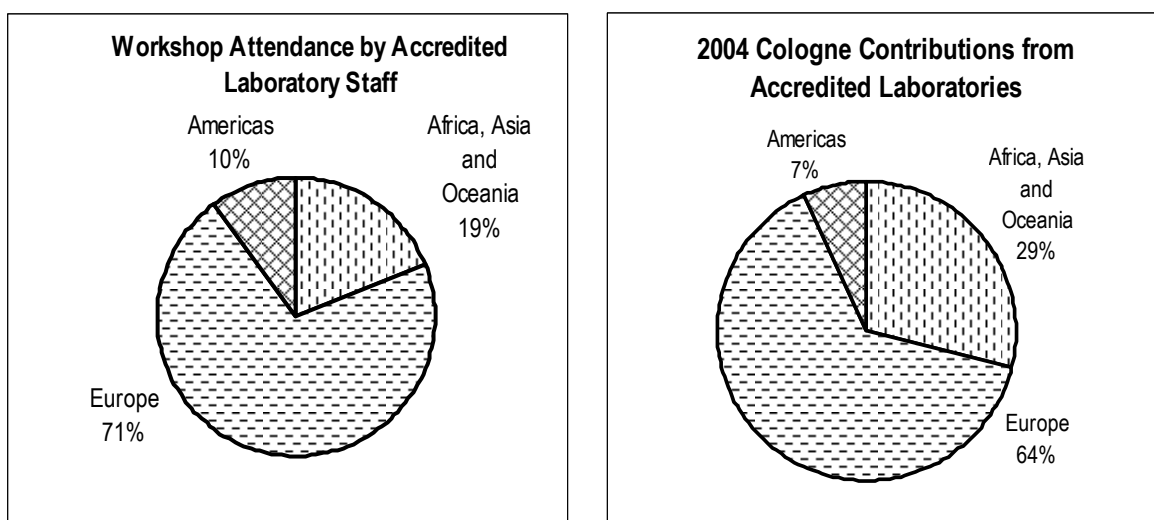


Figure 6-4: Regional attendance and participation for the 2004 Cologne Workshop

Data from the List of Participants indicated that 90 of the 123 (or just over 73%) of the participants were from accredited laboratories. These attendees gave 68 of the 78 (or just over 87%) presentations, either talks or posters. This is represented graphically in Figure 6-5. Further analysis of the List of Participants yielded additional information about the nature of the attendees. Representatives of 32 of the 33 then accredited laboratories (97.0%) attended the 2004 workshop. 23 Scientific Directors of the 33 accredited laboratories (69.7%) attended the workshop but only 5 of them gave talks, 4 of these 5 had been directors of non-European laboratories. However, some directors who did not give presentations participated extensively in the workshop by chairing sessions and/or raising questions in the lecture theatre after the talks. Others directors were more passive, simply attending sessions and participating in more private discussions.

Participation in the 2004 Cologne Workshop

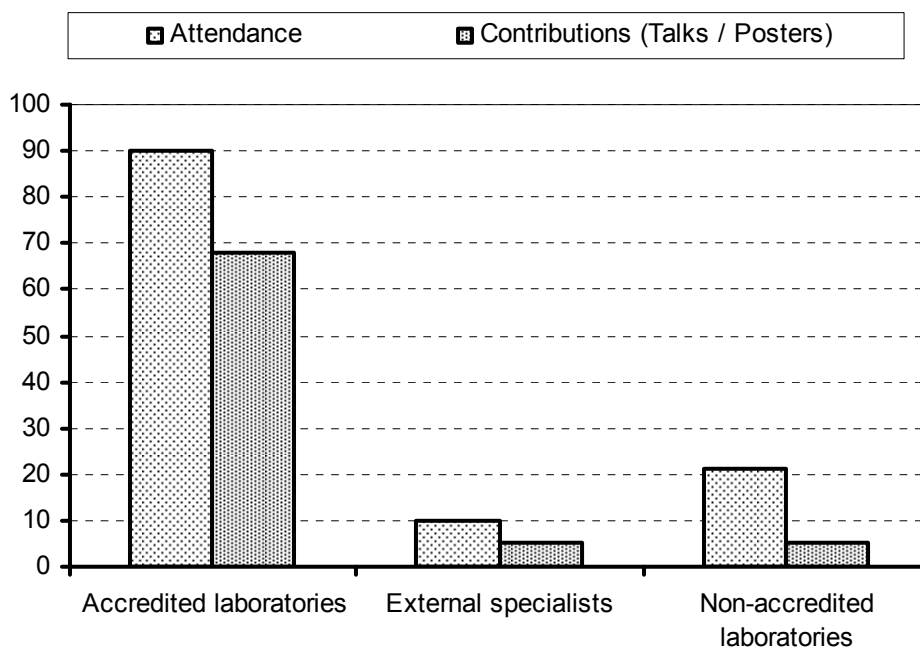


Figure 6-5: Affiliation and Contributions of 2004 Cologne Workshop Participants

The ten external attendees – scientists from other areas, instrumentation experts and the researcher herself, comprised 8.1% of the attendees and proffered 5 (or 6.4%) of the presentations. These contributions described projects which were looking at developing knowledge and/or techniques used in other areas that might be incorporated into anti-doping science. At times, presenters mentioned that their research had been funded by WADA. Instrumentation specialists described improvements in equipment that would be of interest to anti-doping scientists.

There were 21 (or 18.7%) representatives of 13 non-accredited laboratories which were either practising non-accredited or aspiring doping control laboratories. This group of attendees gave 5 (6.4%) presentations. When one compares the attendance and contribution rates of this group with those of the others, it is not surprising that in order to provide places for representatives of the increasing number of doping control laboratories, organizers of the 2005 and 2006 workshops restricted to one, the number of participants from institutions which were not accredited doping control laboratories.

Finally, gender is a shaper of cultural historical experiences. It is notable that only 5 of the scientific directors of laboratories accredited at the beginning of 2004 were women and 37 of the 115 (just over 32%) of the listed participants at the 2004 workshop were women, considerably less than the almost 50% of the general population that is female. In this, as in many other areas of endeavour, women are under-represented.

As stated previously, the workshop has long provided the annual opportunity for this diverse group of scientists from all around the world to come together to communicate intensely about the anti-doping matters that concern them. Communication issues have been discussed in the next section.

6.3.3 Intercultural communication at the 2004 Cologne Workshop

The international nature of anti-doping science, as illustrated in Figure 6-3, has presented additional challenges to anti-doping scientists in the form of establishing effective communication. The data presented above highlights the diverse origins, cultural historical backgrounds and languages of the workshop participants. Whilst English alone has been accepted as the language for the presentations at the workshop, examination of the country of origin of the attendees indicated that it was the day-to-day language of only twelve of the 2004 workshop participants. Observation of informal conversations during the workshop suggest that for some attendees it one of the two, three or even four other languages that they spoke. This could mean that not all workshop participants are comfortable with English.

As stated previously, the efforts of young anti-doping scientists were encouraged through the presentation of an award at the workshop. In 2004, a number of young European and Asian scientists delivered their first major anti-doping science presentation in English, a language that was not their mother tongue. The researcher admired the capable manner in which one young researcher handled rigorous questioning from members of the audience in a language other than her own and felt that her efforts were outstanding. Interview data also suggested that the scientific directors were aware of the difficulties language differences could cause. One director stated that he/she would like to be able to have in depth discussions about his/her work in his/her mother tongue; others were concerned that

they were unable to represent themselves or their ideas adequately in English. Another interviewee spoke of the need to listen carefully in order to maximise communication.

The challenge of communicating in sophisticated scientific ideas English was not the only effect of the different cultural backgrounds of the participants. During the 2004 and 2005 workshops, presentations by the director of the a laboratory in the Africa, Asia and Oceania region led to discussions which highlighted differences between accepted ethical practice regarding excretion studies in that laboratory's country and those of a European country.

Nonetheless, any difficulties caused by communication and cultural differences were eased by the friendly atmosphere of the workshop. Whilst some participants had been coming to the workshop for twenty or more years, for others it was their first visit. Both anti-doping scientists and external attendees appreciated the friendly atmosphere of the workshop. One stakeholder who had attended the workshop only once when interviewed for this research commented:

One thing which I thought was good with the [Cologne] conference was that because it was such an open forum and I think I'd go as far as saying that it was probably the best conference I've been to ... in the sense of the free exchange of information. (ID: S011)

Over the years, the workshop has provided a comfortable space for communication between members of the anti-doping scientific community and selected external specialists. The use of English as a common means of communication, the regularity of the day-to-day workshop program and the friendly atmosphere created by the workshop's organisers have all contributed to building a context in which anti-doping scientists from a wide variety of cultures have explored and continue to explore their particular field of science as well as developing shared perspectives about their community. Prior to this exploration of the workshop attendees' perceptions of community in Section 6.4, the history of the workshop has been given to enhance understanding of the nature of the workshop.

6.3.4 History of the Manfred Donike Workshop

Professor Manfred Donike, a chemist, one of the pioneers in anti-doping science and a former athlete, organized the first of the annual week-long workshops at the German Sports University in Cologne in February, 1983, the year that the IOC became responsible for the accreditation of anti-doping laboratories. The 18 attendees from 11 European countries and the U.S.A. came to the workshop to learn about the recent application of analytical chemistry to the detection of performance enhancing drugs in human urine. The workshop comprised morning lectures, afternoon practical sessions and evening social outings. During the week-long workshop, attendees were accommodated in the nearby Trainer Academy. They lived, worked and socialised together for the whole week. In retrospect, this first workshop was a critical event in the evolution of anti-doping science and established the pattern for future workshops.

Like all complex activity systems in which people learn and grow, over time the changing format for the workshop exhibited the signs of expansive reconfiguration (Engeström, 1987, 2001a) as it responded to the changing needs of the community of anti-doping scientists. Organised by the Manfred Donike Society, which was formed after Professor Donike's sudden death in 1995, the 2004 workshop had more than 120 attendees with only one of the WADA accredited laboratories not represented. In the 1980's the focus was on laboratory-based development of practical skills by attendees. Over the years, the body of scientific knowledge and its application to anti-doping science has expanded and the number of scientists working in the area has grown.

The current format for the workshop placed a greater emphasis on presentations, either as talks in the lecture theatre or posters displayed in the corridor which runs from the lecture theatre to the coffee break area. The talks have been organised in sessions of three or four presentations which usually deal with a particular area of anti-doping science. Both talks and posters disseminated the outcomes of recent scientific research. Lengthy coffee and lunch breaks ensured that participants had time to discuss the research outcomes with the researchers and with each other. The daily practical sessions in the laboratory had been replaced by an extended visit to the doping control laboratory in Cologne on the final morning of the workshop. The number of workshop attendees was such that they could be accommodated at the Trainer Academy and at two nearby hotels. To a large extent, workshop attendees still lived, worked and socialised together for the duration of the workshop.

The workshop acknowledged and nurtured the contributions of new anti-doping scientists. Many of the scientific talks and posters were presented by younger scientists from accredited laboratories. In the final session of the workshops, Marie Theres Donike, widow of the late Professor Manfred Donike, presented an award to the young scientist whose contribution at the workshop has been the most outstanding.

The publication process for the proceedings of the workshop evolved in response to the need to share research outcomes within the community at the earliest possible time without compromising the needs of researchers to publish in more prestigious journals. Since 1993, an editorial committee supervised the publication of the refereed proceedings of the workshop as 'Recent Advances in Doping Analysis'. A few months after the workshop, presenters were invited to submit the paper associated with their talk or poster. The reviewed papers were published and given to attendees at the workshop the following year.

The workshop was the major opportunity for the scientific directors of the laboratories to be together in the same place for a reasonable length of time. The organisation of the week long workshop provided ample opportunities for the directors to engage in the casual discussions that facilitate comfortable inter-personal relationships between directors and laboratory staff as well as to better their formal and informal knowledge of the field. As noted previously, one director regarded the workshop as a compulsory annual event because it allowed the director to keep up by accessing new knowledge and through meeting with colleagues to discuss their common field.

The workshop has also become the occasion when the World Association of Anti-Doping Scientists (WAADS), formed in early 2001, holds its annual general meeting. This meeting provided anti-doping scientists with a forum in which to discuss important issues. As a group, WAADS has stated its commitment to high scientific and ethical standards within anti-doping scientific work and as stated previously. It has also developed its own quality assurance program to help members achieve the high analytical standards associated with this field. Its website provided a forum in which its members have been able to discuss issues of mutual concern between annual meetings.

Each year that the researcher attended the workshop it was officially opened by representatives of the German Government's Sports Ministry and the German Sports University's administration. In 2003 and 2004 there were also sessions in which the media were able to ask the scientists questions about doping issues. A small number of selected

scientists from other disciplines whose work was relevant to anti-doping science were also invited to present their work at the workshop. In this way, the workshop provided a means of connecting anti-doping scientists with government and stakeholder groups.

Over the years, this annual workshop has established its credentials as a regular community event which connects anti-doping scientists with each other and their chosen profession and with the latest advances in anti-doping science. The researcher's observations on the practicalities of how this has been achieved have been described in the next section.

6.3.5 Observations of recent Cologne Workshops

As stated in the research design (see Section 4.6.2) and above, observations were made during the Cologne workshops in 2003, 2004 and 2005. On those occasions, immersion in the international context of the only annual anti-doping scientific event provided an opportunity for the researcher to take note of and reflect upon the nature of the participants, their interactions and their work. The observations by the researcher made during both formal sessions and informal breaks and recorded in field notes have been presented in the following paragraphs

The majority of the scientific directors attended the workshops. In cases where the director did not attend, other senior staff members were sent from that laboratory. This attendance pattern indicated recognition that the workshop was a vital means of attaining and maintaining expertise in this field. A detailed consideration of the attendance at the 2004 workshop has been given in Section 6.3.2.

From the programmes for the 2003 – 2005 workshops and the researcher's observations, it was apparent that the scientific content of the workshops excited the participants. The workshop content was wide-ranging, substantial, and fostered ideas for further research in anti-doping science. Four sessions were held daily from Monday through Thursday. Each session consisted of three or four talks on a theme and was chaired by either a scientific director from one of the accredited laboratories or by another well-known workshop participant. The talks were presented by speakers from many different laboratories. In fact, few scientific directors give talks and make their contribution during the question time after each talk when they offered comments about work in related areas or shared other

information relevant for the speaker and other attendees. Sometimes comments became a discussion about a particular scientific issue or the policies of doping control. Such discussions were often extended over a meal or cup of coffee. After the conclusion of the 2004 workshop one director said that he had enjoyed the workshop immensely and that he was leaving with many questions which he would attempt to answer with further research. Another commented that his laboratory's staff knew that he would return with many new ideas which would be explored over the next twelve months and brought back to the following year's workshop.

The comfort engendered by the established routine of the workshops and the stimulating nature of the science and interactions with colleagues attracted anti-doping scientists from around the world. The researcher found the feeling of community palpable from the warm welcome at the registration desks, through Professor Schänzer's short speech at the opening dinner which began with the words: "*Welcome, Friends*", through other shared meals, the weather forecasts at the commencement of each day's lectures, the morning and afternoon breaks and the evening social events. The workshop format ensured that participants had the opportunity to continuously talk with each other, to share ideas, to form working relationships and to build a shared vision of the community's practice of anti-doping science. The atmosphere affirmed and supported the highly pressurised work of these anti-doping scientists. The term "family" was used by two different scientists to refer to the atmosphere of this annual gathering. External participants who attended the workshop commented on the relaxed, friendly, collaborative atmosphere of the group. One stated that this had not been expected as they had heard comments to the contrary from other stakeholders about anti-doping scientists.

The experience of such feelings of community during the 2003 workshop resulted in the researcher's decision to explore anti-doping scientists' perceptions of themselves as a community of practice through the administration of the survey during the 2004 Cologne workshop. The results of this survey have been given in the next section, prior to consideration of this event from the theoretical perspectives of communities of practice, activity theory and the *Cynefin* framework.

6.4 SHARED PERSPECTIVES ABOUT THE ANTI-DOPING SCIENTIFIC COMMUNITY OF PRACTICE

In Section 3.3 the theory surrounding communities of practice was presented as a social learning theory and its relevance to developing an understanding of maintaining expertise foreshadowed in the research design and outlined in Table 4.3 and Table 4.6. Wenger (1998) described communities of practice as comprising people who were mutually engaged in a joint enterprise having a shared repertoire of “routines, words, tools, ways of doing things, ... actions or concepts that the community has produced or adopted in the course of its existence” (p. 83). Schlager and Fusco (2003) provided a more detailed description of communities of practice as

emergent, self-reproducing, and evolving entities that are distinct from, and frequently extend beyond, formal organizational structures, with their own organizing structures, norms of behaviour, communication channels and history. ... Members come from a larger professional network spanning multiple organisations, drawn to one another for both social and professional reasons. Newcomers gain access to the community’s professional knowledge tools and social norms through peripheral participation in authentic activities with other members. New practices and technologies are brought into the community by leaders, newcomers, and outsiders, and are adopted by the community through the discourse of its members and the evolution of practice over time. Thus from a community-of-practice perspective, one’s work and one’s professional development are inextricably entwined with those with whom one works. (Schlager & Fusco, 2003, p. 204)

Observational and interview data indicated that the annual workshop provided anti-doping scientists with a rich context for new learning about their practice, thus making their learning an integral and inseparable aspect of the social practice (Lave & Wenger, 1991, p. 31) and “an aspect of all activity” (p. 38) during the week-long workshop. Lave and Wenger discussed learning as involving the whole person through “not only a relation to specific activities but a relation to social communities” (p. 53). As well as describing different levels of membership of a community of practice, Wenger, McDermott and Snyder (2002) explored the role of communities of practice as a means of managing knowledge. They listed a number of stages in the development of a community of practice, stages which reflected the focus of a community’s activities: discovery of potential; coalescence into a community; maturation and focus on core issues including taking responsibility for the community’s practice; stewardship of the practice through maintaining the community and ensuring the relevance of its practice, and finally letting go and/or living through the transformation of the practice (see Section 3.3.2).

To ascertain the applicability of these concepts to anti-doping scientists and to test the relevance of observations made during the 2003 workshop as a regular event for a community of practice, the researcher administered a survey (see Appendix G) during the 2004 workshop. The survey asked individual workshop attendees to indicate their level of membership of a community of anti-doping scientific practice and also where they perceived this community in terms of the stages of community development proposed by Wenger, McDermott and Snyder (2002) that were referred to in the previous paragraph. Copies of the survey were distributed to attendees at the commencement of the researcher's presentation at the end of the first day's talks for the 2004 workshop. During the presentation, which also mirrored the findings of the pilot study to participants, the concepts relating to membership of a community of practice and the life cycle of a community of practice were explained. Members of the audience were then asked to complete the survey by providing some demographic data and to indicate with an 'X' where they positioned themselves in the community's membership levels (see Figure 3-17) and where in its development as a community of practice they perceived the scientific anti-doping community's to be (see Figure 3-18). Completing the survey gave workshop attendees an opportunity to jointly re-analyze their status as, and their involvement in, a community of practice. Whilst not all the attendees were present during the session, just over half of the workshop attendees returned completed surveys either immediately after the presentation or later in the workshop.

Analysis of the demographic data provided by the workshop attendees in the survey described earlier suggested that there were four major groups of workshop participants: the scientific directors of accredited laboratories and heads of non-accredited laboratories, experienced senior scientists working in anti-doping laboratories, research students carrying out their research in anti-doping science and others who have a vested interest in anti-doping science but do not work in an anti-doping laboratory. Analysis of the data has led to a number of observations about anti-doping scientists' perceptions of their participation in this community, represented in Figure 6-6, and their perceptions about their community's development, in Figure 6-7.

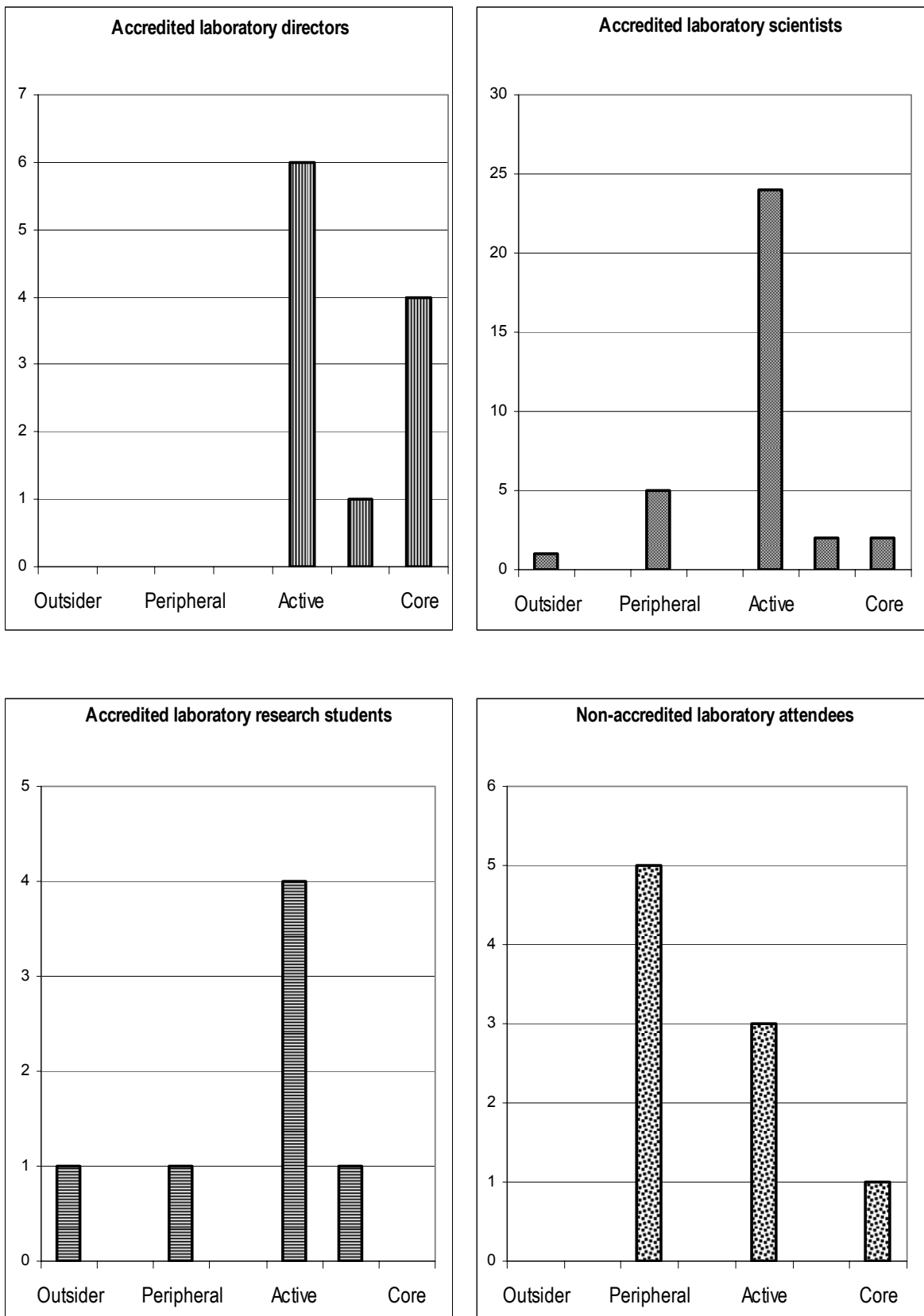


Figure 6-6: Perceptions of belonging to a community of anti-doping scientific practice

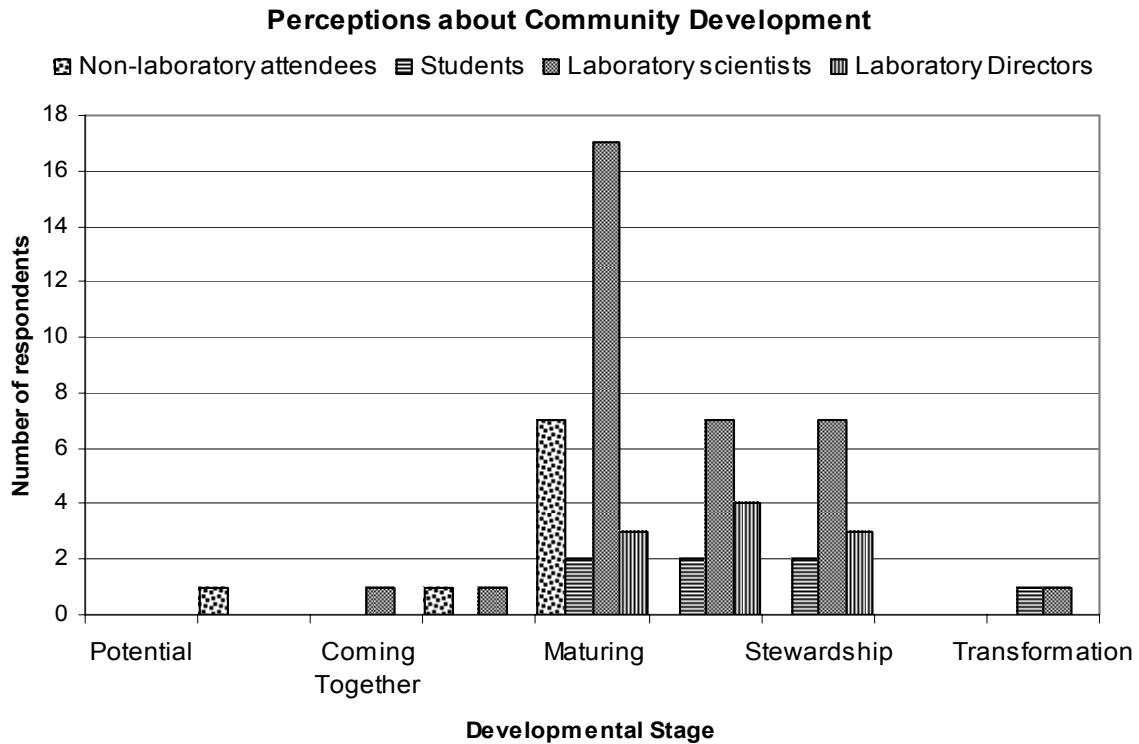


Figure 6-7: Perceptions about the community’s development

As shown in Figure 6-6, all the scientific directors and heads of laboratories who participated in the survey saw themselves as very much at the centre of this community and some (5 of the 11 respondents in this group) regarded themselves as being at the core of the community, making what Wenger, McDermott and Snyder (2002) described as a critical contribution to the health of the community. The vast majority of the senior scientists attending the workshop also saw themselves as active members of the community, with two regarding themselves as core members. The perceptions of the research students indicated that even as relative newcomers, the majority regarded themselves as part of this scientific community and as making a valuable contribution to the practice of anti-doping science. Just over half of the non-laboratory based workshop attendees saw themselves on the periphery of this community. Others regarded themselves as actively contributing to the community whilst one regarded their contribution as vital to the community’s health.

The respondents’ perceptions of the community’s development, shown in Figure 6-7, proved harder to interpret. The directors perceived the community as maturing and the subject of their stewardship. This result was consistent with the extensive experience that

some of these scientists had in the field, their contributions at the end of the scientific talks and to discussions during the workshop. Senior accredited laboratory scientists' perceptions of the community were spread across all possible stages of community development. The most common view was that the community was maturing (17 out of 34). A substantial number of these scientists felt that the community had either matured (7 out of 34) and was being stewarded (7 out of 34). One scientist felt that the community was in a transformative stage whilst two scientists felt that the community was in the process of coming together and maturing. Research students' views of the community also varied: some saw it as maturing, others as being stewarded and one as in a stage of transformation. The views of the external participants' group of workshop participants about the community's stage of development differed from that of the other groups in that this group perceived the community of anti-doping scientists as less mature, some regarded it as only just coming together or coalescing.

These variations between and within the groups of participants may have been a result of lack of understanding of the timeline as well from the different individual perspectives of the anti-doping scientific community. However, from discussions with a number of workshop participants made after the presentation, it would seem that participants found this diagram difficult to relate to their experience – it did not seem to fit. Reasons suggested at the time were historical or contextual: the community was seen as having gone through a transformation after the death of Professor Donike in 1995; the community was going through a contextual transformation and period of uncertainty at the moment with the transfer of doping control from the International Olympic Committee to WADA, the World Anti-doping Agency. Such comments resulted in a re-evaluation and extension of Wenger, Snyder and McDermott's (2002) model (see Figure 3-18) for this community.

Figure 6-8 illustrates a revised model for the scientific anti-doping community's development as a result of the discussions with attendees at the workshop. This model is based on Wenger, Snyder and McDermott's Stages of Community development and incorporates both historical and current contextual factors relevant to the community. In Figure 6-8, the timeline for the community is envisaged as commencing in the late 1960s and early 1970's when scientific analyses of athletes' urine were conducted during the 1968 Mexico Olympic Games and the 1972 Munich Olympic Games, and consists of three cycles.

The first cycle for the anti-doping scientific community began in the late 1960s and lasted until the death of Professor Manfred Donike in 1995. The first stages of doping analyses can be represented as the initial discovery, incubation and delivery stages of CYCLE 1 (shown as the solid line). During the 1970's, both the International Olympic Committee (IOC) and other sporting organisations became increasingly concerned by doping in sport. In 1979 the International Association of Athletics Federations (IAAF) put in place a laboratory accreditation process which was adopted by the International Olympic Committee in 1981.

The jagged lines represent the level of energy and visibility that the community typically generates over time.

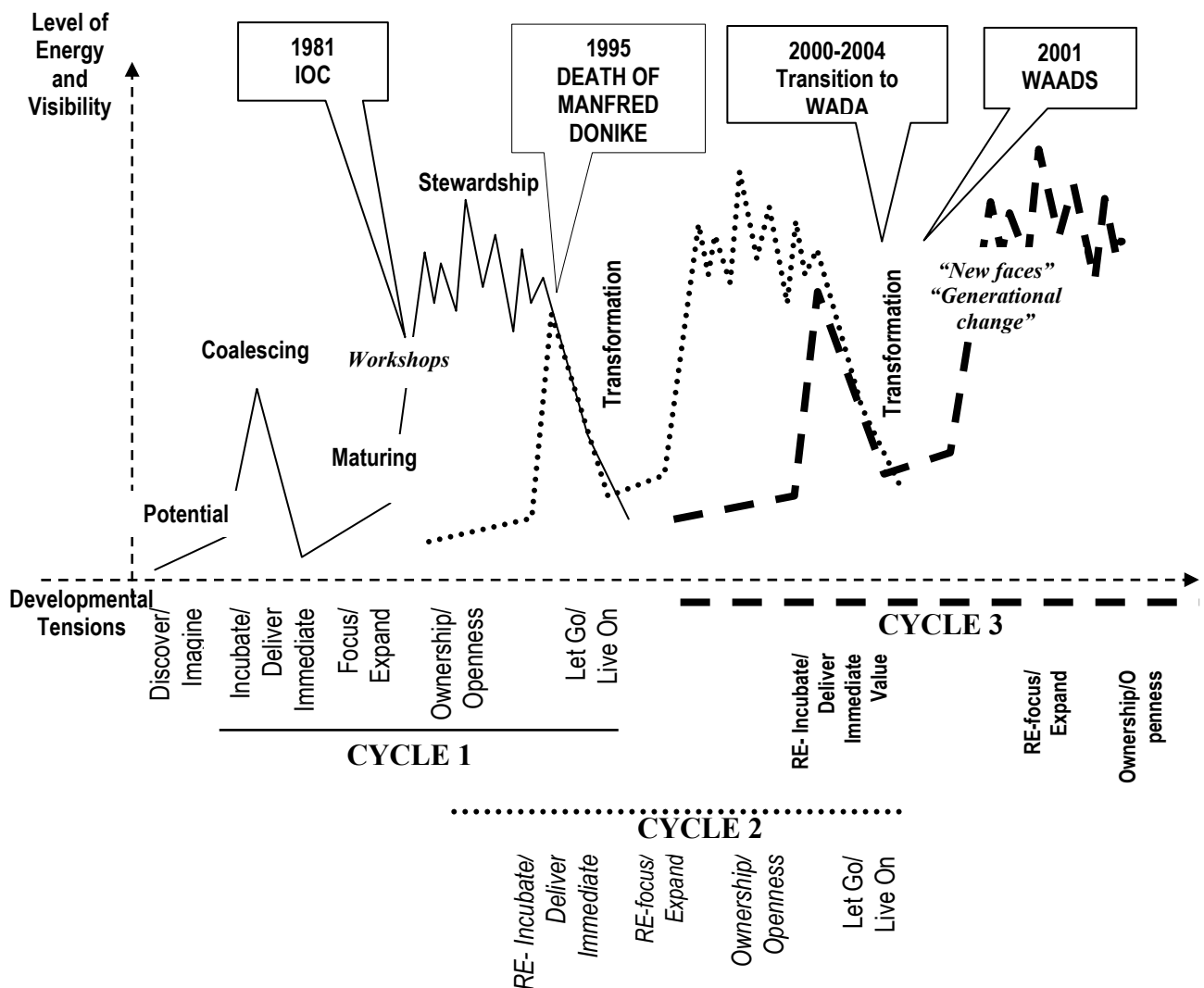


Figure 6-8: Cycles of development of the anti-doping scientific community since 1968

In 1983, Professor Manfred Donike organised the first Cologne workshop, reflecting a desire to promote the development of sound doping control techniques by laboratories already engaged in or hoping to become engaged in doping control work. From then until his unexpected death in 1995, Professor Donike played a major role in doping control matters, both scientific and otherwise. He was well known to all doping control laboratories and assisted many laboratories with their journey to accredited status. His involvement in the IOC Medical Committee's Doping Sub-Commission and other sporting organisations provided him with an opportunity to make a major contribution to the stewardship of doping control and anti doping science during its formative years.

Professor Donike's death was a shock to the anti-doping community at large and presented anti-doping scientists with a changed context which acted the catalyst for CYCLE 2 (shown as the dotted line). The IOC and other organisations appointed others to their committees to take Professor Donike's place, and Professor Wilhelm Schänzer became the scientific director of the Cologne laboratory. There was a recognition that the workshops must continue and they did so with support from the newly formed Manfred Donike Society and continued support from the IOC. The number of attendees at the workshop continued to grow in keeping with the increasing number of accredited laboratories. The Cologne workshop became firmly established as an annual event for those committed to work in doping control. There were few changes in the organisation of the workshops and the workshop continued to provide a venue where new developments in doping control science were shared and new scientific directors supported as they developed their own expertise and that of their laboratory staff.

CYCLE 3 (the dashed line) began with the changed context resulting from the formation of the World Anti-Doping Agency (WADA) in 2000. This agency addressed sports doping issues on a year round basis. From January 1, 2004, WADA was responsible for the laboratory system. During the period of the transfer of control of the laboratory system from the IOC to WADA, the laboratories established their own organisation, the World Association of Anti-Doping Scientists (WAADS). This organisation's membership was restricted to those working in anti-doping science and was committed to promoting ethical behaviour and high quality analytical work by anti-doping scientists. It was in this third cycle that the community of anti-doping laboratories were currently operating.

As presented in Chapter Three in the discussion of the Communities of Practice framework, Wenger (1998) commented that communities of practice come together, learn how to enhance their practice and deliver its outcomes to the broader community. Wenger, McDermott and Snyder (2002) observed members of a community of practice participate in the community to different degrees. Wenger et al. also remarked that in time a practice might be superseded or transformed so that its related community of practice either disappeared or transformed. Data from the survey administered to attendees during the 2004 Cologne workshop, indicated that attendees had been able to visualise themselves as members of a community of practice. They had also been able to indicate a current stage of development for their community. The challenges to the generic model of a community's development by some of the workshop's participants suggested that these attendees had both related their experience to Wenger et al.'s model and been able to modify the model to better suit their context. These findings together with the researcher's observations of this event provided evidence from which the conclusion can be drawn that anti-doping scientists have formed a community whose practice and existence has been supported by the very comfortable, annual Cologne workshop. This regular, familiar event provided a space where the anti-doping scientific community's members in attendance, including the directors of accredited laboratories, developed

- their identity as anti-doping scientists
- a sense of the meaning of what they do
- the knowledge necessary to keep up with their field.

Whilst traditionally, the peer-reviewed literature had played these role in advancing knowledge, the researchers' observations indicated that the annual Cologne workshop had come to occupy such a role for anti-doping scientists. The comments made in interviews by the directors about the role of the Cologne workshop in maintaining expertise together with the researcher's observations of these annual events, indicated that this annual workshop provided "a platform for advancing individual and/or collective knowledge" (Nonaka & Konno, 1998, p. 40), through responding to anti-doping scientists' ongoing needs to learn "what is not yet there" (Engeström, 1991, p. 270) to trying to discern the hidden patterns of their complex field. An examination of the role of the workshop through the lenses of communities of practice, activity theory and the Cynefin framework has yielded additional insights into the role of the workshop. These insights have been presented in the next section.

6.5 AN EXPANDED ROLE FOR THE TRUSTED SPACE

The researcher's observations of the workshop and survey responses provided considerable data for theoretically informed interrogation. The formal and informal exchanges between anti-doping scientists attending the workshop indicated that attendees were engaged in social learning processes described by Wenger (1998) as an integral feature of communities of practice. During the week-long workshops, these scientists demonstrated or developed their knowledge of and capacity to discuss with colleagues the stories, problems, frameworks and perceptions of their work in anti-doping science. They expanded their ability to talk meaningfully about their field of endeavour, and they engaged in discussions about the "social configurations in which (their) enterprises are defined as worth pursuing and (their) participation is recognizable as competence" (p. 5). Siegrist and Gutscher (2005) defined trust as "the willingness to make oneself vulnerable to another based on a judgment of similarity of intentions or values ... [and was] ... based on social relations, group membership and shared values" (p. 147). Confidence was "the belief, based on experience or evidence, that certain future events [would] occur as expected" (p. 147) and could do with "just about anything" (p. 147). Siegrist and Gutscher emphasised that trust was "particularly important in the absence of knowledge" (p. 146) and suggested that the introduction of new technologies was related to both trust and confidence (2005, p. 153). Over time, the reciprocal exchanges within the environment of the workshop had led to the development of mutual trust amongst members of this community and contributed to the development of what Oh, Labianca and Chung have described as group social capital (2006, p. 570). Referring to successful cooperation, Maxwell (2005, p. 416) stated that trust was "the medium within which exchange [took] place, the key ingredient of social capital" and that the group within which knowledge was exchanged had "to be small enough that knowledge [could] be shared. Trust [was] harder to achieve in large groups". Observational and interview data indicated that this event did indeed provide a trusted space for anti-doping scientists.

By engaging in the workshop, the scientific directors and other anti-doping scientists used this trusted space to build and expand their individual and collective identities. They learnt to talk meaningfully about their shared practice and its problems. As such this event provided a secure, shared space from which directors with minimal experience accessed the knowledge and support they required to build the firm foundation for their own activity of routine dope testing. It was also a space from which more experienced directors drew

the new knowledge and collegiality to affirm and renew their own established practice. Importantly, the workshop provided opportunities for experienced directors to come into contact with triggers that initiated ideas for new research projects. Paraphrasing McLaughlin and Mitra (in Schlager & Fusco, 2003, p. 206), it could be said that the community of practice which met at the annual Cologne workshop provided ongoing support, feedback and encouragement for anti-doping scientists to delve deeper in the search for new knowledge. Subsequently, the community consolidated and transformed its practice through ongoing knowledge sharing about the past, the present and the new. Finally, confidence in the workshop provided a space within and from which community members could explore the interface between their own scientific efforts and the broader anti-doping community. To incorporate this expanded understanding of the role of this shared space, the model for the dynamics of the work of the directors developed throughout Chapter Five (see Figure 5-4) has been revised presented in Figure 6-9.

The formal and informal discussions that permeated this week-long event stood out as a major means of knowledge transfer within this community, transfer that enabled knowledge mobilisation activity in anti-doping science. The constant ebb and flow of the knowledge exchanges resonated with a number of activity theory's concepts including those of expansive learning and knotworking. These perspectives on the knowledge mobilisation processes of the workshop have been examined from an activity theory perspective in greater detail in the next section.

6.6 THE COLOGNE WORKSHOP AS A CONTEXT FOR KNOWLEDGE MOBILISATION ACTIVITY

Clearly, the workshop provided the directors of accredited doping control laboratories and other anti-doping scientists with a regular opportunity to consider communally the issues that related to their work and to view and discuss a large number of presentations about the results of recent research relevant to their field. The directors and other anti-doping scientists attended the workshop because they wished to advance anti-doping scientific practice of their own laboratory through ensuring that their knowledge was up-to-date. They were aware of that some of that new knowledge could be integrated successfully into laboratory practice. Through their participation in the Cologne workshop, this multi-

“what [was] not yet there” (Engeström, 1991, p. 270) but was desired by both the scientific and general anti-doping community. The object which anti-doping scientists pursued through their communal activity was one of ensuring that their knowledge and implementation of anti-doping science was at its optimum. To paraphrase one director, attendance at the workshop was a means of ensuring the director kept up with both newly created knowledge and innovations in this evolving scientific context.

Hasan and Crawford (2003) coined the term ‘knowledge mobilisation’ to capture active notions of creativity and innovation rather than the management of something that was “owned and traded by competitive individuals” (p. 2). In this section, the annual activity of mobilising knowledge in the complex and complicated evolving context of anti-doping work has been explored through the lens of activity theory.

6.6.1 An activity theory-based exploration of the Cologne Workshop

The relevance of activity theory as a framework appropriate for the study of complex evolving workspaces such as that of international anti-doping work was explained in Section 4.2. First proposed by Vygotsky (1978), activity theory was further developed by Leont’ev (1978; 1981) and later extended and applied by Engeström and others to the study of organisational contexts, in this section, activity theory has been used as a lens through which to examine the manner in which the annual Cologne workshop contributes to knowledge mobilisation in anti-doping science and the anti-doping scientific community improves its “performance through collective learning for innovation” (Hasan & Crawford, 2003, p.1). The following sub-section examines engagement in this regular annual activity of “keeping up” as an activity system independent of the activity of being a director as discussed in Chapter 5.

6.6.1.1 The Cologne workshop as a communal activity system

As stated in Section 6.3.5, the researcher attended the 2003 – 2005 workshops to interact with and observe anti-doping scientists as well as to inform these scientists about this research and to mirror its findings as part of the developmental work research method. The observations made during those workshops also supported the following activity theory analysis of the workshop as an activity system directed towards meeting the needs of anti-doping scientists working in accredited laboratories rather than the needs of workshop attendees from other organisations. Figure 6-10 diagrammatically represents the activity

system associated with the annual Cologne workshop. The subjects of this activity were those who attend the workshop with “keeping up” as the object of this week-long event. Further details and associated discussion of the elements of this activity system, namely its subjects, tools, community, the division of labour, rules, object and tensions, as well as its outcome of knowledge mobilization have been presented below.

Diverse cultural histories and backgrounds of workshop attendees

As indicated by the data presented in Section 6.3.2 and by the brief description of the subjects of the Cologne workshop as an activity system depicted in Figure 6-10, the workshop participants possessed unique cultural histories arising from their various personal, academic and day-to-day laboratory experiences, as well as from the different geographical regions in which they lived. Whilst these unique histories gave rise to various individual needs, the directors and other workshop attendees also had common needs resulting from the shared objects of their activity discussed in Chapter Five and their shared practice, represented most recently in Figure 6-9. For example, the directors had a common need to maintain the quality of their routine testing in order to demonstrate regularly the proficiency of their laboratory to WADA and to ISO accreditation bodies. The majority of directors therefore came to the workshops to find out about recent advances and to consider ways in which those scientific advances could be implemented in their own laboratories. Some directors came to the workshops to share with other anti-doping scientists, answers to questions that had arisen during their attendance at a previous workshop. These answers had been generated by research within their laboratory and represented their efforts to advance anti-doping science just that little bit more. Other directors brought problems whose answers they presented speculatively in the search for feedback from other anti-doping scientists. Such feedback could include future avenues for exploration.

Some directors brought concerns that had arisen as a result of interaction with other anti-doping stakeholders. These directors hoped to discuss these concerns with other directors. Scientists new to anti-doping work such as those in charge of laboratories seeking accreditation or relatively inexperienced directors of accredited laboratories came to learn more about the role of being an anti-doping scientist and being the director of an accredited laboratory. In brief, the anti-doping scientists who attended the workshop, as subjects of this activity system, had diverse cultural historical backgrounds leading to a variety of

needs, all of which were related to the object of keeping their practice of anti-doping science at an optimum level.

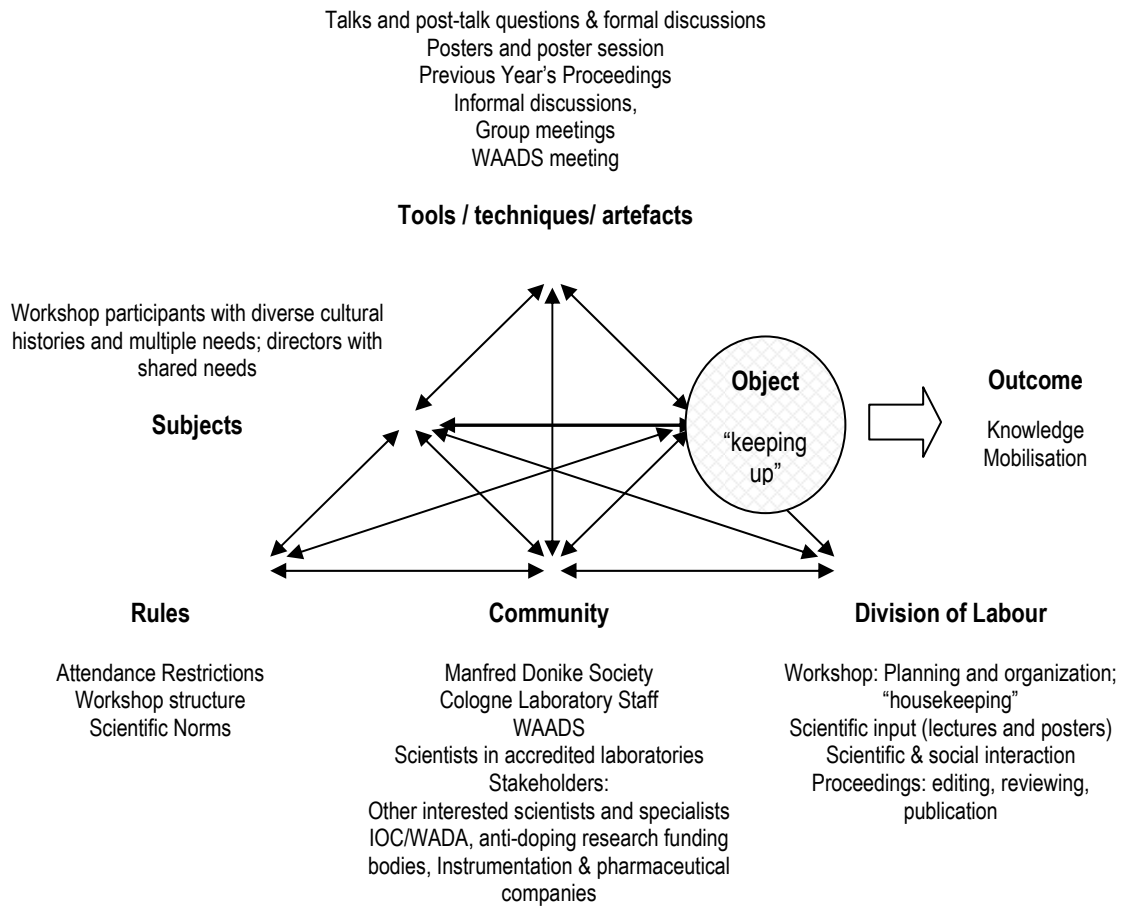


Figure 6-10: The Cologne Workshop on Dope Analysis as the activity of “keeping up”

Tools/ techniques/artefacts to support “keeping up”

As stated in the discussion of second generation activity theory presented in Section 4.2.1.2, subjects worked towards the object of their activity by using mediating tools, instruments or artefacts within a given social infrastructure (Engeström, 1987). Over the years, the organisers of the workshops had developed a variety of social and material artefacts to assist workshop participants as they grappled with their object of keeping up with anti-doping science.

On registration, workshop participants were provided with the refereed proceedings of the previous year's workshop. These carried the title 'Recent Advances in Doping Analysis (#)', where the '#' represented the volume number. These proceedings represented the only regular peer-reviewed annual publication which provided a collation of scientific work in the anti-doping area. The papers also included valuable references to other recent relevant publications for anti-doping scientists.

Short formal lectures and posters provided a forum for the presentation of recent research into the improvement of current methodologies, the development of new analytical techniques and work on areas of concern for the future, such as gene therapy. Question-time at the end of each talk facilitated the emergence of a deeper understanding of both the presentation's content and other related issues. A formal poster session ensured that the authors of each poster were available to discuss their work. One director's interview comment that anti-doping research wasn't completed until a validated test had been implemented (ID: D006) was borne out by the nature of the questioning after each presentation when queries and comments were often directed towards the practical aspects of the work of the anti-doping laboratory. At times possible refinements to the research were suggested or policy related concerns discussed.

As mentioned in Section 6.3.5 above, much informal discussion took place during morning and afternoon coffee breaks, the 5 minute walks to and from the Trainer Academy dining room, around the large circular lunch tables or over breakfast at the various accommodation venues. These interactions covered both the content of the talks and other matters of concern to the workshop's participants. The conversations ranged from stories about particular positive doping cases the laboratories had dealt with, through the functioning of various instruments and analytical approaches, other research that had not been presented formally at the workshop, to the impact of anti-doping policy on the laboratories.

The workshop also provided groups of workshop attendees with the opportunity to meet face to face in order to discuss a matter of shared relevance such as a shared research project. In particular, the annual general meeting of the World Association of Anti-Doping Scientists (WAADS), held during the workshop, facilitated a more formal discussion of policy issues that related to anti-doping laboratories and also about the outcomes of the

WAADS quality assurance program, conducted to support the conduct of quality work by the laboratories.

Overall, these conversations, or discursive discourses, in this trusted community space facilitated learning both individually and collectively in a manner that has been examined more deeply in Section 6.6.2.

The workshop community

The Community that mediated the sharing of experiences, ideas and awareness at the workshop was comprised of the workshop organisers and participants. The workshop was primarily organised by the Cologne-based Manfred Donike Society together with involved staff of the Institut für Biochemie and German Sports University in Cologne. Mrs. Marie Theres Donike, widow of the workshop's founder, was the president of this society during the years that the researcher attended the workshop. As described in Section 6.3.2, the workshop attendees were affiliated with accredited laboratories in various countries situated around the world. There was also a small number of representatives of other relevant scientific and anti-doping organisations.

Division of labour

One feature of this workshop was the variety of ways in which the participants of the community shared responsibility for and carried out various tasks associated with the workshop. These various efforts contributed to the collegiality of the experience. As described in Sections 6.3.1 and 6.3.5, and above, these tasks included scientifically and socially oriented events such as the intense programme of talks and poster sessions, the communal meals, morning and afternoon teas, and a cultural event. All of these contributed to the relaxed atmosphere in which both knowledge and values were exchanged. The division of labour also saw the scientific and social program organisation and "housekeeping" tasks during the workshop carried out by members of the Manfred Donike Society, and the staff of the German Sports University in Cologne. Acceptance of applications to attend and workshop presentations was undertaken by a member of the Manfred Donike Society who was also a senior member of the staff of the Cologne Doping Control Laboratory. The scientific presentations were given by some of the workshop attendees. All workshop participants contributed in varying degrees to the general discussion during the workshop in a way that supported the peer review, networking and identity formation processes. The workshop proceedings, available only since 1993, were

prepared and submitted by presenters, reviewed by a number of experienced anti-doping scientists, edited by a small number of staff from the Cologne laboratory and published in time for the following year's workshop. A prize for the best paper given by a young anti-doping scientist was presented by Mrs Donike, as president of the Manfred Donike Society.

Rules

The anticipated outcome of the workshop activity was that all anti-doping scientists were kept informed of and able to apply the recent advances in their area in a way that was aligned with the ethics of anti-doping work and accepted scientific norms. In order to mobilise knowledge in this way, rules were developed that related to workshop attendance and contributions. These rules continued to evolve in order to resolve tensions that continued to arise over time.

Rules had been put in place by workshop organisers to accommodate the needs of the growing number of attendees from an increasing number of anti-doping laboratories. The proceedings of the workshop were made available only to those who supported the goals of anti-doping work. Lectures were no longer held in a small lecture theatre in the training academy but in one of the German Sports University's larger lecture halls. This also restricted the workshop's timing to a non-teaching period.

Participants in the workshop were expected to work towards controlling the abuse of drugs by athletes and to uphold the ethics of the anti-doping movement and of good science. In 2004, Professor Schänzer, in his welcome address to the workshop, stated that a representative of one commercial laboratory had been "un-invited" as the activities of that laboratory had not been in keeping with the code of ethics of the accredited laboratories. The laboratory had in fact been implicated in the scandal surrounding BALCO and the first designer steroid THG (Catlin et al., 2004; Sheerin & Erson, 2004).

The seating capacities of the venues at the German Sports University used during the workshop also had an impact on the number of possible attendees at the workshop. With the need to accommodate the attendance of the staff from an increased number of accredited laboratories at the workshop, the attendance of personnel from other institutions at post-2005 workshops had been restricted to a single representative. This restriction was also placed on laboratories that were neither accredited nor seeking accreditation such as a laboratory that carried out dope control testing on animals.

Presentation submissions were vetted by workshop organisers in order to ensure that they would be able to provide workshop attendees with a program of talks and posters which covered recent research outcomes in anti-doping science and other relevant issues.

In these ways the workshop ensured that members of the scientific anti-doping community had a trusted shared space and workshop content to support their active engagement with the object of keeping up with the evolving demands of their work.

The Object: Keeping up with anti-doping scientific practice

The activity of the workshop was directed towards satisfying the multiple needs of the workshop participants as they tried to keep up with the changing practices of doping in sport. For aspiring directors, the workshop provided an opportunity to learn about their new field and to return home with knowledge that could be implemented at a future time in the analytical processes employed within their laboratory. For current directors, the workshop presentations and discussion enabled consolidation and extension of their knowledge of anti-doping science. Such knowledge could enhance their current routine testing or generate new research projects. Other reasons for attending the workshop included: the dissemination to colleagues of their own laboratory's research outcomes and developments; the establishment and nurturing of relationships with others through the sharing of stories; conversations with their peers about scientific and policy issues that affect their work in doping control; the construction of a shared vision for the conduct of credible practice in anti-doping science, and the experience of the collegial atmosphere of the workshop as a means of combating feelings of isolation. All these benefits of workshop attendance contributed to individual and collective object of ensuring that anti-doping science, wherever it was practised, kept up with the ongoing stream of unusual outcomes of the analyses of athletes' samples.

The knowledge dissemination processes utilized by the organizers of the trusted shared space of the annual workshop satisfied the object of workshop attendees as well as addressing all of the multiple objects of the directors' activity described in the previous chapter. The participation data showed that most of the scientific directors regularly set aside one week each year and considerable resources for themselves and some of their staff to attend the workshop. If a director was unable to attend, then they almost always sent one of their senior staff. The comfortable, time-tested and true provision of scientific

demonstrations, formal talks, poster sessions, and frequent opportunities for casual conversation and relationship development all contributed to achieving the individual and collective object of the workshop's participants: the exchange of knowledge as a means to promote the mobilisation of new knowledge in anti-doping science: keeping up.

6.6.1.2 Expansive resolution of tensions

As described above, over the years the workshop's organisers had resolved a number of tensions which had arisen relating to the workshop. This had resulted in a number of expansive reorganisations of the workshop. Each has been described briefly in this section.

The most obvious of these tensions had resulted from the growing number and increasing expertise of attendees and the workshop's organisation. With increasing attendance, existing venues for scientific and social activities could no longer accommodate the number of prospective attendees. Since the aim of the conference was to be inclusive of all anti-doping scientists, this tension was resolved by finding alternative, larger venues for workshop activities. The change from an intensive-classroom and practical "hands-on" approach described earlier in this chapter to the current presentations and laboratory visit format also accommodated the increased number of attendees and improved expertise. Larger venues also had to be found for evening social engagements to create the ongoing proximity that facilitated the intense frequent interactions amongst the workshop attendees, interactions that had become an integral aspect of the workshop.

The restriction on the number and organisational affiliation of attendees not from accredited laboratories to ensure both places for representatives of accredited doping control laboratories and the alignment of attendees' attitudes on anti-doping issues ensured that workshop attendees were able to trust that their exchanges with other workshop attendees would not be used against the anti-doping community and its efforts to control doping in sport.

Interview data also indicated that, in the past, concerns about intellectual property had also caused tensions. Workshop organisers and some laboratories regarded the workshop as a venue through which recent research outcomes could be disseminated for incorporation into anti-doping laboratory analytical practice. Some university based scientific directors preferred to disseminate their research outcomes in prestigious peer reviewed academic

journals thus subjecting the research to peer review and publicly establishing their intellectual ownership of the research. In keeping with this point of view, one university based interviewee (ID: D012) had described publication in the academic literature as “the only way” to share new knowledge. As reported in Section 5.4.3.2, another university based interviewee suggested that the intellectual property related tension concerning the sharing of knowledge at the workshop had been addressed through the twelve month delay in the publication of a workshop’s proceedings, a delay that gave presenters sufficient time to publish their research in both a prestigious academic journal as well as make a presentation at the workshop in order to enable discussion of the research with colleagues. Another interviewee had noted that everything worked well when due acknowledgement was given to the researcher who made the initial discovery (ID: D008). The data presented in this chapter pointed to the growing acceptance of the workshop by many anti-doping scientists as an appropriate channel for dissemination of new knowledge generated within their laboratories. This suggested that a growing number of these scientists trust their colleagues sufficiently to disseminate knowledge to them prior to publication in the academic literature.

A more recent tension for the workshop organisers was generated by the need to keep workshop attendees informed about relevant scientific developments generated by the work of scientists from other fields such as genetics and protein chemistry. These fields represented those where there is a growing need for the transfer of knowledge to anti-doping science for mobilization by doping control scientists. The inclusion in the workshop program of talks by scientists carrying out work demonstrating the relevance of the knowledge and expertise of other fields to anti-doping proved a means of addressing this ongoing tension.

The tensions resulting from the interactions between anti-doping scientists and other anti-doping workers led to the need for time for more formal discussion of their concerns by anti-doping scientists. The allocation of time for such discussion during a meeting of the World Association of Anti-Doping Scientists (WAADS) evolved over the 2003-5 workshops. During the 2003 workshop, participants were notified during the workshop of the meeting which was fitted in at the end of one day’s lectures. The following year the WAADS Annual General Meeting had been formally incorporated into the workshop’s programme at the end of one day’s lectures with light catering and by 2005 the meeting had become a regular, catered event in the Trainer Academy hall. The meeting had

become the accepted time when the community explored their governance related concerns and developed an informed base upon which to determine their communal attitude to such matters.

Timing of the workshop has also created tensions for workshop organisers who aim to hold the workshop at a time when as many anti-doping scientists as possible could attend the workshop. This presented organisers with a problem in 2006. Whilst the workshop had traditionally been scheduled for late February / early March, in 2006 this clashed with the Winter Olympic Games in Turin, Italy and the Commonwealth Games in Melbourne, Australia. Such re-organisation was not necessarily easy as the usage of the German Sports University's facilities had to fit in with its academic calendar. The unusual scheduling of the workshop for early June, 2006 in order to ensure that staff of accredited laboratories in Italy and Australia were able to attend the workshop, was even more interesting given that the 2006 Football World Cup, commenced in Germany on June 9 and the Cologne and Kreischa Laboratories would be carrying out dope testing for that event. Such a decision emphasised the value put on this annual event by the workshop organisers and the anti-doping scientific community and their preparedness to address the tensions relating to it.

Over the years, the workshop's convenors have proved their ability to resolve the various tensions surrounding the workshop through expansively transforming the workshop's organisation. These transformations help to achieve the outcome of mobilising new knowledge within all accredited anti-doping laboratories and so supported the continued quality of and confidence in anti-doping science. As indicated above, data from the multiple sources of observations, interviews and the documentation associated with the workshop in 2003, 2004 and 2005 indicated that many of the directors of anti-doping laboratories regarded the workshop as a major means by which they kept up with the expanding knowledge and skills base of their field. Over time, the directors' trust in this space has grown as workshop organisers have implemented strategies to ensure that anti-doping scientists could confidentially discuss and make sense of complex and complicated problems and situations with knowledgeable others with whom they shared the common goal of deterring doping in sport. These strategies acknowledged workshop participants' concerns that their intellectual property rights surrounding their new discoveries be

respected. In the process of building this trusted shared space, the workshop organisers created a dynamic which has been able to support the outcome of knowledge mobilisation within this field. This outcome has been discussed in the next section.

6.6.1.3 Workshop outcome(s): Knowledge mobilisation

The workshop activity described above, gave anti-doping scientists, individually and collectively, access to new and innovative knowledge about their field. It supported a process of knowledge mobilisation which was creative, ongoing and cumulative rather than the competitive management of an entity that was owned and traded until it was no longer valuable. For those in attendance, the workshop provided the opportunity for individual and collective learning. Attendees were able to facilitate the growth of the knowledge and skills of both themselves and their co-workers, to carry out further research and to improve their own laboratory by transforming their new knowledge into laboratory practice. They were also able to get a better picture of how they, as anti-doping scientists, were positioned within the general international context of anti-doping work. The accumulation of the improvements in individual accredited laboratories contributed to the advancement of the accredited laboratory system as a whole and achieved the workshop's outcome: knowledge mobilisation in anti-doping science.

This examination of the annual workshop as a collective and changing endeavour of anti-doping scientists using the “ ‘eyeglasses’ of activity theory” (R. Engeström, 2005) also drew attention to the interactive processes that generated and mobilised knowledge within the anti-doping scientific community. During these interactions, the participants took on the roles of knowledge giver and /or receiver, or of producer and/or client as determined by the nature of the exchange. These processes were also at the heart of the expansive learning that occurred during knotworking and co-configuration work (Engeström, 2004a, 2004b; Engeström, Engeström, & Vahaaho, 1999; Fenwick, 2004; Helle & Engeström, 2005a, 2005b; Victor & Boynton, 1998) and have been discussed in the next section.

6.6.2 Knowledge mobilization processes at work

With the concepts of expansive learning in mind, further analysis of the observations of the 2003-2005 workshops led to a deeper investigation of the processes surrounding knowledge mobilisation within this community. The results of this additional work and

their relevance to answering the research question about how expert anti-doping scientists maintain their expertise (see Table 4.6) have been presented below.

From an activity theory perspective, collective learning for innovation associated with knowledge mobilisation is a consequence of the expansive learning that results from crossing a zone of proximal development, a space “of potential radical transformation and reorganization of (an) activity system” (Engeström, Engeström, & Kerosuo, 2003, p. 287). The future-directed actions of an activity system are linked to the solution of the double bind - a “dilemma which cannot be resolved through separate individual actions alone - but in which joint co-operative actions can push a historically new form of activity into emergence” (Engeström, 1987, p. 165).

Observations of the knowledge exchanges within the community of anti-doping scientists indicated that zones of proximal development had been generated by the need to develop new or improved testing methodologies to ensure that doping tests that were accurate, trustworthy and legally defensible. The workshops acted as “microcosms in which collective zones of proximal development [were] articulated and enacted as practitioners [looked] back on the history of their activity and [engaged] in future-oriented framing experiments” (Engeström et al., 2003, p. 288). As a regular event, the workshop encouraged the scientists individually and collectively to analyse existing solutions and relevant knowledge in order to frame or model new solutions through a process of expansive learning (see Section 4.2.2.1). The ongoing examination and implementation of these new model solutions, reflection on them followed by further refinement eventually led to the adoption of a reliable and robust testing practice. The environment of the workshop allowed for a space for the deep play Bruner (cited by Engeström, 1987, p. 135) regarded as important for the generation and modelling of new forms of behaviour also referred to in Section 4.2.2.1.

This collective journey through a shared zone of proximal development where the community participated in the design, implementation and mastering of the next solution, as described in Section 4.2.2.2, presented a significant contrast with the classical ideal of university-based research where “the ingenious individual scientist and his selfless striving after pure truth seem to be the prime movers behind great discoveries” (p. 266). This ongoing interactive development of anti-doping analytical practice also resonated with the multiple interactions associated with ‘knotworking’ (see Section 3.2.3.3) in which

practitioners and their stakeholders transformed a concept through their actions of implementing the concept in practice, experiencing and challenging it (Engeström, 2000a, p. 971).

Engeström and others (Engeström, 2000b, 2004b; Engeström et al., 2003; Engeström et al., 1999; Hasu & Engeström, 2000; Toiviainen, 2003) focussed on the interactions and negotiations between producers and users. They believed that these interactions and negotiations formed a necessary part of the transfer of an innovation, be it a physical object or a service, from the innovation's producer to its prospective user. These authors referred to such interactions as 'knotworking' and regarded the negotiation and knotworking involved as indicative of horizontal learning and development processes. In the context of collaborative activity, a knot was described as a "rapidly pulsating, distributed and partially improvised orchestration of collaborative performance between otherwise loosely connected actors and activity systems", (Engeström, 2000a, p. 972) and 'knotworking' was described as "a longitudinal process in which knots are formed, dissolved, and re-formed as the object is co-configured time and time again, typically with no clear deadline or fixed end point" (p. 973). The new challenges to work communities and researchers presented by the collaborative nature of knotworking were contributed to by the central importance of "rapid negotiation and improvisation with constantly changing configurations of partners" (p. 973). The extended temporal nature of knotworking was stressed when its negotiations were described as having "to be embedded in a radically extended time perspective – the entire life trajectory of the product or service" (p. 973).

Not surprisingly, Engeström contrasted the horizontal and vertical processes of knotworking with the traditional view of learning which focused on vertical processes that "aimed at elevating the human upward, to higher levels of competence" (p. 970). The horizontal learning processes involved in knotworking occurred when hybrid solutions arose from negotiating and combining ingredients from the familiar, multiple parallel contexts within which workers increasingly found themselves. (Engeström, 2001b). Engeström and others (Daniels et al., 2005; Engeström, 2004a; Helle & Engeström, 2005b; Leadbetter, Daniels, Soares, & NacNab, 2005; Warmington et al., 2004) referred to the alignment of knotworking with Victor and Boynton's (1998) concept of co-configuration work where producer and client jointly configure the product. Importantly, Victor and Boynton based success in this type of work firmly on knowledge accumulated through carrying out other types of work: craftwork, mass production, process enhancement and

mass customisation (see Section 2.2 and Figure 2.5). Victor and Boynton, and Engeström et al. (2003), stressed the role of discourse in the co-configuration and knotworking processes required to cross the zones of proximal development associated with generating flexible and adaptive responses to changing workplaces. Engeström (2000a) regarded knotworking as the “emerging interactional core of co-configuration” (p. 973).

Observation of the workshops 2003-2005 and their agendas suggested that anti-doping scientists have used the trusted shared space of this community event for knotworking and co-configuring advances in their area of expertise and so put into place validated, reliable analytical processes. Further evidence of these temporally distributed processes was obtained through an analysis of the contents of the proceedings of the workshops from 1992 - 2004. The ongoing discourse in a number of areas: peptide hormones, biochemical and immunological methods, steroid analyses, profiling steroids, new and improved analytical techniques, detections of non-steroidal doping agents, organisation of doping control, and nutritional supplements was collated (see Appendix J) and represented graphically in Figure 6-11. This graphical representation of the data for each of the research areas made it quite clear that anti-doping research had been a longitudinal process. The ongoing publication of research into steroid analyses, new and improved analytical techniques, the detection of non-steroidal doping agents and steroid profiling, reflected the progressive accumulation, refinement and application of new knowledge in these areas. Similarly though to a lesser degree, there had been persistent interest in peptide hormones, biochemical and immunological methods and issues relating to the organisation of doping control. The graph of research into nutritional supplements reflected the comparatively recent use of dietary supplements by athletes to enhance their performance and the subsequent findings that many such supplements are contaminated by steroids whose use has been banned in sport.

The multi-voiced, interactive nature of the process of knotworking also became clear during further analysis of the authorship of papers in selected proceedings of the workshop (see Appendix K). This multiplicity of voices over the years 2002-2004 has been represented graphically in Figure 6-12. Figure 6-11 and Figure 6-12 make it apparent that contributions to the development of knowledge in each of the categories came from a variety of researchers. In Figure 6-12 different patterned columns highlight the fact that anti-doping scientific knowledge was created and disseminated by researchers both within and external to the accredited laboratory system. In all, accredited laboratories working

alone or with another accredited laboratory made 103 contributions (almost 65%) to the workshop proceedings over the years 2002-2004 whereas 32 contributions (almost 22% of the total number of contributions) were made by accredited laboratories working with external partners. One example of the importance of such joint work between external researchers and accredited laboratories has been the ongoing collaboration in peptide hormones research (11 out of 18 presentations), represented by the checker-boarded columns in the chart at the top left of Figure 6-12. Only 7 contributions (just under 5% of the total) were made by external laboratories working independently of accredited doping control laboratories.

Reflection on the data represented in Figure 6-11 and Figure 6-12 contributed to the expanded understanding of the role of the trusted shared space in the model of the dynamics of the work of the scientific directors whose development was begun in Chapter Five. Analysis of the proceedings of the Cologne workshop emphasised the role workshop as a regular space for the collaborative, longitudinal discourse associated with the processes of knotworking and co-configuring knowledge as it is transferred between the producers and users of anti-doping science.

Engeström's (2000a, p. 972) account of knotworking and learning, and its two dimensional representation of the vertical and horizontal nature of movements in concept formation has been described in Section 3.2.3. Drawing on this explanation, the vertical and horizontal nature of knotworking associated with ongoing research into the peptide hormone erythropoietin (EPO) presented at the Cologne workshop over the years 2002-2004, has been represented two dimensionally in Figure 6-13. This diagrammatic representation also highlighted the "relatively open-ended long-term" (Engeström et al., 2003, p. 306) nature of the object of these experts' research work as they continue to improve their scientific capability through declaring, experiencing and refining concepts related to the development of robust and reliable methods of detecting athletes' use of EPO. The continuing research effort in this area was apparent recently at the 2006 IAAF Anti-Doping Symposium in a talk by Dr Françoise Lasne from the accredited laboratory in Paris.

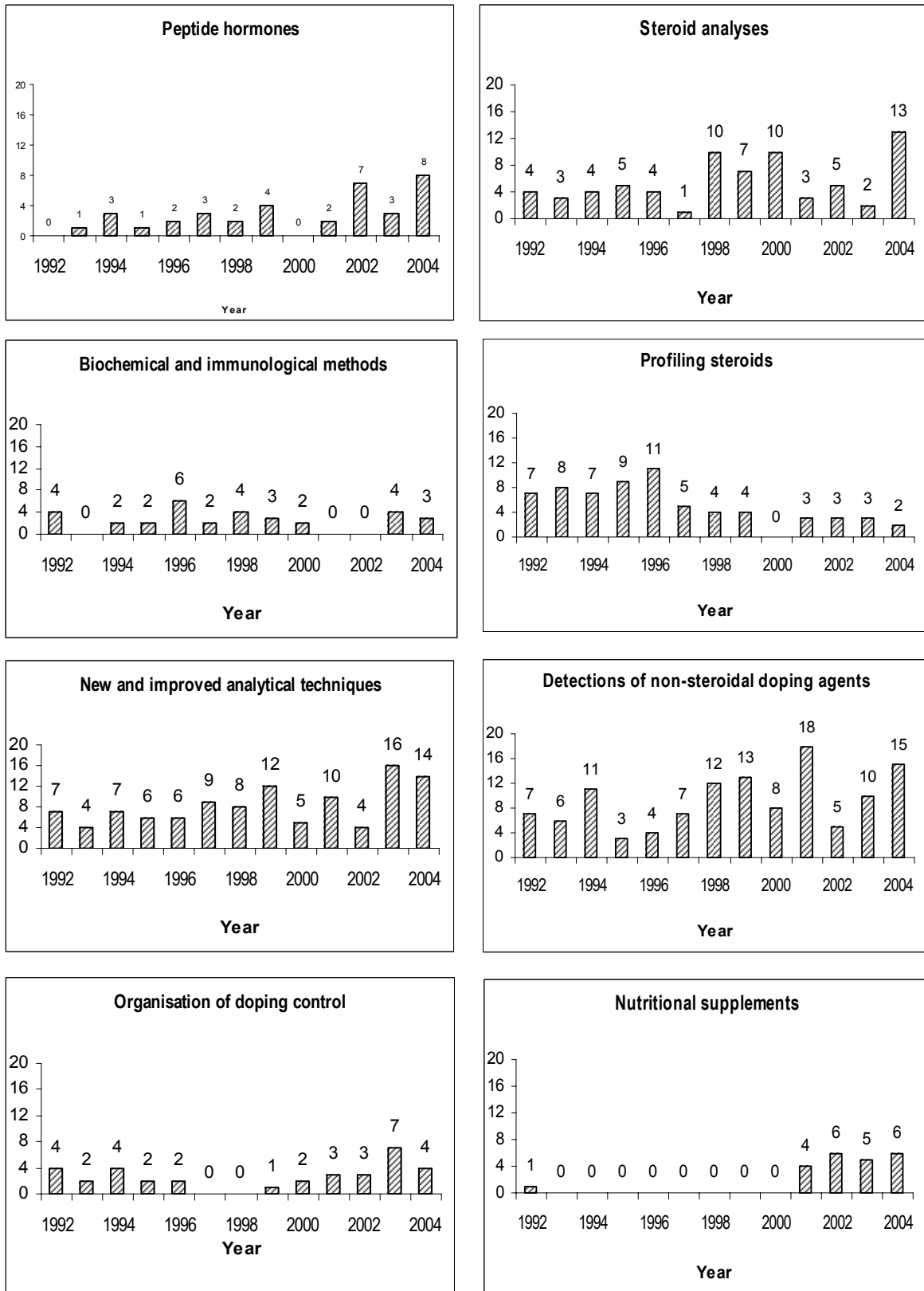


Figure 6-11: Distribution of papers by research category in Cologne Proceedings 1992-2004

Contributor Legend

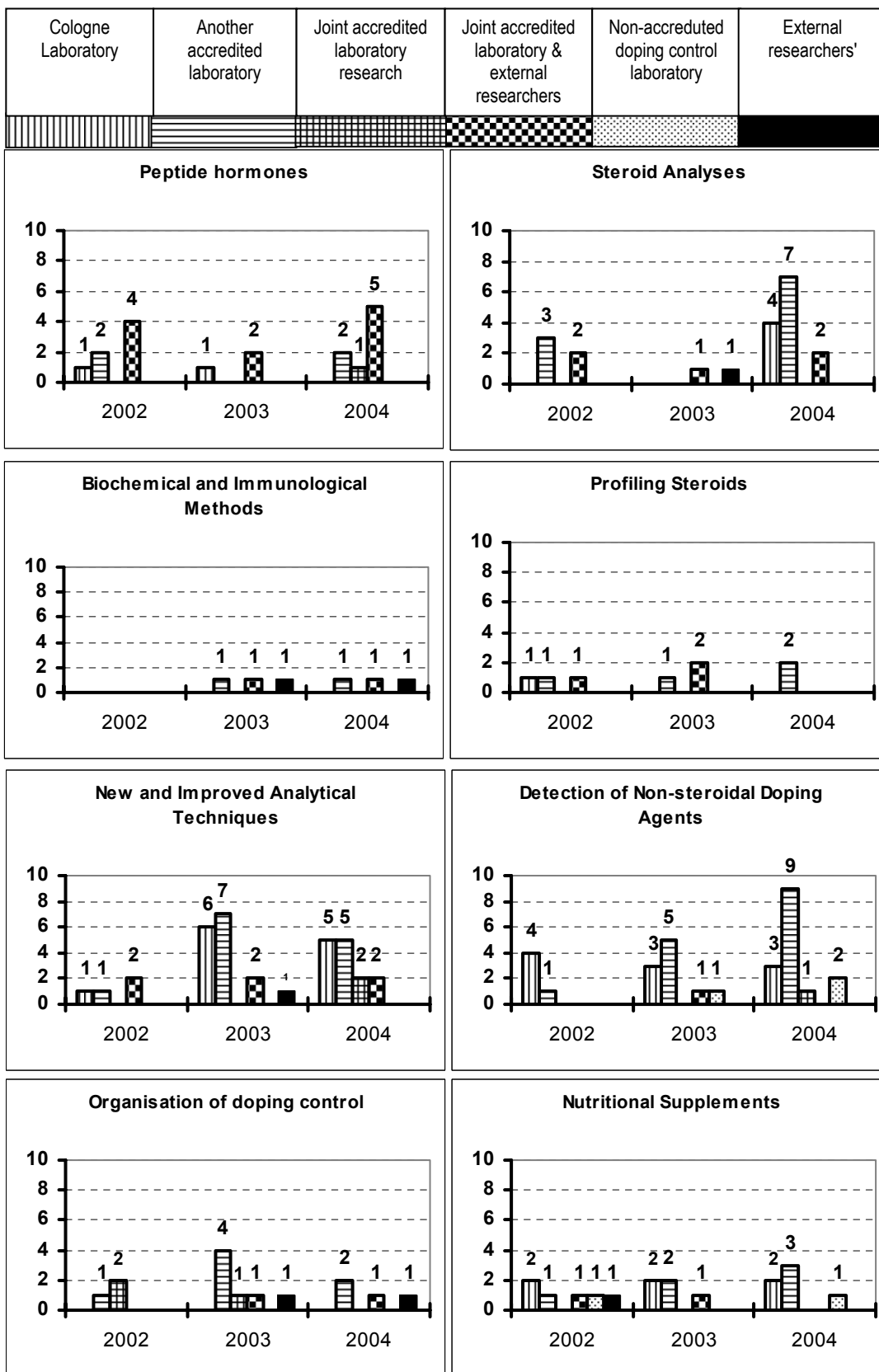


Figure 6-12: Multi-voiced contributions to the Cologne Proceedings 2002-2004

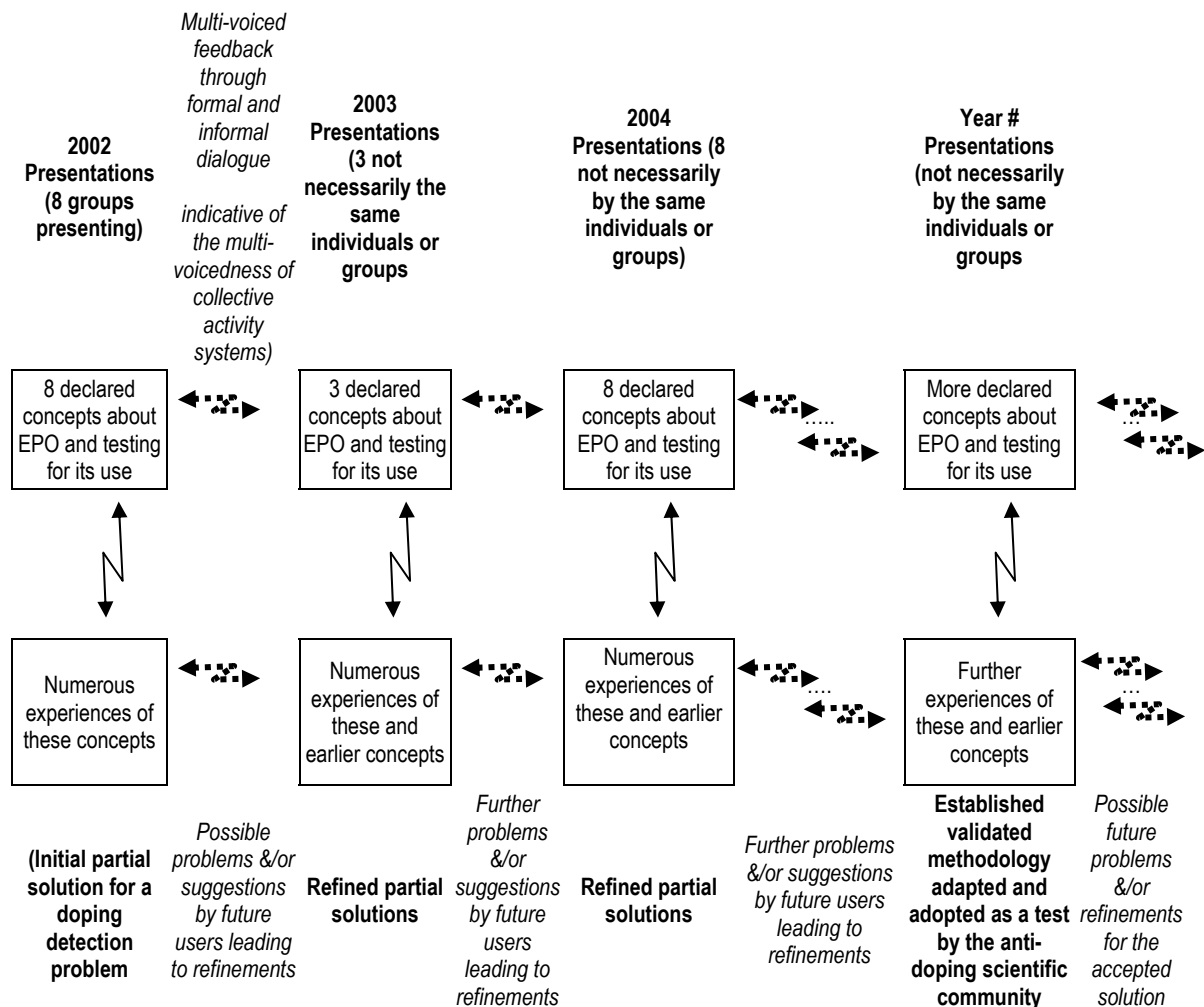


Figure 6-13: Vertical and horizontal movement in concept formation and learning surrounding EPO through presentations at the annual Cologne workshop

Each of the temporally distributed articulations in this knotworking processes relating to the various categories of banned substances represented a new joint starting point for future research work, a base from which future expansions could occur. The also represented collective zones of proximal development for anti-doping scientists and reflected the expanded understandings of the indicators for the presence of banned performance enhancing substances in urine. Over time, the ongoing discourse of knotworking supported the co-configuration of processes associated with the implementation of defensible analytical methods customised to suit each laboratory's environment. Rather than "glorified small talk" (Engeström et al., 2003, p. 287) the workshop discourse, formalised within the publications of the workshop proceedings, exemplified the means by which plans, scenarios and findings had gradually been translated into practice by the anti-doping scientific community.

The vertical and horizontal movements within the knotworking process indicated the various roles taken by anti-doping scientists as either the initiators / producers of new and innovative ideas and/or processes, or as the critics / users of those ideas. In taking on these roles, scientists drew deeply on the tacit, articulated, practical and architectural knowledge gained from the craft, mass production, process enhancement and mass customisation work associated with laboratory-based anti-doping analytical work. They acquired what Victor and Boynton described as configuration knowledge. Such knowledge represented an understanding of “how the product or service, in its essential elements or modules, must vary as the customer’s need and wants vary” (Victor & Boynton, p. 197). Through their participation in co-configuration, these scientists were involved in “building and sustaining a fully integrated system that can sense, respond, and adapt to the individual experience of the customer” (p. 195), as well as in building an ongoing relationship that ensured that the product of knowledge to improve anti-doping laboratory practice was continuously customized by the producers to meet their scientific colleagues’ needs.

This activity of “keeping up” with advances in anti-doping science through participating, even peripherally, was made possible by the annual Cologne workshop. This event provided the community with a trusted, shared space that supported the “tightly coupled linkages, which feature [the] constantly shared information, ideas, and experiences around [an innovative] product or service experience” (Victor & Boynton, p. 207). The evolution of this space as an annual workshop had evolved through what Helle and Engeström (2005a; 2005b) described as the collaborative construction of the functional rules and infrastructures, as well as through the dialogical and reflective knowledge tools necessary to promote co-configuration work. The dialogue associated with the negotiative knotworking between the partners, the subjects of the activity, provided real-time feedback information that they interpreted, negotiated and synthesised in attempts to resolve the ‘knots’ or problems associated with their practice. It may well also have led to the acquisition of dialogical knowledge, that is knowing how to engage in the intensive dialogue associated with knowledge mobilisation, by the anti-doping scientific partners as a result of their previous experiences of successfully co-configuring the complex integration of their particular products and services over extended periods of time (Engeström, 2004b). The existence or non-existence of such abilities could be ascertained through future research.

As in other areas, activity theory researchers have come to recognise that there are challenges associated with the transfer of new products from developers to users. During the development and implementation of a new anti-doping scientific method or the improvement of existing techniques, many difficulties must be resolved. The discourse of negotiative knotworking described above has been used to explain the joint development processes in which anti-doping scientists engaged during the annual Cologne workshop to develop or improve, to validate and implement legally defensible, robust analytical methods in the context of routine laboratory procedures. However, the discussion has not considered the transitory nature of the objects of activity, objects which Foot (2002), Miettinen (Miettinen, 2005) and Engeström et al. described as moving “in space and time, across various situations and boundaries” (Engeström et al., 2003, p. 308). Boundary crossing occurs when ideas, concepts and instruments are transported from one domain to another between different activity systems. It also occurs in contexts where there is a need for innovation which involves “ ‘encountering difference, entering onto territory in which we are unfamiliar and, to some extent therefore, unqualified’ ” (Suchman in Y. Engeström, 2005a, p. 220). This concern has been addressed in the next section.

6.6.3 An activity theory perspective on knowledge mobilisation

As discussed in Section 4.2.1.3, third generation activity theory evolved in order to better understand the collective, historical, evolving nature of networks of activity systems. Third generation activity highlighted the transitory nature of the object by describing its movement “from an initial state of unreflected, situationally given ‘raw material’, ... to a collectively meaningful object constructed by the activity system ... and to a potentially shared or jointly constructed object” (Engeström, 2001a, p. 136). (See also Figure 3-8). Engeström, Engeström and Kerusuo (2003) spoke of the need for the study of collective artefact-mediated activity as a response to the increasingly socio-spatially and temporally distributed forms of professional work. They suggested that these trends arise from the objects of expert work having a nature that is relatively open-ended and long-term. The pressure of this long-term open-endedness drove organizations toward “strategic alliances and other forms of partnerships and interactive networks” (p. 306). Whilst the critical and seemingly difficult process in which these partnerships engaged were frequently hampered by the inability of innovators to recognize the nature of users’ problems, such difficulties were not apparent during the workshop where participants shared an understanding of the practice. Consequently, anti-doping scientists contributed interdependently to the

achievement of their mutual evolving object, regarding difficulties as challenges which could be addressed by the expertise within community. This brief section considers the development of a new scientific method from the perspective of developing an object shared by anti-doping scientists.

At the micro-level of the context of the activity of developing a doping test for one particular substance, a review of the publication data demonstrates that many transitory objects are usually generated before an analytical method is accepted and implemented as standard practice. The negotiated, knotworking of this process has been represented in Figure 6-13. An alternate representation has been to regard the initial research as having been directed towards an initial object, $object_1$, such as the achievement of one step of an analysis in the context of one particular laboratory. When other scientists draw on their individual experience of anti-doping activity to give formal and informal feedback in the light of their own activity, they effectively refine the object for the current activity, rendering it transitory. Discussion within community to which the initial presenter and critic belong, result in the proposal of a second collectively meaningful approach to the analysis: $object_2$. This jointly constructed object, perhaps the achievement of a modified step in the analysis, may then be further discussed and refined by other members of the community, subsequently giving rise to numerous other jointly constructed transitory objects in the process: $object_3$, $object_4$, $object_5$, and so on. Over time, the interacting activity systems of the researchers construct a collective object (O_C) which is accepted and shared by the various activity systems and adapted for implementation by each laboratory as a robust, reliable and defensible doping test. This process of negotiating a collective object is achieved through the knotworking process described in the previous section. This process is represented graphically in Figure 6-14 and makes clear the negotiated, collective and evolving nature of the shared, jointly constructed object of the network of activity systems formed by the accredited anti-doping laboratories. In Figure 6-14, the darkest area at the centre of the “knot” represents the current state of the evolving, collectively meaningful object (O_C), the result of the transformation of many preceding transitory objects ($O_{\#}$).

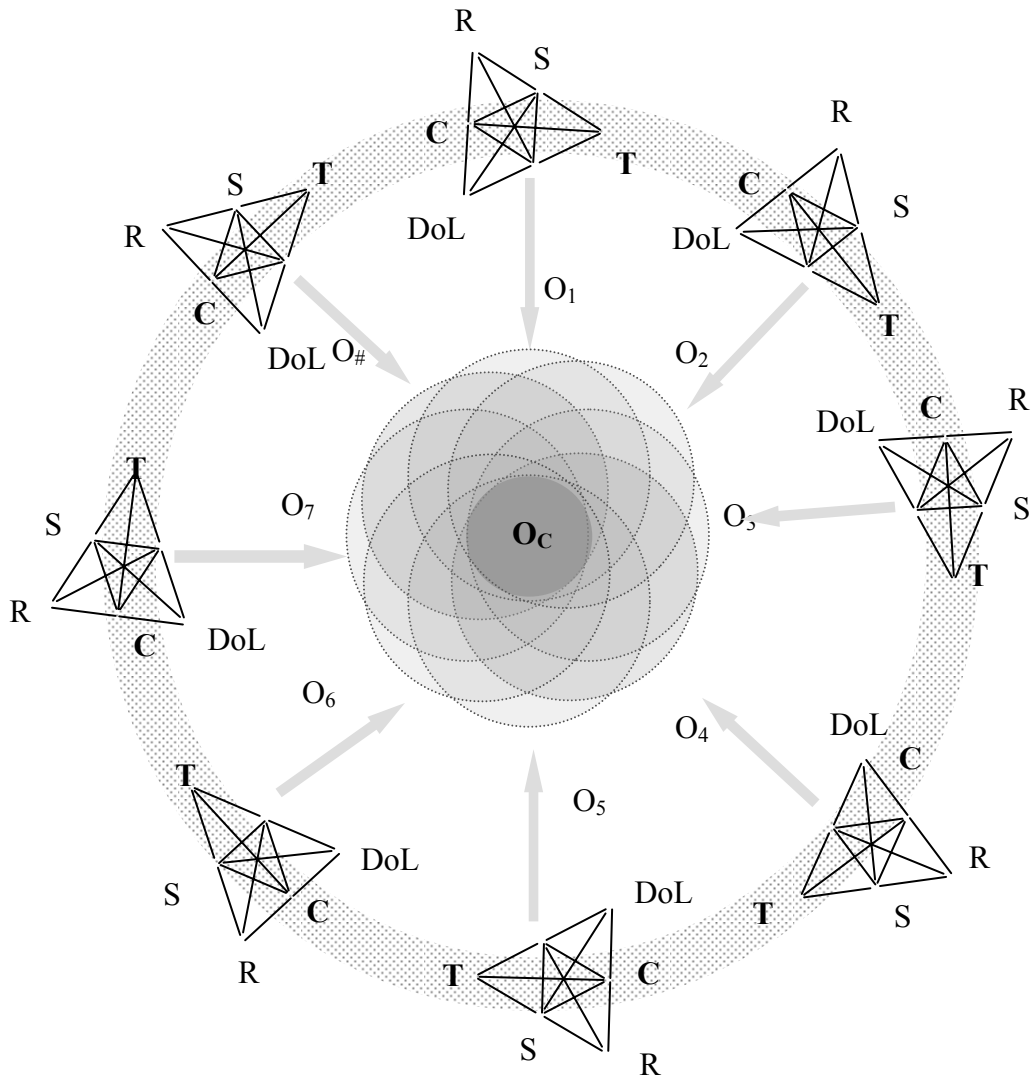


Figure 6-14: Knotworking as shared object formation by interacting activity systems

(In the figure S: subject, T: tools, R: Rules, C: community and DoL: Division of Labour)

The ability to jointly construct the objects of their scientific activity has been acquired by anti-doping scientists over a considerable period of time. To carry out this joint activity, anti-doping scientists have made use of the shared, trusted, private space of the annual Cologne workshop. Given the recent allocation of considerable funding by agencies such as WADA and USADA, the United States Anti-Doping Agency, to research by scientists from outside the accredited laboratories to elucidate techniques for use in anti-doping science, the development of effective strategies for crossing interdisciplinary boundaries

and transforming the outcomes of external researchers to validated, robust, defensible routine testing methods is worthy of further (social science) research.

Making sense of the complexity of anti-doping science has proved a long-term undertaking for a small group of specialist scientists. In the previous chapter, the scientific directors have been described as possessing a unique set of knowledge and a willingness to share this knowledge. They also viewed research in this field as more complex than that of research in other fields because of the focus of anti-doping research on the development of a validated test that would withstand forensic scrutiny. As a result the validity of much of this research occurred within the privacy of a trusted community space. The *Cynefin* framework for sense-making (Kurtz & Snowden, 2003; Snowden, 1999a), also acknowledges that much of the work of unravelling the complexity of a problematic situation takes place in private. The *Cynefin* framework has been used in the next section to make further sense of the challenge that must be understood by the broader community if they are to understand the complex nature of anti-doping scientific work and its associated research.

6.7 MAKING FURTHER SENSE OF ANTI-DOPING SCIENCE

In Section 3.4, complexity science was introduced as a discipline which had proved useful in understanding complex, disorderly physical and social systems which had evolved through interactive and co-evolutionary processes. The multiple individual and collective identities that humans take on together with the unpredictability of human systems, have led to the development of the *Cynefin* framework (Kurtz & Snowden, 2003; Snowden, 1999a). In particular, the framework addressed the lack of tools and techniques for making sense of and supporting decision making in complex, changing contexts. The four domains of the *Cynefin* sense-making framework (see Figure 6-15) offered a means for exploring the processes used by anti-doping scientists to address their problems as the domains provided a lens through which to examine both the historical context of anti-doping work and the creation of new scientific knowledge.

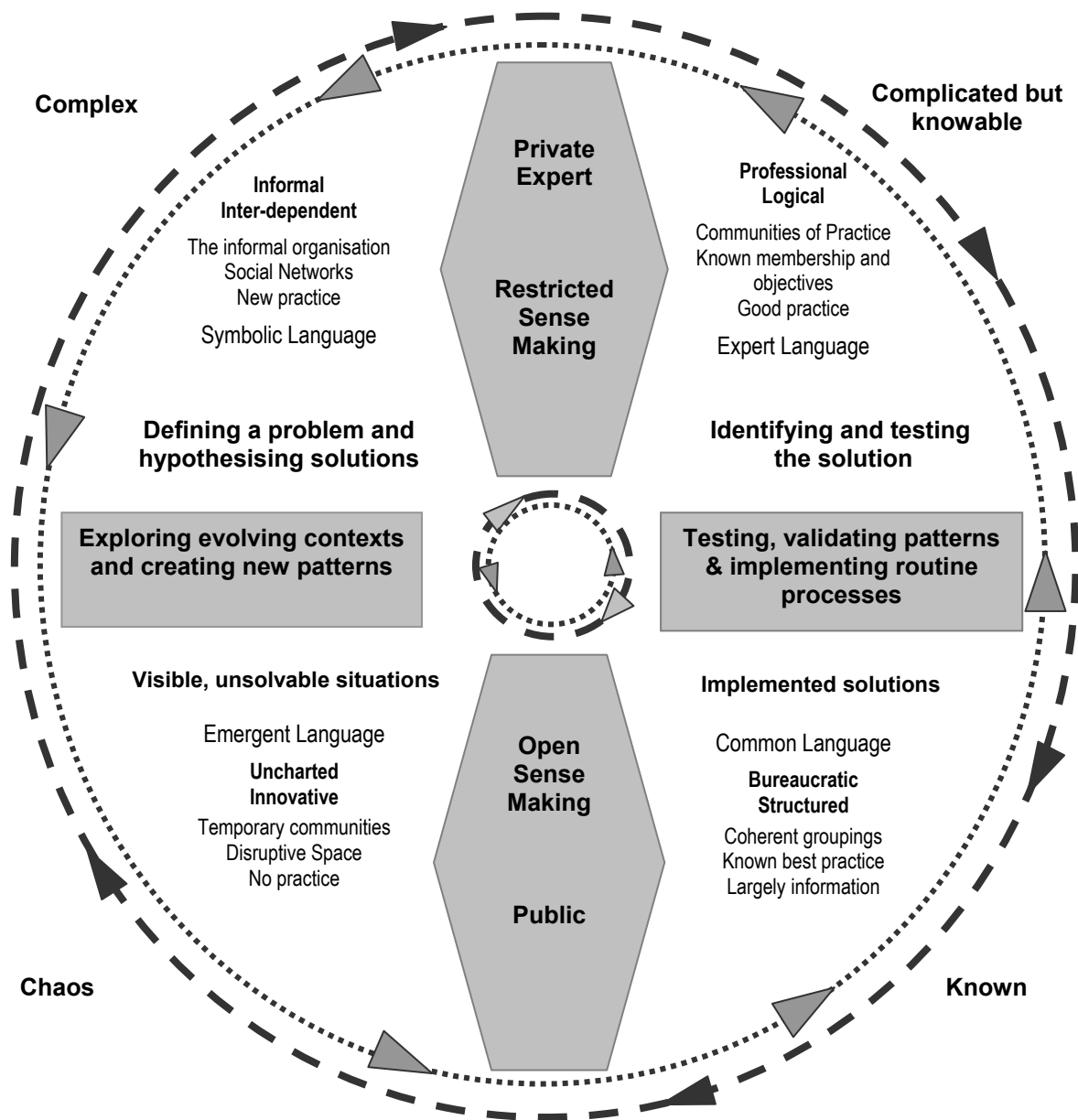


Figure 6-15: The Shifting Dynamics of Complex Socio-technical Systems

In modern times, the public chaotic situation presented by the doping related deaths of athletes Tommy Simpson, Jean-Louis Quadri and Yves Mottin (Wilson & Derse, 2001) during the late 1960s had failed to respond to the sets of anti-doping rules introduced by various sporting organisations. That is, the introduction of a set of rules had not resulted in the movement of this problematic situation from the lower left hand quadrant in Figure 6-15 of chaotic situations to the lower right hand quadrant where transparent solutions

were implemented. Subsequently, an alternate solution for the situation was sought in the private space occupied by scientists with expert knowledge who set about identifying those chemical attributes of an athlete's urine that could indicate the presence of drugs, and developing the methods for reliably detecting doping by an athlete. Success in this work made it possible for doping violations to be made public and for athletes to be subjected to the previously imposed but unenforceable anti-doping rules and regulations (UCI, 2001). As noted in Section 3.4.2, the *Cynefin* framework also set out a description of the transformation of private knowledge, whose understanding was restricted to experts, to public knowledge where it could be understood and used by experts and non-experts. Further, the framework referred to the use of symbolic and expert language in the private complex and not yet understood, and the knowable but problematical and still complicated, domains of the framework. The relevance of these concepts for the role of the Cologne workshop have been discussed below.

6.7.1 The nature of the shared space

The highly specialised interactive nature of the workshop was consistent with the *Cynefin* model of sense-making's complex and complicated domains. In these domains, the private, abstract knowledge of experts was represented using a symbolic or specialised language that was incomprehensible to the ordinary person (see Section 4.4.2.3). The use of such symbolic and specialist language was evident during the workshop where discussion frequently referred to data represented specialised diagrams using words and terms whose meaning was a mystery to an observer from a non anti-doping science background. An excerpt from Guddat et al.'s (2005) paper in the proceedings of the Cologne workshop has been used in Figure 6-16 to illustrate the symbolic and expert nature of communication used during this community event.

• **LC-MS/MS Analyses**

The mass spectrometric behaviour of α -cyclodextrin ($M_w = 972.9$ Da), β -cyclodextrin ($M_w = 1135$ Da) and γ -cyclodextrin ($M_w = 1297.2$ Da) after positive electrospray ionisation was studied using the commercially available reference compounds. The lithium adduct ions $[M+Li]^+$ of α , β and γ -cyclodextrin were predominant in full scan analyses. Collisionally activated dissociation (CAD) of the lithium adduct ion ($[M+Li]^+$, m/z 979.5, m/z 1141.3 and m/z 1303.5) of α -, β - and γ -cyclodextrin gave rise to the product ion spectra shown in Figures 2 A-C.

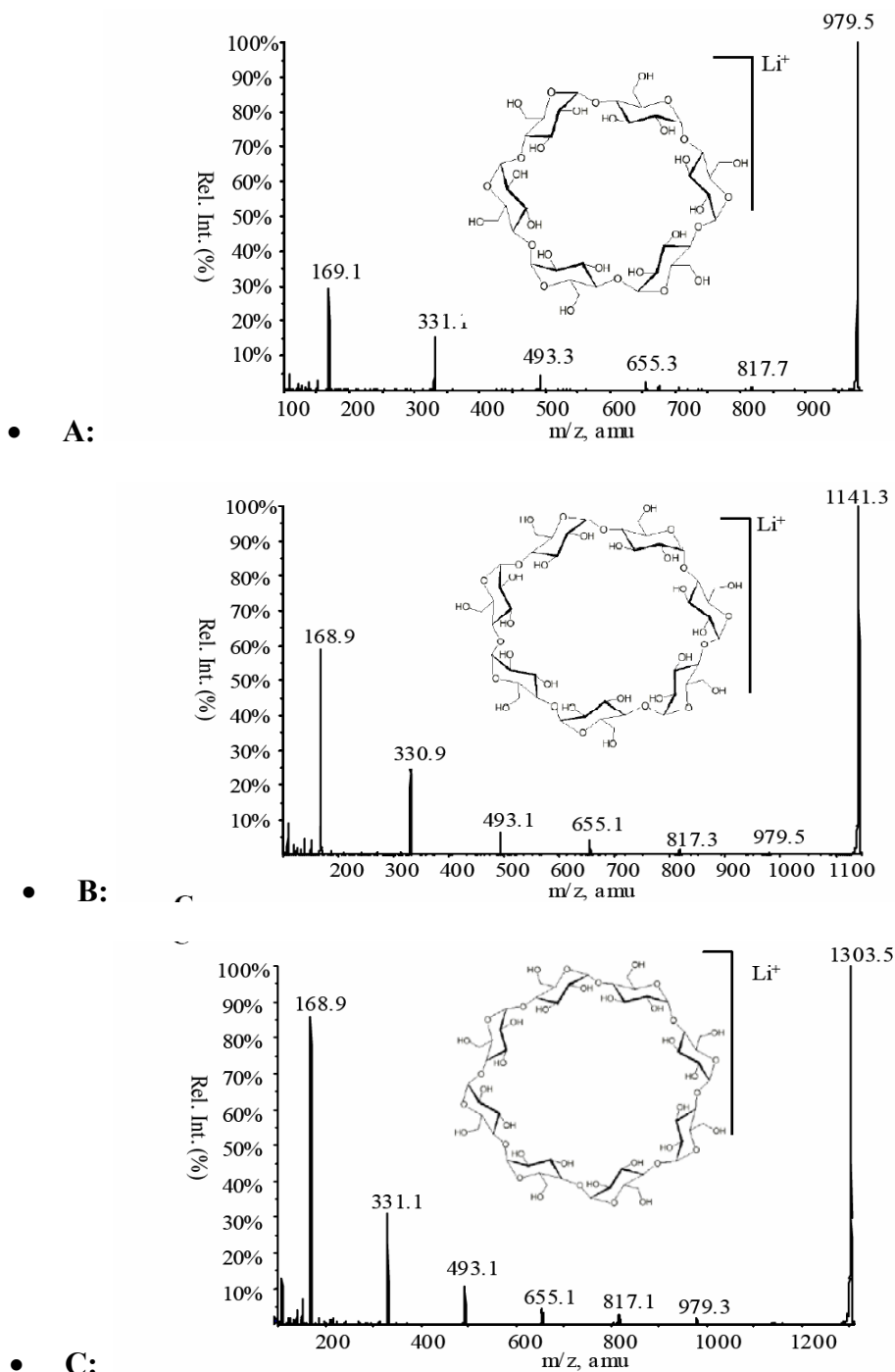


Figure 6-16: An illustration of the symbolic and expert communication used during the Cologne Workshop

It was quite apparent that the expert language used at the Cologne workshop and in its proceedings obviously supported the rapid exchange of ideas about the complexity of the work at hand, assisting the exploration of the context by describing the processes of creation and retrospective identification of new patterns (see the upper left quadrant in Figure 6-15). In turn these patterns generated new, even tentative, knowledge about the context. Caution was required when interpreting possible patterns giving rise to further pattern testing through experimentation, and validation before new findings could be confidently implemented as part of doping control tests. In general, such work was carried out in private, behind laboratory doors and later brought back for further discussion with trusted colleagues in the restricted shared space of the annual workshop. There was a movement between the complex and complicated domains as unsolvable problems seemed to move towards the solvable, and then repeatedly slipped back to the unsolved and then again moved towards the solvable. Over time, as the various aspects of each unsolved problem were elucidated, the problem became more and more solvable until it was finally solved. At times, a solution required interaction with expert scientists in different areas in order to shed light on the hidden patterns under investigation.

As noted in the previous section, the ongoing exchanges connected with making sense of the complex problems associated with anti-doping science have been described as knotworking and co-configuration. The ability to engage in such processes took time and was associated with the development of confidence in the relationships between colleagues supported by access to the private, trusted shared space provided by the annual workshop. Such relationships between workshop attendees were evidence of the strong relationships Kurtz and Snowden (2003) described as emerging between those working in the complex domain. Such relationships emerged as a result of repeated interaction, mutual goals and experiences. In the light of the previous content of this chapter, there is no surprise in Kurtz and Snowden's statement that it was in this private space that professionals formed social networks and communities of practice.

6.7.2 Movement to the public space

The implementation of a validated anti-doping test whose results could be relied upon represented a move from the upper private domains of expert anti-doping scientists to the structured environment of routine testing by accredited anti-doping laboratories (see the lower right 'Known' quadrant in Figure 6-15). At this stage, the results produced by the

test and its conduct constituted best practice and could be presented as reliable information which administrators could interpret and subsequently determine a course of action. The language of this information was no longer that of experts, but one which could be understood and used by anti-doping administrators and the general public. An athlete could be described as returning a negative or positive dope test. In the case of a positive, the athlete could be described as having returned a positive test for a particular banned or illegal substance. For example: journalist Linda Mottram reported on Friday, 21st February, 2003 that: “The cricketing world's focus [would that day] be on Melbourne and the three-person tribunal which [would] hear champion leg spinner Shane Warne explain how vanity made him accept a pill from his mother which contained an illegal substance” (Mottram, 21 February , 2003). The chaos of uncontrollable doping by athletes had become one in which it had become possible to detect athletes’ use of 250 of the 255 substance on the banned list which one director regarded as quite an achievement. The associated growth of national and international anti-doping organisations that, together with sporting federations, used laboratory results to enforce national and sporting anti-doping policies has progressively moved much of general anti-doping work to the lower right ‘Known’ quadrant of the *Cynefin* framework, where solutions to identified problems are implemented through standard procedures.

The interpretations of the role of the Cologne workshop through the lenses of communities of practice, activity theory and the *Cynefin* framework have provided additional insights into the dynamics of expert work beyond that captured in the model described in Figure 6-9. A further revision of that model has been presented in the next section.

6.8 A REVISED MODEL FOR THE DYNAMICS OF SCIENTIFIC EXPERT WORK

The use in this chapter of the frameworks of communities of practice, activity theory and the *Cynefin* model of sense-making have provided considerable insights into the nature and critical role of the Cologne workshop as a shared space accessed by anti-doping scientists to maintain their expertise.

Examination of the annual workshop as the regular community event of a community of practice highlighted the importance of a safe and trusted environment in which the members of the anti-doping scientific community could build their professional identities as doping control scientists and discuss meaningfully and negotiate solutions to their

shared problems, both scientific and those they experienced with the broader anti-doping community, including the World Anti-Doping Agency (WADA), sporting federations and national anti-doping agencies. The recent formation of the World Association of Anti-Doping Scientists (WAADS) represented the latest transformation undergone by this community of practice as it responds to a need to ensure the quality and effectiveness of the interactions between scientific and general anti-doping workers at both routine and governance levels.

The use of the lens of activity theory also yielded numerous insights into the role of a trusted shared space for this community and how that space supported knowledge mobilisation. Stakeholders as well as the directors agreed that the expanding field of anti-doping science presented increased demands on those working in the field had presented many challenges for the scientific directors of accredited anti-doping laboratories to learn what was not yet known (Engeström, 2004a). As either an individual or a collective subject, the scientific directors and other anti-doping scientists who attended the Cologne engaged in expansive learning through the formal and informal interactions that occurred during this week-long regular event. It was during this week that collaborative relationships and practices were generated, re-negotiated and/or reorganised, and as concepts, tools, rules and infrastructures were created and implemented (Engeström, 2004b, p. 5). Further, the knotworking associated with the ongoing configuration and reconfiguration of the different aspects of the outcomes of research into the development of anti-doping scientific methods as the products/services used by this community, signified the involvement of these scientists in co-configuration work. However, in this community, the contributions of multiple researchers to the generation of an accepted research outcome meant that these scientists could experience the roles of both producer and client. The configuration knowledge gained by being involved in co-configuration work was based solidly on the tacit scientific, articulated, practical and architectural knowledge built on their extensive expertise and experience in this complex evolving field, thus stressing the foundational role of routine and research work in this context.

Finally, the *Cynefin* framework yielded further understanding of the role of a private, trusted, shared space. Here, experts had the privacy to explore the complex and complicated nature of the problems that they were trying to solve. As they knotworked and co-configured solutions, their discourse was couched in symbolic and expert language using it as a tool for promoting rapid exchange of ideas. They enthusiastically trialled

ideas and followed them through. Some immediately led to “dead ends” and were discarded, others were more promising and pursued jointly over a longer period. Overall only a few ideas led to usable solutions. The privacy of the space made such mistakes not just acceptable but an integral part of expanding the expertise of anti-doping scientists.

Together activity theory and the *Cynefin* model pointed to the heavy demands of complex problem solving both in terms of expertise and time. At times, new knowledge was accessed from external sources. However, there was always a need to test such knowledge to ensure its applicability. The implementation of methods rooted in other scientific fields had to prove their reliability and validity in the anti-doping context.

These concepts have been incorporated into the expanded description of private, trusted, shared space in the revised model of the dynamics of the work of the scientific directors of accredited anti-doping laboratories in Figure 6-17.

6.9 CONCLUSION

This chapter focussed on answering the second research question: “How do the scientific directors maintain their expertise?” As professionals already at the cutting edge of their field internationally, anti-doping scientists were found to expand their expertise by continually creating new knowledge for assimilation into and implementation into their community’s practice. In particular, they made use of a regular event, the annual Manfred Donike workshop in Dope Analysis, as a private, trusted shared space to support knowledge mobilisation in this field. The use of the frameworks of activity theory, communities of practice and the *Cynefin* model in the data analysis resulted in a deeper theoretically informed understanding of the contribution of the workshop which was used to revise the model for the dynamics of expert work proposed in Chapter Five.

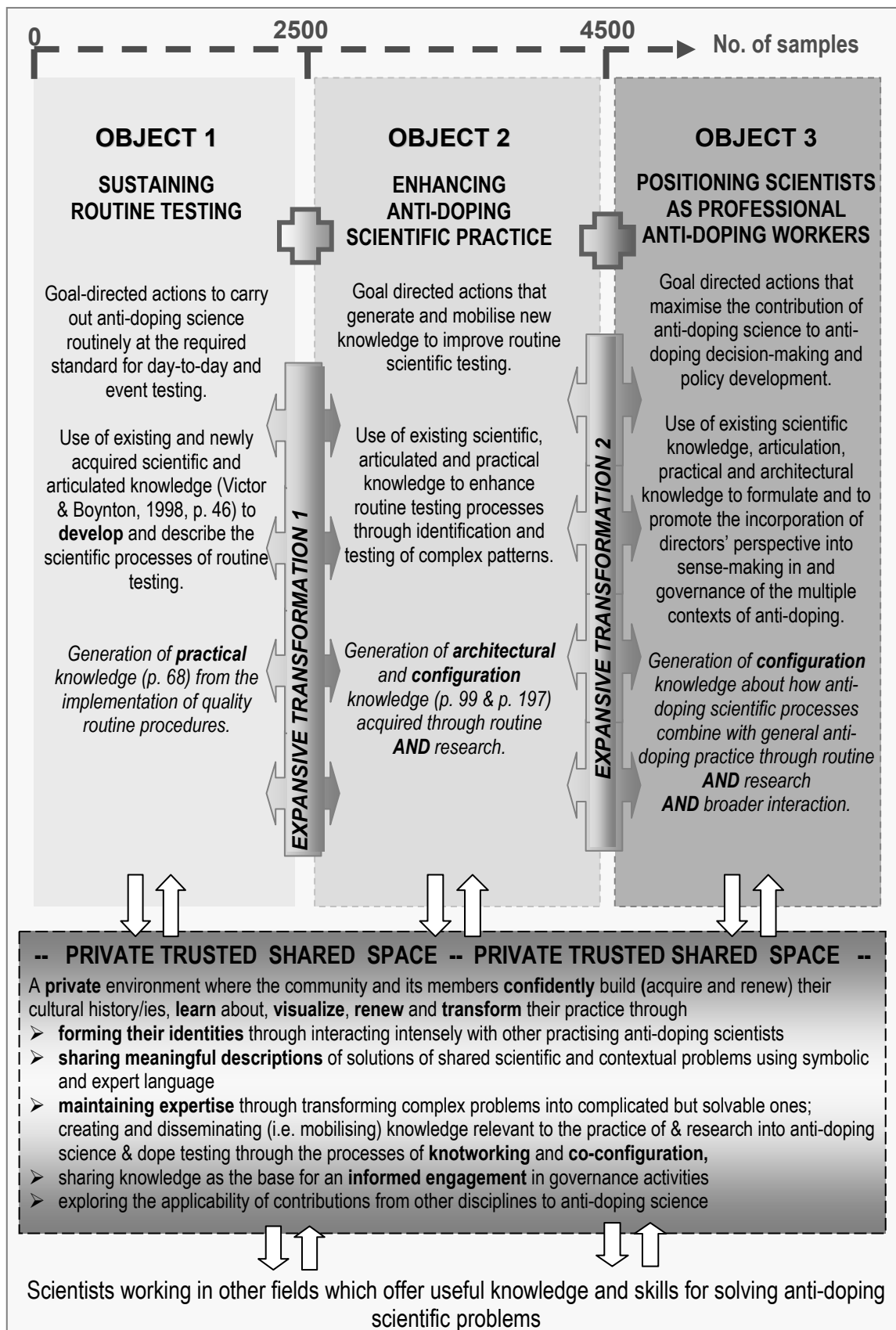


Figure 6-17: The model for expert work incorporating a private, trusted, shared space

Whilst the diversity of individual cultural histories of anti-doping scientists and other workshop attendees triggered particular individual knowledge needs, there was a commonality in that all attendees' needs were directed towards the object of collectively "keeping up with doping and anti-doping practice" through constantly developing new and better scientific methods. The functional rules and infrastructures relating to the workshop's current organisation had evolved over time through the process of expansive visibilization. Consequently, the familiar, trusted environment of the workshop format facilitated the interactive discourse and reflection necessary for expansive individual and collective learning that accompanied the advances in anti-doping science and its role in anti-doping work. The formal presentation sessions, formal question times and informal discussions between the producers – the researchers – and users – other workshop attendees, made possible the space, physical, temporal and intellectual, for interactions that constituted the multi-voiced dialogue of knotworking between the knowledge producers and the knowledge users as they co-configured the dynamic collective object.

The analysis of the workshop as an anti-doping scientific community annual event through the theoretical frameworks described in Chapter Three also resulted in multiple understandings of the critical role of a private, trusted shared space in this expert community. In addition to the mobilisation of new scientific knowledge through the formal presentations, the workshop provided many of the scientific directors of the accredited laboratories whose work was frequently under external scrutiny, with a private space where they could develop and renew their identity through meaningful interactions with trusted colleagues. It was a place to relax, to enjoy and to playfully explore the new ideas. Importantly, the workshop was a space where they could learn, and like the rest of us, learn from mistakes which rather than wasteful failures were accepted as an integral part of future successes.

In the next chapter, stakeholders' perceptions of the past contributions and their expectations of the role to be played in the future by the scientific directors have been presented.

Chapter 7 OUTSIDERS' VIEWS OF SCIENTIFIC EXPERT WORK

7.1 INTRODUCTION

In Chapter Five, the Scientific Directors' perceptions of what they do were presented. Using activity theory as a theoretical framework, the overarching complex activity of being a director was described as having a cluster of three subordinated but identifiable objects associated with those aspects of their work that dealt with routine analytical work, research that advanced anti-doping science, and interaction with the broader anti-doping community on issues relating to its governance. These multiple objects were related to the number of routine analyses carried out by a director's laboratory. A model incorporating these objects and a space in which the community consolidated and expanded their practice was introduced. In Chapter Six, this model was expanded. In particular, all three frameworks of activity theory, communities of practice and the *Cynefin* model of sense-making were used to develop a deeper understanding of the role played by the trusted, private, shared space of the annual workshop for anti-doping science and its scientists. Not only was this regular community event found to promote the expansion of both individual and collective expertise within the community of anti-doping scientists, it also enabled the scientific directors to develop an informed base for governance related interactions.

In this chapter, the focus has returned to the work of the directors but from a different perspective, that of their stakeholders. A principal aim of this chapter has been to examine the extent to which stakeholders' perceptions of the objects of the directors' activity agreed with those of the directors. In this way, the research has further extended the model developed through in Chapters Five and Six. The chapter has reported stakeholders' perceptions of the past, current and desired future role in anti-doping work. In view of the directors' frustrations about their lack of involvement in anti-doping governance, this chapter has given an account of stakeholders' opinions on this matter and the increasing regulation of anti-doping scientific work by the World Anti-Doping Agency, the major stakeholder in international anti-doping work. Once again, the use of activity theory and the complexity based *Cynefin* have been used to attain a higher level of analysis and interpretation of the data. Finally, an expanded model for the dynamics of the work of the directors, a model that incorporates the stakeholders' perspectives has been presented.

The implications of this model for anti-doping and its multiple stakeholders have been presented in Chapter Eight.

7.2 STAKEHOLDER PERCEPTIONS OF THE WORK OF THE SCIENTIFIC DIRECTORS

An overview of efforts to deal with the abuse of performance enhancing drugs, or doping, in elite sport has been presented in Section 5.2. Over the years, representatives of various groups of politicians, professionals and members of the public have spoken out against doping in sport demonstrating that the issue of doping in sport was a high profile, complex, global social issue that has not been the concern only of anti-doping scientists and sports organisations. In Chapter Five it was reported that, in the course of their work, the scientific directors of anti-doping laboratories interacted with a variety of stakeholder groups included anti-doping organizations, sports medicine professionals, coaches, journalists, the legal profession and other branches of science. Consequently, to obtain an additional perspective on the work of the directors, the design for this research into the dynamics of the work of the scientific directors included the use of interviews with representatives of the above stakeholder groups (see Table 4-1 for a list of participant affiliations with anti-doping work) and the use of publicly available material (e.g. newspapers, radio, television and on the World Wide Web). The stakeholder interview data presented below, depicted the context of doping control work in sport in rich and at times emotive terms, and acknowledged the historical and current contribution of the scientific directors and the accredited anti-doping laboratories as highly significant. However, in light of the changed nature of anti-doping work itself, stakeholders envisaged a changed role for work of the directors and the accredited laboratory system.

7.2.1 The current context of doping control work

Both public documentation and data collected during this research pointed to stakeholders' perceptions of the work of doping control as occurring in a highly charged public context, a legal minefield being addressed through a harmonised regulatory framework.

The language of journalists, for instance, reinforced the current perception of combativeness surrounding the efforts of anti-doping workers. In the months preceding

the 2004 Athens Olympic Games, numerous pieces appeared in the media with evocative titles such as:

Dope – the battle for the soul of sport (2004)

Can Drug-Busters Beat New Steroids? It's scientists vs. scientist as the Athens Olympics approach (Weintraub, 14th June, 2004)

Other more recent articles have been titled:

War on drugs (in sport) must continue (Walsh, 16th October, 2005)

Chemists stay a step ahead of drug tests: Internet offers new steroids designed to be undetectable (Shipley, 18th October, 2005)

In interviews, other stakeholders described it as “*an evolving field. It's big news; a political issue, ... captivating*” (ID: S012). Anti-doping work was “*a critical part of fairness in sport ...[and] a struggle*” (ID: S007). Anti-doping science was regarded by stakeholders as “*a scientific battleground where the lines are clearly drawn and ... both sides (are) trying to do the exact opposite of each other*” (ID: S015). It was “*a competition between the scientists who use any medicament they can get and the (doping) controller*” (ID: S009). In an article titled “Stop profiting from steroids, doctors told” Silmalis (2006) reported an increasing number of medical practitioners who prescribed performance enhancing drugs including anabolic and growth hormone steroids to sportsmen or body builders whilst others who warned of the “harm associated with the use of performance-enhancing drugs, including death and serious, life-long morbidity” (p. 35).

The expressive language in the preceding comments highlighted a context where there were expert scientists hard at work for both those who fight against the use of performance enhancing substances and for those who seek to use available means, natural and artificial, to enhance athletic performance.

The increasing involvement of lawyers in doping matters and subsequent need for anti-doping scientific and general practices to withstand forensic challenges was apparent in the titles of a number of recently articles published in the academic legal literature:

“Drugs in sports and the law – moral authority diversity and the pursuit of excellence” (Opie, 2004)

“The Olympics: a celebration of sport and the role of law” (Moss, 2004)

“Judging the judges: dispute resolution at the Olympic Games” (Kristin, 2005)

“Enhancing the performance of the doping court: how the Court of Arbitration for Sport can do its job better” (Straubel, 2005)

“The year of the steroid: are new testing regimes enough?” (Wendt, 2005)

This data denoted that the context for doping control work for both scientists and general anti-doping practitioners was combative, legalistic and high profile. Meeting the growing ethical, organisational, legal, scientific and public requirements of anti-doping work, had placed considerable pressure on anti-doping workers. From a complexity theory perspective, the national and international anti-doping programs and organisations that have formed over time (see Section 5.2) represent the adaptation of human systems to the complex, evolving context of doping in sport. Throughout this evolution, anti-doping scientists have continued to work in accredited laboratories. To obtain an understanding of the perspectives held by stakeholders about the past, current and future work of the directors, stakeholders were interviewed using the interview schedule in Appendix F. Those perspectives have been presented in the following sections.

7.2.2 Stakeholder perceptions of the way things were...

Responses to an interview question asking stakeholders to describe the past contributions of the directors to anti-doping work provided considerable information about the past contribution of the directors to anti-doping work. Data collected in response to this question indicated that stakeholders perceived the directors’ involvement as varied and crucial. These perceptions have been presented in the following sections, beginning with a description of the directors’ as supporters and educators of other anti-doping stakeholders.

7.2.2.1 Educated and supported stakeholders and governance activities

Over the years the directors had come in contact with general anti-doping workers who came to work against doping in sport. These general anti-doping workers took time to develop the understanding of doping control scientific work that would enable them to develop much needed processes, programmes and policies necessary to improve the

effectiveness of anti-doping efforts. Stakeholders with little scientific knowledge appreciated the help the directors had given them during this time. One stated their appreciation of “*the always available support the lab gives in interpreting findings, results management process and helping ... with difficult cases and to prepare simple explanations of difficult science for athlete information*” (ID: S016).

The provision of this support was confirmed by another stakeholder’s observation:

what [the directors have] done really well up to this point, is being able to filter... information so that it’s meaningful for [stakeholders] so that we can use it in our planning and coordination of our test programs so that we can target ... most effectively. (ID:S021)

Further stakeholder comment noted that the directors’ expertise had supported sporting organisations who were developing anti-doping policy or who had to “*legislate a rule breach*” (ID: S018). One stakeholder (ID: S025) extended this comment beyond assistance with individual sports when the stakeholder referred to the general situation, remarking that the directors had worked internationally with sporting federations and government bodies to assist their comprehension of doping issues and policy development.

The comments above indicated that the scientific directors have, since the outset of scientific doping control efforts, supported the development of knowledge and expertise amongst general anti-doping workers. They have provided stakeholders with explanations of hard-to-understand scientific concepts to help stakeholders grasp the relevance of anti-doping science to governance issues as national and sports-based anti-doping programs evolved. To use the language of the *Cynefin* framework, they have helped stakeholders make sense of the incomprehensible chaos of doping in sport into an ordered set of validated, reliable set of processes which they have used to combat doping in sport.

7.2.2.2 *Advanced anti-doping science with limited financial and stakeholder support*

Stakeholders recognised that the atmosphere in which the directors work had not been easy. The lack of commitment of major stakeholders such as the International Olympic Committee and sporting organisations had meant that the directors had had to “*rely on scandals to force groups to spend money on doping issues*” (ID: S015). Stakeholders stated that the directors had worked in difficult financial situations that had not been “*really economically viable ... [as there wasn’t] enough money in it for it to be big business*” (ID: S016). One stakeholder with a scientific background commented that it was

“hard to do routine and research - scientifically satisfying but very, very difficult to balance ... particularly when you’ve got a very tight, very important programme”
(ID: S006).

7.2.2.3 Initiated knowledge sharing practices

Stakeholders acknowledged that the directors had been responsible for the development of science in this area. Some comments referred to collegiality, cooperation and collaboration between the directors and in the scientific community, but others did not:

Individual labs and the lab network really enabled the first accretion of knowledge on the effect of substances and the detectability of substances. ... [There is a] lot of sharing of knowledge. (ID: S021)

[I have] seen a lot of people trying to protect their national perception, even at a scientific level at some times, instead of trying to have a more global sort of thinking ... even in science. (ID: S024)

Another stakeholder suggested that some directors were “*a bit removed*” (ID: S017). This stakeholder went on to comment:

My understanding is that [the directors are] fairly good at providing information about new tests once it’s done, once it gets approved and they have to provide how to do these tests to each other. But in terms of the actual operations in the lab, particularly these days with competing business interests in order to keep afloat, ...[there is] a fair bit of angst amongst the scientific directors. (ID: S017)

These comments suggested that there had been sufficient knowledge sharing amongst the laboratories to establish and maintain the field of anti-doping science, although it could have been better. In activity theory terms it seemed that some stakeholders were aware of underlying tensions in the directors’ activity. These tensions related to the dissemination of the new knowledge necessary to ensure that doping control laboratories kept abreast of banned evolving techniques used by athletes to enhance their performance and to the limited funding for both anti-doping scientific research and routine work. As noted in Section 5.5.2, stakeholders themselves have been forced to resolve this last tension as a result of the requirement by WADA for the provision of a specified level of funding and samples for analyses by those organisations that host an accredited doping control laboratory. In effect, stakeholders have been forced to expansively reorganise their own activity in order to resolve a tension within the activity system of their accredited

laboratory. At the same time, host organisations have been required by WADA to work with their accredited laboratories and other local bodies to develop an effective, sustainable anti-doping program. In doing so, these groups have engaged in the inter-agency working of the third generation of activity theory (see Section 3.2.1 and Section 3.2.3).

7.2.2.4 *Provided leadership*

The directors were perceived by stakeholders as having had the necessary commitment and integrity to provide the leadership required to deal with the issue of doping control in sport. One stakeholder commented that “*there were some early [directors] who were committed enough to specialize in this area, was really the kick-start of having any form of international anti-doping effort*” (ID: S021).

Stakeholders regarded the directors as having integrity with their own ethics: “*The sorts of programs they go through and their own ethics are such that it’s unlikely that mistakes (i.e. false positive or negative analytical results) will occur*” (ID: S007). The existence of such integrity may well have led another stakeholder to comment that “*by and large, you can trust the whole lot*” (ID: S027). A different stakeholder suggested that this commitment had led to a situation where even though the directors had “*pushed it to where it is ... they would still like to develop the system further and make it a much stronger entity*” (ID: S015).

Another stakeholder noted that:

Whenever there’s a crisis, whenever there’s an idea, whenever ... people above – obviously it’s a political issue – whenever they need information, of course the point of contact is the laboratory director - sometimes even more so than the CEO of the national anti-doping agency or even WADA. The directors really are or always seem to be called upon ... for information because they’re the ones that know better than anyone the scientific consequences of those results. (ID: S030)

In short, the knowledge, commitment, integrity and passion of the directors have provided leadership for the anti-doping community. Whilst some informal comments indicated that Professor Manfred Donike’s death in 1995 had left a leadership vacuum within the anti-doping scientific community (see Section 6.4), stakeholders’ remarks pointed to their high opinion of the directors’ overall efforts in the context of anti-doping work. One stakeholder described the directors as being “*revered as people that have a set of knowledge that only*

they have ... quite unique people who are very passionate about what they do” (ID: S021). These comments about the qualities of the directors reflected those ascribed to the experts who laboured in the publicly invisible complex and complicated domains of the *Cynefin* framework as described in Section 3.4. As indicated by stakeholder comments in the next section, some stakeholders went so far as to describe the directors’ efforts as having been fundamental for all subsequent efforts in the area.

7.2.2.5 *Provided the framework for doping control work*

A number of stakeholders viewed the directors’ contributions as providing the foundation upon which anti-doping work had been built. Stakeholders commented that over the years, the directors had established practices and guidelines for anti-doping work. The directors had played *“a vital role and a significant one in building up what is now an extensive, worldwide network of experts – all the assays and techniques – a fundamental role”* (ID: S004). As noted previously, another stakeholder commented that the directors did both the routine and research work upon which successful anti-doping work relied (ID: S014).

Another comment referred to a lack of appreciation for the work that the directors had carried out in order to develop the doping control infrastructure and the high quality analytical methods it required (ID: S025). This stakeholder also commented that doping control science had consisted of *“many small and often unappreciated advances”* (ID: S025). Another comment described the directors as having *“pushed and pushed and pushed and pushed to get [doping control work] up to speed”* (ID: S015). Other stakeholders remarked that the efforts of the directors had been *“largely invisible”* (ID: S008) and not only frequently unacknowledged, but that at times the directors received *“the bad press”* (ID: S011).

Comments were made that underlined the key role of anti-doping science in doping control work. One stakeholder simply stated: *“They do the work. It’s them. ... The whole thing would be nothing without them.”* (ID: S014). Another stakeholder was of the opinion that *“If the lab can’t detect substances then we’ve got no anti-doping program”* (ID: S021). A more expansive stakeholder stated:

They are the ones generally but not totally, finding the methods to detect the banned substances. We wouldn’t be doing what we’re doing – it doesn’t matter how much we’d like to say that we can ... deter people from an ethical

background, the deterrent from the actual drug testing is no doubt the big stick. It doesn't matter how much you say the other [approach] would be nice ... the contribution [of the directors] must be acknowledged. (ID: S017)

These comments reflected stakeholders' regard for the fundamental, incremental and pervasive nature of the contributions of the scientific directors of accredited anti-doping laboratories in doping control, "*the big stick*" (ID: S017) on which the development of doping control programs in sport relied.

The stakeholders' perceptions of the historical contributions of the scientific directors to anti-doping work reflected the views of stakeholders drawn from groups such as international and national anti-doping agencies and Olympic Committees, international sporting federations, athletes, coaches, sports physicians, sports lawyers and journalists. They highlighted a widespread acknowledgement of the key historical role that the scientific directors of accredited laboratories played in establishing the current body of anti-doping scientific knowledge and the structure of anti-doping work in sport. Stakeholders recognized that the role of the directors had been a demanding one, both personally and professionally. They acknowledged that the scientific directors had initiated and, in spite of the lack of financial and other stakeholder support, had persisted with research. In the language of the *Cynefin* framework, this research had untangled aspects of the complex nature of the detection of doping, rendering the problems complicated but solvable. The subsequent development and implementation of validated, accurate, routine analytical methodologies that detected the presence of banned performance enhancing substances in urine, moved decision making from the invisible domain of experts towards the visible, information based domain of the known. In effect, the accredited laboratory system provided a deterrent without which athletes' use of such substances would have continued unchecked, endangering the health of athletes, breaking the rules of sport, undermining fair competition and the spirit of sport.

Stakeholders also referred to the critical role the directors had played in the development of anti-doping procedures and policy which had helped them to make sense of their response to the chaotic context of doping in sport. In fact, many of the qualities that stakeholders described, resonated with Senge's (1990) description of the life-experience of natural leaders:

the by-product of a lifetime of effort – effort to develop conceptual and communication skills, to reflect on personal values and to align personal behaviour with values, to learn how to listen and to appreciate others and others’ ideas (p. 359)

In their comments on the past contributions of the directors, stakeholders had identified, the existence of the same three objects of and tensions within the activity of ‘being a director’ that the scientific directors themselves acknowledged namely: routine work to assist identification of athletes who dope, research to advance anti-doping science and participation in anti-doping governance activities such as policy development and decision-making (see Chapter Five). Stakeholders had described some of the tensions the directors had identified in doing their work, namely the lack of adequate funding of both routine and research work (see Section 5.5.2). Further, some stakeholders also perceived difficulties in knowledge dissemination processes amongst anti-doping scientists, another tension identified by the directors (see Section 5.5.2). Additionally, stakeholders pointed to the important role directors had played in the evolution of anti-doping programmes and policy development processes as a result of the clarity of their communication of scientific matters to general anti-doping workers. In terms of third generation activity theory, stakeholders, as subjects of their own, separate anti-doping related activity system, recognised the contribution of the activity of the directors and laboratories in the visibilization of their own activity.

In the light of the *Cynefin* framework for sense-making (see Section 3.4), the above stakeholder comments about the past contributions of anti-doping scientists, highlighted the early efforts of the scientific directors and their staff as providing sporting organisations, national governments and society at large with an emergent response to the visible evidence of doping in elite sport, a chaotic situation that they had found unacceptable. The application scientific knowledge and skills transformed an original chaotic situation into a complex one which further efforts rendered complicated but knowable. The eventual development of valid, defensible doping tests provided an effective visible base upon which anti-doping practice could be built by the sporting federations, the governments who finance their nations’ sporting activities and the medical practitioners who regard sport as a means of promoting good health and admirable behaviour. The historical response to doping in sport through the lens of the *Cynefin* framework has been discussed in Chapter Eight).

Times change and so has anti-doping scientific work. When asked about the future, stakeholders' perceptions of the current and future role of the directors reflected their concern about changes in doping techniques: changes they feared would see the use even more complex doping techniques such as gene doping. Stakeholders were of the opinion that detection of such approaches to doping presented additional challenges for anti-doping scientists, and particularly for those who took on the role of the director of an accredited anti-doping laboratory. Stakeholders' perceptions of the personal attributes necessary for a person to be able to adequately fill this evolving role have been presented in the following section.

7.2.3 Current and future expectations

As stated in Chapter Four, during interviews with both the scientific directors and stakeholders, interviewees were asked to suggest criteria for an advertisement inviting applications for the position of the scientific director of an accredited anti-doping laboratory. This question elicited data which ascertained interviewees' perceptions of the essential and desirable professional skills and personal attributes needed by the person who carried out the role of a scientific director in what stakeholders regarded as an increasingly complex context. The subsequent inventory of skills and attributes of the 'ideal' scientific director was extensive, varied and demanding and represented a considerable evolution from that previously carried out by the directors. The first criterion described related to the personal attributes of the 'ideal' director.

7.2.3.1 Personal integrity and commitment to anti-doping work even under pressure

Stakeholders' comments indicated that carrying out the duties of a scientific director required considerable personal integrity. Stakeholders expected that scientists in accredited anti-doping laboratories would behave in an ethical manner both in their day-to-day work and their research. The 'ideal' director required respect for the privacy of athletes as at times they could be "*dealing with personal information*" (ID: S026). The 'ideal' director should be honest and possess integrity to the point where they were able to admit their mistakes publicly: "*If the lab believes they've stuffed up – left a sample open .. spilt coffee over it ... they have to be prepared to say so*" (ID: S027). In short, the 'ideal' director had "*to be above suspicion*" (ID: S014).

The ‘ideal’ director was expected to be aware of his/her moral and ethical responsibility to both the sport and to government organisations that run anti-doping programs as well as of their responsibility to the athlete. One stakeholder said that the directors also had a role to follow the unusual, regardless of whether it favoured the athlete or not (ID: S014). The director would ensure that his/her laboratory would consistently carry out high quality forensic work and actively do research that “*support[ed] anti-doping rather than doping*” (ID: S019).

Stakeholders perceived the directors as needing a firm personal and professional commitment to global efforts to solve the problem of doping in sport. Only four stakeholders stated that the directors of accredited doping control laboratories should have an interest in sport (IDs: S004, S005, S0012, S022), whereas ten stakeholders regarded it as necessary that a director have an interest in solving the problem of doping control in sport and in meeting the broad needs of the anti-doping programme, its associated rules, testing procedures and protocols (S006, S007, S009, S010, S014, S015, S017, S018, S020, S021, S030).

As responsible for the work of an accredited anti-doping laboratory, stakeholders indicated that the ‘ideal’ director would need to be able to handle the stresses of conducting the analyses for international competitions, handling the scientific aspects of a high profile, positive doping case, and involvement in court cases. A director would need to be pragmatic and have the ability to accept an adverse tribunal outcome as highlighting an area that needs to be addressed (ID: S027) and to “*live in the ‘grey zone’ where there is not a lot of black and white*” (ID: S015).

In these ways, stakeholders described the ‘ideal’ director as honest, aware of their ethical and moral responsibilities, committed, and independent. He/She possessed strength of character and would be able to withstand the pressures of working in a high profile global context. The director’s work would focus on carrying out scientific routine and research work as well as supporting anti-doping governance work: the three objects identified by the directors interviewed for this research and incorporated into the model developed through Chapters Five and Six. However that wasn’t all that stakeholders expected – more was required of the ‘ideal’ director. From the data presented in the following sections, it was apparent that in addition to having the interpersonal skills to foster cooperative and collaborative relationships with scientists and stakeholders, the management skills to

oversee and accredited laboratory, and the ability to balance objective and investigative approaches to his/her work, stakeholders expected that a director would be an outstanding scientist.

7.2.3.2 *Outstanding and expanding scientific knowledge*

Stakeholders were of the opinion that the ‘ideal’ director would be a scientist of “*very high calibre*” (ID: S020). Such a scientist would have “*impeccable credentials*” (ID: S023) and be “*way up there in the scientific scale*” (ID: S014) in areas such as analytical chemistry, biochemistry, drug metabolism, endocrinology, forensic toxicology, genetics, pharmacology, protein chemistry, and the use of associated instrumentation. This was necessary if a director was to have the ability to “*fully understand exactly what’s going on*” (ID: S011) in the complex field of anti-doping science.

Increasingly, the director would need the ability to oversee the research and routine work of experts from other disciplines:

There will be new detection techniques including not only pure analytical chemistry, but also biology ... the lab directors in the future will still need to be skilled in one area but also have a good understanding of other areas and to manage skilled people in that area. So they will keep the responsibility of releasing the positive result but it will need to expand his or her understanding to other areas and rely on very skilled people in those areas. (ID: S024)

Another stakeholder commented that the area was a unique use of science, one in which the ‘ideal’ director would need to be “*a renaissance person with a lot of skills in a lot of different areas*” (ID: S015), areas that were expanding into new and previously uncharted waters.

Stakeholders’ expectations regarding the personal qualities of the ideal director are consistent with the process of identity formation that occurs through membership of a community of practice (see Section 3.3). Interpreted through the framework of activity theory, the expectations described above and below describe both the rules and division of labour in this activity system from the stakeholder’s perspective (see Section 3.2.1).

7.2.3.3 *Networkers advancing anti-doping science through research and collaboration*

Stakeholders regarded anti-doping science both as a shared enterprise to be advanced by a collaborative effort and as a context whose benefits extended beyond anti-doping science. Stakeholders’ comments indicated that for these reasons, the communication and

interpersonal skills of the ‘ideal’ director would enable a director to build and support collaborative networks with scientific colleagues. Through these networks a director would generate and share knowledge and research outcomes (ID: S004, S021).

Stakeholders were aware of difficulties that flexible knowledge sharing practices could create. As a result one stakeholder recommended that an approach to knowledge dissemination within the anti-doping scientific community needed to be developed which would “*protect the innovator, the creator, the contributor of this new knowledge ... but at the same time ... [support] the exchange and extent of information ... crucial in this system*” (ID: S024). This stakeholder recognized the difficulties associated with knowledge dissemination, commenting that traditionally scientists have been “*very careful about information sharing because [they] don’t want [their] discovery used by others without any recognition. ... They want to make sure that they are acknowledged for their contribution.*” (ID: S024). This stakeholder went on to highlight the important role that trust would play in such a flexible knowledge sharing environment by suggesting that “*trust between ... scientists [could] also be improved to a level where people are confident that [they are] working in the same direction*” (ID: S024).

At the same time, other stakeholders expected that anti-doping scientists would share their knowledge and research outcomes with each other and with other scientists and “*[engage] with the broader scientific community to link up with other bodies of science*” (ID: S020). Whilst such engagement might “*cost some part of efficacy it [was] absolutely necessary that the field [remained] open to discussion and [that] every step forward [was validated] with the scientific community*” (ID: S031). Another stakeholder extended the contribution of the anti-doping research beyond the laboratory, noting that it could further the research profile of both the director’s own area and that of their nation (ID: S012).

This ability to span, integrate and utilise knowledge from and contribute to multiple scientific areas through research required a broad range of interpersonal skills. These additional skills were necessary for collaboration and networking with other laboratories and went beyond those needed by a director for the management of his/her own accredited laboratory. In effect, directors would be involved in the inter-agency work associated with third generation activity theory (see Section 3.2.1 and Section 3.2.3) and in crossing boundaries between various fields of scientific endeavour. They would need to negotiate the ongoing relevance of their work for the broader community served by their practice

(see Section 3.3). Directors would also need to be part of the informal social networks that inhabit the private, complex domain where the patterns required to advance anti-doping science are investigated and gradually revealed (see Section 3.4.2).

7.2.3.4 Builders of trusted multi-disciplinary teams

Stakeholders perceived that the ‘ideal’ director’s supervisory and communication skills would ensure that all their own staff members were committed to anti-doping work and aware of their responsibilities. Staff would feel motivated and “*critically aware at each step of the process that they do*” (ID: S006) as well as sensing that they contributed to a common aim (ID: S021).

The nature of the work of the laboratory required that the ‘ideal’ director would have considerable trust in their staff. One stakeholder commented

Although [the directors are] the boss, they need to be one of the team. They need to be able to trust their analysts – that’s the biggest thing. While they should have a solid grounding in every facet of the work ... and they’re learning all the time ... in the end they’re making the decision, signing off on a result whether it be positive or negative. ... They’re dependent on the expertise ... proficiency and competence of their analysts – so they’ve got to be able to trust their analysts. ... [Directors] need to be able to ... bring people out of their shell a bit – people need to be rejuvenated. (ID: S030)

Some stakeholders flagged the changing nature of anti-doping science as meaning that the ‘ideal’ director would need to manage his/her own laboratory staff in a way that incorporated new areas into anti-doping scientific work:

We are going to see in the years to come ... more growth of the lab director [as] not only ... a good analytical chemist ... but able to expand to other areas, be able to manage people and understand and again foresee ... the future ... The goals and the objectives are going to change a bit ... to the point where it’s going to cover more scientific areas. ... It could be very difficult for the lab directors to remain at the very top in every single area. The lab directors have to ... as any good scientist, [be] critical when faced with the information and the results ... but at the same time ... [integrate] all these different elements into the lab to make sure that the lab can be structured in such a way that it can cover all these new areas in doping testing. (ID: S024)

Another stakeholder supported this comment, stating that if a scientific director didn’t have skills in a wide variety of areas then they needed “*the ability to manage those who do*” (ID: S015). This comment pointed to stakeholder concerns about the needs for

directors to guide research that kept up with the changing nature of doping and subsequently met the expanding demands of anti-doping science noted in Section 7.2.3.3.

7.2.3.5 Management skills to oversee the complex operations and meet the standards required of an accredited laboratory

The ‘ideal’ director was described as needing strong organisational, business, financial management and planning skills in order to provide adequate staffing, financial and technical resources, to guarantee the viability and efficiency of the laboratory and to manage scarce resources to maximise the number of tests. One stakeholder commented that the directors had to be good financial managers because “*they [couldn’t] have everything*” (ID: S017) and needed to be able to maximize what they could do with what they had. Subsequently, the ‘ideal’ director also needed strategic planning skills (ID: S017). Another stakeholder was of the opinion that directors required entrepreneurial skills to raise money for anti-doping research (ID: S023).

The forensic nature of routine anti-doping analytical work required that ‘ideal’ directors be “*constantly critical of what they [were] doing*” (ID: S024). They needed to be competent in quality assurance management processes (ID: S002, S006, S011, S012, S020, S025, S031) to ensure the ongoing proficiency of the laboratory. The ‘ideal’ director required

fairly good management skills in terms of maintaining integrity of a process... One of the first attempts [athletes] make is to get off on a technicality, saying this process is flawed in terms of collection or the lab’s process was flawed in terms of storage or testing. They clearly need someone there who’s going to make sure that the integrity of that process is maintained right through. (ID: S018)

In short, directors were required to manage a laboratory in a manner that ensured that “*what [had] come out of the lab [was] 100% right*” (ID: S027). Another stakeholder described the responsibility of being a director thus: “*They cannot make a mistake with the testing – that’s a big burden*” (ID: S014).

Stakeholders referred to the responsibility of the director of an accredited doping control laboratory to ensure that the work of his/her laboratory could withstand public scrutiny and met the external standards formally imposed by WADA’s International Standard for Laboratories (ISL) (WADA, 2004b) and the International Organisation for Standardization’s ISO17025 standard for the competence of testing and calibration laboratories (2005). Meeting such standards, of which passing WADA’s quarterly

proficiency testing programme is a part, engendered confidence that laboratory results were above suspicion and justifiable. One stakeholder commented that “*Proficiency testing and external quality control is the key to the credibility of the system*” (ID: S031). The formal requirements of WADA’s ISL have been discussed below in Section 7.2.5.

The increasing regulation and legalisation of anti-doping work, had shifted the focus of anti-doping work from that where doping was regarded and treated as a medical problem because it was dangerous to health, to one where there was far greater emphasis on legal issues and thus increasingly involved lawyers (ID: S027). This stakeholder commented that when an athlete retained a lawyer, that lawyer’s role was to show that there was a flaw in the processes or policies. Whilst directors might find such challenges to a laboratory’s work hard to accept, they provided the opportunity for the system’s improvement. The directors’ comments reported in Chapter Five, describing the stress directors feel when dealing with the legal aspects of positive cases (see Section 5.4), corroborated this stakeholder’s remarks. The stakeholder further commented that the lawyer’s ability to argue their clients’ cases was limited by the lack of trained personnel who understood anti-doping science and by the lack of preparedness on the part of the directors to criticise another laboratory’s work “*it’s a bit like trying to get one doctor to testify against another – they don’t like to do it*” (ID: S027).

Stakeholder remarks about the skills needed to manage an accredited laboratory were consistent with a perception that the nature of the activity of being the director of an anti-doping laboratory was changing: that stakeholders’ visibilization of the activity had expanded (see Section 3.2.3). The remarks also reflected the expectations of the broader community for the practice of the directors and the laboratories to transform in order to meet the new regulations and practices of anti-doping work (see Section 3.3). When examined through the lens of the *Cynefin* framework, these remarks were indicative of those workers whose role is situated in the public, known domain where validated knowledge and associated routine processes have been incorporated into standardised, information-based bureaucratic practice (see Section 3.4.2).

7.2.3.6 *Communication with general anti-doping workers and lawyers*

As well as being able to communicate with their own staff and scientific colleagues, stakeholders stressed the need for the ‘ideal’ director to be able to communicate clearly with general anti-doping workers, sports physicians, sporting organisations, lawyers,

committees, athletes, media, and the public in order to “*demystify the technicalities*” (ID: S008, S010). Whilst one director had noted the need to use “*words which could not be contradicted at all in court*” (ID: D015), one stakeholder expanded on this idea. Given the nature of the expert language used by anti-doping scientists (as exemplified by Figure 6-16) the following stakeholder comment was not surprising:

It is a difficult thing for the lawyers. Just pronouncing names of the drugs can be hard enough and so therefore understanding what they do [and] what the differences are is hard for them and it's out of their field. Yet when you go before the Court of Arbitration for Sport and you've got three lawyers from different countries, different legal systems sometimes, and English is not their first language although they're reasonably proficient in it and they get these scientific reports, they struggle. Time has to be taken to explain it to them. They're intelligent people, they're well educated but they need time. ... The lawyer ... does want it to be put in language that they can understand. (ID: S026)

The communication situation was further compounded when there was variation in the scientific opinions presented in the Court of Arbitration for Sport (CAS). One stakeholder suggested that to promote positive perceptions of anti-doping science and the cause of anti-doping work, anti-doping scientists needed to reach a consensus:

A lot of challenges [to positive test results] are on the scientific side. The scientific people are more and more called to testify in CAS and its legal processes. Whilst science is made of contradictions and it is good to have a debate, the problem [anti-doping has] suffered to date is that very often when an opinion was expressed by a scientist or group of scientists, there was always the counter-balance opinion from another scientists or group of scientists. ...[There is a need for the development of] some concerted views, some consensual views of some issues – again for the benefit of harmonization of the fight against doping in sport but also for the credibility of science within the anti-doping system. (ID: S024)

The sense of frustration apparent in these comments highlighted not only the need for the communications between scientific and general anti-doping workers to be expressed in language that non-scientists could understand, but also for stakeholders to be helped to understand, from the *Cynefin* perspective, the reasons why they find it difficult to make sense of the complex and complicated domains of anti-doping science. Stakeholders pointed to the negative impact of these communication problems on the effective implementation of anti-doping policy. Whilst frustration was also evident in the director's perspective, there was also acknowledgement of the role of improved communication in

Professor Ayotte's (2004) comment that "While there is little [anti-doping scientists] can do to prevent subjective, biased opinions gathered from reading headlines and abstracts of articles, we definitely can deal with improving the communication of scientific knowledge, [laboratory] standards, procedures and regulations" (p 244-5). This appears consistent with the need for the discourse of both the knotworking of third generation activity theory (see Section 3.2.3) and the consensual sense-making in the *Cynefin* framework's domain of disorder (see Section 3.4.2).

7.2.3.7 "The eyes of anti-doping" AND / OR "the independent expert"?

The changing regulatory and scientific context of anti-doping work in sport resulted in the evolution of differing views of the role of the directors as scientific experts. As noted in the introduction to this section, stakeholders expected that the 'ideal' director would be interested in solving the problem of doping in sport and subsequently incorporated an investigative role into the work of the 'ideal' director. Other stakeholders emphasised the importance of the independent integrity of the directors to ensure that justice was done.

Some stakeholders suggested that the laboratories would ideally be "*the intelligence providers ...the eyes of anti-doping*" (ID: S024), remarking that the international mobility of the elite athletes made it important to avoid situations where information was "*trapped in a file in[a] lab[oratory] and not shared*" (ID: S024). Anti-doping scientists would be "*scientific detectives ... this business with THG and Catlin and the US laboratories is evidence of that*" (ID: S026). Consequently, the laboratory work would enable a tactical response to new attempts by athletes and others to achieve improved performance using unacceptable means through their ability to identify athletes who were the "*least common denominator of mankind ... [someone who was] trying to pull the wool over the eyes of the rest of the world*" (ID: S015).

Other stakeholders argued for the scientific directors to have a more independent role. One stakeholder pointed out that whilst anti-doping workers would like the laboratories to act as intelligence providers by identifying the unusual, such a role had to be carried out in an ethical manner (ID: S031). Another saw a need for the scientific directors to "*accept their obligation to sport and athletes to be independent*" (ID: S027) and to "*keep the whole approach acceptable within human rights*" (ID: S031). From a legal point of view, some stakeholders expected the directors to provide "*a service to the legal system in terms of producing the core evidence necessary for a prosecution*" (ID: S026) by giving "*an*

independent and un-biased view on the field” (ID: S031). These stakeholders acknowledged the personal burden of such a role stating that the directors would require a “*huge degree of honesty ... [in order to] earn the trust and confidence of the athletes who have to be absolutely certain that they will not be wrongly accused*” (ID: S027). The directors would also need to “*bring to the non-scientist clear indication on what is known, what should be done, and say the truth, the whole truth, not hiding what is not good to see and not to tell*” (ID: S031).

The dilemma for the scientific directors encapsulated in these contrasting views did not go unnoticed. One stakeholder commented that as ‘warriors in a war’, the directors could be loath to reveal

techniques for finding out things [because] then people would engineer ways around that.[and] I can understand that point of view. However the lawyers’ point of view is that your technique for finding out things might be wrong and if it’s not freely known, then it can’t be subjected to critical analysis by other scientists and so therefore we could have a scenario where you’re coming up with false positives because your methodology is flawed; and there’s no way of testing that unless it’s out in the open. And so we have that tension between the two and concern from lawyers who are defending people that they can’t subject [the testing processes] to rigorous analysis from ... other scientists ... because [the testing processes are] not known [outside the laboratories]. (ID:S026)

The comments in this section describing the diversity of stakeholders’ views about the role of the ‘ideal’ directors of accredited anti-doping laboratories highlighted the extensive expectations stakeholders place on the scientific directors. In activity theory terms, stakeholder comments indicated a tension resulting from contradictory stakeholder expectations that the directors of accredited laboratories would act as investigators AND as independent experts (see Section 3.2.1.2). The comments were also consistent with the placement of this issue in the *Cynefin* framework’s domain of disorder.

Throughout the stakeholders’ interviews, it was apparent that stakeholders’ perspectives were in agreement with the directors’ descriptions of their activity as a complex one with the multiple objects (see Section 5.5.3). Stakeholders pointed to the importance of their being able to trust the directors, a trust triggered by their personal integrity, commitment to anti-doping, and extensive scientific knowledge directed towards advancing anti-doping science, their broad range of management skills within and beyond the laboratory.

Stakeholders emphasised the expectation that directors would support the flow of accurate information between the diverse groups of anti-doping workers and other stakeholders through clear communication pitched at an appropriate level for the particular audience. However, stakeholder comments about the ‘ideal’ director failed to clarify expectations about the directors’ involvement in anti-doping governance. Fortunately stakeholders’ views on the involvement of the directors in governance related interactions had been addressed in a specific question during the interview. Data elicited in response to this question indicated that stakeholders held various views that will be discussed in the next section.

7.2.4 Diverse stakeholder attitudes to the involvement of the scientific directors in anti-doping governance

Both stakeholders and directors had referred to their interactions as related to routine work and to supporting the professional development of general anti-doping workers through explaining anti-doping scientific concepts to general anti-doping workers (see Sections 7.2.2.1 and 7.2.3.6). As described in Section 5.4.4, perceptions of the scientific directors about their lack of participation in anti-doping governance activities resulted in the inclusion of a question about this issue in the stakeholder questionnaire in order to ascertain stakeholders’ perceptions about the role that the scientific directors of accredited laboratories should play in anti-doping policy development and decision making. Analysis of the responses to this question indicated that stakeholder opinion on this issue varied. Whilst one stakeholder commented that scientists “*can bring to the non-scientist clear indication on what is known, what should be done*” (ID: S031), other stakeholders provided more detailed description of ways that the directors could be involved. Some expressed the view that the scientific directors could suggest appropriate directions for future research, others that they should be represented on committees that advise policy-making bureaucrats. Some saw a role for the directors only on specific committees that were concerned with anti-doping science, others that the directors should act as knowledge providers to the policy development process and thus avoid potential conflicts of interest.

Some stakeholders stated that the directors should be more involved in these non-scientific aspects of anti-doping work as their “*contribution has been underestimated and their skills a bit underused*” ID: S024). Other stakeholders stated:

It's a role that probably hasn't been explored and used enough. ... My perspective as a sort of first principle is that the people who work at the pointy end of any operation have to have a significant role in policy development. ... [The directors] have a lot that they can bring to bear in terms of how the policy frame needs to work. (ID: S020)

I wouldn't actually pigeonhole [the directors] as having their expertise restricted to the area of science and science alone. Sometimes their insights and the things that they observe and see can have broader policy implications. (ID: S016)

It's important that the directors who bring an incredible depth of knowledge about the analytical approaches and what their staff can do, with the melding of the political and the business, should be at the table with the people making decisions ... as contributors in that debate ... but particularly within their realm of result reporting, results management and those sorts of things. (ID: S012)

[The directors] should definitely have a very active role in that at both a national and international level, ensuring that they are comfortable with any policies or standards that are going to affect them ... quite a critical point of view to make sure there is harmonization internationally across all laboratories. (ID: S006)

Whilst one stakeholder summarised their role as “*the sort of interface between ... the more political aspect of anti-doping and the actual practice*” (ID: S019), other comments described specific but less involved roles which particular stakeholders saw as appropriate for the scientific directors:

[Advising] the legislators as to whether something should be on the banned list. (ID: S018)

[A] very ongoing role in research and in informing the approach that is taken by the anti-doping organisations. (ID: S021)

[Anti-doping agencies need] a constant flow of information about what's happening out there in athlete world – the labs can contribute to that because they see a whole lot of things that aren't necessarily reported. (ID: S021)

Obviously [the directors] need to be involved in the process of developing the International Standards for Laboratories. (ID: S016)

I would have thought that the major contributions would be the quality control issue. (ID: S011)

Whilst acknowledging the importance of consultation of the directors by policy and decision makers, one stakeholder warned of potential conflicts of interest if the laboratories were too involved in policy development and decision making (ID: S025).

Another stakeholder commented that the directors were “*an important part of ... decision making in terms of where we go with anti-doping but they shouldn’t be the dominant part*” (ID: S010). A different stakeholder didn’t think that the directors had much of a role as:

I always thought that they are reacting not pro-acting. ... It’s not their role in terms of policy decisions. ... If I was WADA, I’d be taking notice of what these guys are saying, but I wouldn’t be taking notice of them saying ‘Here’s the way you’ve got to do it. (ID: S014)

A further stakeholder comment limited the director’s role to the interpretation of test results and assisting decision making in instances where athletes had been found to have used prohibited substances (ID: S008).

One stakeholder explored the issue of the role of the directors in policy development and decision making by stating that there needed to be a way for the directors to interact with each other and administrators and policy makers about short, mid and long term strategy, a need for “*debates and exchange of ideas ... communication between the different actors or scientists within the anti-doping community*” (ID: S024). Another stakeholder commented that in some instances in the past, some directors who had been appointed to committees did “*not appear to contribute sufficiently*” (ID: S005).

The mixed nature of these comments resonated with the findings of Lach, List, Steel, & Shindler (2003) who investigated the advocacy and credibility of ecological scientists in resource decision making. Lach et. al. referred to List’s description of the traditional role of the scientists as one where scientists “are expected to remain essentially separate from decision-making, serving only to provide data, findings, and expertise as needed and called for” (p. 173). Lach et. al.(2003) also set out the challenges to this traditional model of the role of scientists arising from the increased complexity of ‘wicked problems’, citing Freeman’s description of these problems as characteristically having “multiple definitions as to their nature” (p. 173). Wicked problems were “the object of several and conflicting criteria for defining solutions, [had] ‘solutions’ that [became] ‘problems’ for others, and ‘[had] no obvious stopping rules that [defined] when enough [had] been accomplished’ (p. 173).

Lach, List, Steel, and Shindler (2003) regarded environmental problems as an example of a wicked problem. The experience of this research suggested that the problem of doping in

sport could be regarded as another example of a wicked problem as it exhibited the characteristic complexity of these types of problems.

From their research into advocacy and credibility of ecological scientists in resource decision making, Lach, List, Steel, & Shindler (2003) found that the role of the expert scientist was not always confined to the purely scientific. Lach et al. concluded that there was a need for scientists who engage more actively in such management and policy matters to become effective communicators. They also found that stakeholder groups would “have to learn now to accept the uncertainties that come with scientific experimentation and modelling” (p. 178), an opinion which contrasted with that of one of the stakeholders (ID: S024) reported earlier in this chapter. This stakeholder wanted to see scientists reach a consensus (see Section 7.2.3.6).

There was also agreement between Lach et al.’s (2003) study and this research with regard to the need for clear communication between scientists and stakeholders. In a manner similar to that found by Lach et al. in their study of ecological scientists’ stakeholders in North America, the comments of stakeholders in this study indicated that there were mixed feelings amongst stakeholders about the type of involvement of anti-doping scientists in decision making, but widespread acknowledgement of the role that scientists were able to play in obtaining leverage from the knowledge generated through their routine and research efforts in the laboratory. Lach et al. found that non-managerial stakeholders perceived the complexity of wicked problems as demanding an expanded role for scientists in decision making, an expansion which would see scientists working “closely with managers and others to integrate scientific results into management decisions” (p. 175). Current analysis of the data suggested that such a role has not yet been visibilised by the anti-doping community. Further research would enable such developments to be monitored.

Against this background of mixed opinions about the involvement of scientists in decision making and policy development, Bäckstrand (2003) proposed the notion of ‘civic’ science as a view of science in which “citizens and the public [had] a stake in the science-politics interface” (p. 21). Bäckstrand stated that this interface could “no longer be viewed as an exclusive domain for scientific experts and policy-makers only” (p. 21). Bäckstrand also noted “calls for refashioning scientific expertise into a more transparent, accountable and democratic enterprise” (p. 21).

Such calls could be interpreted using each of the frameworks selected for this research. In third generation activity theory terms, such calls represented the need for the co-construction of a joint object that could be shared by anti-doping scientific and stakeholder activity systems (see Section 3.2.1). It pointed to the need for expansive reorganisation of these activity systems if they were to achieve this shared object. In communities of practice, the calls represented a challenge to the members of a community of practice to transform their practice so that it was more in line with the needs of their clients in the broader community (see Section 3.3.2). Finally, from the perspective of the *Cynefin* framework, the diversity of opinions represented a domain of disorder where the nature of meaningful decision-making was questioned by the various stakeholder groups (see Section 3.4.2).

It seems then that, as suggested by S024, there is a need for further discourse, for exchanges of ideas and communication between the different actors within the broader anti-doping community in order to resolve the tensions that have arisen as a result of differences of opinion about the nature of the role of anti-doping scientists in the policy development and decision making associated with doping control work, for an agreed way of leveraging their knowledge. Formal resolution of this tension will require the visibilization and acceptance by all those involved in anti-doping work of an agreed level of involvement of anti-doping scientists in policy development and decision making.

The stakeholders' historical, ideal and regulated descriptions of the attributes of the scientific directors of accredited anti-doping laboratories were a far cry from the oft-seen public portrayal of scientists in a laboratory filled with strange looking apparatus, highly focussed on their current task and caring about little else, oblivious to both surroundings and time. Rather, stakeholders expected these scientists to be

- skilled across a range of scientific areas
- good managers of a team of other highly skilled scientists, resources, a quality process, and their work environment
- good communicators with both their scientific peers and with non-scientists
- researchers who could supervise projects by their own staff and rapidly disseminate information to advance the cause of anti-doping work.

These individuals were expected to demonstrate their opposition to the use of drugs in sport both personally and through their work. They should be noted for their honesty,

integrity and independence and have the ability to withstand the stresses of working in a high-profile context. One stakeholder stated that visits to accredited laboratories had led to a conclusion of “*what a huge job it is ... Quite a daunting task to try and stay on top of it really*” (ID: S006). Stakeholders viewed the work of the scientific directors as multi-faceted and dynamic, “*a mixture of scientific knowledge and leadership, including the ability to communicate internally and externally*” (ID: S021). After considering the wide variety of skills and attributes seen as appropriate for a scientific expert working in this particular field, it was not surprising that one stakeholder reflected that he/she was “*not sure you [could] have all those in one person*” (ID: S025). Interestingly, when asked about what advice they would give someone who was about to apply for a position like theirs, one director had responded “*That was [an easy question.] – Don ’t!*” (ID: D006).

As will be seen in the next section, many of these expectations of the ‘ideal’ scientific director of an accredited laboratory have recently been formalised in the regulations relating to the role of the director as set out in the World Anti-Doping Agency’s (WADA) International Standard for Laboratories (ISL) (WADA, 2004b).

7.2.5 The regulated director

As stated in Section 5.2, global anti-doping efforts have given rise to the evolution of the WADA, an organisation responsible for achieving harmonisation of the many and disparate national and sports-based efforts to deal with doping in sport. WADA has developed and implemented a tri-level program (WADA, 2005c) comprising the formal policy frameworks of the World Anti-Doping Code, International Standards and Models of Best Practice (p. 6) as shown in Figure 7-1.

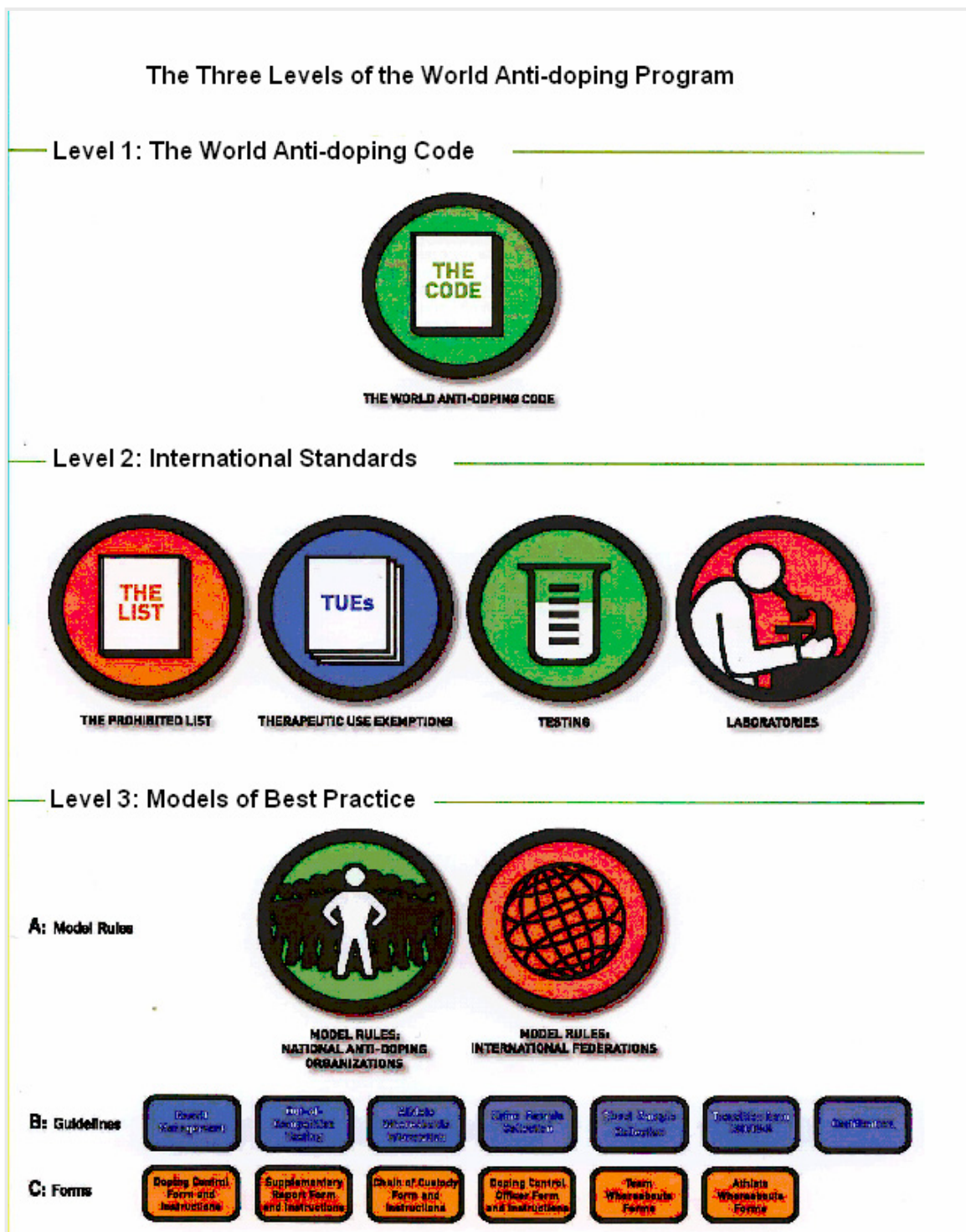


Figure 7-1: WADA’s tri-level Anti-Doping Program (WADA, 2005c)

The second level of these international measures have placed increased expectations on anti-doping workers through the implementation of international standards relating to the List of Prohibited Substances and Methods, Therapeutic Use Exemptions, testing processing and laboratories. WADA’s (2004b) International Standard for Laboratories (ISL) has impacted considerably on the work of the directors and replaced the accreditation

requirements that the International Olympic Committee (IOC) had put in place (see Section 5.2) that was in place until the end of 2003. The IOC's accreditation program had "relied on laboratory personnel to develop methods, validate methods, regulate, and issue certification for testing, to review and interpret test results, and testify to the accuracy of the process" (Black, 2001, p. 30). Black regarded this program as lacking "impartial peer review and critical inspection of analytical and forensic sample handling procedures" (p. 31). WADA's International Standard for Laboratories (ISL) addressed this situation.

Developed between November 2002 and June 2003 (WADA, 2004a, p. 4), the fourth version of the ISL was implemented from January, 2004. The ISL provided a detailed list of regulations and requirements for accredited anti-doping laboratories. Under the provisions of the fifty-seven pages of the ISL, an accredited laboratory's Scientific Director normally had the responsibilities of the Chief Executive (WADA, 2004a, Section 5.3.1.2, p. 25) including meeting WADA's accreditation requirements (WADA, 2004a, Section 4, p. 12-16) by

- providing an official letter guaranteeing administrative, financial and resources support from relevant national public authority responsible for the national anti-doping program
- providing official assurance of and demonstrating an ability to manage at least 1500 samples per year
- obtaining ISO 17025 accreditation as a testing laboratory to certify that the laboratory's analytical and technical, management and support processes are at a satisfactory performance level
- ensuring that laboratory personnel are adequately trained
- successfully analysing proficiency testing samples
- providing reports and documentation for adverse analytical findings (positive drug tests) as required to WADA and sporting federations in accord with the confidentiality requirements of WADA's code
- demonstrating evidence of research and development activities which will advance anti-doping science
- demonstrating willingness to share knowledge and the outcomes of research and development activities with other WADA accredited laboratories
- providing evidence of compliance with the provisions of WADA's Code of Ethics.

In summary, WADA's ISL set out the expectations that directors would ensure that their laboratories met both quality routine and research requirements, conducted their operations in an ethical manner and communicated with their colleagues. Laboratories that failed to meet these requirements would be suspended or have their accreditation revoked, depending on the situations (WADA, 2004a, Section 6.4, pp 40-44). Laboratories would be informed in writing of the reason, terms and duration of their suspension or revocation. WADA would also inform relevant public authorities, national anti-doping organisations, sporting federations, national and the International Olympic Committee of the laboratory's suspension / revocation of accreditation providing a copy of WADA's reasons when requested to do so in writing (WADA, 2004a, Section 6.4.9.3, p. 44).

WADA demonstrated its intention to implement this section of the ISL when it suspended the Korean accredited laboratory in 2004 (WADA, 22nd April, 2004). During 2003, the Korean laboratory had analysed the third lowest number of samples in 2003 with just over 1400 samples (WADA, 2004d). After the suspension of the Korean laboratory, a new director was appointed to take responsibility for the Korean accredited laboratory and the number of samples analysed annually by the laboratory increased to 1688 in 2004 (WADA, 2005a) and 2527 in 2005 (WADA, 2006a). In the light of the comments in Chapter Five about the role of sufficient sample numbers in ensuring a laboratory's proficiency, this increase in sample numbers could be expected go some way to promote proficiency within this laboratory. The views of the directors about such public enforcement of the ISL would be an interesting aspect to explore in future research.

Both stakeholder comments and the regulated expectations of WADA's ISL have flagged the changed nature of the work of the scientific directors in the increasing complexity of the socio-technical context that constitutes anti-doping work. In the next section, the additional aspects of the directors' work highlighted by these comments have been incorporated into a revised model for the dynamics of the work of these experts last presented.

7.3 A FURTHER REVISED MODEL OF THE DYNAMICS OF THE WORK OF THE SCIENTIFIC DIRECTORS

The presentation of stakeholders' perceptions of the work of the scientific directors of accredited anti-doing laboratories in this chapter confirmed the structure of the model developed through Chapters Five and Six and most recently represented in Figure 6.17. However, stakeholder data also pointed to need for the inclusion of additional elements which captured the critical role of communication between the directors and their stakeholders. When considering how to incorporate these elements into the research, the work of Ancona and Caldwell (1992) and the work of Oh, Labianca and Chung (2006) provided a number of insights.

Ancona and Caldwell's (1992) investigation of the external activities undertaken by groups led them to conclude that groups engaged to a varying degree in a number of strategies in dealing with their environment including:

- task-coordinator strategies aimed at using coordination, negotiation and feedback achieving "a tighter coupling with other organizational units, often filling many of the gaps left by formal integrating systems" (p. 659)
- scouting strategies aimed at "adding to the expertise of the group by updating the group's information base by providing new ideas about technologies and markets" (p. 659)
- ambassadorial strategies that provided them with "access to the power structure of the organization as [group] members promote the team, secure resources, and protect the team from excessive interference". (p. 659)

In the context of the dynamics of the work of the scientific directors, it would seem that the directors engaged in the first of these strategies in the course of their routine work, whereas scouting strategies were part of research activity and ambassadorial strategies part of their desire for greater involvement in governance.

Oh et al.'s (2006) investigation of group social capital found that in relation to group effectiveness, the optimal profile of a group was one where there was moderate closure and diverse bridging ties to other groups. Closure related to the

characteristics of the relationships among group members and by the overall social network properties of the group. In strong-closure (“closed”) groups, group members are connected by *strong, positive, multiplex* and *reciprocated* relationship ties; ... and the network is very dense. (p. 572)

Members of closed groups interacted both at work and socially and had little to do with other groups. They exhibited greater cooperation, greater conformity to agreed norms, greater information sharing and less tendency to engage in social loafing and opportunism. Such groups were able to provide both work-related instrumental and personal expressive benefits such as emotional support to members. Oh et al. (2006, p. 576) argued that groups that exhibited excessive group closure did not perform as well as other groups in which there was the moderate rather than strong closure that permitted group members to have reasonable sense of mutual accountability between members as well as external ties to a diverse range of other groups. Such ties involved external groups with knowledge and skills relevant to the group or facilitated the group’s influence over individuals in other groups from whom they could obtain political support.

In light of the work of Ancona and Caldwell (1992) and Oh et al. (2006), it seems that the needs of stakeholders for clearer communication to enhance leverage of the work of anti-doping scientists can be addressed through avenues for improved interaction between scientific and non-scientific anti-doping organisational groups (task coordination strategies), between anti-doping scientists and scientists working in other disciplines that have knowledge needed by anti-doping scientists (scouting strategies), and between governance bodies and anti-doping scientists (ambassadorial strategies). These elements have been represented in Figure 7-2 by the coloured arrows to the left and right of the objects of the directors’ work and below the box containing the trusted space. In Figure 7-2, task coordination interactions have been represented by the blue double headed arrows on the left hand side of the objects. These interactions are triggered by routine sample analysis, by the clarification and interpretation of positive doping results as well as discussion about unusual results or new scientific concepts. Green arrows represent the scouting strategies inherent in communication with external scientists. Ambassadorial interactions concerned with policy development and decision making have represented by the pink and red arrows on the right hand side of the diagram.

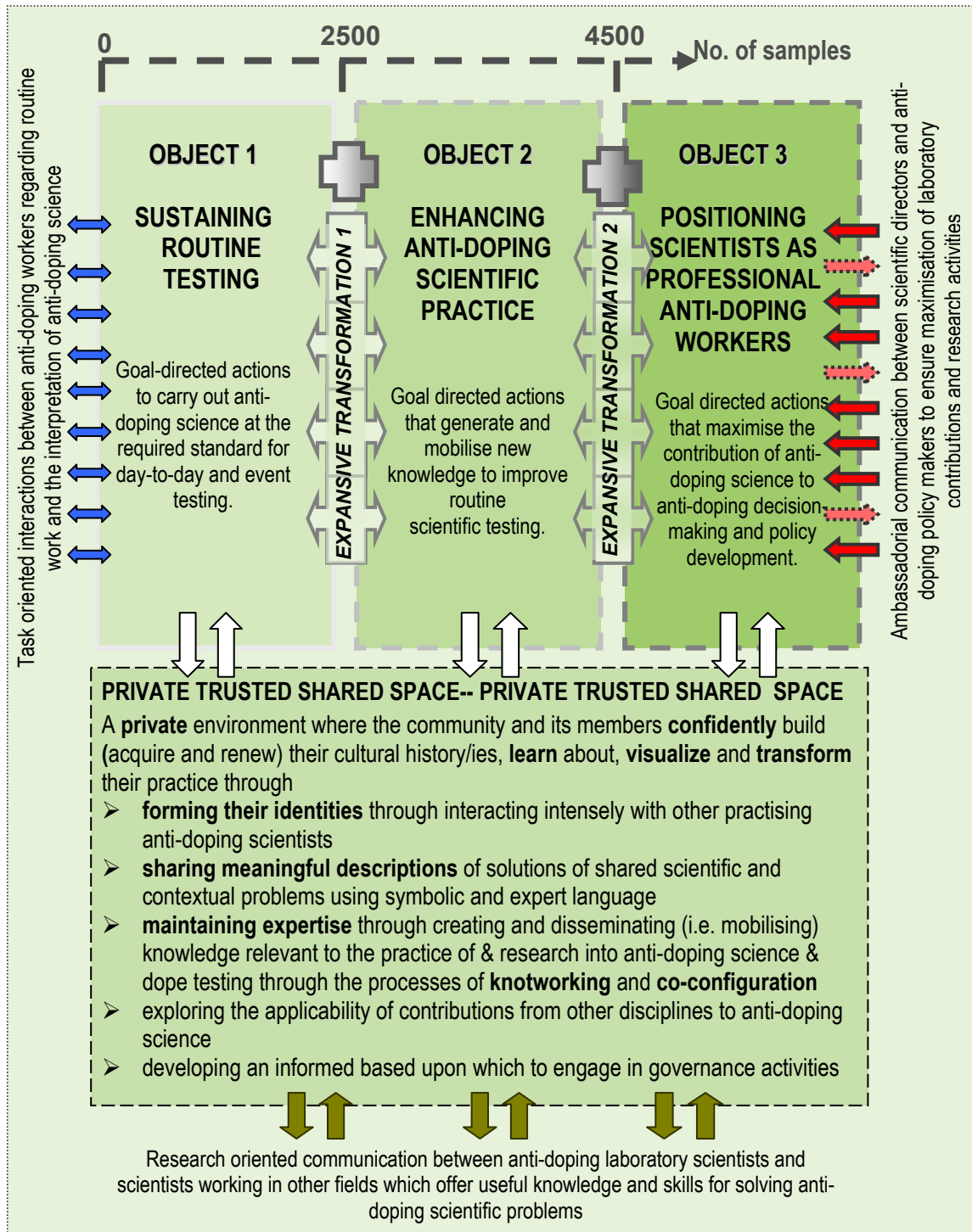


Figure 7-2: A final model of the dynamics of the work of the scientific directors

This research has indicated that there is a lack of certainty about the degree to which the scientific directors should be involved in such governance activities. This is indicated by the dotted black edge on the arrows heading from the directors to the policy developers and decision makers. Consequently these interactions are limited, as indicated by the lower number of these arrows. What is certain however is that the policies and decisions made by

external bodies do impact on the work of the laboratories as they are frequently in the form of formal requirements (as indicated by the red filled-edge arrows pointing from the policy and decision makers to the work of the directors. In an ideal situation, these arrows would be double-headed to indicate the mutually acceptable nature of interactions between the directors and anti-doping governing bodies. The interactions between anti-doping scientists and scientists working in other disciplines where anti-doping scientists scout for new knowledge to incorporate into their individual and collective knowledge base have been represented by green arrows placed at the bottom of the diagram beneath the box representing the trusted space.

Figure 7-2 draws on the frameworks of activity theory and communities of practice together with the *Cynefin* model of the sense making processes of organic knowledge management in evolving complex contexts to represent the elements of this activity. The model captures the multifaceted-ness of the directors' work and the restrictions placed on the director's work when only small numbers of samples are received for routine analyses. It highlights the critical role of a private trusted shared space in which the directors can explore, examine and transform their own individual and collective professional identities and their practice through the generation and validation of new knowledge through longitudinal co-configuration work before exposition in the high-profile public context within which they work. The model also identifies the varied nature of the communications between these scientists and the various members of their community during the day-to-day interactions of routine anti-doping work, the less-frequent involvement in governance activities and highly technical engagements with their external scientific peers. Looking back on the data and at the model, it seems that the anti-doping scientific community, including the directors have multiple, positive reciprocated interactions with each other and with external groups. In this way, they have, of their own accord, gone some way towards optimising the social capital of their community referred to by Oh, Labianca and Chung (2006) as there is moderate closure as demonstrated by the relationships between the directors described in Chapter Six and diverse bridging ties to other groups, as indicated by their collaborations with external scientists, also in Chapter Six.

7.4 CONCLUSION

In this chapter, stakeholders' views of the work of the scientific directors of anti-doping doping have been described, analysed and interpreted in the light of the theoretical frameworks of activity theory, communities of practice and the complexity based *Cynefin* model. Stakeholders indicated their considerable respect for the past contributions of these scientists, perceiving current anti-doping work as based on a foundation laid down over the years by the directors. Stakeholders identified the same objects for the directors' work as the directors themselves had done. Stakeholders pointed to the provision of accurate routine analyses as "the big stick" (ID: S017). They stressed the importance of research activity in order to enhance detection methods as the means of keeping up with athletes' ongoing attempts to use undetectable unacceptable means to enhance their performance.

The findings of this chapter also pointed to the perceived reliance of other anti-doping workers on anti-doping scientists. Stakeholders acknowledged the benefits that policy makers could obtain by tapping into the knowledge and experience of the directors. However, stakeholders also stressed the need for and importance of communication between the directors and the broader anti-doping community. Such communication was necessary to ensure that doping programs, research efforts and policy were advancing the cause of anti-doping. Additionally, lawyers identified the need for the directors to better understand and accept the requirements of the legal system, particularly in helping lawyers to understand the scientific background with which they dealing.

In effect, stakeholders highlighted the importance of optimising anti-doping efforts through finding better ways of leveraging the contextually relevant knowledge of anti-doping scientists through improved communication with the directors. When interpreted through the lenses of activity theory, communities of practice, this finding pointed to the need for a better understanding of the space in which the communication between anti-doping workers can be improved. Consideration of this space, that activity theorists refer to as a zone of proximal development in which tensions and contradictions stimulate the negotiated, or knotworked, evolution of new forms of activity; that exponents of communities of practice describe as a transformation stage and *Cynefin* proponents as the domain of disorder where consensus based on respect supports sense-making, is part of the *Cynefin*-based interpretation of the complex, evolving anti-doping context presented in the next chapter.

Chapter 8 THE CHANGING STATE OF PLAY: THE EVOLVING COMPLEXITY OF ANTI-DOPING WORK

Citius Altius Fortius / Faster, higher, stronger:
The motto of the modern Olympic movement.

(International Olympic Committee, n.d.)

8.1 INTRODUCTION

In Chapters Five, Six and Seven, the data elicited using the research design as set out in Chapter Four, was presented. The frameworks of activity theory, communities of practice and the complexity based *Cynefin* model of sense-making, described in Chapter Three, were integrated into the research and informed a higher level of analysis and interpretation of the data elicited from both the scientific directors and their stakeholders. Throughout the three previous chapters, these theoretical frameworks were incorporated into the grounded model for the dynamics of the work of the directors as experts in anti-doping science (see Figure 7-2). The emerging model from this research comprised

- up to three objects, depending upon the routine experience of the director: the more experienced directors worked towards more objects
- a shared, private, trusted space for innovation, knowledge exchange and refinement
- up to three foci for communication with stakeholders: routine matters, scientific research and governance aspects of anti-doping work

Throughout the study, interview data as well as frequent press releases from the World Anti-Doping Agency (WADA), numerous items in the media, symposia and conference attendance supported stakeholders' views that anti-doping activity was taking place in a complex, evolving international context. As the data for this research was elicited from participants between late 2002 and mid 2004, the sense of change in anti-doping work was a pervasive aspect of the research context. Increasingly doping in sport was being seen and addressed as a global issue. To paraphrase Nardi, Whittaker and Schwarz (2002) these new conditions and contexts for work call for a further examination with a view to expanding our theories. Both the complexity based *Cynefin* model of sense-making and activity theory have been used once again in this chapter to facilitate a deeper analysis of the data

relating to the changing environment of anti-doping work. The lens of the *Cynefin* framework has been employed to re-examine the history of anti-doping, thereby discerning the past and the present as a basis for a sound base for making decisions about the future, particularly those that must be made within the domain of disorder. Activity theory has been applied to understanding the interactions between anti-doping workers to find better ways to leverage the contextually relevant knowledge of these various groups to enhance the future of this complex, evolving, global context.

8.2 A COMPLEXITY INFORMED REVIEW OF EFFORTS TO CONTROL DOPING IN SPORT

WADA (n.d.-a) stated that doping in sport is “as old as competitive sport itself” (par. 1). Houlihan (2002) described the dispersed and varied approaches to performance enhancement in the ancient world: the Greeks used special varieties of mushroom to improve performance and included dried figs in their specialised diets, Roman gladiators took stimulants to overcome fatigue, and the Egyptians turned to the ground rear hooves of the Abyssinian ass. Delbeke (2000) stated that whilst there were periodic reports describing the use by athletes of caffeine, strychnine, opium, ether and alcohol between the mid 1800s and 1940, the first recorded death was probably that of cyclist Arthur Linton in 1886. The collapse of American athlete Tom Sticks at the 1904 Olympics followed his use of a combination of brandy and strychnine. In the latter half of the twentieth century, anabolic steroids, blood doping by transfusions, erythropoietin (EPO), human growth hormone and other drugs had made their way into the athletes’ pharmacopoeia. In a general discussion during the first Conference on Ethics and Social Science Research in Anti-Doping, Dr Christophe Brissonneau (2006) drew on his research into road cyclists’ perceptions about health and pharmaceutical substances, to comment that some athletes referred to their doping related behaviour as “pharmacological training”. The early 21st century has already seen the advent of designer steroids and the prospect of gene doping. Houlihan (2002) remarked that

In general, wherever and whenever the outcome of a sporting competition has involved status, money or other similar rewards, attempts have been made to seek an advantage through doping. From the standpoint of the beginning of the twenty-first century, the methods and substances seem crude and of questionable value but the motive provides an indelible link between the centuries. (Houlihan, p. 33)

In contrast to doping, anti-doping work has had a relatively short history, beginning in the 20th century (see Section 5.2). When viewed from the macro-level of the international perspective, doping in sport has presented anti-doping workers with a complex problem situated in a turbulent and uncertain environment, a problem that has resisted being solved by traditional problem solving methods, a ‘wicked’ problem (see Section 2.3.1). In Section 2.4, research by Lach, List, Steel and Schindler (2003) into the role of North American environmental scientists in decision-making was noted. In their research, Lach et al. referred to the work of Freeman when they described wicked problems as

having ‘multiple definitions as to their nature’, ...[as] the object of several and conflicting criteria for defining solutions, ... [as having] ‘solutions’ that become ‘problems’ for others, and ‘...[with] no obvious stopping rules that define when enough has been accomplished’. (2003, p. 173)

Subsequently, the solutions to wicked problems such as the environmental issues studied by Lach et al. and doping in sport required the efforts of multiple stakeholders who combine their efforts and work towards a common goal. The content of the previous three chapters indicated that attempts to control doping in sport have resulted in the efforts by multiple groups of anti-doping workers: scientists in accredited laboratories as well as general anti-doping practitioners in national and international anti-doping agencies and sporting organisations.

Efforts to harmonise the work of these groups internationally has only come about over the last seven years, since the 1999 Lausanne Declaration on Doping in Sport (WADA, n.d.-b) resulted in the formation of the World Anti-Doping Agency (WADA). Following its formation in 1999, WADA facilitated the development and international acceptance of the World Anti-Doping Code, a code that came into force on January 1, 2004 (WADA, n.d.-c). It also developed international standards for testing programs, accepted in June 2003 (WADA, 2004c), and for the accredited laboratory system, accepted in August, 2004 (WADA, 2004b).

Before presenting a Cynefin based interpretation of the evolution of anti-doping work, a simplified representation of the Cynefin framework has been provided in Figure 8-1. This representation has placed emphasis on the processes of sense-making in the various stages of problem solving and has been applied to each of four strategies of anti-doping work to be interpreted through the lens of the Cynefin framework in the following sections

- Strategy A: The introduction of rules:
‘Don’t do it!’
- Strategy B: The development of scientific methods to detect doping:
‘The accredited laboratories will tell us if you do it!’
- Strategy C: The development of national and sport-based testing programs
‘We educate, test and sanction our athletes.’
- Strategy D: The international harmonisation of anti-doping work
‘We have harmonized doping control in sport!’

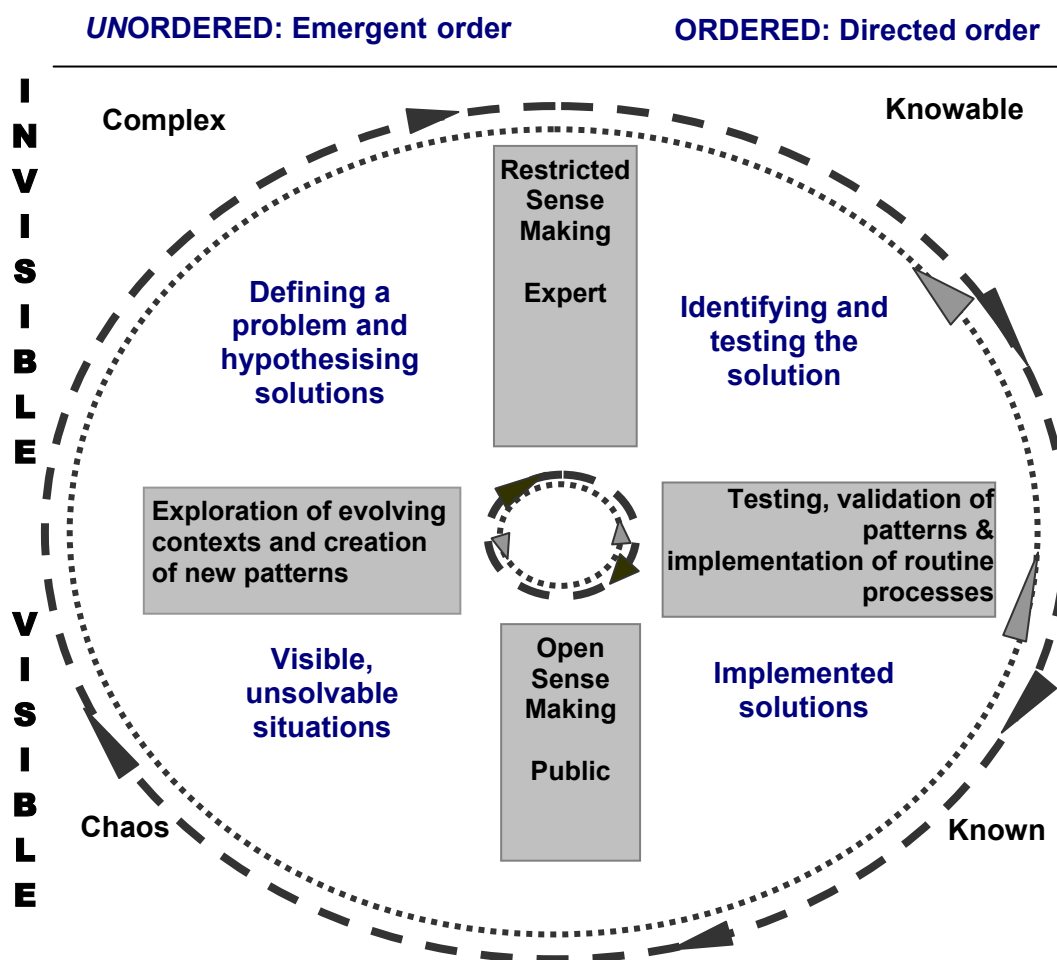


Figure 8-1: A simplified version of the Cynefin framework

8.2.1 Strategy A: ‘Don’t do it!’

Whilst drugs were used to enhance athletic performance during the late 1800s and early 1900s, WADA (n.d.-a) asserted that it was not until the 1920s that “it had become evident that restrictions regarding drug use in sports were necessary” (par. 2). The first use of rules

to prevent drug use by athletes in modern times occurred in 1928 when the International Amateur Athletic Federation (IAAF) introduced rules which banned doping in athletics (WADA, n.d.-a). Other sporting federations followed suit during the late 1920s and 1930s but such regulations proved ineffective due to the absence of any means of determining whether or not athletes were breaching the regulations. Athletes continued to use banned drugs to enhance their performance.

From the Cynefin perspective,

- Noticeable doping in sport presented a visible chaotic situation to sporting organisations, situating decision making in the lower left quadrant of the framework in Figure 8-1 on the previous page.
- Organisations decided to use a regulatory framework to impose visible order through the public implementation of this justifiable in the lower right quadrant of Figure 8-1. Doping was a medically dangerous activity, counter to the spirit of sport and the rules reflected this view.

The graphical representation of these statements has been summarised below Figure 8-2. The strategy was the initial element in efforts to control drug abuse in sport.

The problem of doping in sport was not solved by this approach, signalling the need for an alternate strategy for transforming this visibly chaotic situation into a visibly ordered one. This second strategy involved the use of analytical science as a means of enhancing the effectiveness of the anti-doping regulations previously developed by some sporting organisations.

8.2.2 Strategy B: ‘The accredited laboratories will tell us if you do it!’

In the early 1960s a few laboratories in Europe began to develop methods for detecting drug use by athletes (Delbeke, 2000, p. 83). Whilst the regulatory framework and the new field of anti-doping science situated decision making in the lower right quadrant of Figure 8-1, its implementation was not immediate. Rather, the expansion of anti-doping activity was a gradual process.

At its 1963 meeting a subcommittee of the International Olympic Committee (IOC), the European Council of the Biological Preparations of the Athlete Taking Part in Competitive Sports recommended that the IOC

establish an international commission whose purpose would be to (1) educate officials and athletes about the dangers of doping, (2) study the behaviour of

athletes involved in doping, and (3) appoint a permanent board charged with keeping track of doping methods and keeping a list of proscribed drugs and activities. The council further (argued) in favour of drug testing for artificial stimulants, tranquilizers, drugs that modify the blood pressure or respiratory action, and hormones. (Todd & Todd, 2001, p. 67)

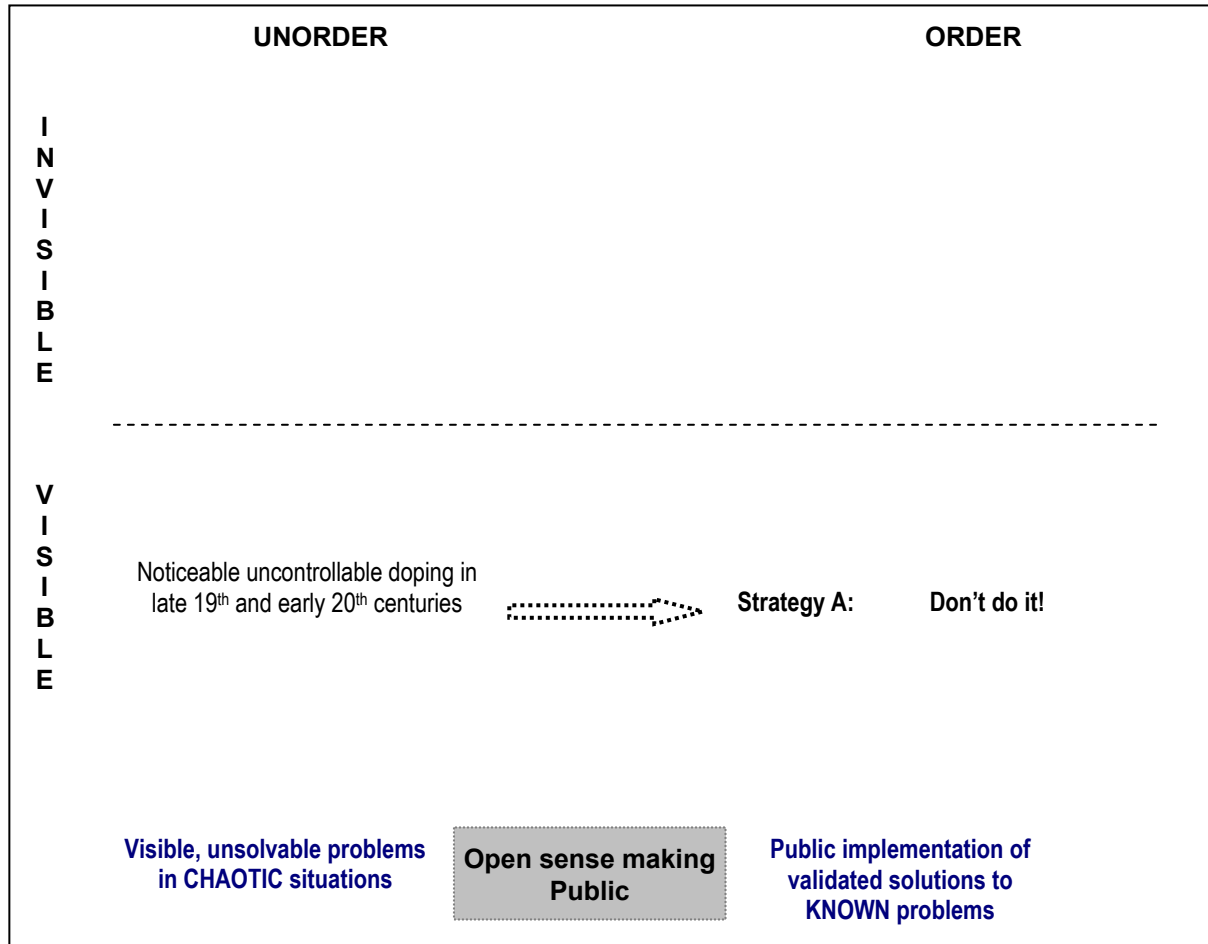


Figure 8-2: Enforcing order: An initial strategy to control drug abuse in sport

According to Todd and Todd (2001).the following year, the IOC formally condemned the use of drugs in sport, decided to sanction those individuals or national organizing committees who promoted drug use, asked athletes to sign a pledge on non-drug use as part of their application process for participation in the Olympic Games and asked national organizing committees to inform athletes that they would be subject to medical examination and testing. Todd and Todd went on to state that in 1965, France and Belgium passed laws which prohibited doping in sport, becoming the first governments to do so. The same year the Union Cycliste International (UCI) introduced regulations that gave their officials:

the right to take samples from ‘refreshments’ or the riders’ ‘bodily fluid’, for the purpose of chemical analysis ... (and introduced) a schedule of sanctions ...: first offence, a fine of FF 1,500; second offence, FF 4,500; third offence, withdrawal of the licence. (UCI, 2001, p. 5)

The Federation Internationale de Football Association (FIFA) was also among the first international federations to introduce doping tests in their respective World Championships. In 1966, the International Association of Athletics Federations (IAAF) formally announced that it would introduce drug testing for track-and-field competitors at both the Olympic Games and the European Championships (Todd & Todd, p. 68). Throughout the 1970s, most International Sports Federations introduced some form of drug testing at major events, although history was to prove that these efforts were insufficient.

In 1967, the IOC announced that it would have a medical centre at the 1968 Olympic Games in Mexico. Here doctors would check for the use of drugs by athletes (Todd & Todd, 2001). The IOC conducted drug testing at all subsequent Olympic Games, although an organised approach to doping control processes was not initially apparent. Todd and Todd described claims by Dr. Irving Dardik of the United States Olympic Committee that the dope testing done at the 1976 Montreal Olympics was inconsistent, with

some of the tests ... conducted by the various sport organizations. ... [One American athlete] was tested twice at the Games, on the day he arrived and the day after his event, but the IOC did not officially test him even though he won. (Todd & Todd, p. 75)

By 1977, the development of dependable and sufficiently robust analytical methods for drug detection led to the Prince de Merode, a member of the IOC’s Executive Board, discussing with the IOC the need for IOC-approved drug testing laboratories throughout the world (Todd & Todd, 2001, p. 76). In 1981, doping control efforts took a step forward when the IAAF not the IOC, introduced a laboratory accreditation process, in order to ensure “a high level of testing and avoid any uncertainty concerning the results obtained” (International Olympic Committee, 1999, p. 3). Within months, the IOC recognised the IAAF process and the laboratories the IAAF had accredited and, in May 1981, met with the IAAF to transfer responsibility for the dope testing accreditation system. The IOC’s Medical Commission appointed a Doping Sub-Commission to oversee the accreditation system and the list of prohibited and detectable substances. Four scientific directors were appointed to the committee, thus establishing a communications channel between the laboratories and their overseers. By 1983, 7 laboratories were accredited by the IOC to carry out sports drug testing. By 1986, this number had increased to 18 and since then the

number has grown steadily through 25 in 1996 to 33 at the beginning of 2006. The number of samples analysed by the accredited laboratories has increased from 106,561 in 1996 to 169,187 in 2004 (WADA, 2005d). This committee oversaw the laboratory accreditation system and the conduct of doping control during the Olympic Games.

The evolution of the IOC's accredited doping control laboratory system indicated the acceptance and institutionalisation of the contribution of science to the problem of doping in sport. Because amphetamines and steroids were not the only type of drugs that athletes abused, research into the identification, development and implementation of routine tests for other substances of abuse has instigated repetitions of the Cynefin sense-making cycle to keep pace with the ongoing need for knowledge, knowledge creation, knowledge management and knowledge mobilisation within the laboratory system. For example, the use of anabolic steroids was first reported in the 1952 Helsinki Olympic Games (Delbeke, 2000, p. 82) and has continued ever since, especially in strength events such as weightlifting. The widespread use of steroids by athletes including East German athletes during the late 1960s and 1970s presented sporting organisations with another chaotic doping problem. Following the development and introduction of a reliable test method in 1974, the IOC added anabolic steroids to its list of prohibited and detectable substances in 1976. Repeated with other banned substances, these knowledge mobilisation processes in the anti-doping science, in activity theory terms, represented the ongoing expansive visibilization of the activity of doing doping control scientific work (see Section 6.6).

In terms of the Cynefin framework, in scientists' investigation of the chaotic problem of doping in sport represented a clockwise journey from chaos to the known summarised in Figure 8-3. Scientists with an interest in the scientific aspects of the problem redefined the situation in terms of their own knowledge expertise moving it away from the lower left quadrant of the Cynefin framework in Figure 8-3 and into the invisible, upper left quadrant where it represented a complex problem whose threads they were to investigate and untangle. At the same time the scientists developed an expert language in which they communicated about this new area as they slowly unravelled previously hidden patterns. Scientists then hypothesised solutions to this complex problem in scientific terms.

As scientists tested possible solutions with a view to developing and validating reliable and robust analytical methods of drug detection, the problems of detecting doping were shifted towards the knowable but still publicly invisible upper right hand quadrant in Figure 8-3.

Working behind laboratory doors, the scientists converted the complex into the knowable, making sense of the pharmacological effects of taking particular drugs and identifying and testing solutions.

Continued scientific efforts tested and validated the robust analytical techniques needed for the implementation of routine drug testing to detect athletes' usage of the various banned drugs. In this way, the invisible use of science to detect the use of amphetamines, added to existing regulations resulted in a publicly visible strategy to solve the problem of doping in sport situated in the lower right hand quadrant of Figure 8-3.

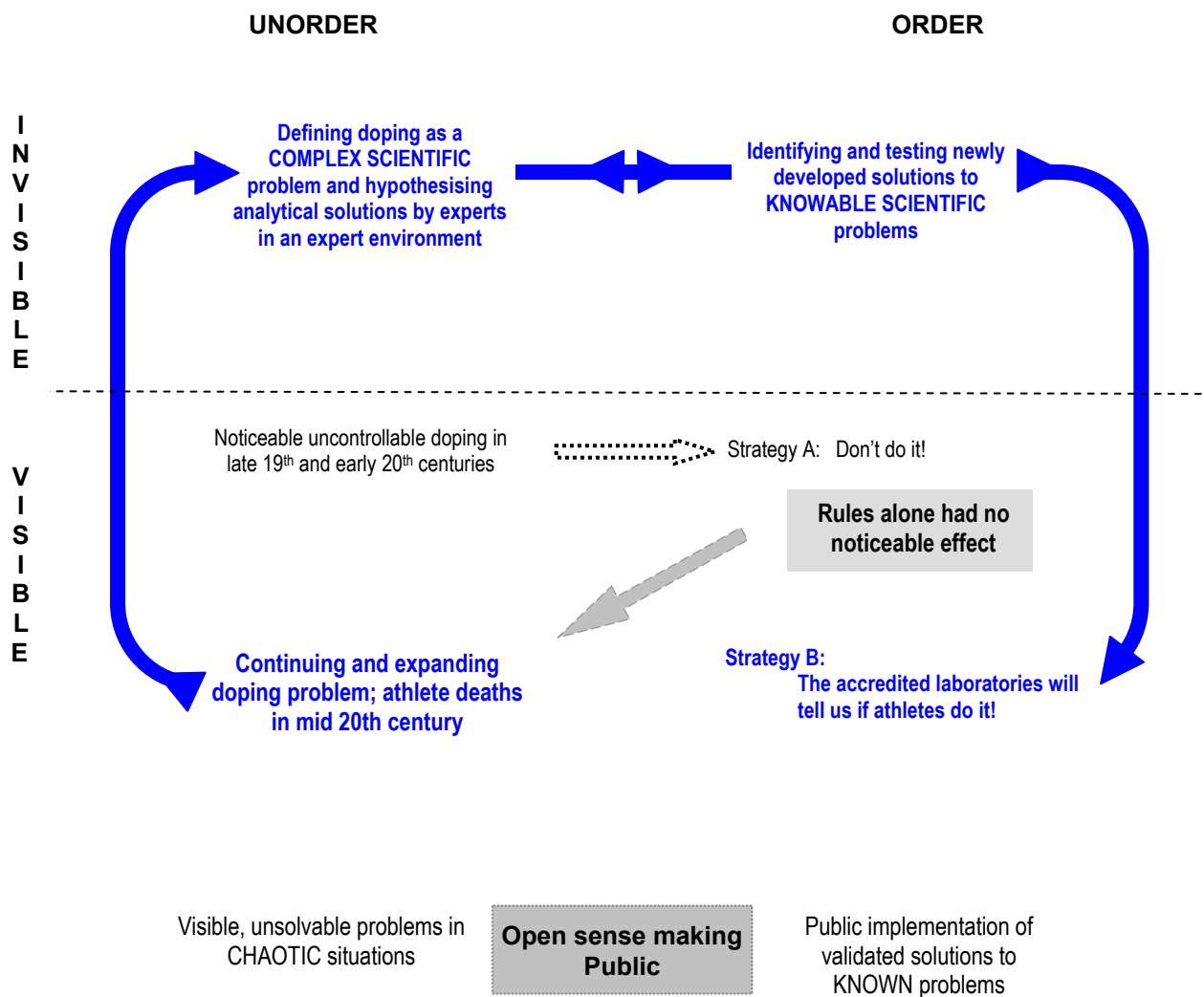


Figure 8-3: A second anti-doping strategy: Accredited analytical laboratories

However, science did not prove the final strategy to solve the problem of doping in sport. Ben Johnson's positive drug test at the 1988 Seoul Olympics (Waddington, 2000, p. 56) raised public awareness of doping in sport. Consequently, from the late 1980s,

governments began to look at the continuing problem more closely and general, non-scientific anti-doping strategies emerged as efforts by governments and particular sports to control doping continued to evolve. These will be discussed in the next section.

8.2.3 Strategy C: ‘We educate, test and sanction our athletes.’

Whilst some sporting organisations had rules in place to ban doping by their athletes and scientists had developed analytical techniques to determine whether or not an athlete had used particular drugs to enhance their performance, dope testing programs that organised regular sample collection were few and far between. Athletes were often tested only when they participated in the Olympic Games or a world sporting championships. Nor were athletes being educated about the dangers of doping in sport. Disquiet about these issues eventually defined another aspect of the chaotic problem surrounding doping in sport: the need for organised national and sport-based policies and programs through which athletes would be educated about doping, regularly tested for drug use both during competition and away from competition during training, and sanctioned for doping offences. During the late 1980s and 1990s, as scientists continued to develop more and better analytical methods for detecting doping, some sporting federations and national governments developed strategies for anti-doping education and programs for athlete testing. Additional sanctions were put in place for those athletes who tested positive for performance enhancing substances. Todd and Todd (2001) stated that at the UNESCO Conference in 1988, 100 countries approved a charter that provided the guidelines for governments to combat doping in sport (p. 92) and that the IAAF, following on its earlier efforts which triggered the establishment of doping control laboratories, hosted the 1989 World Symposium on Doping in Sport (p. 94). In 1988, a Standing Committee of the Australian Senate looked at the issue of drugs in Sport (Black, 1990) leading to the 1990 establishment of the government supported Australian Sports Drug Agency (ASDA). Governments in some other countries also establish agencies which would oversee anti-doping work in their country, e.g. New Zealand established the New Zealand Sports Drug Agency (NZSDA) in 1993. On the other side of the earth, the Council of Europe approved an Anti-Doping Convention (1989) whilst Canada, which had introduced dope testing its athletes in 1984, initiated the Dubin Royal Commission to examine the issue of doping in sport as part of the aftermath of the disqualification of Ben Johnson from the 100 metre sprint at the Seoul Olympic Games.

By the late 1980s some sports had also organised testing programmes which included organised sample collection, analysis and results management and sanctions within their sports. For example, cycling's UCI noted that its doping control efforts had continued to "multiply and intensify, as is shown by the detailed list of measures taken in this respect between 1991 and 2001" (UCI, 2001, p. 6). To paraphrase the UCI's earlier words, the time had ripened. WADA noted that "there is an evident connection between more effective test methods and a remarkable drop in the level of top results in some sports in the 1990s, notably in track and field athletics" (n.d.-a, 'Tests begin to work', par. 2).

These efforts to educate, test and sanction athletes represented a third strategy in the evolution of a complex socio-technical system to tackle drug use in sport represented an additional attempt to journey from the domains of visible chaos to visible order when viewed through the lens of the Cynefin framework:

- In spite of anti-doping rules and accredited doping control laboratories, the insufficient numbers of analyses resulted in the continuation of a visible out-of-control doping situation in sport – the lower left quadrant in Figure 8-4.
- The definition of the problem in terms of education and testing programs moved decision making relating to the development of solutions to the invisible offices of administrators. In consultation with the directors of accredited laboratories and representatives of sports/governments already carrying out doping control work, policies and procedures evolved that could tested for widespread implementation by the governing bodies of a particular sport or nation as a means of ensuring athletes were tested regularly – the upper left and right quadrants of Figure 8-4.
- The acceptance and implementation of these education and testing programs, together with the rules of various sporting laboratories provided a public tri-level strategy for addressing the problem of doping in sport – the lower right corner of Figure 8-4.

These points have been summarised in Figure 8-4.

However, as has been discussed in the next section, these measures were not enough as doping issues in sport continued to be regarded publicly as a chaotic situation.

8.2.4 Strategy D: 'We have harmonized doping control in sport!'

The persistence of doping practices by elite athletes from a number of different nations and in a variety of sports and considerable variation in the manner in which doping was handled by government and sporting organizations around the world, resulted in the

recognition of another chaotic problem for anti-doping workers: that of achieving international consistency amongst anti-doping efforts in sport. In 1994, a number of countries (Australia, Canada, New Zealand, Norway, Sweden, the Netherlands and the United Kingdom) signed the International Anti-Doping Arrangement (IADA) which signalled the beginning of organised international co-operation in anti-doping matters. This agreement aimed to improve the high-quality anti-doping programs of individual countries and sports through a process of harmonisation. By so doing, Todd and Todd (2001) remarked that these countries hoped that their examples of good practice would have a positive influence on the international sporting community.

The situation where the IOC tested athletes participating in the Summer and Winter Olympic Games, and some governments and sporting organisations developed their own anti-doping programmes had resulted in discrepancies between, inconsistencies within and confusion about anti-doping efforts. In its publication 'A Brief History of Anti-Doping', WADA (n.d.-a, 'United efforts', par. 1) commented that "one result of this confusion was that doping sanctions were often disputed and sometimes overruled in civil court". Whilst there was a plethora of approaches to anti-doping programs, all efforts utilised the IOC accredited laboratory system.

Growing concerns about doping in sport and the problems in anti-doping work led to the establishment in late 1999 of a world body, WADA, whose efforts have been directed towards the harmonisation and extension of anti-doping efforts on an international basis (WADA, n.d.-a, n.d.-b). The resulting World Anti Doping Program encompassed a Code, international standards, and models of best practice (WADA, 2003a, p. 1), all of whose development involved stakeholder participation (WADA, 2003b, par. 3). WADA's stated purpose was:

- To protect Athletes' fundamental right to participate in doping-free sport and thus promote health, fairness and equality for Athletes worldwide; and
- To ensure harmonized, coordinated and effective anti-doping programs at the international and national level with regard to detection, deterrence and prevention of doping. (WADA, 2003a, p. 1)

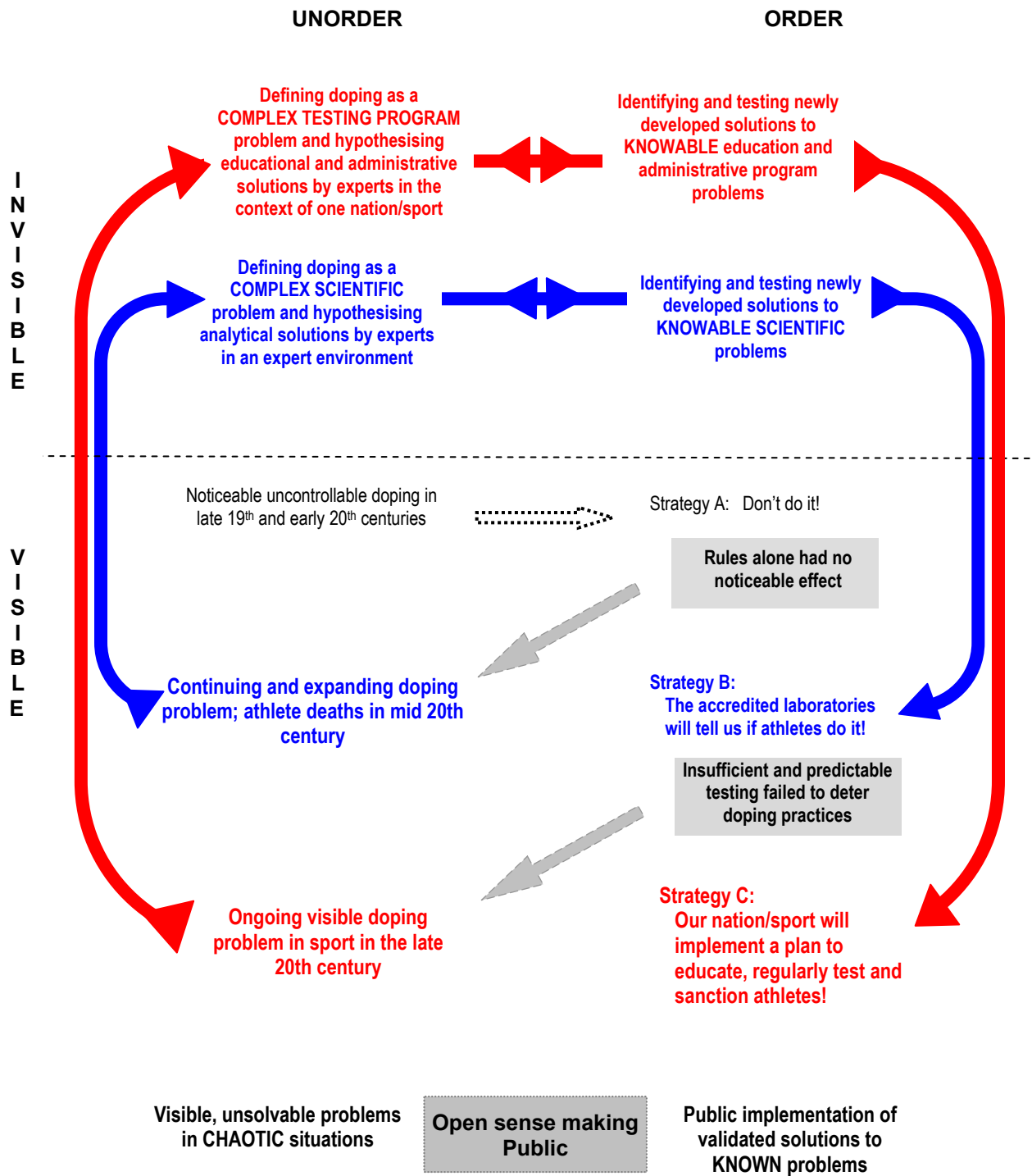


Figure 8-4: The third anti-doping strategy: National or sports-based programs

The Code was the “core document that provides the framework for anti-doping policies, rules, and regulations within sport organizations and among public authorities” (WADA, 2003b, par 2). The Code also set out the sanctions that athletes, teams and sporting bodies incurred when they were convicted of a doping offence (WADA, 2003a, Articles 10, 11 & 12) as well as setting out the process for legal appeals against such doping convictions

through either a nationally organised impartial and independent body, in the case of national-level athletes, or the Court of Arbitration for Sport (CAS) in the case of international-level athletes (WADA, 2003a, Article 13, Sections 13.2.1 & 13.2.2, p. 38). The Code's signatories (WADA, 2007) reflected the international nature of anti-doping work as they were drawn from international sporting federations, major games organizations, national anti-doping organizations, national Olympic and paralympic committees. At a governmental level, 184 governments (WADA, 2006c) signed the Copenhagen Declaration on Anti-doping in Sport presented at the World Conference on Doping in Sport in March 2003. This declaration signals the intention of these governments to "formally recognize and implement the World Anti-Doping Code" (WADA, 2006b, par. 1). In late 2005, WADA "welcomed with great satisfaction the unanimous adoption of the first International Convention against Doping in Sport by the General Conference of UNESCO, at its plenary session" (WADA, 2006e, par. 1). This UNESCO convention resolved a situation which had prevented many governments from being legally bound by the non-governmental nature of the World Anti-Doping Code. At the time of writing, the convention was open for ratification by governments and six governments were listed (<http://www.wada-ama.org/en/dynamic.ch2?pageCategory.id=484>, 7th February, 2006) as having ratified the convention. The International Olympic Committee (IOC) expressed its support for WADA's efforts:

Jacques Rogge, the president of the International Olympic Committee, has stated numerous times that there is no place at the Olympic Games for those sports that do not accept the World Anti-Doping Code, a statement confirmed by changes to the Olympic Charter. (WADA, 2004e, p. 14)

The integrity of the doping control process was addressed by the International Standard for Laboratories (WADA, 2004a) and the International Standard for Testing. The former aimed to "ensure production of valid test results and evidentiary data and to achieve uniform and harmonized results and reporting from all accredited laboratories" (WADA, 2004b, par. 1). The latter set out to "plan for effective testing and to maintain the integrity and identity of samples, from notifying the athlete to transporting samples for analysis" (WADA, 2004c, par. 1). Since 2000, WADA sent teams of Independent Observers to major sporting events such as the Olympic and Commonwealth Games to ensure that doping control is carried out properly.

The addition of this fourth international strategy through the emergence of WADA represents the culmination of current efforts to control doping in sport at this time. In terms of the Cynefin framework the evolution of this additional anti-doping strategy can be interpreted as follows:

- The continuation of a public chaotic situation in doping in sport where only some sports and governments had implemented education and testing programs. International public confusion about discrepancies and inconsistencies between these programs – the context was situated in the lower left quadrant of Figure 8-5.
- The definition of the problem as an international social issue that required consistent, ongoing effort across all nations and sports moved the context to the invisible upper left quadrant of Figure 8-5 where it would be dealt with through international political channels.
- The identification, negotiation and trialling of strategies by WADA for a global approach to addressing inconsistencies and discrepancies between nations and sports relating to the problem of doping in sport – the context was moved to the upper right quadrant of Figure 8-5,
- The public, consistent application of WADA’s strategies – the context was moved to the lower right quadrant of Figure 8-5.

This interpretation has been represented in Figure 8-5. The four strategies represented by the ‘tracks’ in Figure 8-5-and its predecessors represent the current state of play in the complex context of anti-doping work in sport. As well as demonstrating the historical evolution of anti-doping work, they give further indication of the evolving complexity this context and insight into the dynamics of the efforts of those who work in the area. Whilst each group of anti-doping workers concentrates on their own scientific or general anti-doping activity, they are also part of a collective effort to combat drug abuse in sport. Under WADA’s tri-level strategy of the code (see Figure 7-1), international standards for laboratories and testing, together with models of best practice for national / regional agencies and sporting organisations, anti-doping efforts currently consist of four interconnected approaches to anti-doping work. Both time and further research are necessary to determine the ability of WADA’s strategy to make sense of and sound decisions in the domain of disorder that is at the heart of the complex evolving milieu of anti-doping work.

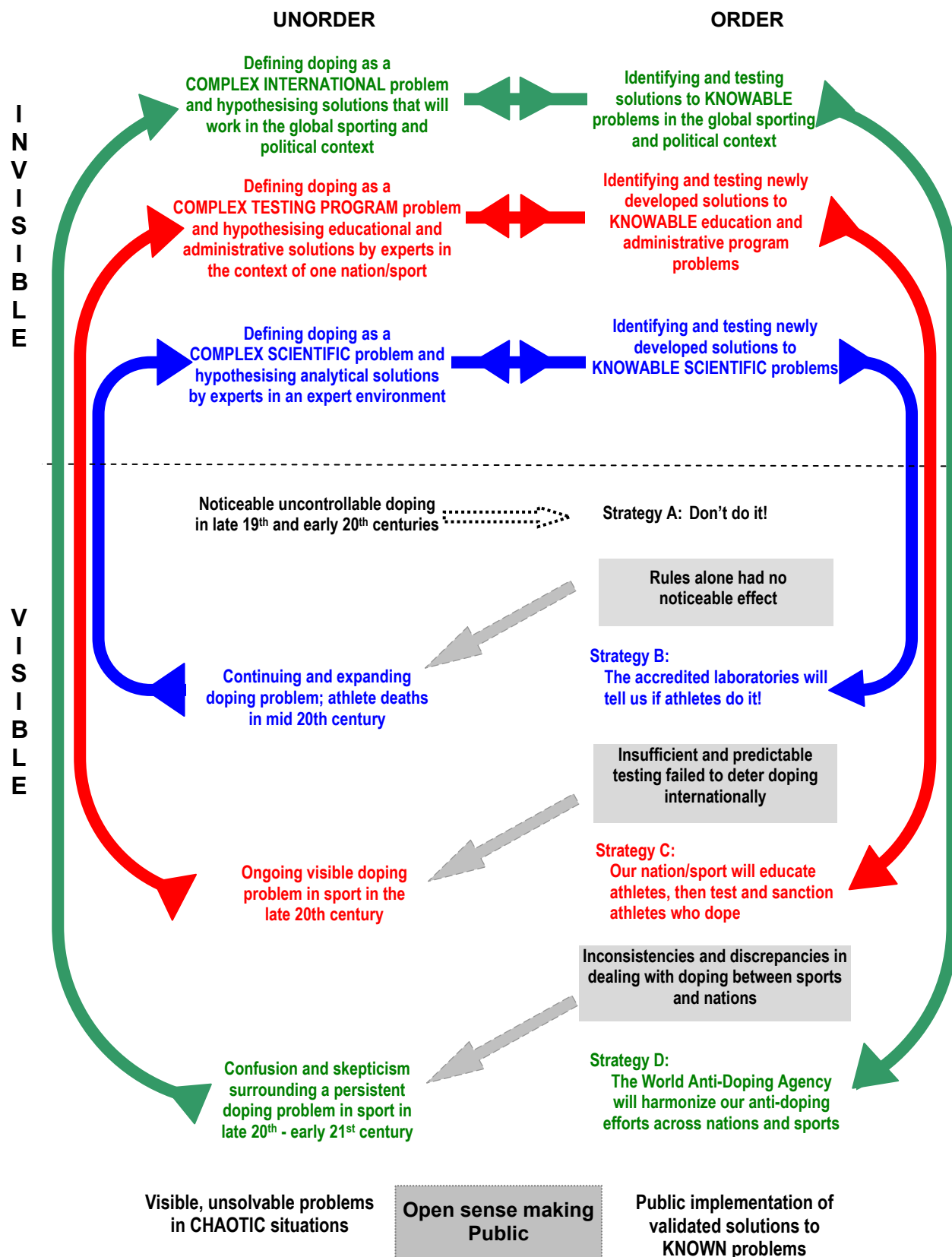


Figure 8-5: The fourth anti-doping strategy: International harmonisation

Anti-doping efforts have brought together diverse groups of professionals and their organisations and necessitated interactions between diverse groups of professionals. While

further research is needed to investigate these interactions, one could hypothesise that to gain leverage from the group-based knowledge about anti-doping work, this increased number of anti-doping workers corresponded to an increase in interactions between these stakeholders. This has been represented in Figure 8-6 using multiple web-like globes. Whilst simplistic, this diagram highlights the complexity and the challenges in attaining effective communication between the stakeholders working in this area. This issue has been examined using third generation activity theory in the next section.

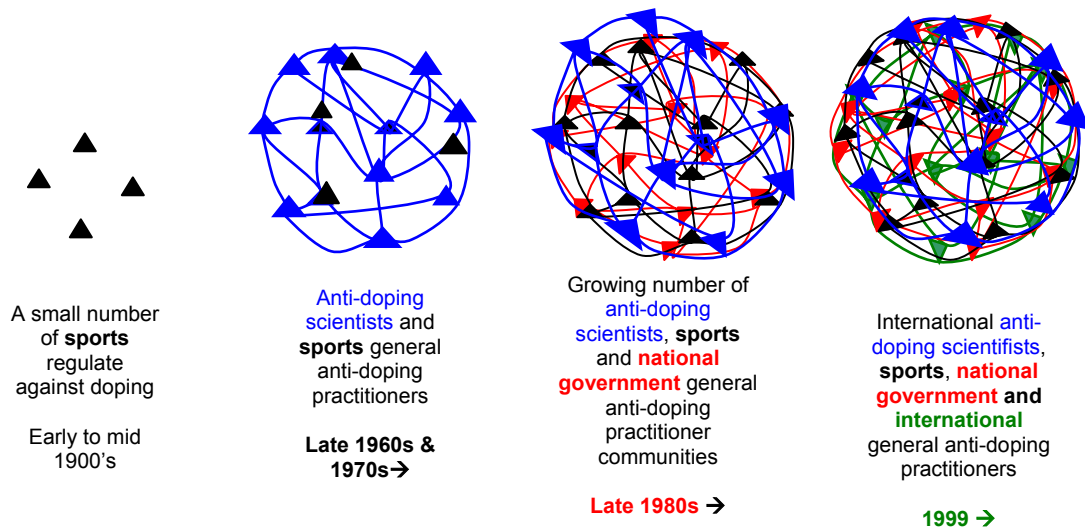


Figure 8-6: Growing interactions between anti-doping stakeholder groups

8.3 AN ACTIVITY THEORY PERSPECTIVE ON CHANGING ANTI-DOPING WORK

As indicated in Section 3.2.1 and in Section 6.6, third generation activity theory proved a suitable framework for analysing contexts where multiple activities were directed towards a common object. A number of activity theorists including Daniels (2004), Engeström (2001a), Hasu (2000) and Kontinen (1999) used the model of interacting activity systems (see Figure 4-8) to explore the development by stakeholders of jointly constructed objects which are collectively meaningful (Engeström, 2001a, p. 136). In Engeström's case, work was conducted with health practitioners from various fields in a children's hospital whereas Daniels' investigation was concerned with "the learning of professionals in the creation of new forms of practice, which required joined-up solutions to meet complex and diverse client needs" (Daniels, 2004, p. 185). Daniels went on to describe the use of third generation activity theory as a means through which researchers could "develop conceptual

tools to understand dialogues, multiple perspectives, and networks” (p. 189). Together with Warmington and other colleagues (Warmington et al., 2004; Warmington et al., 2005), they coined the term ‘inter-agency working’ to describe the processes engaged in by the subjects of two or more activity systems as they co-constructed an object. This concept drew on Victor and Boynton’s (1998) work on innovation (see Section 2.3.1) which indicated that co-configuration work took time and particular knowledge and skills. Victor and Boynton argued that the ability to do such work was based on a deep familiarity with and understanding of the work, a knowledge that resulted from the tacit, articulated, practical and architectural knowledge associated with small scale craft work, mass production, process enhancement and mass customisation. In effect, it began with achievement on a smaller scale.

Each of the groups involved in anti-doping work, the general anti-doping practitioners in anti-doping agencies and sporting federations as well as the scientists has an activity system with its own subjects, tools and (multiple) object(s). However, because each activity system is involved in anti-doping work, its social infrastructure includes some rules that are shared with other anti-doping activity systems, some common community members and agreement about the division of labour in the broad context of anti-doping endeavours. There are situations where different groups of anti-doping workers work together and at times cross the boundaries of their roles and responsibilities to efficiently and effectively co-construct shared objects. Examples of such joint undertakings include the development of the doping control processes for a large sporting event, or a national anti-doping program. In the case of a sporting event, the event’s sport-based organisers, both international and national, a collection agency (often the national anti-doping agencies), and at least one accredited laboratory negotiate and collaborate in achieving a successful doping control program for the event. Similarly, during the development of a national anti-doping program, national anti-doping workers together with sporting bodies and an accredited laboratory work together to set in place an achievable program for their particular context. Such activities are short lived and comparable to those investigated by Daniels and other activity theorists referred to in the previous paragraph. Consequently, the concepts of third generation activity theory, interagency working and co-configuration are relevant to the joint work of anti-doping practitioners.

The perceived inconsistencies and discrepancies of international anti-doping efforts described in Section 8.2.4 suggest that prior to the formation of WADA as the international

harmoniser of anti-doping work, various groupings of anti-doping workers located throughout the world, did not yet share a common object. At best they shared a common outcome. In the last five to six years, efforts to harmonise anti-doping work internationally have involved the development of international policies through interaction between representatives of national governments, anti-doping agencies, sports organizations, accredited laboratories and other experts. These efforts have been directed towards developing a model for anti-doping work that is internationally accepted and implemented and are changing the work of anti-doping practitioners. In effect, WADA could be regarded as overseeing the construction of a shared object of controlling doping in sport on an international basis through engaging with the myriad of groups involved in anti-doping work throughout the world. A representation of the third generation activity theory to model the international, multi-organisational, publicly oriented context of anti-doping efforts is given in Figure 8-7.

From an activity theory perspective, each subject of an activity system envisages the object through their own particular cultural history; in the case of a shared object, that object is perceived through the subject's own cultural history and activity system. To achieve the desired result of control of doping in sport through harmonised, global anti-doping efforts, anti-doping activity requires an object that has the stability, balance, flexibility and energizing qualities that Kaptelinin (2005, p. 17) listed as being preliminary criteria for successful objects. It requires that the various organisations involved in this work co-configure the shared object using similar techniques to those employed by anti-doping scientists to co-configure new anti-doping scientific practices (see Section 6.6.2). The question that now arises is whether or not anti-doping workers perceive such qualities in recently developed harmonised objects of anti-doping activity; have anti-doping workers co-configured a shared object for their joint activity? Are they there yet?

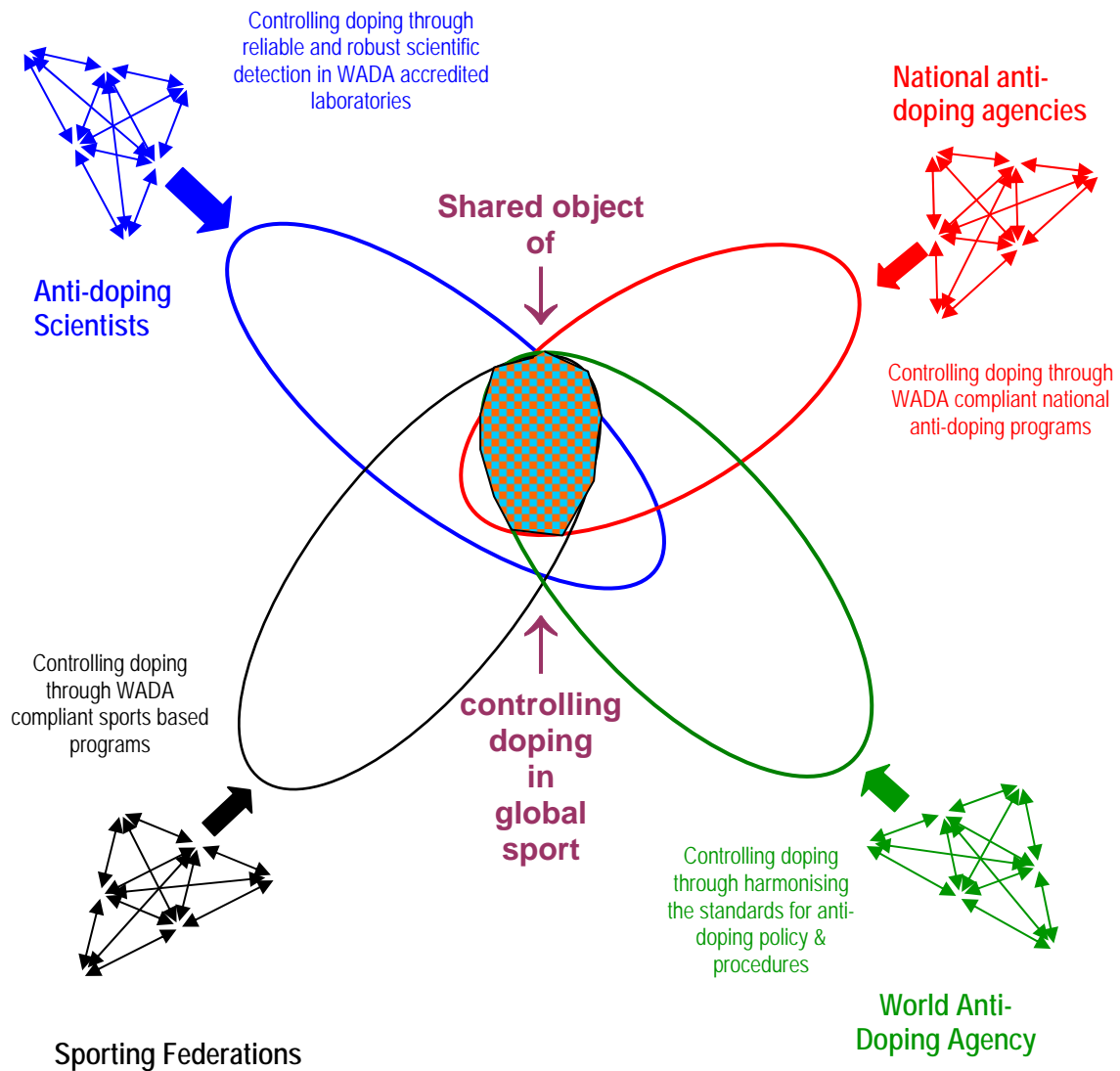


Figure 8-7: A third generation activity theory model for collaboration in the complex socio-technical context of anti-doping work in sport

8.4 ARE THEY THERE YET?

Before answering this question it is important to once again recall that much of the interview and survey data for this research was collected at a very early stage (2002 – 2004) of the formal efforts to harmonise international anti-doping efforts. Nonetheless, a number of participants enunciated their optimism about the future of doping control in light of WADA’s future efforts of coordinating and harmonising the efforts of anti-doping workers on a global basis. Some participants looked forward to a successful outcome to the public issue of doping in sport:

The hope is WADA and WADA is making all the right noises. ... The idea of getting all the nations agreeing to set penalties and set rules, that is the salvation from the way the IOC were working. I think WADA is a very determined organisation. ... When you think of it, every four years the IOC [was] in charge of it for two weeks ... It wasn't their place to sanction but they did. It was too much of a mess. It hasn't been sorted out at the moment, but it's going to be done very soon. (ID: S014)

Others were less optimistic, commenting:

If the sports and those who administer anti-doping programs do not properly supervise programs then they will not succeed because they will not get the trust, confidence of the athletes who have to be absolutely certain that they are not going to get wrongly accused (ID: S027)

Even whilst the Code was being developed, members of sporting organisations expressed their concerns over some of its aspects including its overall aim (Jones, 2002).

More recent data indicated other that there are other concerns about WADA's efforts to deal with doping in sport. The high profile of doping incidents (Clarey, 2005; Downes, 2005; Jones, 2002; O'Donoghue, 2005; Wendt, 2005) continued to keep doping issues in the media and in the public mind. This put pressure on governments, sporting organisations and anti-doping workers to persevere with their efforts to deal with doping in sport. WADA's response was to keep the successes and efforts of anti-doping work in the public eye. WADA's president at the time of writing, Dick Pound, has made frequent public comment on the handling of doping cases. For example, he commented negatively about a perceived lenient sentence to Australian cricketer Shane Warne (Mottram, 21 February, 2003) and positively about the upholding of the two-year sanctions given to American athletes Tim Montgomery and Chryste Gaines by the Court of Arbitration for Sport base on evidence gathered during the designer steroid case (BBC Sport, 14th December, 2005). In a similar way, WADA announced publicly in early 2004 that the Korean doping control laboratory had been suspended from full accreditation (WADA, 22nd April, 2004). Such methods have not always been well received nor have they gone unnoticed.

In the light of a more recent debate in cultural studies circles on the issue of governmentality, Park (2005) argued that "WADA policies fundamentally work to police athletic bodies ... WADA embodies a First World, technology-driven governance of doping" (Park, p. 174). Rushall and Jones (2006) carried out a critical analysis on a number of aspects of WADA's operations, drawing data from research papers which presented

original data or refereed evaluations of WADA's efforts (p. 14). Rushall and Jones expressed their concerns about the basis upon which banned substance classifications were made, the attribution of performance enhancement to substances, as well as standardised of testing and reporting procedures. Rushall and Jones commented that WADA's actions would change sport forever and may well deter professional athletes, targeted by WADA's testing, from participating in the Olympic Games from (p. 15). The authors concluded:

The activities of WADA and its affiliates, having gone unquestioned for so long by governments, the media, and a large naïve public need to be exposed and a better, socially responsible anti-doping agency installed. The actions of the current World Anti-Doping Agency are causes for grave concern. (Rushall & Jones, p. 15)

This call for transparency echoed an earlier comment from a participant in this research:

We are now in a very critical phase where the WADA is willing to control the whole thing and this should be done in an open way and not hidden. They cannot decide what is good for the whole world. They have all the time to check if what they decide is correct and within the human rights system because mistakes can be made very quickly. This will be a disaster for the credibility of the whole system. (ID: S031)

Two recent situations reported in the media, one general and the other scientific serve as cases in point. The first concerns the operation of a national testing program and the frequency of the out-of-competition early-morning testing of an athlete: nine times in six weeks. An official from the sport was reported as stating:

The vast majority of sports people are supportive of out of competition drug testing as long as it is evenly shared and not targeting just a few [in a way] that it becomes such a huge invasion on their privacy and training. (Vaughan, 2006)

The second situation reflected ongoing concerns regarding the test for erythropoietin (EPO). In recent times, there were occasions when WADA's decisions werenot accepted by sporting bodies. For example, journalist Sam Abt (5th February, 2006) reported that cyclist Franck Bouyer was given permission by WADA to compete whilst using a medication containing the banned substance modafinil. Abt wrote that the decision had been contested in the Court of Arbitration for Sport by the International Cycling Union (UCI). Bouter's lawyer was reported as describing the situation as a "turf war" (par. 14).

Situations such as those described above indicated that, at least from some stakeholders' perspectives, global anti-doping efforts were not there yet and that ongoing concerns about

doping in sport and the manner in which anti-doping work was being carried out, needed to be addressed. Other researchers have also begun to examine the complexity of doping and anti-doping in sport from different perspectives. For example, economists including Krakel (2005) and Maennig (2002) have begun to explore the connection between doping and its possible economic benefits for athletes. Time will tell whether or not these and other explorations result in additional anti-doping strategies and extra tracks or layers for Figure 8-5.

Nonetheless, as Figure 8-3, Figure 8-4 and Figure 8-5 demonstrated, anti-doping efforts over the years have gone a long way towards addressing the chaotic wicked problem of doping in sport through the use of multiple strategies. The increased scientific and organisational capacity of harmonised anti-doping work has added momentum to public efforts to tackle the issue of doping in sport. The evolving set of scientific, general, educational and procedural problems which face sport and society are being dealt with at a more rapid pace. Both the challenges and the achievements of anti-doping efforts were recognised during the International Association of Athletics Federations Anti-Doping Symposium, held in Lausanne Switzerland, 30th September – 2nd October, 2006. There is also recognition of the need for further enhancement of anti-doping efforts. Anti-doping practitioners acknowledged that they are not there yet, that there is a need for continued, innovative efforts. In her summary of the main messages from the 2006 IAAF World Anti-Doping Symposium attended by the researcher, Abby Hoffman, a Council Member of the International Association of Athletics Federations set out the following as the challenges of and recurring themes in anti-doping work: Complexity, innovation, co-operation, coordination, standardization, consistency, quality control, partnerships, efficiency and effectiveness, and credibility. In the light of these recent comments, further consideration of sense-making in anti-doping has been presented in the next section.

8.5 MEETING THE DEMANDS OF DECISION-MAKING IN THE COMPLEX CONTEXT OF ANTI-DOPING WORK

The Cynefin informed analysis of the evolution of global anti-doping efforts suggested benefit could be gained from anti-doping practitioners being ‘complexity informed’, particularly when it comes to making decisions. In terms of the Cynefin framework, order has been progressively imposed on the chaos of doping in sport through the

implementation of what Snowden (2002a) referred to as predictive and prescriptive models which addressed the various facets of this multifaceted, wicked problem. However, the combination of the magnitude of the problem, new ways of doping and new approaches to developing solutions which withstand legal and public scrutiny continues to keep anti-doping efforts on what complexity theorists describe as the edge of chaos (McMillan, 2004; Waldrop, 1992).

In the language of complexity theory, the historical and ongoing challenges faced by anti-doping workers to develop techniques and programs, i.e. activities, to detect and deter doping in sport (see Section 8.2) acted as ‘strange attractors’ which, though sensitively dependent upon their initial conditions, resulted in behaviour that exhibited “a range of complex, exotic patterns, each one different, yet the whole [was] creating and exhibiting a new kind of order. It [was] order within apparent chaos” (McMillan, 2004, p. 20). These challenges have highlighted and continue to highlight areas where work needed to be done, particularly with respect to the discovery of the nature of the strange attractors.

Historically, this work has been carried out in the invisible spaces of the upper complex and knowable domains in Figure 8-1. Snowden and Stanbridge (2004) and Snowden (2005) commented that the lack of understanding of these spaces tested the capabilities of traditional decision-makers. As described in Section 3.4.2, Snowden and Stanbridge (2004) and Snowden (2005) drew on the Cynefin framework to develop the landscape of management model which reflects the varying degrees of visibility of order and disorder inherent in organisational contexts in which decisions are made and interventions designed. This model highlighted the dangers of a single model of decision-making and provided insights into decision-making in the complex, dynamic context of anti-doping work that will be explored in this section.

Snowden and Stanbridge (2004) described traditional ordered and rule-based management thinking, such as that of ‘Best Practice’ and process engineering, as based on a perception of the organization “as a machine which can be designed, structured and planned and which will produce consistent and repeatable performance” (p. 144). The type of decision making associated with this management strategy corresponded with the visible, ordered lower right KNOWN domain in Figure 8-1 (see page 300) where decision making was based on sensing and categorising a situation and responding according to a set of well established rules. An example of such decision-making in the anti-doping context would be the use of the rules to deal with doping violations that meet the established scientific

criteria. The comments of both Park and Rushall and Jones in the previous section suggested that some writers perceive the current efforts to harmonise anti-doping efforts internationally as an instance where order has been imposed through the use of rules and regulations when circumstances are still uncertain. Snowden (2002a) warned that

the mistake of scientific management [was] to assume that such imposed order [was] an absolute or universal structure. Its stability and accordingly its usefulness [were] based on common will and a stable environment. When conditions of uncertainty [were] reached, the order [could] break down or artificially persist beyond its usefulness. (p. 111)

The Cynefin based management landscape model described alternate approaches to decision making suited to such contexts.

The work of authors such as Senge (1990) and Nonaka (1994) and his co-workers on management strategies that took human factors into account were based on systems thinking. The resulting emphasis on the alignment of organizations with human values led to the recognition of evolving, refinable core competence rather than a fixed set of knowledge and skills (D. Snowden & Stanbridge, p. 144). The use of a hidden but increasingly well honed and thus less ambiguous set of heuristics on which to base decisions, rather than firm rules, reflected the increasing but not absolute order that accompanied the improved understanding of cause and effect associated with this ongoing evolution of competence. Decision making in this context relied on a process of sensing then expertly analysing and interpreting a situation and responding to it based on expert interpretation. Rather than the black and white situation of the KNOWN domain, in the KNOWABLE domain in the upper right quadrant of Figure 8-1 there exists “a large grey area, where interpretation is the key” (p. 144). Decision-making surrounding the use of the results of scientific research would fall into this category.

The third type of management described by Snowden and Stanbridge (2004) employed the concept of ‘unorder’ as neither order nor disorder, but something “ ‘other’ that we can not fully understand or comprehend” (p. 144). Snowden and Stanbridge described this as that needed in a socially complex context where the relationships between cause and effect were beginning to be unravelled, where the heuristics were just beginning to emerge. In particular, Snowden and Stanbridge noted the development of issues associated with language and communication as individuals engaged in sense-making through conversation. In this complex social context, the heuristics were more ambiguous. Decision making required recognition of the abilities of humans to make decisions based

on patterns, to create and maintain multiple identities, to ascribe intentionality and cause, and to recognise that structured social interactions create order from unordered. This corresponded to the Cynefin framework's upper left quadrant, the COMPLEX domain (see Figure 8-1). Snowden (2005) commented that management in such unordered socially complex contexts required the manipulation of boundaries, attractors and identities and needed to be mastered by both not-for-profit and commercial organisations as they are faced with increasing demands but diminishing resources (p. 50).

The fourth and final type of management context described by Snowden and his colleagues was an unordered one based on simple and basic rules that were beyond the control of management. Patterns emerged but were self-organising. Snowden (2005) warned

unordered systems work bottom-up not top down. ... Patterns, behavioural and otherwise, emerge from the interaction of many agents operating on unarticulated rules with other agents and with the environment; it cannot be determined top down and the patterns do not necessarily repeat except by accident. (p. 50)

Subsequently decision-making in chaotic contexts was most appropriately 'act – sense – respond' in nature and corresponded to the CHAOS context of the lower-left quadrant in Figure 8-1. The failure of the initial use of rules by sports organisations to control doping in their particular sport represented the inappropriate use of a top-down approach in a chaotic context. As has happened since, the context required considerable effort and time to develop the knowledge base needed to generate the order that would support a scientific management approach. The comments of the IAAF's Council member Abby Hoffman (IAAF, 2006) recognised the need to address the complexity of anti-doping work through innovation, co-operation, partnerships and coordination of the COMPLEX and KNOWABLE domains. But they also referred to the need for consistency, quality control and standardization, as appropriate for the KNOWN domain.

Complexity informed considerations provide a sound base from which anti-doping workers are more likely to address successfully the emerging demands that confront them. In view of the above description, the Cynefin framework's landscape of decision-making can be seen as providing the fulcrum needed to balance the attributes Hoffman listed as needed for anti-doping work. The landscape of management also highlights the need for practitioners and decision-makers to interact and communicate intensively regarding the nature of the various contexts of anti-doping work when making decisions. In this way, the size of the domain of disorder (see Section 3.4.2) can be reduced through accessing and leveraging

the knowledge of within the diverse groups involved in anti-doping work. This informed base supports in-depth shared understanding of the nature of the situation and identifies the most appropriate response for that particular context. As stated previously, the current tri-level model of WADA's anti-doping program (see Figure 7-1) has built its decision-making around the use of the World Anti-Doping Code, international standards for laboratory and testing processes and models of best practice for anti-doping and sporting organisations. Further investigation is needed to determine whether or not these measures enable the styles of decision-making appropriate for the diverse, dynamic contexts of doping in sport made apparent by this research.

8.6 CONCLUSION

The use of the complexity based Cynefin framework and activity theory in this chapter supported a better understanding of anti-doping work and its efforts to address the wicked problem of doping in sport. Time and again groups of anti-doping workers used their own particular skills, knowledge and interests to assess, visibilise solutions for and act on out-of-control situations in order to advance their cause. The construction of a Cynefin-informed model of the evolution of the multi-organisational context of anti-doping work and a third generation activity theory based model for current anti-doping efforts highlighted the variety of socio-cultural contexts of the current efforts of anti-doping practitioners and the diversity of interactions between these practitioner groups. These frameworks also pointed to the need for recognition and development of the means and avenues to traverse this zone of proximal development, this domain of disorder, for anti-doping efforts.

Drawing on the *Cynefin* and activity theory frameworks, it was stated that the management of such multiple contexts as that of international anti-doping work should reflect and support this multiplicity rather than employ a single management and decision making strategy. The use of a management style suited to the particular context at hand, be it chaotic, complex, complicated or well understood, would promote the desired attributes of co-operation, partnerships, quality and credibility outcomes described by Hoffman (see 8.4). Such an approach would also ensure that anti-doping structures have the means to support innovation in this evolving milieu through the expansive visibilization processes inherent in transforming the chaotic into the known by exploring the complex hidden patterns of each particular context and then generating and validating these patterns to

establish predictable and visible best practice needed by other stakeholders, e.g. lawyers and athletes. It would, in effect, go some way to crossing the zone of proximal development by reducing some of the disorder within this wicked problem.

As anti-doping work gathers international momentum, strengthens its capabilities to deter doping and expands in professional expertise, tensions can be expected to arise as part of the effort of anti-doping practitioners to develop a shared object for their activities. The resolution of these tensions provides new directions for anti-doping work as well as for further social research into this rich, complex and evolving context. Suggestions for further investigations into this and other contexts are given in the next chapter.

Chapter 9 FINDINGS, IMPLICATIONS AND LIMITATIONS

We must be the change we wish to see in the world.

Mahatma Gandhi

9.1 INTRODUCTION

As explained in Chapter One, this research set out to fill a gap in the knowledge about, and understanding of, the nature of the work of experts by studying a small group of scientists. As described in Chapter Four, the work of this expert group, the directors of accredited doping control laboratories numbered fewer than thirty, and was situated in an international, high profile, complex context. As demonstrated in Chapters Five through to Chapter Eight, the comments of these experts and their stakeholders, as well as public documentation about doping in sport, provided rich data on which to ground theory about the dynamics of expert work in the early 21st century.

This final chapter of this thesis reviews how the outcomes of this study have contributed to addressing the gap in understanding of the dynamics of the work of experts in an increasingly complex world. The chapter provides an overview of the study, its findings and their implications. Additionally the limitations of the study have been acknowledged and possible directions for further research have been suggested.

9.2 OVERVIEW OF THE STUDY

The aim of this study, as set out in Chapter One, was directed towards finding out about the dynamics of expert work. That is, the research intended to discover what experts did and how they stayed experts by examining a particular group of scientists whose context exemplified many of the characteristics of 21st century workplaces.

As explained in Chapter 2, preliminary reading about experts indicated that the role of experts in our society has changed and suggested that current models for the dynamics of expert work should be revised. Increasingly in the international arena, the solution of complex social problems, described by some as ‘wicked problems’, required the combined contributions of experts from a variety of professions. Technical expertise in a single area was no longer the only approach to solving these wicked problems faced by society. Attitudes to problem solving and to experts had changed. No longer could experts expect

to remain aloof from the world around them, only communicating with their peers via the scholarly publications. The broader community expected to engage with experts but not under the traditional rules of engagement.

In keeping with this background reading, the focus of the study shifted. It was decided that the research into dynamics of the work of experts would investigate the perceptions of both the experts themselves and their stakeholders. In Chapter Four, the selection of the scientific directors of accredited anti-doping laboratories as the case to be studied enabled the framing of the specific questions for the research:

1. What perceptions do the scientific directors of accredited doping control laboratories hold about their work?
2. What perceptions do other stakeholders involved in anti-doping work in sport hold about the work of the scientific directors of accredited doping control laboratories?
3. How do the scientific directors maintain their expertise?

The design for the research, as set out in Chapter Four, integrated the methods of the case study, grounded theory and developmental work research (DWR) (Engeström, 2005a; Hill, Capper, Wilson, & Otto, 2005). The design featured an iterative grounded approach to data collection analysis and theory building. Interpretation of data drew on the literature relating to activity theory, communities of practice and the complexity-based *Cynefin* framework. Beginning with a pilot study to establish the feasibility of the research and later surveys and interviews, data was elicited from a number of the directors, a manageable sample of their stakeholders and public documentation. The incorporation of developmental work research's dialectical technique of mirroring, confronted participants with interim research findings, provoking reflection and further comment. The process of answering the research questions and interpreting those answers in Chapters Five, Six and Seven led to the development of a model for the dynamics of the work of the scientific directors and how they maintained their expertise when they were already at the cutting edge of their field (see Figure 7-2). This model illustrated the routine-related multiple objects of the directors' complex activity; sustaining high quality routine doping control work, enhancing anti-doping scientific practice through research and positioning scientists as anti-doping professionals through participation in the governance aspects of this work. The model pointed to the role a private, trusted shared space, an annual meeting, for this scientific community of practice. Legitimate peripheral participation through attendance at this meeting his space supported identity formation of both new and experienced anti-doping scientists and laboratory directors, as well as facilitating knowledge mobilisation

within this scientific community. Additionally, the model pointed to the different communication channels between scientific experts and other anti-doping workers with whom they shared the complex evolving context.

Chapter Eight extended the research by examining the dynamic context in which these experts and their stakeholders worked. The use of the complexity based *Cynefin* sense-making framework to interpret the cultural-history of anti-doping work provided a deeper understanding of the multiplicity of approaches needed to solve the international problem of doping in sport and other wicked problems. This chapter also presented insights into the difficulties associated with decision-making in the domain of disorder associated with this evolving context. The lens of third generation activity theory pointed to the need for the intensive discourse of inter-agency working as various groups of anti-doping workers engage in the knotworking associated with the co-configuration of a shared object through effective interagency working. Whilst it is beyond the bounds of this research to assess the current status of this shared object, the conclusions drawn from the research have been presented in the next two sections.

9.3 FINDINGS ABOUT THE DYNAMICS OF THE WORK OF ANTI-DOPING SCIENTIFIC EXPERTS

As a result of this study a number of conclusions have been drawn about the work of the scientific directors of WADA accredited anti-doping laboratories, and how these expert scientists maintain their expertise. Each of these conclusions has been summarised below.

9.3.1 The motivator: Personal and professional satisfaction

The personal commitment and professional satisfaction of these experts to anti-doping provided the underlying motive for their activity.

The directors' passionate commitment to and extensive knowledge of the anti-doping cause was apparent in, the length of service and extensive knowledge of the directors had of their field as well as the high regard in which other anti-doping workers held them. It was also evident in

- the directors' expectation that all those working in the field were committed to the anti-doping cause

- the directors' willingness to share their knowledge and experience with other anti-doping stakeholders such as sporting organisations and anti-doping agencies as they developed the knowledge and skills for their own particular type of anti-doping work
- the directors' willingness to share their knowledge and skills with other anti-doping scientists
- the directors' frustration with lack of funding to support routine and research work in the field
- the directors' frustration with experts in other fields who cast doubt upon the work of the laboratories.

Perceiving it as a niche which satisfied their own personal and professional needs, the collegial relationships formed between the directors and other scientists working in the field resulted in a motivating commitment to and sense of shared responsibility for work of high quality as well as to their individual and collective ability to contribute the anti-doping cause.

9.3.2 Routine experience: Delimiter of the objects of individual activity

The work of the scientific directors was a complex activity with a cluster of up to three distinct objects, whose adoption was delimited by the volume of routine work carried out by the director's laboratory.

To become and to remain an expert, these scientists continually built on their pre-existing theoretical knowledge and expertise through experience. The more routine experience they had, the more objects they adopted as part of their activity. Those directors with limited experience, analysing less than 2500 samples per year, focused solely on sustaining high quality routine practice within their laboratory. With more analyses, directors expanded their activity to incorporate to a second object: enhancing anti-doping scientific activity through research. The directors of those laboratories that analysed more than 4500 samples per year extended their activity further to accommodate a third object, that of positioning scientists as participants in the governance of anti-doping work.

9.3.3 A shared, private, trusted space: A critical element of becoming, being and bettering individual and collective professionalism and expertise

As a regular community event attended by the majority of the directors, the annual Manfred Donike Workshop on Recent Advances in Doping Analyses played a critical role

in both knowledge mobilisation and in the formation and affirmation of the professional identities of these scientists.

The small number of anti-doping scientists, the low volume of relevant research output and the sparse distribution of anti-doping laboratories throughout the world presented these scientists with challenges as to how they acquire and maintain the necessary knowledge to become and to stay experts in this area. As described in detail in Chapter Six, the majority of scientific directors who participated in this research found that the annual workshop in Cologne provided a trusted shared, private space where they:

- developed and affirmed their emerging individual and collective identities and commitment to their field through experiences and knowledge encapsulated in personal narratives
- engaged with each other and with relevant external in the discourse associated with the knotworking processes involved in the co-configuration and refinement of new and existing scientific knowledge
- mobilized knowledge within their community
- developed an informed base for their interaction with other groups working in their context and their participation in governance activities.

9.3.4 Changed context - changed work: The need for interagency work

The work of the scientific directors and the accredited laboratories has changed as a consequence of different approaches to doping in sport and the evolution of national and international anti-doping programs.

Approaches to both doping and anti-doping in sport evolved in recent times. General anti-doping practitioners recognised the foundational contribution of the scientific directors to anti-doping efforts but outlined additional ways in which these experts would be expected to contribute to the work of anti-doping. The advent of designer steroids, blood doping and the prospect of genetic enhancement together with “smarter” ways of using existing drugs underpinned the consensus amongst both scientific and general practitioners for continued scientific efforts in anti-doping science to enhance and extend current detection capabilities. The subsequent need to incorporate knowledge from other branches of science unused to the forensic context of doping control work into robust, reliable detection methodologies presented anti-doping scientists with one such challenge. Another came from the re-contextualisation of anti-doping scientific work beyond a partnership

between the laboratory and the sporting field, and into a larger milieu inhabited by professionals and stakeholders from a variety of fields with other distinct and shared domains of disorder, some of which are emerging or are yet to emerge. Other non-scientific, investigative approaches to detection, as well as the development and implementation of national and international government and sports-based anti-doping policies, education and testing programs, became part of the context of anti-doping work. The diversity of professionals and approaches to anti-doping work pointed to the need for these expert scientists to build on their existing knowledge of and abilities to engage in the intensive, extended dialogue of knotworking and co-configuration work supported by the safe, private, informal space of the Cologne workshop experienced within their own scientific community, when they participate in interagency work with other general anti-doping workers and scientists from other disciplines.

9.4 FINDINGS ABOUT RESEARCHING GLOBAL SOCIAL CONTEXTS

This qualitative study explored the dynamics of the work expert scientists in a changing international, socially and politically sensitive context. The use of a grounded approach to investigate such evolving contexts is all the more challenging as the ground itself kept moving! In order to maintain balance within this context, the research employed the activity theory based developmental work research (DWR) method which iteratively mirrored the results to study participants, ensuring that the participants had an ongoing opportunity to engage in the research and to co-construct its outcomes. The research extended the use of the DWR method beyond the physical boundaries of the single room Change Laboratory used by other researchers (Edwards & Wiseman, 2005; Engeström, 2005a, 2005c; Hill et al., 2005; Kuutti, 1996; Leadbetter, Daniels, Soares, & NacNab, 2005; Warmington et al., 2005) who, as noted in Chapter Four, had worked in contexts where study participants could be brought together for meetings on a regular basis. Consequently, a number of conclusions can be drawn about the use of this method for working in a global Change Laboratory.

9.4.1 Acceptance: A complex task

The task of gaining access to the field is made all the more complex as a result of the global dispersal of the members of this community.

All research presents its own types of barriers relating to scoping the research question to developing a research design which employs practical research methods, entering the field and carrying out the research. Whilst human society is increasingly regarded as global, researching this global context is both similar to and different from investigating a nearby context which is more accessible to the researcher. In particular, the successful research into the activity of a high-profile group of workers spread around the globe relied upon initial acceptance by a smaller group of members of the community under investigation. The realisation that other members of the anti-doping community must have participated in the research to generate the results of the pilot study influenced others to participate in the research. Maintaining contact with study participants contributed to the development of a trusting relationship between the study participants and the researcher. Once again the mantra: ‘Think big: Act small’ proved its worth.

9.4.2 Communication: A critical element

Clarity and timeliness of communication about research intentions, protocols and results promoted participants’ understanding of the nature of the research and what it was trying to achieve as well as establishing rapport and trust between the participants and the researcher.

As in most of life’s endeavours, communication played a critical role in this research into the activity of this particular community. Presentations at the annual Cologne workshop helped the researcher to gain acceptance into and earn the trust of the community as a social researcher. The presentations explained the research and provided updates about the research’s progress as well as giving the community the opportunity to give feedback. Recent presentations gave anti-doping workers in other areas similar opportunities to comment on the research findings. Data was elicited in both face-to-face and telephone interviews. The ability to conduct interviews in this way was vital to the international nature of this study. Interviews also allowed the researcher to establish a rapport with participants, a rapport that is impossible to achieve using a survey document. Email established a direct communication link between the researcher and study participants. As well negotiating interview times, email enabled the researcher to inform participants about the research and its protocols, to distribute surveys, to begin to establish rapport with the participants and to mirror back research results for their comments and to keep them up to date with publications resulting from the research.

9.4.3 Thinking tools: the contribution of theoretical frameworks

The use of the theoretical frameworks of activity theory, communities of practice provided tools with which to think about and consequently build a grounded model for the complex activity and context under study.

The possible overwhelming impacts of the size and unfamiliarity of this global research context were reduced by making use of ‘tools’ which would support thinking about the context investigated in the study. Ongoing reading throughout the study helped the researcher to interpret the study’s findings and to build these findings into theoretical models of the work of the directors, the knowledge mobilisation processes at work in the Cologne workshop and the evolving dynamics of international anti-doping work.

9.4.4 Expansive visibilization in the global context: a mixed-mode Change Laboratory

The use of presentations, email and the telephone went some way to reduce the impact of the geographical distribution of the study’s participants and to emulate the processes of the developmental work research method’s Change Laboratory.

The limited funding available for meeting international social goals means that workers in these areas need to use their shared resource efficiently and effectively through ensuring that their diverse efforts are not wasteful. The developmental work research method with its Change Laboratory (see Section 3.2.3 and Section 4.5.3) has been used to assist in the visibilization of existing and development of desired activity in order to promote efficiency and effectiveness within workplaces which are either collocated or sufficiently close together to enable regular face-to-face meetings . In this research, email exchanges, telephone interviews together with presentations at communal activities substituted for the video-player and camera equipped Change Laboratory room used by other activity theorists, to capture interactions between and mirror back research findings to a very limited number of research participants. The resulting visibilization of the current and desired activities for the work of the scientific directors of accredited laboratories demonstrates that the processes of the Change Laboratory can be emulated in a widespread context with a higher number of research participants through the combination of both face to face approaches and information and communication technologies.

9.5 IMPLICATIONS AND FUTURE RESEARCH DIRECTIONS

This research took a sociological perspective in its investigation of the work of a small group of scientific experts. Its findings have implications for the scientists themselves, for the anti-doping context within which they work and for experts working in other fields.

9.5.1 Implications for and future research directions in anti-doping work

The research found that restricted funding for the anti-doping work impacted on the resources available for scientific work in the area and that those who find a satisfying career in the non-profit sector did so because it met their personal needs in a satisfactory manner. Whilst there was some indication that the directors' regarded their work as filling a social need, the degree to which all the directors agreed with the sentiments of breast cancer researcher, Professor Mary-Claire King's statement "If you have the knowledge, you must use it", reported by Steyaert (2006, p. 3), was beyond the scope of this research. Given the increasing stresses associated with anti-doping science and the role it plays in anti-doping work, further investigation is necessary to better understand how weight of the problems does not reach the point where it dominates the intrinsic rewards of working for the good of society, and working in an intellectually stimulating and collegial environment.

The impact of funding for anti-doping work was also apparent in the volume of routine work carried out within each accredited laboratory, in the research capabilities of the laboratories and the abilities of a laboratory director to see the 'big picture' and contribute to governance issues. Whilst WADA's International Standard for Laboratories (WADA, 2004b) required the organisations supporting an accredited laboratory to guarantee to provide 1500 samples annually for analysis, the study's findings suggest that at least 2500 samples annually are needed to form a base for the conduct of a viable research program by an accredited laboratory. This discrepancy in sample numbers suggests that some laboratories will still find it difficult to meet WADA's requirement to carry out anti-doping research. Further investigation of research activity of individual laboratories will determine with greater accuracy those attributes that support anti-doping scientific research by accredited laboratories.

The critical role of the annual Manfred Donike Workshop on Recent Advances in Doping Analyses in knowledge mobilisation and identity formation was explored in Chapter Six. The privacy of the annual workshop provided a safe space for anti-doping scientists to

engage in the exploration of new concepts and approaches to their work, to discuss and improve their ideas with respected peers. As new bodies of knowledge are being integrated into anti-doping science, questions arise about the knowledge mobilisation approaches used by bodies such as WADA and the United States Anti-Doping Agency who fund such research. The concerns of the directors about the underlying motives and lack of contextual knowledge of external researchers together with other concerns such as the intellectual property issue, imply that a sufficient level of acceptance and trust has not yet been established between scientists in accredited laboratories and the “new kids on the anti-doping scientific block”. Further work needs to be done in this area to identify trustworthy means to support the co-configuration of new knowledge into robust, reliable and defensible doping control measures by scientists from both within and beyond accredited laboratories.

The changed context of anti-doping efforts impacted upon the work of the directors and the laboratories. Stakeholders acknowledged the foundational contribution of the directors of accredited anti-doping laboratories to establishing modern anti-doping efforts to educating a generation of anti-doping practitioners, and assisting the development of anti-doping policy. However, stakeholders described additional expectations of the directors in light of the increased complexity of the anti-doping context. In particular, the stakeholders emphasised the need for extensive scientific knowledge across numerous scientific disciplines, the ability to manage scientific work in a variety of fields, and skills that would ensure effective communication between the anti-doping scientific community and others on matters of routine anti-doping work, scientific research and policy matters. The work of the directors, as scientific experts in anti-doping science, had changed. No longer were they the leaders of the anti-doping movement. They and their laboratories had become one part of an international system to address a global social problem. Opinions from a variety of experts had to be considered and integrated when policy makers made decisions; no longer did the stated opinion of a scientific expert hold supreme sway. Rather, scientists had to understand, accept and learn to work with the connections between the diverse elements of the complex networked contexts within which they now worked. This changed understanding of the work of the directors also pointed to the need for the World Association of Anti-Doping Scientists (WAADS) as the professional association of the scientists working in accredited laboratories, to reflect on its current role and to consider whether or not it should become more engaged in dialogue relating to the governance of anti-doping efforts. Further investigation of the perceptions of the interactions between

these expert scientists and their stakeholders would identify whether this WAADS had adopted an active role in anti-doping governance, and if so, how that role was regarded within the anti-doping community.

In addition to the areas described in the previous paragraphs, there are a number of avenues arising from this research where further investigation is needed to enhance understanding of the dynamics of anti-doping work, and the work of experts in the international non-profit context and the research method. Suggested avenues for future work include:

- the impact of research funding on new developments in anti-doping science and the expectations of those funding the research about research outcomes
- social and professional commitment of other anti-doping workers and of workers in other non-profit areas
- the broader anti-doping context to determine the current status of attempts of anti-doping workers to harmonise their international efforts in order to bring about consistent, strong, effective approaches to dealing with the problem of doping in sport
- the creation of safe spaces where diverse groups of anti-doping workers can come together to engage in the expansive visibilization and learning necessary for the co-construction of innovative solutions to shared problems.

9.5.2 Implications for and future research directions in other contexts

Whilst this study's findings are grounded in the global context of anti-doping work, there are implications for and suggestions for future research in other contexts. The empirically based, theoretically informed model for the dynamics of expert work developed in this thesis builds on concepts relating to the work of experts contained in the work of Engeström and his many colleagues, Gaines (1999), Lave and Wenger (1991), Nonaka and Konno (1998), Victor and Boynton (1998), Wenger (1998) and Yelder (2004). The model for the dynamics of expert work set out in Figure 7-2 addresses the formation, development and role of both individual and collective expertise, the interaction between experts and their stakeholders and the creation and mobilization of the new knowledge that expands any particular field. Future research could investigate the applicability of this model in other 21st century contexts as well as the use of this model to facilitate the development of an expert community and to advance individual and collective expertise within the community.

Comments by participants in this study indicate that issues arise when one group possesses scientific or technical expertise that has played a significant historical and financially demanding role in a non-profit area. It seems that scientists who become involved comparatively early in historical attempts to solve the problem, do so because of their need to find a scientific niche for their research and because they see themselves as able to make a contribution to society through their work. Consequently to ensure the continuing engagement of such scientific / technical experts, there is a need to ensure that sufficient financial and other resources, both immediate and ongoing, are committed to allow these experts to do their work at the required level, to maintain their expertise and to make worthwhile contributions to the field. Such intrinsic rewards balance the lack of extrinsic rewards that can result from the limited funding for public sector work.

The analysis of and models for the changing and complex milieu of anti-doping work presented in Chapter 8 suggests a way in which other wickedly problematical contexts can be examined and better understood by those working in them. It is only with insights from such understanding that maximum benefits can be obtained from the efforts of the various groups working in a field. This study of the complex multi-faceted evolving nature of the wicked problems of doping in sport, also points to the need for the development of effective management strategies for the diverse situations within these contexts. Such management strategies need to be underpinned by an ability to make sense of the particular situation at hand and the ability of those involved to make sense of and collaborate effectively in these environments. This ability is related to participants' ability to co-construct a shared object for a joint activity through inter-agency working. Such an object reflects the underlying shared motive of all community members, regardless of their national and/or organisational cultures. Future research into understanding the complexity of, and ways to enhance inter-agency working in, the many complex contexts of our 21st century world is needed to benefit to those working in those contexts and to help solve the problems addressed by these workers.

As stated in the research design (see Chapter Four), the developmental work research method was adapted for use in this study. To enhance the use of this method in a global context, further research is needed into the use of information and communication technologies for creating a virtual version of the developmental work research method's

Change Laboratory. Whilst these spaces are already able to be created, there is a need to investigate how research participants can be encouraged to better engage in a virtual mirroring process whose discourse enables the joint construction of a shared object.

9.6 LIMITATIONS OF THE STUDY

As with all of life's undertakings, this study has been limited by a number of constraints:

- This research, like all research, is coloured by the personal cultural history of the researcher(s), study participants and unknown writers of publicly available documentation. However, from an activity theory perspective, the cultural histories of those involved are regarded as a key strength, rather than a weakness, in the interpretation of data. Consequently, the magnitude of the effect of the researcher's own personal cultural history was addressed through the mirroring process in which participants were given the opportunity to comment on undue bias in the research findings.
- The principal data collection period from participants in this research was between the end of 2002 and mid-2004. The rapidly evolving nature of anti-doping work over the last six years was apparent during the research and meant that this research into the dynamics of expert work experienced aspects of that dynamic as it happened. The use of "hot off the press" data from organizational websites and online newspapers rather than from the formal academic literature provided the means of travelling with the context rather than presenting a rapidly fading snapshot of the past, recent though it may be.
- The inability of the researcher to engage in a face-to-face manner with the participants on the regular basis that is normal for the developmental work research method limited the research. Although the approaches described in the previous section went some way towards simulating the Change Laboratory used by developmental researchers, it did not recreate it in a completely satisfactory manner. This was particularly true in the matter of engaging participants in the mirroring process where the researcher sought further comments from the participants about the research findings. In another sense, this limitation also provided an insight into what it was like for the globally dispersed directors themselves as they engaged with each other in the course of their work and a greater understanding of the role of the annual workshop in Cologne.
- The decisions of some scientific directors and stakeholders not to participate in this research may have been because of the researcher's inability to conduct interviews in any language other than English. The diverse nationalities of those involved in anti-doping work point to the wide range of languages spoken within this context. Although English is the language of scientific interaction and the language spoken at the Cologne workshop, and is one of the two languages of the World Anti-Doping Agency (WADA) and the International Olympic Committee (IOC), it does not mean that all the scientific directors and their stakeholders were comfortable communicating in English. The researcher addressed this concern by taking considerable care with the phrasing of questions and requests in the survey and the interview in order to better support the participation of individuals whose first language was not English.

9.7 IN FINISHING

The full, complex impact of globalisation on society is currently beyond our comprehension. Social science research can play a major role in unravelling this impact and can help equip individuals and groups to adjust to and find satisfaction in this changed context. Experts will continue to play a vital role, albeit a changed one in the complex evolving socio-technical contexts surrounding the wicked problems that are part of human society. If as committed global citizens, experts seek to change the world, then, as Ghandi said, they must be the change they wish to see. Experts will need extensive and expanding knowledge in their own area and related areas as they seek solutions to the problems that challenge their extensive but limited expertise. This research indicates that experts maintain their expertise through learning more, through co-configuring and mobilising new knowledge in a trusted, private, shared space where they can engage, almost playfully, as they imagine and rehearse their future and ours. However, this raises a question as to how these spaces can be created and trusted by a society where transparency is almost a virtue. For without respect for such spaces, how can experts, who do not know everything, collaborate to invent and co-configure new solutions? Additionally, it seems that the abilities that stakeholders expect experts to demonstrate as they cross the boundaries between their own and other cultures, disciplines and fields, are the same abilities that stakeholders themselves, if not all of humanity, need to demonstrate in a world where global and local problems are increasingly complex and in need of multi-faceted solutions.

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**APPENDIX A INTERNATIONAL OLYMPIC COMMITTEE
ACCREDITED DOPING CONTROL LABORATORIES**

**A1 ACCREDITED DOPING CONTROL LABORATORIES IN OCTOBER,
2002**



LABORATOIRES POUR LES ANALYSES DE CONTROLE DE DOPAGE
ACCREDITES PAR LE COMITE INTERNATIONAL OLYMPIQUE

LABORATORIES FOR DOPING CONTROL ANALYSES ACCREDITED
BY THE INTERNATIONAL OLYMPIC COMMITTEE

avril 2002
April 2002

SITUATION LOCATION	CHEF DU LABORATOIRE HEAD OF THE LABORATORY	ADRESSES ADDRESSES
ATHENS Grèce Greece	Dr. Costas GEORGAKOPOULOS	OLYMPIC ATHLETIC CENTER OF ATHENS "Spiros Louis", Doping Control Laboratory of Athens 37, Kifissias Ave., 15123 MAROUSSI/Athens Grèce Tel : (30.10) 686 85 49 Fax : (30.10) 683 40 21 E-mail : costa@ioc.com
BANGKOK Thaïlande Thailand	Dr Tongtavuch ANUKARAHANONTA Director	NATIONAL DOPING CONTROL CENTRE Mahidol University New Biology Building 6th Floor, Rama 6 Road, BANGKOK 10400 Thailand Tel : (662) 245 6701 / 03 Fax : (662) 245 6704
BARCELONA Espagne Spain	Prof. Jordi SEGURA	INSTITUT MUNICIPAL D'INVESTIGACIÓ MÈDICA, (IMIM) Unitat de Recerca en Farmacologia c/ Doctor Aiguader, 80 08003 BARCELONA Espagne Tel: (34.93) 421 10 09 Fax: (34.93) 221 32 37 Mobile JS : +34659957349 E-mail : js@imim.com



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<p>BLOEMFONTEIN</p> <p>République d'Afrique du Sud Republic of South Africa</p>	<p>Dr. P.J. van der MERWE</p>	<p>DEPARTMENT OF PHARMACOLGY UNIVERSITY OF THE ORANGE FREE STATE P.O.Box 339 (G6) 9300 BLOEMFONTEIN South Africa Tel: (27.51) 401 31 82 Fax: (27.51) 444 15 23 E-mail : gnfmpvdm@med.uovs.ac.za</p>
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<p>KREISCHA Allemagne Germany</p>	<p>Prof. Klaus MÜLLER</p>	<p>INSTITUT FÜR DOPING ANALYTIK und Sportbiochemie Dresdner Strasse 12 D-01731 KREISCHA b. Dresden Allemagne Tel: (49.352) 06 20 60 Fax: (49.352) 062 06 20 (49.341) 971 51 09 Email: dopinganalytik.kreischa@t-online.de.</p>
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<p>LISBON Portugal Portugal</p>	<p>Prof. Lesseps LOURENCO REYS Scientific Director</p>	<p>INSTITUTO NACIONAL DO DESPORTO Laboratório de Análises de Dopage e Bioquímica Direcção de Serviços de Medicina Desportiva, Av. Professor Egas Moniz, (Estádio Universitário) 1600-190 LISBOA Portugal Tel : (351.21) 795 40 00 Fax : (351.21) 797 75 29 E-mail cmd.lisboa@mail.telepac.pt</p>



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TUNIS Tunisie Tunisia	Prof. Kamel BOUZOUITA Directeur général	LABORATOIRE NATIONAL DE CONTROLE DES MEDICAMENTS 11, bis rue Jebel Lakhdar 1006 Bab Saadoun TUNIS Tunisie Tel : (216.71) 570 117 577 643 Mobile : 216 98 314 917 Fax : (216.71) 571 015 e-mail : Kamel.bouzouita@rns.tn

*** PHASE I:** Le laboratoire est temporairement suspendu pour les contrôles internationaux. Au niveau national (échantillons provenant du pays dans lequel le laboratoire est situé), le laboratoire peut effectuer des analyses mais les échantillons A déclarés positifs doivent faire l'objet d'une seconde analyse pour confirmation par un autre laboratoire accrédité par le C.I.O. L'échantillon B correspondant sera également analysé dans le laboratoire accrédité par le C.I.O. qui a confirmé le résultat de l'analyse de l'échantillon A.

*** PHASE I:** *The laboratory is temporarily suspended from international testing. At the national level (samples originating from the country in which the laboratory is located), the laboratory may perform screening procedures but analytically positive A-samples must be confirmed by another IOC accredited laboratory. The corresponding B-sample will also be analysed in the IOC accredited laboratory which has provided confirmation of the A-sample.*

*** PHASE II:** Le laboratoire est temporairement suspendu pour la confirmation du résultat positif des échantillons A et l'analyse des échantillons B. La confirmation de l'échantillon A et l'analyse de l'échantillon B seront effectuées dans un autre laboratoire accrédité par le C.I.O..

PHASE II: *The laboratory is temporarily suspended from confirmation of analytically positive A samples and analysing B samples. Confirmation of the A sample and analysis of the B sample will be performed in another IOC accredited laboratory*

APPENDIX B ETHICS DOCUMENTATION

B1 ETHICS APPROVAL

Australian Catholic University
Brisbane Sydney Canberra Ballarat Melbourne

Approved by ... *Jaime*
Date of Approval ... 8.10.02



ACU National



Human Research Ethics Committee

Application for Approval to Modify a Research Project with Human Participants

1. This form is available upon request via Email or on the Internet at: <http://www.acu.edu.au/research>. All questions must be answered fully. If a question does not apply, indicate N/A.
2. It is a requirement of the *National Statement on Ethical Conduct in Research Involving Humans* (1999) that any changes to a research protocol which involves contact with human participants or access to their records or files must be subject to review and approval by a Human Research Ethics Committee.
3. The completed form should be signed and dated then lodged with the local Research Services Officer:

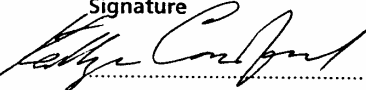
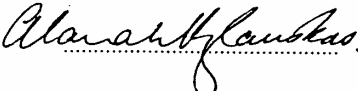
Research Services Australian Catholic University Melbourne Campus Locked Bag 4115 FITZROY VIC 3065 Tel: 03 9953 3157 Fax: 03 9953 3315	Research Services Australian Catholic University Sydney Campus Locked Bag 2002 STRATHFIELD NSW 2135 Tel: 02 9739 4159 Fax: 02 9739 4350	Research Services Australian Catholic University Brisbane Campus PO Box 247 MITCHELTON QLD 4053 Tel: 07 3855 7294 Fax: 07 3855 7328
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4. The application will normally be processed within 20 working days.

NO modification to the protocol is permissible before the HREC's written approval has been received.

<ol style="list-style-type: none">1. HREC Register No.: N2002.03-52. First Approval Date of Project: 1/8/023. Approval Date of Extensions Granted: []4. Project Title: MAXIMISING THE INVESTMENT: RESEARCH AND DEVELOPMENT OF STRATEGIES FOR THE CAPTURE, USE AND LEVERAGE OF KNOWLEDGE BY ACCREDITED ANTI-DOPING LABORATORIES5. Proposed Modifications to the Project <i>NOTE: Such modifications may include changes to: the aims, procedures or direction of the project; the sources or manner of recruitment of participants; the number or age of participants; the questionnaire, survey instruments, Information Letter(s) to Participants, or Consent Forms.</i> Title: THE DYNAMICS OF INTERNATIONAL EXPERT SCIENTIFIC WORK IN A NON-PROFIT, HIGH PROFILE, CHANGING GLOBAL ENVIRONMENT: A CASE STUDY OF THE WORK OF THE HEADS OF ACCREDITED ANTI-DOPING LABORATORIES Researchers: Mrs Alanah Kazlauskas (Staff and doctoral student) Dr Kathryn Crawford (Principal Supervisor), Director, Creative Interactive Systems Pty Ltd Suite 210, Bay 3 Locomotive Workshop Australian Technology Park

7. Certification by Principal Investigator / Supervisor and Student Researcher

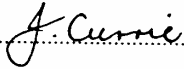
We certify that the information provided above is an accurate and full account of the modification proposed to the protocols for this research project. We understand that the proposed modification is not to be introduced until the written approval of the Human Research Ethics Committee has been received.

Name (<i>block letters</i>)	Signature	Date
Dr Kathryn Crawford Principal Investigator / Supervisor		26-9-02
Mrs Alanah Kazlauskas Student Researcher		26-9-02

APPROVAL BY CHAIR / DEPUTY CHAIR OF HREC

The application needs to be referred to the next HREC meeting.

I approve the modification of the Research Project as described by the applicant subject to the following conditions:

Signed:  Date: 8-10-02

Eveleigh, NSW 1430
Australia

Associate Professor Pam Gibbons (Co-Supervisor)
Head, Sub-faculty of Business and Informatics
ACU National
Mackillop Campus
40 Edward Street
North Sydney, 2059

Anticipated Duration of the project: From 1/11/02 to 31/12/05

Anticipated duration of data collection From 1/11/02 to 1/7/05

Aims: To ascertain the

- * means by which the scientific experts maintain their expertise
- * perceptions of scientific experts about the international context of their field of practice
- * perceptions of scientific experts about their own work
- * perceptions of internal and external stakeholders about the work of international scientific experts

To develop

- * an understanding of the dynamics of international scientific expert work in a socially oriented, nonprofit global environment.
- * a theoretical model of the work of international scientific experts working in a socially oriented, nonprofit, global environment.

Participants will benefit by having a greater knowledge and understanding of the

- * shared perceptions of work as an international scientific expert in their field of practice
- * means by which scientific expertise can be maintained

In general the project will improve understanding of the nature of international scientific expert work, expertise and its contribution to international nonprofit projects

Procedures will remain the same with the addition of observation of the group at a workshop and examination of relevant public documentation. Some changes to survey and interview questions will be needed.

Participants:

Description: A number of internal and external stakeholders will also be interviewed. The external stakeholders will be voluntary participants and selected on the basis of stakeholder groups named by the heads of accredited anti-doping laboratories in their interaction with the researcher. Internal stakeholders will be voluntary accredited laboratory staff.

Number of participants: An additional 5 or 6 survey / interviews will be conducted as a result of the inclusion of adult external stakeholders. Possibly 50 survey/interviews will be conducted with internal adult stakeholders.

Method of Recruitment: External stakeholders suggested by participating heads of laboratories will be contacted and invited to participate voluntarily in the research project.

During and after the completion of the study data will be stored in a locked filing cabinet or on a password protected computer system in the researcher's locked office at ACU National

6. Reasons for the Modifications

Please indicate whether any adverse effects have occurred or whether any concerns have been expressed by participants.

Modifications are being sought before the project starts in order to allow the project to examine both

- * the maintenance of expertise by the study's participants as proposed in the initial application and
- * the dynamics of the expert work of the same participants in a socially oriented, nonprofit, global context. ?

This additional aspect of the project will be used for the student researcher's doctoral work.

B2 INFORMATION LETTER TO PARTICIPANTS

Australian Catholic University
Brisbane Sydney Canberra Ballarat Melbourne



TITLE OF PROJECT:

THE DYNAMICS OF INTERNATIONAL EXPERT SCIENTIFIC WORK IN THE GLOBAL PUBLIC CONTEXT: A CASE STUDY OF THE WORK OF THE SCIENTIFIC DIRECTORS OF ACCREDITED ANTI-DOPING LABORATORIES

NAMES OF INVESTIGATORS:

ALANAH KAZLAUSKAS (DOCTORAL STUDENT),
DR. KATE CRAWFORD AND ASSOCIATE PROFESSOR PAM GIBBONS (SUPERVISORS)
ASSOCIATE PROFESSOR PAM GIBBONS (CO-SUPERVISOR)

You are invited to participate in a qualitative research project that will examine the work of international scientific experts whose efforts are directed towards a social rather than a commercial goal. The project will aim at developing an understanding of the dynamics of scientific expert work in a high profile, changing public global environment through the use of questionnaires, interviews and focus group discussions. This study will focus upon the work of the scientific directors of accredited sports anti-doping laboratories whose work is directed towards the reduction of the abuse of drugs by athletes. Study participants will be drawn from scientific directors of the accredited laboratories for the first three stages of the project and from external stakeholders for the fourth stage. Earlier stages of the research have been conducted during late 2002 and 2003.

If you agree to participate in this study, you will be asked to take part in a semi-structured interview or to complete a survey which asks you to briefly describe in general terms your perceptions of your work, the challenges facing doping control programs, communication between scientific and non-scientific workers in the area, issues relating to the maintenance of scientific expertise and the future of doping control.

If you agree to participate in this stage of the project, the only inconvenience to you will be the time taken to read this Letter to Participants, to complete and return the 'Consent Form', and to participate in the interview which I estimate will take approximately thirty to forty five minutes to complete. You are free to withdraw consent and discontinue participation in the study at any time without giving a reason. You are not expected to disclose any matters which compromise the confidentiality or privacy of yourself or your organization.

The potential benefits of this project will be the capture of first hand information about the nature and context of the work of the scientific directors of the accredited laboratories from the scientific directors themselves. Participants will be asked to review and comment upon notes of their interview before their inclusion in the analysis stage of the research. Some time later the investigators will facilitate discussions about selected issues raised by accredited anti-doping laboratory directors and external stakeholders. Participants will be asked to comment upon preliminary results of each stage of the research. The investigators hope to publish their findings in general terms during and after the study. If you are prepared to participate in the project, would you please indicate your willingness on the attached Consent Form.

The data from the first stage survey and subsequent stages will be kept in the researchers' locked filing cabinet in a locked office or on a secure password protected computer. All data and results will be confidential. Survey data will be anonymous. The results will be reported in general terms and will not disclose the details of individuals or their organizations. Individuals will not be able to be identified. Results will be published in appropriate journals and the principal researcher's doctoral thesis.

Any questions regarding this project should be directed to

Mrs Alanah Kazlauskas,
Telephone: (+612) 9739 2884
Fax: (+612) 9739 2315
Email a.kazlauskas@mackillop.acu.edu.au

Or to
Dr Kathryn Crawford
Telephone (+612)
Mobile: (+612) 0414267929
Email: katecis@ozemail.com.au

in the
School of Business and Informatics (NSW),
Mackillop Campus,
ACU National,
40 Edward Street,
North Sydney NSW 2059,
Australia

The Director,
Creative Interactive Systems Pty Ltd
Suite 210, Bay 3
Locomotive Workshops,
Australian Technology Park,
Eveleigh NSW, 1430,
Australia

The Human Research Ethics Committee at Australian Catholic University has approved this project. If you have any complaint about the manner in which this activity has been conducted or any query that I have been unable to satisfy, you may write to the following address:

Chair, HREC
C/O Research Services
ACU National
Mount St Mary Campus
Locked Bag 2002
STRATHFIELD NSW 2135
Tel: +612 9701 4159
Fax: +612 9701 4350

Any complaint or concern will be treated in confidence and fully investigated. The participant will be informed of the outcome.

If you agree to participate in this project, then please return a completed copy of the Informed Consent Form to me by fax on (+612) 9739 2315

Yours sincerely,

Alanah Kazlauskas
PRINCIPAL INVESTIGATOR

B3 INFORMED CONSENT FORM

Australian Catholic University
Brisbane Sydney Canberra Ballarat Melbourne



TITLE OF PROJECT: THE DYNAMICS OF INTERNATIONAL EXPERT SCIENTIFIC WORK IN THE GLOBAL PUBLIC CONTEXT: A CASE STUDY OF THE WORK OF THE SCIENTIFIC DIRECTORS OF ACCREDITED ANTI-DOPING LABORATORIES

NAMES OF INVESTIGATORS: Alanah Kazlauskas
Dr Kate Crawford (supervisor)
Associate Professor Pam Gibbons (co-supervisor)

I (*the participant*) have read and understood the information provided in the *Letter to Participants*. Any questions I have asked have been answered to my satisfaction.

(Please mark the option/s which best describe how you are prepared to participate in this project.)

- I agree to complete the survey
- I agree to participate in an interview.
- I do not wish to participate in the study.

I realise that I can withdraw from the study at any time.

I agree that research data collected for the study may be published or may be provided to other researchers in a form that does not identify me in any way.

NAME: (block letters)

SIGNATURE

DATE

SIGNATURE OF PRINCIPAL INVESTIGATOR:

Alanah Kazlauskas.

February 4, 2003

School of Business and Informatics (NS)
Australian Catholic University Limited
ABN 15 050 192 660
North Sydney Campus (MacKillop)
40 Edward Street North Sydney
New South Wales 2060 Australia
PO Box 968 North Sydney
New South Wales 2059 Australia
Telephone (+612) 9739 2368
Facsimile (+612) 9739 2315
CRICOS registered provider:
00004G, 00112C, 00873F, 00885B

APPENDIX C CORRESPONDENCE RELATING TO THE PILOT STUDY

C1 INITIAL REQUEST FOR PARTICIPATION IN THE PILOT STUDY.

Dear XXXXXXXX

I am writing to request your participation in a pilot study that will inform my doctoral research.

My topic is

'The dynamics of international, scientific, expert work in a nonprofit, high profile, changing, global context'

My research will use a qualitative research methodology that will incorporate a case study. I wish to focus upon the work of the heads of accredited anti-doping laboratories for this case study.

I hope that this research will facilitate a better understanding of the work of scientific experts by both the experts themselves and other stakeholders in the programs that their work supports.

The Human Research Ethics Committee of ACU National has approved this research. If you are prepared to participate in this project, please

- read the attached Letter to Participants
- return a completed copy of the attached Consent Form to me by fax at 61 2 9739 2315 and keep the original for your records.

On receipt of a completed consent form from you, I will send a short questionnaire for you to answer.

I have attached some brief autobiographical details for your interest.

Looking forward to hearing from you,

Alanah Kazlauskas

C2 FOLLOW-UP EMAIL TO PARTICIPANTS IN THE PILOT STUDY

Dear XXXX,

A few weeks ago I wrote to you requesting your participation in a pilot study that will inform my PhD research into the dynamics of international scientific expert work. In that email, I forgot to mention that I would appreciate your reply to my request by November 15, 2002. This will provide me with enough time for the distribution, completion and analysis of the results from the pilot study before I distribute the main survey in early January 2003.

I believe that developing an understanding of the “global” nature of work is of importance in our changing world. As someone who interacts regularly with colleagues outside your own country, you are already familiar with many of the challenges of work in a global context. Further, as a woman who has achieved international success, your participation in my research would be greatly appreciated.

If you are prepared to participate in this research, would you please

- read the attached Letter to Participants
- return a completed copy of the attached Consent Form to me by fax at 61 2 9739 2315 and keep the original for your records.

On receipt of a signed Consent Form from you, I will send a short questionnaire for you to answer.

I have also attached some brief autobiographical details for your interest.

Looking forward to hearing from you,

Alanah

C3 REMINDER EMAIL TO PARTICIPATING DIRECTORS

Dear XXXX

Thanks once again for agreeing to participate in my research into the dynamics of international scientific expert work.

A week or two ago, I sent you a pilot survey to complete. I forgot to mention that I would like to have the completed survey returned to me by November 30. This will give me sufficient time to analyse the results of the pilot study and prepare the main survey for distribution in January 2003.

I have included the pilot survey at the end of this email in case you prefer to complete it as a "return email". I assure you that your reply will be treated confidentially.

Best wishes,

Alanah

Alanah Kazlauskas
School of Business & Informatics (NSW)
Australian Catholic University Limited (ABN 15 050 192 660)
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PO Box 968
North Sydney 2059 NSW Australia
Ph: +61 2 9739 2884
Fax: +61 2 9739 2315
Email: A.Kazlauskas@mackillop.acu.edu.au

APPENDIX D PILOT STUDY SURVEY

D1 THE PILOT STUDY SURVEY

Delete the inappropriate answers for the first two questions.

1. How long have you been working in anti-doping?
 0 to 3 years 4 to 8 years 9 to 12 years More than 12 years
2. Is your laboratory part of
 a hospital a university a government institution other (please insert your answer)

For the remaining questions, please insert your answer after each question.

3. What part of your work do you enjoy most?
4. What part of your work do you enjoy least?
5. As a recognised scientific expert in the anti-doping area, which groups of people ask you questions or seek advice about anti-doping matters. (Eg doctors, athletes, politicians, newspaper reporters etc.)
6. Please give a general description of anti-doping related committees of which you are a member (eg national sports doping policy committee, international sporting federation etc).
7. What problems confront scientific experts working in accredited dope testing laboratories? How do you think that these problems could be resolved?
8. What general difficulties are associated with international anti-doping programs? How could these problems be reduced?
9. How do you maintain your expertise in the anti-doping area? Are there any particular activities or events that make it easier for you to keep up with recent developments?
10. What difficulties are there to maintaining your expertise?
11. How do you ensure that the scientific staff in your laboratory maintain their skills and expertise?
12. What is the best way for research outcomes to be shared between accredited anti-doping laboratories?
13. Please comment on any other aspect of your role as a scientific expert working in anti-doping.
14. Please suggest any other questions which I could ask in this research.

Thank you for participating in this survey. Now that you have completed the questionnaire, please save it then return it to me by email. In due course, I will send you a summary of the pilot survey results.

APPENDIX E MATERIAL RELATING TO INTERVIEWS OF THE SCIENTIFIC DIRECTORS

E1 INITIAL PARTICIPATION REQUEST

Subject: Research project participation request

Dear

I am writing to tell you about my PhD research project which is investigating the changing context of the work of the scientific directors of IOC accredited anti-doping laboratories.

One aim of this qualitative research project is to facilitate a better understanding of the work of scientific experts by both the experts themselves and other stakeholders in the programs that their work supports. A pilot study has already been completed and raised several important issues. For this project to be successful, I need the participation of experts in the field. I hope you will be able to participate.

The Human Research Ethics Committee of Australian Catholic University has approved this research. All data will be confidential to my supervisor (Dr K. Crawford) and myself. The results will be reported in general terms and will not disclose the details of individuals or their organizations. Results will be published in appropriate journals and the principal researcher's doctoral thesis. Participation is voluntary and participants are free to withdraw from the study at any time.

I have attached:

- the Main Study Survey
- and a 'Letter to Participants' which contains further information.

If you can participate but would prefer to complete the survey via telephone, please let me know and I will arrange a time to call you.

If you have any questions, please do not hesitate to contact me.
I look forward to hearing from you,

Alanah Kazlauskas

Alanah Kazlauskas
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North Sydney 2059 NSW Australia
Ph: +61 2 9739 2884
Fax: +61 2 9739 2315
Email: A.Kazlauskas@mackillop.acu.edu.au

E2 FOLLOW-UP PARTICIPATION EMAIL

Subject: Follow up request

Dear XXXX

I am writing to you to follow up my earlier request for your participation in my doctoral research project. I was very happy to receive encouraging comments about my research project from some of your colleagues who have agreed to participate in my research. They have also been kind enough to suggest that I provide a clearer explanation of my project's purpose and recruitment methodology. My research is not about anti-doping science; rather it will examine the work of scientific experts who are helping to address social problems.

Increasingly, international cooperation is a means of tackling social issues that are of global concern. Some of these global public issues require scientific expert participation if they are to be resolved. Examples of such issues include biosecurity, chemical safety, pesticide evaluation, environmental concerns and anti-doping in sport. Scientific experts who work in such areas find themselves in a complex work setting resulting from the interactions between and within scientific and non-scientific organizations at both national and international levels.

My research is directed towards understanding how scientific experts involved in a complex mixed scientific and non-scientific environment manage their work. It is not concerned with the scientific aspects of the scientific experts' work.

I chose to investigate the work of the experts who are the scientific directors of the IOC accredited anti-doping laboratories around the world because the expertise of the scientific directors is internationally recognized, the number of scientific directors is a manageable sample size for my study and because the contact details of the scientific directors can be obtained from the internet.

I hope that the improved understanding of the issues relating to complex nature of the work of the scientific expert that will result from my study will be of benefit to the group of scientific experts who participate in my research, as well as to other scientific expert groups. It may also be of benefit to organisations which rely on the work and knowledge of scientific experts.

The research I am undertaking is quite different to the scientific research with which you are familiar. You may not be aware that part of qualitative research is the design and use of a protocol for recruiting participants. The protocol I am following in order to confirm each participant's participation or non-participation consists of an initial email to explain the project and request participation; a reminder email ten days later; a further email ten to fourteen days later; and finally direct contact such as a phone call.

Participation in this stage simply involves completing the attached survey. A consent form and details of later stages of the research are attached to this email. If you do not receive them, please let me know and I will send them immediately.

Once again, I would like to assure you of the confidentiality and anonymity of the identities and the data given by those who agree to participate in this research. Since participation is voluntary, participants who wish to withdraw from the project may do so at any stage.

I hope that the information contained in this email will be of use as make your decision about your participation in my research into the different aspects of scientific expert work.

I look forward to hearing from you,

Alanah Kazlauskas

Alanah Kazlauskas
School of Business & Informatics (NSW)
Australian Catholic University Limited (ABN 15 050 192 660)
CRICOS Reg: 00004G,00112C,00873G,00885B

E3 DEMOGRAPHIC QUESTIONS FOR THE SCIENTIFIC DIRECTOR INTERVIEW

THE WORK OF THE SCIENTIFIC DIRECTORS OF ACCREDITED ANTI-DOPING LABORATORIES

Thank you for agreeing to this interview. The purpose of this interview is to clarify and extend your perceptions of your work as an international scientific expert in the anti-doping context. What you say is confidential and you need only answer those questions that you feel comfortable with. If you have agreed to the interview being taped, you can ask me to stop the tape and/or the interview at any time.

Before we start are there any questions you would like to ask me about my research?

Demographic questions

1. How many years have you spent working in doping control?
 0 to 3 years 4 to 6 years 7 to 9 years 10 or more years
2. How long have you been working as the scientific director of an IOC accredited anti-doping laboratory?
 0 to 3 years 4 to 6 years 7 to 9 years 10 or more years
3. How frequently has your laboratory provided testing for a major international sporting event?
 Never Once 2 or 3 times 4 or more times
4. Is your laboratory part of
 a hospital a university a private company
 a government scientific institution other: (please specify)
5. Male Female
6. Is your first language
 English French Spanish other:
 (please specify)
7. In which region is your laboratory located?
 North Western Europe Eastern Europe
 Southern Europe & Africa Americas Australasia
8. Roughly how many samples would your laboratory analyse each year?
 2500 or less Between 2500 and 6000 6000 or more
9. How often outside organized meetings would you contact another accredited laboratory director about work?
 Never Daily Weekly Fortnightly
 Monthly 1 or 2 times in 3 to 6 months 1 or 2 times a year
10. Which of the following do you use to maintain this contact by
 phone fax email meetings
 other:
11. Does your country have a formal sports anti-doping program? YES NO

E4 OPEN-ENDED QUESTIONS IN THE SURVEY INTERVIEW

Subject: Follow up request

Dear XXXX

I am writing to you to follow up my earlier request for your participation in my doctoral research project. I was very happy to receive encouraging comments about my research project from some of your colleagues who have agreed to participate in my research. They have also been kind enough to suggest that I provide a clearer explanation of my project's purpose and recruitment methodology. My research is not about anti-doping science; rather it will examine the work of scientific experts who are helping to address social problems.

Increasingly, international cooperation is a means of tackling social issues that are of global concern. Some of these global public issues require scientific expert participation if they are to be resolved. Examples of such issues include biosecurity, chemical safety, pesticide evaluation, environmental concerns and anti-doping in sport. Scientific experts who work in such areas find themselves in a complex work setting resulting from the interactions between and within scientific and non-scientific organizations at both national and international levels.

My research is directed towards understanding how scientific experts involved in a complex mixed scientific and non-scientific environment manage their work. It is not concerned with the scientific aspects of the scientific experts' work.

I chose to investigate the work of the experts who are the scientific directors of the IOC accredited anti-doping laboratories around the world because the expertise of the scientific directors is internationally recognized, the number of scientific directors is a manageable sample size for my study and because the contact details of the scientific directors can be obtained from the internet.

I hope that the improved understanding of the issues relating to complex nature of the work of the scientific expert that will result from my study will be of benefit to the group of scientific experts who participate in my research, as well as to other scientific expert groups. It may also be of benefit to organisations which rely on the work and knowledge of scientific experts.

The research I am undertaking is quite different to the scientific research with which you are familiar. You may not be aware that part of qualitative research is the design and use of a protocol for recruiting participants. The protocol I am following in order to confirm each participant's participation or non-participation consists of an initial email to explain the project and request participation; a reminder email ten days later; a further email ten to fourteen days later; and finally direct contact such as a phone call.

Participation in this stage simply involves completing the attached survey. A consent form and details of later stages of the research are attached to this email. If you do not receive them, please let me know and I will send them immediately.

Once again, I would like to assure you of the confidentiality and anonymity of the identities and the data given by those who agree to participate in this research. Since participation is voluntary, participants who wish to withdraw from the project may do so at any stage.

I hope that the information contained in this email will be of use as make your decision about your participation in my research into the different aspects of scientific expert work.

I look forward to hearing from you,

Alanah Kazlauskas

Alanah Kazlauskas

School of Business & Informatics (NSW)

Australian Catholic University Limited (ABN 15 050 192 660)

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PO Box 666

E5 EMAIL RELATING TO ORGANISATION OF A TELEPHONE INTERVIEW

Dear XXXX

Once again, I thank you for being prepared to participate in my research into the dynamics of international scientific expert work. As I have now moved on to the next stage of this research, I am writing to ask you to participate in a telephone interview which will clarify and extend the issues raised by the survey which you completed some months ago. I anticipate that the interview will take approximately 45 to 50 minutes.

If you are prepared to contribute to my research in this way, please let me know some suitable times before xxxxx when I could telephone you in order to conduct the interview.

Kind regards,

Alanah

E6 PRE-INTERVIEW INFORMATION INCLUDING BROAD TOPICS FOR DISCUSSION AND DEMOGRAPHIC QUESTIONS

List of interview topics

- Your career
- Your laboratory
- Challenges of anti-doping scientific work
- Achievements
- Future directions
- Interaction with other groups – scientific and non-scientific
- Expertise
- Outstanding event(s)/incident(s)
- Comments or questions

E7 RESEARCHER’S INTERVIEW SCHEDULE SHOWING PROMPTS

Preamble

Thank you for agreeing to this interview. As you know I've already conducted a survey and this interview is to clarify and extend how you feel about your work as a scientific expert. What you say is confidential and you need only answer those questions that you feel comfortable with. You can stop the tape and/or the interview at any time.

Before we start are there any questions you would like to ask me about my research?

How did you come to be involved in scientific work in the anti-doping area?

How interested are you in sport?

Please tell me about your laboratory?

What’s its main purpose?

Who / Why / Where / When / How was it set up?

Does your laboratory work cooperatively with any other laboratory (ies) in this area?

With whom do you work? Are they accredited?

Do you work with any other groups?

What’s usually your role in cooperative work?

(If no, why?)

A matter of opinion...

One matter that came out of the preliminary study was whether or not routine anti-doping analyses should or should not be carried out in the same laboratory as anti-doping research.

Would you please give one argument for and one argument against each point of view

	<i>Analyses & research should be separated</i>	<i>Analyses & research should be integrated</i>
Argument for		
Argument against		

What sorts of interactions do you have with other stakeholders in the anti-doping area? Why do they occur?

What challenges do you experience as an expert working in this field?

How do you meet these challenges?

How could the pressures of these challenges be reduced?

What is your assessment of the current direction of doping control

<i>in your own country?</i>	
<i>internationally?</i>	

What, if any, is the impact of culture and/or language on international doping control programs?

Can you tell me about a particular incident / event that stands out in your career?

What skills and knowledge are be needed by someone who wants to be the scientific director of an accredited anti-doping laboratory?

What advice would you give someone who was about to apply for a position like this?

Are there any other comments you would like to make about your work?

Are there any other questions you would like to ask me about this research?

Appendix F Stakeholder interview schedule

F1 INTRODUCTION AND DEMOGRAPHIC QUESTIONS

Thank you for agreeing to participate in this research project. Be assured that your anonymity will be preserved. Your answers are confidential and will be kept securely. Demographic data will be reported in summary form only so that individuals cannot be identified. As your participation is voluntary, you may withdraw from the study at any time.

Before I start asking questions, are there any questions you would like to ask about this research?
 Interviewee clarified who I was and where I was coming from with the research and why I chose the area and where I hope to go with it

1. In which region are you located?

<input type="checkbox"/> North Western Europe	<input type="checkbox"/> Eastern Europe	<input type="checkbox"/> Southern Europe & Africa
<input type="checkbox"/> Americas	<input type="checkbox"/> Australasia	

2. Does your own country have a national sports anti-doping program?

<input type="checkbox"/> YES	<input type="checkbox"/> NO
------------------------------	-----------------------------

3. Briefly describe your current occupation.:

4. How long have you been doing this work?

<input type="checkbox"/> 0 to 3 years	<input type="checkbox"/> 4 to 6 years	<input type="checkbox"/> 7 to 9 years	<input type="checkbox"/> 10 or more years
---------------------------------------	---------------------------------------	---------------------------------------	---

5. Are you current involved with an organized national anti-doping program?

<input type="checkbox"/> YES	<input type="checkbox"/> NO
------------------------------	-----------------------------

 If yes, for how long have you been involved?

<input type="checkbox"/> 0 to 3 years	<input type="checkbox"/> 4 to 6 years	<input type="checkbox"/> 7 to 9 years	<input type="checkbox"/> 10 or more years
---------------------------------------	---------------------------------------	---------------------------------------	---

6. What sorts of experiences have lead to your association with anti-doping issues (please tick all boxes that are appropriate.)

<input type="checkbox"/> membership of a national sports anti-doping agency	<input type="checkbox"/> membership of a national sporting federation
<input type="checkbox"/> membership of an international sporting federation	<input type="checkbox"/> membership of an international anti-doping agency
<input type="checkbox"/> work for a company (e.g. a consultancy or supplier)	<input type="checkbox"/> work as a medical practitioner
<input type="checkbox"/> work as a legal expert	<input type="checkbox"/> work as a journalist
<input type="checkbox"/> involvement as an athlete	<input type="checkbox"/> membership of a national Olympic committee
<input type="checkbox"/> work as a sports coach	<input type="checkbox"/> membership of the IOC
<input type="checkbox"/> work as a scientist outside an anti-doping lab	<input type="checkbox"/> work as a scientist in an anti-doping lab

 (Other please specify)

7. Is your association with anti-doping issues

<input type="checkbox"/> central to your current occupation	<input type="checkbox"/> require regular involvement each week
<input type="checkbox"/> require some recurrent, fixed involvement	<input type="checkbox"/> require occasional involvement

8. Does your commitment take

<input type="checkbox"/> most of your time	<input type="checkbox"/> about half of your time
<input type="checkbox"/> some of your time	<input type="checkbox"/> very little of your time

9. Does your own country have an accredited anti-doping laboratory?

<input type="checkbox"/> YES	<input type="checkbox"/> NO
------------------------------	-----------------------------

10. How often would you have contact with a scientific director of an accredited anti-doping laboratory about anti-doping issues?

<input type="checkbox"/> Daily	<input type="checkbox"/> Weekly	<input type="checkbox"/> Fortnightly	<input type="checkbox"/> Monthly
<input type="checkbox"/> 1 or 2 times in 3 to 6 months	<input type="checkbox"/>	<input type="checkbox"/> 1 or 2 times a year	<input type="checkbox"/> Never

11. Which of the following means do you use to for this contact?

<input type="checkbox"/> meetings using casual – does not seek director out specifically; can be a long time between meetings	<input type="checkbox"/> phone	<input type="checkbox"/> fax	<input type="checkbox"/> email	<input type="checkbox"/> (other)
---	--------------------------------	------------------------------	--------------------------------	--

F2 OPEN-ENDED QUESTIONS WITH INTERVIEWER PROMPTS

1. Please tell me how your INVOLVEMENT in the “drugs in sport” issue came about?

*How you came to work in this area? What do you hope to achieve by your work?
Why do you continue to work in this area? How much of an interest do you have in sport?*

2. Doping in elite sport is a problem at both the global and national level.

What do you see as the MAIN ISSUES facing those involved with doping control in sport?

Big picture / broad? Day to day? For the scientists?

Are there any CHANGES would you like to see in this area in order to address these issues?

3. Communication between people is very important and can be casual or serious in nature.

Do you have many CASUAL CONVERSATIONS with others about this area?

In general terms, with whom do you have these conversations? Why do these conversations occur?

With whom would you have SERIOUS DISCUSSIONS about this area?

In general terms, with whom do you have these discussions? Why do these discussions occur?

What impact do CULTURE AND/OR LANGUAGE have on anti-doping work in sport?

4. MAINTAINING KNOWLEDGE of what’s happening is important for those interested in this area.

How do you obtain information about what’s new in doping and anti-doping in sport?

explain how you maintain your own knowledge and expertise?

describe any particular activities or events which make it easier for you to keep up with recent developments in doping

control?

from whom you obtain information about anti-doping issues and why?

to whom do you give information about anti-doping issues and why?

5. The accredited laboratory system is part of national and international efforts in the anti-doping area.

Would you please describe the CONTRIBUTION of the scientific directors of the accredited laboratories to this area?

What role do scientists play in POLICY DEVELOPMENT AND DECISION MAKING in anti-doping?

From your perspective, what SKILLS & KNOWLEDGE does someone need to be the scientific director of an accredited anti-doping laboratory need?

6. Can you tell me about a PARTICULAR DOPING RELATED INCIDENT / EVENT that stands out in your memory?

Please add any other comments you would like to make about the anti-doping aspects of sport.

Are there any other questions you would like to ask me about this research?

APPENDIX G COMMUNITY OF PRACTICE SURVEY

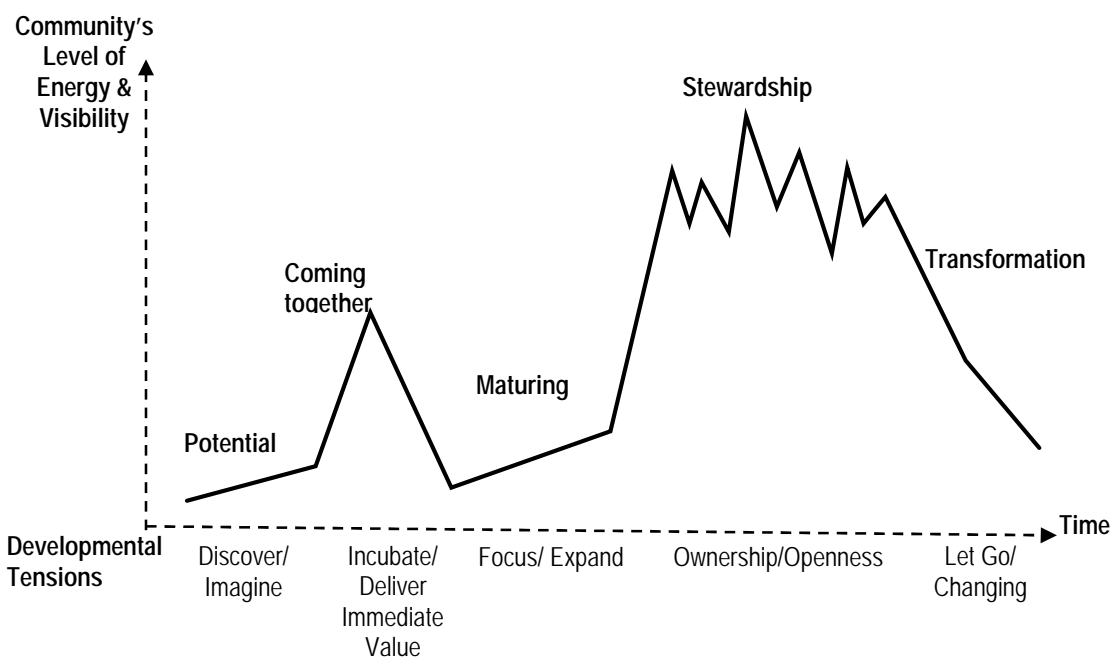
FROM COLOGNE 2004 WORKSHOP

Thank you for participating in this research. Your anonymity will be preserved. Your answers are confidential and will be kept securely. Demographic data will be reported in summary form only so that individuals cannot be identified.

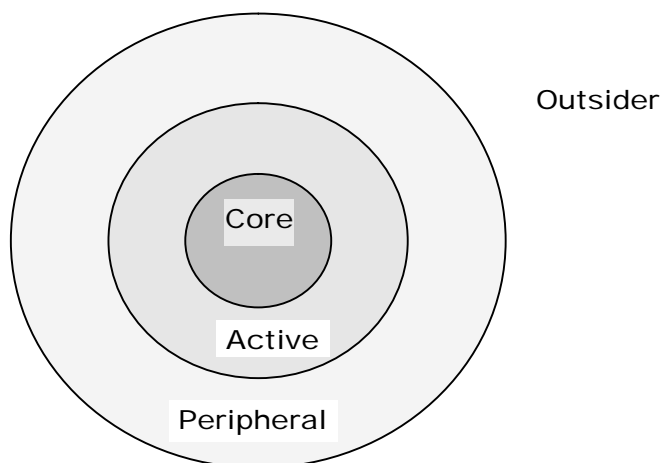
Alanah Kazlauskas, March 2004

A few questions

- On the diagram below, please use an 'X' to mark where you would place the international anti-doping community on a 'community of practice' timeline?



- On the diagram below, please use an 'X' to mark where you think you are as a member of the scientific anti-doping community?



3. In which region do you live?
 Europe Americas Africa, Asia & Oceania
4. What is your age group?
 less than 25 25 to 35 years 36 to 45 years more than 45 years
5. Gender: Male Female
6. Do you work in an accredited anti-doping laboratory?
 Yes No
- If no, is your association with anti-doping issues
 central to your current occupation
 require regular involvement each week
 require some recurrent, fixed involvement
 require occasional involvement
7. How long have you been doing work that is related to drugs-in-sport?
 0 to 3 years 4 to 6 years 7 to 9 years 10 or more years
8. In a few words, please describe your current role
 (eg senior scientist, research student, lab director, non-lab)
9. If you wish, tell me more about what you think about the work of scientists in the anti-doping area below or on the back of this page or talk to me! ☺

The Emerging Practice of Global Scientific Work

Alanah Kazlauskas
ACU National, Sydney

Dr. Kate Crawford
Novae Research Group, Sydney

Globalisation has led to worldwide efforts by scientific experts tackle issues that are of concern to international social concern. Over the last twelve months, this research has been investigating the work a group of international scientific experts whose work in a global public context is aimed towards dealing with one such social issue – doping in sport. These experts, the scientific directors of anti-doping laboratories, are few in number and have a day-to-day workspace which extends beyond their own laboratory and own country to around the globe.

This research has identified factors that affect the work of the scientists whose efforts are directed towards deterring doping by athletes as well as generating and applying new scientific knowledge to the area. The work has also indicated that scientific directors of accredited anti-doping laboratories contribute to public debate about doping issues. The paper uses a theoretical framework to describe and explain the dynamics of scientific expert work in a highly charged, complex socio-political context that has a critical role in relation to elite sport with its nationalistic and commercial imperatives. Indications are that the outcomes of this study will be of interest and potential importance to both the scientists themselves and to others who have a stake in their work as the study suggests the existence of gaps in understanding of and tensions within this work context.

APPENDIX H COMPARISON OF ANTI-DOPING SCIENTISTS' USE OF VARIOUS CHANNELS FOR KNOWLEDGE SHARING

Perspectives about the work of the scientific directors	Number of directors who participated from this group	(Study participants & their laboratories) Average number of Cologne Presentations (Talks & Posters) 2003-5	(All scientific directors & their laboratories) Average number of Cologne Presentations (Talks & Posters) 2003-5
	<i>Number of samples in 2003</i>	<i>Cologne Publications from 2002-2004 workshops</i>	<i>Cologne Publications from 2002-2004 workshops</i>
	Overall number of laboratories in this group	PUBMED listings (2002-4)	PUBMED listings (2002-4)
Sustaining routine testing	3	1.25	2.3
Managing the laboratory	Less than 2500	0.7	1.1
Maintaining forensic proficiency	10	1	1.5
Keeping up with new scientific techniques			
Acknowledging a shared responsibility			
Advancing anti-doping science AND sustaining routine testing	3	5.7	5.1
The nature of anti-doping scientific research	<i>2500 to 4500</i>	4.7	3.5
Mobilizing new knowledge within the community	8	3	3.1
Keeping up with doping practices			
Strengthening community relationships			
Participating in anti-doping governance AND advancing anti-doping science AND sustaining routine testing	8	12	11.2
Critiquing anti-doping practice and governance	<i>More than 4500</i>	11.0	8.5
Contributing to anti-doping practice	13	5.8	5.9
Exploring the role of a professional association			
TOTALS			
Cologne Presentations 2003 - 2005		130	210
Cologne Proceedings 2002-2004		104	150
PUBMED Listings for 2002-2004		70	117

**APPENDIX I 2004 COLOGNE WORKSHOP
PARTICIPATION AND ATTENDANCE BY
GEOGRAPHICAL REGION**

	Africa, Asia and Oceania	Europe	Americas	Category Total
Number of accredited laboratories	8	18	5	32
Percentage representation	25.0%	59.4%	15.6%	100.0%
Attendees from Accredited Laboratories	17	64	9	90
Percentage representation in this category	18.9%	71.1%	10.0%	100.0%
Percentage representation at the workshop	13.8%	52.0%	7.3%	73.2%
Attendees from non-accredited practicing or aspiring laboratories	8	10	5	23
Percentage representation in this category	34.8%	43.5%	21.7%	100.0%
Percentage representation at the workshop	6.5%	8.1%	4.1%	18.7%
Other attendees (external scientists, consultants & observers)	2	4	4	10
Percentage representation in this category	20.0%	40.0%	40.0%	100.0%
Percentage representation at the workshop	1.6%	3.3%	3.3%	8.1%
Number of Participants from this region	27	78	18	123
Percentage representation from this region	22.0%	63.4%	14.6%	100.0%
Number of samples analysed in the region in 2004	25019	92615	51553	169187
Percentage representation from this region	14.8%	54.7%	30.5%	100.0%

**APPENDIX J CONTRIBUTIONS TO THE COLOGNE
PROCEEDINGS 1992 – 2004 BY RESEARCH FIELD**

Theme	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	TOTAL
Peptide hormones	0	1	3	1	2	3	2	4	0	2	7	3	8	36
Biochemical and immunological methods	4	0	2	2	6	2	4	3	2	0	0	4	3	32
Steroid analyses	4	3	4	5	4	1	10	7	10	3	5	2	13	71
Profiling steroids	7	8	7	9	11	5	4	4	0	3	3	3	2	66
New and improved analytical techniques	7	4	7	6	6	9	8	12	5	10	4	16	14	108
Detections of non-steroidal doping agents	7	6	11	3	4	7	12	13	8	18	5	10	15	119
Organisation of doping control	4	2	4	2	2	0	0	1	2	3	3	7	4	34
Nutritional supplements	1	0	0	0	0	0	0	0	0	4	6	5	6	22

**APPENDIX K PAPERS IN COLOGNE PROCEEDINGS
2002–2004 BY RESEARCH FIELD & AUTHOR
AFFILIATION**

	Year	Cologne Lab	Other Accredited Lab	Joint Accredited Lab research	Accredited & External Lab(s) research project	Non-accredited lab	External	TOTALS
Peptide hormones	2002	1	2		4			7
	2003	1			2			3
	2004	0	2	1	5			8
Biochemical and immunological methods	2002	0	0	0	0	0		0
	2003	0	1		1		1	3
	2004	0	1		1		1	3
Steroid analyses	2002	0	3		2			5
	2003	0			1		1	2
	2004	4	7	0	2		0	13
Profiling steroids	2002	1	1		1			3
	2003	0	1		2			3
	2004	0	2					2
New and improved analytical techniques	2002	1	1		2			4
	2003	6	7		2		1	16
	2004	5	5	2	2			14
Detections of non-steroidal doping agents	2002	4	1					5
	2003	3	5		1	1		10
	2004	3	9	1		2		15
Organization of doping control	2002	0	1	2				3
	2003	0	4	1	1		1	7
	2004	0	2		1		1	4
Nutritional supplements	2002	2	1		1	1	1	6
	2003	2	2		1			5
	2004	2	3			1		6
TOTALS		35	61	7	32	5	7	

