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## **Improving the sustainable retirement village framework: From theory to practice**

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### **Abstract**

The retirement village industry is currently facing a sustainability challenge. In response to this, developing sustainable retirement villages is becoming popular in practice, and a sustainable retirement village framework had been developed to facilitate the trend. However, this framework is more theoretical than practical, as its development lacks the input of industry practices. In response, this study aims to improve the theoretical framework by incorporating industry practices. Inductive content analysis is adopted to identify the sustainable practices of village development and operation in eight retirement villages in Queensland, Australia, from which the sustainability features and sustainability dimensions of retirement villages are identified. The theoretical framework is improved by adding the identified sustainable practices, sustainability features, sustainability dimensions, and their interactions. In total, 109 sustainable practices are identified, which leads to the determination of 26 sustainability features and 3 sustainability dimensions. Of these sustainability features, 15 are newly added to the theoretical framework. All the sustainable practices are linked to the sustainability features of each sustainability dimension to illustrate the industry's best practices. The improved framework is an advancement on the existing theoretical framework and deepens the stakeholders' understanding of sustainable retirement villages based on the lessons learnt from industry practices. It additionally offers practical implications for the future delivery of sustainable retirement villages, and the sustainability of village projects can be assessed and benchmarked against the framework.

### **Keywords**

Retirement villages; Framework; Theory; Sustainable practices; Australia

## **1. Introduction**

Retirement villages provide a viable living option for older Australians. They comprise a residential environment that is specifically designed to provide older people with accommodation, services, and facilities to meet their requirements (Hu et al., 2017a). Although living in retirement villages can benefit residents in many ways (e.g., enhanced independence and safety), their dissatisfaction with such problems as unaffordability and social isolation has also been reported (Gardner et al., 2005). Developing retirement villages with sustainability features is a promising approach to improve the situation (Zuo et al., 2014). A sustainable retirement village, which has its roots in the theories of Sustainable Development and Environmental Gerontology, can well accommodate the residents' social, economic, and environmental needs in their later life (Xia et al., 2015). Consequently, there is increased interest in developing and operating sustainable retirement villages in Australia. This trend has been further driven by the cooperation between village developers and Green Building Council of Australia to develop a Green Star rating tool for the retirement living sector (Green Building Council of Australia, 2015).

In spite of the increased popularity of developing and operating sustainable retirement villages, the concept of "sustainable retirement villages" is still new and has yet to be comprehensively explored and comprehended. A theoretical framework for sustainable retirement villages has been proposed to contribute to a better understanding of the nature of sustainable retirement villages (Hu et al., 2015). This theoretical framework defines three interrelated sustainability dimensions of a sustainable retirement village living environment, namely an age-friendly social environment, financial sustainability, and environmental sustainability. It represents an advancement in the Environmental Gerontology literature by incorporating the sustainability philosophy into the development and operation of the institutional environment of retirement villages.

Nevertheless, the development of this existing framework mainly focuses the two theories of Triple Bottom Line of Sustainability and Environmental Gerontology, which makes it still less practical. Thus, the main drawback of this framework is that it lacks input from empirical studies. This prevents village stakeholders from clearly grasping the crucial issue of how to achieve sustainability in practice.

Although a few case studies of sustainable retirement villages reveal various industry practices and have helped village stakeholders in understanding this framework (Hu et al., 2018), they focus mainly on the identification of the best practices of village development and operation and do not link these to the theoretical framework in a systematic way. Consequently, there is a need to integrate more practical experiences into the theoretical framework for village stakeholders.

Therefore, this study aims to improve this theoretical framework by incorporating industry practices. The aim is achieved by using the inductive content analysis method based on identified sustainable practices in eight representative retirement villages in Queensland, Australia. The research findings of the study advance the theoretical framework to reflect industry practices better, which contributes to the stakeholders' deeper understanding of sustainable retirement villages. In addition, the study's findings offer practical implications for the future development and operation of sustainable retirement villages to facilitate the healthy ageing of their residents.

## **2. Literature review**

### *2.1. The living environment of older people*

As the vulnerability of older people to environmental changes increases with age, their living environment is a crucial determinant of their life quality in terms of physical, social, and psychological well-being (Lawton, 1983). For instance, the evidence indicates that older people residing in a poor environment are more likely to suffer from health problems (e.g., accidents and diseases) (Donald, 2009). In contrast, a living environment equipped with appropriate characteristics (e.g., suitable social services and facilities) contributes to older adults' social engagement, and benefits their physical and psychological well-being (Nathan et al., 2014). Other reported benefits of living in a qualified environment include greater independence, improved self-directedness, and enhanced safety (Fänge et al., 2007).

Various government initiatives have been proposed to promote a qualified living environment for older adults. For instance, the Queensland Government's *Positively Ageless Queensland Senior Strategy 2010-20* places importance on the delivery of age-friendly communities as a response to the pressing

issue of housing older people (Queensland Government, 2010). In England, the *Laying the Foundations: A Housing Strategy for England* suggests a new deal for older people's housing by offering them greater choice and supporting their independent living for a longer period (Department for Communities and Local Government, 2011).

It is crucial to offer the aged cohort an appropriate living environment that can satisfy their housing requirements and Environment Gerontology theory is popularly applied to guide the design of this kind of living environment (Schwarz, 2012). From the perspective of this theory, the living environment of older adults should be in balance with their personal competencies to obtain a Person-Environment Fit (Schwarz, 2012), and suggestions for a better-designed older adults' living environment have been widely proposed as a result. In general, the design of an older adults' living environment should place importance on its economic, social, and environmental characteristics. From an economic aspect, as older people generally experience reduced financial capabilities after retirement (due to their declining employment and the reluctance of financial institutions to provide loans), affordability is a key consideration (Hui et al., 2014). In addition, as older adults' demands on social services and support increase with age, the design of their living environment should also benefit their social well-being (e.g., social interaction, independence). This can be achieved through such ways as providing opportunities for participating in social activities and having access to facilities and services (Liddle et al., 2014). Such other social requirements as safety, privacy, freedom, and a sense of community, should also be carefully considered in the development of their living environment. Moreover, suggestions have also been widely proposed concerning the environmental features of the living environment of older people. For instance, the location of their living environment should be in close proximity to friends, family members, and service providers (Hunt, 1992). Given the declining mobility of older people, a barrier-free design is essential to ensure accessibility to their community (Menec et al., 2011).

The complexity of delivering an appropriate living environment to older adults has increased due to differences between baby boomers, who are entering into retirement, and their prior generations. Australian baby boomers, for instance, having experienced enormous social changes, expect more from retirement than other generations (Humpel et al., 2009). In addition, they are labelled as financially

irresponsible and poor savers focused on consumption (Quine and Carter, 2006), generating a higher demand for affordable living. Moreover, Australian baby boomers are switching to a more sustainable manner of living (Kamruzzaman et al., 2014), highlighting the importance of incorporating sustainability features into their living environment. All these issues are challenging the conventional patterns of delivering a living environment to older people.

## *2.2. Age-friendly communities*

Age-friendly communities are specially designed to satisfy the living requirements of older adults. In age-friendly communities, older people are significant contributors to society development instead of being mere recipients of social resources (Austin et al., 2009). The development of age-friendly communities has gained popularity in recent years; several reasons contribute to this trend. First, interest has been aroused significantly by the policy priority of ageing-in-place and the increasing discussions and applications of Environmental Gerontology in practice (Lui et al., 2009). In addition, this trend has also been encouraged by endorsements from international organizations to create a more supportive environment for older people, such as the Global Age-friendly Cities initiative suggested by the World Health Organization (2005).

Due to their popularity, the term “Age-friendly communities” has been widely defined. Landsberg and Schwartz (2007), for instance, define them as a place where older people are actively involved, valued, and supported with infrastructure and services that effectively accommodate their requirements; while Scharlach (2009) state that a community can be viewed as such when its major systems are effectively responsive to the changing requirements and capabilities of its members as they age, and provide opportunities for fulfilment in terms of their psychosocial well-being. In spite of these different definitions, the core aim of age-friendly communities is to support older people’s active ageing. The development of age-friendly communities focuses on their social and physical environment in order to deliver an integrated environment where the requirements of older adults are carefully accommodated (Lui et al., 2009). The key components of the physical environment include senior-oriented planning and design, housing accessibility and affordability, and transportation accessibility and mobility (Lui et al., 2009; Menec et al., 2011). In terms of social environment, age-friendly communities attach

importance to social integration, service accessibility, independent living, respect, safety, and lifelong learning (Austin et al., 2009; Lui et al., 2009).

Governments are showing increased interest in the delivery of age-friendly communities through planning and implementing related initiatives. For instance, the Government of Canada's Age-Friendly Communities initiative aims to ensure older adults "age actively" to help them live safely, enjoy good health, and stay involved (Government of Canada, 2016). In the United Kingdom, Lifetime Neighbourhood was proposed to offer older adults an age-friendly environment by providing more resources for areas of resident empowerment, access, services and amenities, built and natural environments, social well-being, and housing (Bevan and Croucher, 2011). Such initiatives are now stimulating the delivery of age-friendly communities in many parts of the world today.

### *2.3. Sustainable retirement villages and the theoretical framework*

The delivery of sustainable retirement villages is a relatively new phenomenon in the housing market because of the urgency in addressing such retirement village problems as the residents' high living costs and social isolation (Xia et al., 2015). This is additionally prompted by the residents' increasing awareness of sustainable development and the growing popularity for developing a supportive living environment such as age-friendly communities (Barker et al., 2012; Pillemer et al., 2011). Xia et al. (2015) define a sustainable retirement village as a residential living environment, where older adults' social, economic, and environmental requirements are carefully satisfied. For the social sustainability dimension, a sustainable retirement village facilitates the residents' active and healthy life styles (Xia et al., 2015), economic sustainability ensures residents are financially comfortable (Finn et al., 2011), while environmental sustainability involves meeting the green living requirements of residents (Zuo et al., 2014).

Developers are one of the most influential stakeholders in sustainable retirement villages, and both private and not-for-profit developers are taking action to make their villages sustainable (Hu et al., 2018; Xia et al., 2015). For instance, the Xia et al.'s (2015) case study results indicate that the sustainable practices used by a private developer include landscaping and design, the provision and accessibility of

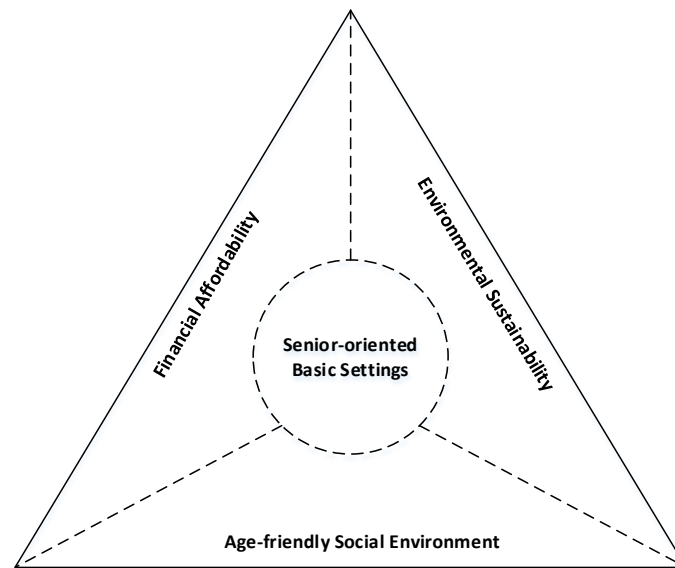
facilities and services, internal communication, and social activities; while Zuo et al.'s (2014) case study results reveal that not-for-profit developers' sustainable practices cover the design, construction, and operation stages.

However, there are also problems with retirement village developments. For instance, developers primarily emphasize such social sustainability features as care and services provision, social interaction, security/safety, and independent living (Hu et al., 2017b). In contrast, environmental sustainability has been largely ignored (Hu et al., 2017b). The consumption of unsustainable resources is of great concern to village residents who expect to reside in a green living environment (Barker et al., 2012). Residents are positive contributors to delivering sustainable retirement villages as evidenced by their having taken such daily action to make the village environment sustainable as turning off electronic devices when not in use and attending activities with other residents (Xia et al., 2014). However, the high living costs involved are a common concern of village developers and residents (Barker et al., 2012), although the study results of Zuo et al. (2014) and Hu et al. (2018) indicate that the use of certain sustainable practices does not result in additional costs to developers and residents but enhances residents' life quality profoundly.

A theoretical framework has been proposed to facilitate the stakeholders' understanding of the nature of sustainable retirement villages (Hu et al., 2015). Fig. 1 shows its structure. The development of the framework relies on the two theories of Triple Bottom Line of Sustainability and Environmental Gerontology. Three interrelated sustainability dimensions are defined, namely financial affordability, age-friendly social environment, and environmental sustainability. The sustainability features in each dimension are identified based on the rule of Person-Environment Fit. For instance, affordability and sharing capital gains are the core features in the financial affordability dimension. In addition, the framework stresses a balance of the three sustainability dimensions instead of their all being simultaneously optimal. Moreover, as the competencies of older people change with age, the framework also suggests that there is a need for a dynamic balance between older people's competencies and their village environment. However, the theoretical framework has the limitation of being heavily reliant on



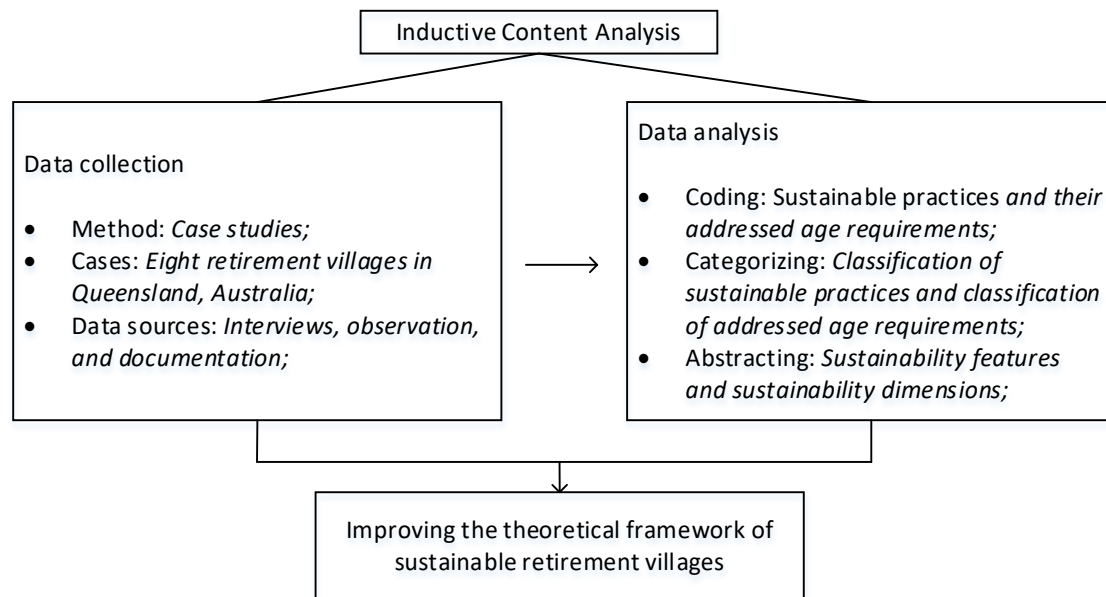
the two theories without any input of industry practices. Consequently, it is important to re-think the framework from a more practical perspective by linking it with industry practices.



**Fig. 1.** Structure of the theoretical sustainable retirement village framework

### **3. Research methods**

A framework is an empirical or quasi-empirical-based theory of social and/or psychological processes that can be applied at various levels to understand phenomena (Given, 2008). Various research methods can be used to develop frameworks, such as literature review, inductive content analysis, and inductive reasoning. In this study, inductive content analysis is adopted, which is a qualitative method that interprets meaning from collected data to develop theories and identify themes (Elo and Kyngäs, 2008). Several reasons contribute to its use in this study. First, as sustainable retirement villages are under-researched, the accessibility to limited knowledge hinders the adoption of other methods (e.g., literature review). The use of inductive content analysis can address the lack of related knowledge as it is suitable for contexts where insufficient or fragmented knowledge is available concerning an investigated phenomenon (Elo and Kyngäs, 2008). In addition, using inductive content analysis facilitates the input of industry practices as it can help retrieve themes directly from collected data. Fig. 2 shows the inductive content analysis process of this study, including data collection and data analysis.



**Fig. 2.** The inductive content analysis process

### 3.1. Data collection

The data collection aims to identify sustainable practices adopted in the development and operation of sustainable retirement villages in Australia based on the method of case studies. The case study is an effective method for investigating a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly defined (Yin, 2003). Several reasons contribute to its use in data collection. First, case studies are suitable for the research area of sustainable retirement villages, where associated theories are inadequate and insights can be retrieved from contexts for the development of structured tools, systems, and frameworks (Yin, 2003). In addition, case studies support deeper and more-detailed investigations into “how” and “why” issues of sustainable retirement villages through learning from real-world situations (Zuo et al., 2014). Moreover, case studies have earned a good reputation for identifying sustainable practices (Hu et al., 2018).

Eight case studies of representative retirement villages were conducted in Queensland, Australia. Queensland is selected as it not only has a relatively large number of retirement villages but also has a higher proportion of residents aged 65+ in Australia (Hu et al., 2017a). The criteria for selecting cases are based on the following reasons: (a) the cases should be developed and operated by developers who have established a good reputation as leaders in the Australian market; (b) the cases should be from

both the not-for-profit and private sectors; and (c) the cases should be of different sizes (small, medium, and large) and accommodation types (villas, apartments, and mix of villas and apartments). Therefore, all these cases are representative. In addition, given the different features of these eight retirement villages (Table 1), they cover the major types of retirement villages in the market. Therefore, the best practices retrieved from them reflect the main practices used in the market for the development of a sustainable living environment, providing a comprehensive identification of current practices. Both their representativeness and comprehensiveness mean that the selected eight retirement villages are adequate for this study.

Case studies use multiple data sources to achieve a research aim (Yin, 2003). In this study, the data sources are interview recordings, direct observation, and documentation. First, in each retirement village, a semi-structured interview with its village manager was conducted. Each interview lasted approximately 1.5 hours and was recorded by a voice recorder. All the interviewees have worked in the Australian retirement village sector for years, and have accumulated rich experience and knowledge of developing and operating retirement villages (Table 1). The interview questions are open-ended and interviewees introduced the sustainable practices adopted in the development and operation of their village. In addition, direct observation was conducted in each retirement village and site photos were taken to record the best practices used. This provides a supplementary way of recording sustainable practices that may be ignored in the interviews. Moreover, useful documentation in each village (e.g., brochure, site map, and official website information) was additionally collected to ensure a relatively comprehensive data collection. Resident satisfaction questionnaire survey results were collected in some villages as an important supplement. Thus, the collected data well depicts the best practices used in the development and operation of the villages.

**Table 1.** The interviewees and village characteristics

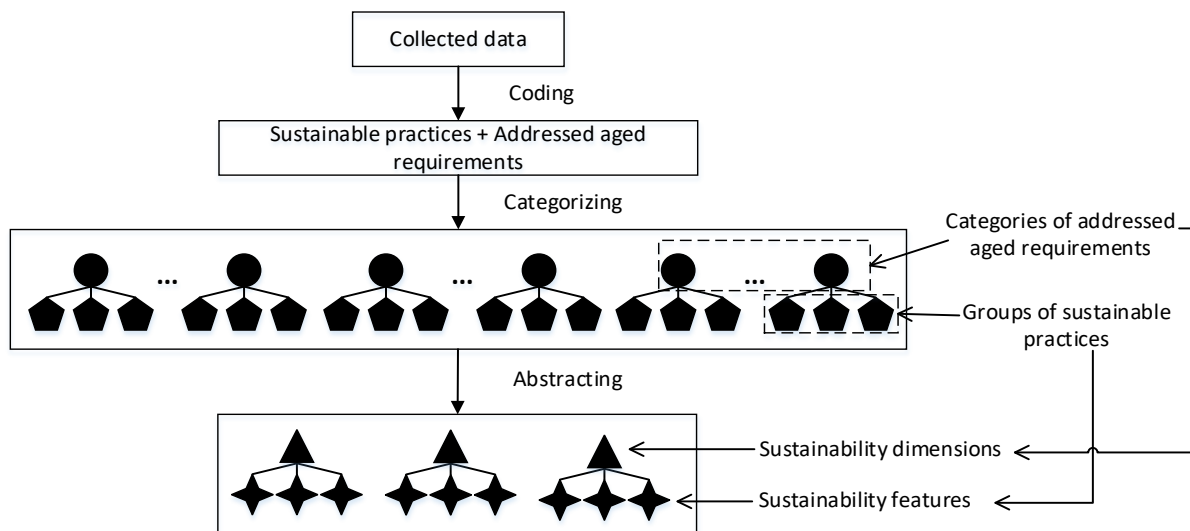
Interviewee	Working years	Position	Retirement village features		
			Financial type	Size*	Accommodation type
1	4	Developer manager	Private	Large	Mix of villas and apartments

2	5	Retirement living manager	Not-for-profit	Small	Villas
3	5	Business manager	Private	Large	Mix of villas and apartments
4	6	Integrated community manager	Private	Large	Mix of villas and apartments
5	7.5	Chief executive officer	Not-for-profit	Large	Mix of villas and apartments
6	7.5	Chief executive officer	Not-for-profit	Large	Apartments
7	16	Resident service manager	Not-for-profit	Small	Apartments
8	20	Retirement living manager	Not-for-profit	Medium	Villas

\*The village size is determined based on Hu et al. (2017c)'s classification.

### 3.2. Data analysis

Using inductive content analysis to propose a framework comprises three steps of coding, categorizing, and abstracting (Elo and Kyngäs, 2008). Coding is the process of recording as many notes as necessary in the margins to describe all aspects of contents. In this study, it refers to the identification of sustainable practices adopted in the selected villages. This was achieved through carefully reviewing the collected data and taking sustainable practice notes in a Microsoft Word document. In addition, as the aim of sustainable practices is to meet the residents' aged requirements (Zuo et al., 2014), the age-related requirements of sustainable practices were also determined. All the identified sustainable practices and their aged requirements were organized and managed in a Microsoft Excel document. Consequently, an Excel-based sustainable practice database was developed. Categorizing is a decision-making process of bringing together observations that are similar or related to each other. First, the sustainable practices that meet the same aged requirements were gathered as a group. In addition, the aged requirements that pertain to the same sustainability dimension were classified as one category. At last, abstracting formulates a general description of the research topic through generating categories. In this study, this involves naming different groups of sustainable practices (sustainability features) and categories of aged requirements (sustainability dimensions). Fig. 3 illustrates the three steps of the data analysis.



**Fig. 3.** Illustration of the three steps of identifying, categorizing, and abstracting

The theoretical framework was improved through embedding the identified sustainable practices, sustainability features, sustainability dimensions, and their interactions. Specifically, the sustainability dimensions were compared with the pre-defined ones in the theoretical framework for updating where necessary. The identified sustainability features that are not already in the theoretical framework were added, leading to a more comprehensive framework. The sustainable practices were also attached to the sustainability features of the framework to increase its practicality.

## 4 Results

### 4.1. Coding

One hundred and nine sustainable practices were identified from the eight retirement villages (Appendix A). These refer to site location, site planning, facilities and services, social life, and living cost arrangements. For instance, the site planning practices focus on site entry/exit, site drive, main arrival court, unit and building entry, parking and building access, shared social spaces, pedestrian and bicycle circulation, amenities, and design detailing. The use of sustainable practices can address various aged requirements of residents. For instance, the north-face orientation of a unit/villa makes full use of natural sunlight, which is a way of meeting the aged requirements of energy efficiency and affordable living. Therefore, the aged requirements of the sustainable practice “The north-face orientation of

villas/units” is “Energy efficiency” and “Affordable living”. In total, 26 aged requirements were identified (Table 2). All these are crucial components, stressed by environmental gerontologists in the development of a supportive living environment for older adults, and developers are advised to pay attention to them in the delivery of a sustainable living environment (Carstens, 1993).

**Table 2.** The aged requirements of the sustainable practices

	<b>Items</b>
<b>Addressed aged requirements</b>	Easy access and mobility; Safety; Easy recognition; Social interaction; Easy way-finding; Convenience; A sense of community and neighbourhood; Privacy; Capital gains sharing; Waste recycling and management; Keep informed; Affordable living; Energy and resource efficiency; Comfort; Visibility; Easy to use; Transparent fee arrangements; Service provision and accessibility; Peace of mind; Companionship; Respect; Independent living; Easy pick-up; Continuous improvement; Use of green techniques;

#### *4.2. Categorizing and abstracting*

The sustainable practices identified were classified into 26 groups based on their aged requirements. Each group is abstracted as a sustainability feature and its name relies on its aged requirements. Consequently, 26 sustainability features were identified (Table 3), with each sustainability feature including a set of sustainable practices. The sustainability features together with their sustainability practice members were grouped into three categories based on their relationships with the three social, environmental, and economical sustainability dimensions. According to the theoretical framework, the three sustainability dimensions are named as Age-friendly social environment, Environmental sustainability, and Financial affordability. Table 3 shows the three sustainability dimensions and their sustainability features. The majority of sustainability features are located in the age-friendly social sustainability dimension. Additionally, environmental sustainability involves the development of a green village environment, while economic sustainability refers to affordable living, transparent fee arrangements, and capital gains sharing.

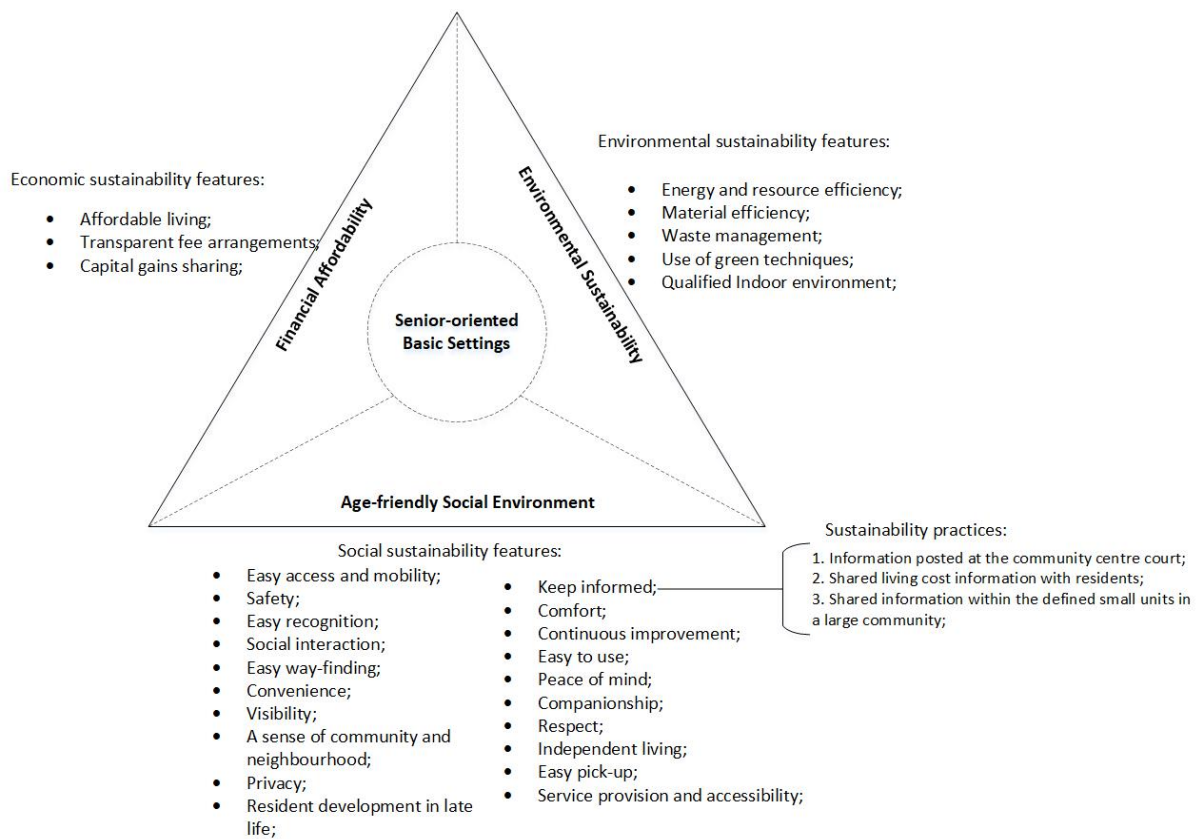
**Table 3.** Sustainability dimensions and sustainability features

<b>Code</b>	<b>Sustainability dimensions</b>	<b>Sustainability features</b>
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1	Age-friendly social environment	Independent living; Safety; Social interaction; Easy access and mobility; Easy recognition; Easy way-finding; Convenience; A sense of community and neighbourhood; Service provision and accessibility; Resident development in late life; Privacy; Keep informed; Visibility; Comfort; Easy to use; Peace of mind; Companionship; Respect; Easy pick-up; Continuous improvement
2	Environmental sustainability	Energy and resource efficiency; Waste management; Use of green techniques
3	Financial affordability	Affordable living; Transparent fee arrangements; Capital gains sharing

## 5. The improved sustainable retirement village framework

The results led to the improvement of the theoretical sustainable retirement village framework. First, some existing sustainability features in the theoretical framework were merged or split in order to ensure that all the sustainability features are specific and clear enough to be understood. For instance, the sustainability features of “Social connection” and “Social participation” were merged into “Social interaction” in the improved framework. In addition, newly identified sustainability features and their sustainable practices were added into the theoretical framework to improve its comprehensiveness and reflect the practical implications involved. For instance, the “Transparent fee arrangements” sustainability feature and its sustainable practices are newly added. Fig. 4 shows the improved framework where, due to space limitations, only the sustainable practices of “Keep informed” are shown for the illustration purpose. The full list of sustainable practices and their linked sustainability features are provided in Appendix A.



**Fig. 4.** The improved sustainable retirement village framework

Affordable living is a key indicator of the economic sustainability dimension. Affordability is heavily emphasized in the provision of housing services for older people as they usually have reduced financial capabilities after retirement (Finn et al., 2011). Although affordability is a key contributor to potential residents' relocating to retirement villages, they are generally concerned about the fees of village living, and the high living cost has been reported as a problem (Hu et al., 2017a). Consequently, retired persons with sufficient financial resources are more likely to relocate to retirement villages (Crisp et al., 2013). Moreover affordability should not be only limited to the period of living in retirement villages but also cover the period when residents leave the village (Hu et al., 2015). To achieve this, some developers share capital gains with residents who do this to ensure they have sufficient financial resources for their future accommodation. A transparent fee arrangement is also a crucial indicator owing to the declined cognitive abilities of older people and the confusion caused by complicated village living contracts (Hu et al., 2017a).



In terms of environmental sustainability, as older adults consume more energy and resources than young people do, it is crucial to ensure the energy and resource efficiency of their living environment (Garau et al., 2013). In fact, both developers and residents express concern over the consumption of unsustainable energy and resources, and would like to make the village environment green. For instance, developers have used various strategies to promote energy efficiency, such as sustainable architecture, using energy efficiency materials, and adopting energy saving technologies and appliances (Xia et al., 2015; Zuo et al., 2014). Residents take daily action to make their environment green by using as little as water as necessary and turning off electrical devices when not in use (Xia et al., 2014). In terms of waste management, developers have specially considered waste generation and recycling at the construction stage of village developments (Zuo et al., 2014). Some residents conduct their own waste management by making compost from food waste, and separating landfill waste and recycled waste (Xia et al., 2014). Using green techniques is also a popular strategy of making the village environment sustainable. In addition to the solar panels identified in this study, other techniques identified in the literature include rainwater harvesting and recycle systems, water-saving fixtures, and gas hot water systems (Zuo et al., 2014). Material efficiency and indoor environmental quality enhancement are two sustainability features suggested in the original theoretical framework – material efficiency referring to selecting and using green materials in the design and construction stages of a project (Hu et al., 2015). Given older people spend most of their time indoors, it is important to offer them a suitable indoor environment to ensure their health and comfort (Xia et al., 2015).

Social sustainability refers to the development of an age-friendly social environment. As shown in Fig. 4, a number of social sustainability features are identified, such as independence, safety, and social interaction. The importance of incorporating these features into a village environment is well documented. For instance, as companionship, privacy, and security are prominent features of a retirement community, Graham and Tuffin (2004) suggest that developers require the careful management of these features. Independent living is heavily stressed as a key indicator of older adults' quality of life (Gabriel and Bowling, 2004), and is viewed as one of most important features of retirement villages (Hu et al., 2017a). A sense of community and neighbourhood can promote the health

and well-being of older adults (Young et al., 2004) and is suggested to be a key feature in need of careful consideration in the delivery of retirement villages (Hu et al., 2017a). It should be noted that social sustainability features are not isolated in retirement villages, but are interrelated to form a complete social system. For instance, keeping residents informed about community activities can stimulate their participation, which further benefits their social interaction and independence (Liddle et al., 2014). It is therefore important that developers understand the interaction between different sustainability features and choose the most appropriate strategies as responses.

## **6. Discussion**

### *6.1. What are the differences between the original and the improved framework?*

With 15 newly added sustainability features, the improved framework is more comprehensive than the original one. Specifically, the “Transparent fee arrangements” and “Waste management” sustainability features are newly added to the economic and environmental sustainability dimensions respectively. Residents of retirement villages are concerned about their living cost partly due to their decreased financial capabilities after retirement (Finn et al., 2011). It is of great importance for village developers to ensure that their fee arrangements are transparent, given that there are different and complex fees for residents currently (e.g., entry fee, ongoing service charge, exit fee, and optional fees) and resident confusion over fee arrangements was reported previously (Petersen et al., 2017). Waste management is an important concern of residents due to their increased recognition of sustainability (Barker et al., 2012), which is consistent with the appeal of a green living environment in an aging society (MaloneBeach and Zuo 2013; Pillemer et al., 2011). However, the implementation of waste management in retirement villages may not be an easy task in some retirement villages for such reasons as the lack of recycling facilities and the high cost paid for the use of some waste management technologies (Zuo et al., 2014). Thirteen more sustainability features were added to the social sustainability dimension, such as “A sense of community and neighbourhood”, “Respect”, and “Easy access”. The importance of all these newly added social sustainability features were confirmed in previous studies. For instance, based on investigating the living experience of residents in England, Liddle et al. (2014) reveal that an accessible environment is a crucial component of age-friendliness in

villages. Easy access has also been confirmed as an important feature that enhances the life quality of older people in general communities (Stineman et al., 2011). This comprehensive inclusion of sustainability features offers village stakeholders a foundation of developing an effective instrument for assessing sustainability, and future projects can also be benchmarked against this instrument to improve their sustainability.

In addition, the dominant characteristic of the improved framework is that it reflects industry practices. Therefore, in addition to addressing the issue of “What is a sustainable retirement village?”, the improved framework provides developers with the implications of “How to achieve sustainability in retirement villages” by learning from the industry practices incorporated in it. This is especially meaningful for developers who have less experience and knowledge of developing and operating sustainable retirement villages.

#### *6.2. What are the relationships between the three sustainability dimensions in the improved framework?*

Three sustainability dimensions are identified in this framework, comprising financial affordability, an age-friendly social environment, and environmental sustainability. Previous studies regarding sustainability have indicated that the inherent conflicts between the three pillars of sustainability (economic, social, and environmental) are inevitable given that they involve different types of values, and it is therefore crucial to balance them through effective integration (Hansmann et al., 2012). For instance, pollution resulting from economically opportunistic resource exploitation is detrimental to the achievement of environmental sustainability (Liu, 2006). Conflicts can also be found among these three sustainability dimensions in the improved sustainable retirement village framework. First, there are conflicts between financial affordability and environmental sustainability in the short-term, given the higher living costs resulting from the incorporation of environmental sustainability features. This conflict can also be found in general communities when green features are incorporated into their development (Salonen and Åhlberg, 2013). However, from a long-term perspective, incorporating environmental sustainability features can lead to the reduction in residents' utility costs (e.g., reduced energy fees), which improves affordability (Zuo et al., 2014). Second, conflicts between an age-friendly social environment and financial affordability can exist, the development of such as environment

needing the support of diverse strategies, facilities and activities that may increase living costs, although it can also positively impact residents' life quality (e.g., enhanced health), which reduces the need for assisted services (Kennedy and Coates, 2008) – promoting affordable living. Regarding the relationship between environmental sustainability and an age-friendly social environment, the social benefits (e.g., those relevant for a higher quality of life) resulting from residing in an environmentally sustainable environment can help the two dimension to be conjointly maximized in retirement villages (MaloneBeach and Zuo, 2013; Pillemer et al., 2011). However, it should be noted that potential conflicts exist. For example, using facilities and organizing activities to support the development of an age-friendly social environment may lead to environmental problems in retirement villages (e.g., more energy consumption). In general, the three sustainability dimensions are interrelated, and their potential conflicts make it difficult for developers and operators to optimise them all at the same time. Instead, it is suggested that developers and operators balance these three dimensions based on a comprehensive understanding of their residents' social, physical, and psychological requirements (Ten Bruggencate et al., 2018).

### *6.3. Does the improved framework have the potential for reducing people's negative attitudes towards retirement villages?*

Though retirement villages can be a viable accommodation option after older adults' retirement, and such benefits of village living as enhanced safety and independence have been recognized (Gardner et al., 2005), the majority of older people do not consider relocating to a retirement village (Crisp et al., 2013). Many have a negative attitude to the retirement village living, and criticisms and reported problems have questioned the ability of retirement villages to facilitate residents' healthy ageing from mainstream society (Bohle et al., 2014). For instance, a retirement village is an institutional environment where social norms and regulations need to be followed, which may create stress for residents and restrict their freedom and choices (Stein and Morse, 1994). Additionally, the residents of a specific retirement village tend to have a similar socio-economic background, which can lead to their social isolation (Bohle et al., 2014). Moreover, people criticize retirement villages as being developed for the rich due to the high living costs involved (Liddle et al., 2014). An institutionalized environment like a

retirement village is not preferred by people who advocate 'ageing-in-place' (Wiles et al., 2012). However, the improved framework provides a means of addressing these criticisms and problems given the diverse aged requirements satisfied by residing in sustainable retirement villages. First, an age-friendly social environment requires various strategies to respond to reported problems (e.g., residents' stress, restricted freedom and choices, and social isolation) through such ways as improved social interaction based on organized village activities, which has been confirmed in previous studies (Cattan et al., 2005). Additionally, the financial affordability dimension of the framework can promote the residents' affordable living, which helps address the issue of high living costs. Regarding environmental sustainability, given its positive contribution to people's life quality (e.g., improved health and involving physical activities) (Balaban and de Oliveira, 2017; Pillemer et al., 2011), its incorporation into the retirement village environment has the potential to further help address the reported issues and criticisms. Despite this, it should be noted that the improved framework itself is not an antidote to retirement village criticisms and issues. Its combination of different strategies, such as the predominant ageing schemes of Healthy Ageing (Peel et al., 2004) and Age-friendly Communities and Cities (World Health Organization, 2005), provides a promising way to better deal with these problems.

## **7. Conclusions**

The original theoretical framework developed to facilitate the delivery of sustainable retirement villages lacks the input of industry practices. Using inductive content analysis, this study corrects this situation by incorporating retrieved sustainable practices from eight retirement villages into it. Consequently, an improved practical sustainable retirement village framework that contains comprehensive sustainability features in three sustainability dimensions is developed.

The improved framework promotes stakeholders' understanding of the sustainable living environment issue in retirement villages, which is of great importance given that sustainable retirement villages are a relatively new phenomenon in the Australian market. This will facilitate the future development of the retirement village sector which is now faced with the sustainability challenge in an ageing society (Pillemer et al., 2011). More importantly, it provides practical insights into the development of a sustainable living environment in retirement villages. Retirement villages have been widely criticized

for their institutionalization which negatively affects the well-being of older adults (Legge, 1984). However, the incorporation of sustainability features is a promising approach of supporting the residents' healthy ageing as various aged requirements can be well accommodated. At last, developers are expected to deliver an "appropriate" village environment, although it is still unclear what is meant by "appropriate". This study provides one optional answer from the perspective of sustainability, and the improved framework can be adopted as a practical instrument to guide the delivery of an "appropriate" retirement village.

The proposed framework is still in a preliminary stage and requires more work for its improvement. For instance, it lacks the input of industry practices. However, the framework is open-ended, and emerging sustainability features can be easily incorporated to make it more comprehensive. In addition, although the identification of sustainable practices increases its comprehensiveness, some may still be missing. It is suggested that sustainable practices retrieved from more retirement villages can be used to improve this framework further. Moreover, the improvement process focuses on the three sustainability dimensions, while the senior-oriented basic settings in the theoretical framework are not discussed. Finally, the improvement of the framework relied on data collected from retirement villages in Queensland, while the sustainability features of retirement villages located in different states and territories may differ from each other significantly due to their different environmental conditions. Future studies to improve the framework further need to consider the location of retirement villages based on such methods as spatial analysis.

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**Appendix A.** The identified sustainable practices and their linked sustainability features

<b>Code</b>	<b>Sustainable practices</b>	<b>Mainly linked sustainability features</b>
1	Village located in a subtropical climate;	Comfort; Energy and resource efficiency;
2	Village location near off-site facilities and service providers;	Convenience; Social interaction;
3	Convenient village location for visiting family members and friends;	Convenience; Social interaction;
4	Centralized site planning pattern;	A sense of community and neighbourhood; Easy access and mobility; Easy way-finding;
5	Defined on-site service zones;	A sense of community and neighbourhood; Easy access and mobility; Social interaction;
6	Orientation of site entry/exit toward a minor street;	Safety;
7	Provided lights at site entry/exit;	Safety;
8	Private property warning sign at site entry/exit;	Safety;
9	Adequate sight distance (e.g., low ground covers) at site entries/exits;	Safety;
10	Traffic-related detailing (e.g., reflecting mirror, traffic signs, speed hump, yellow reflecting road studs) at site entry/exit;	Safety;
11	Enough places for residents' car and cycle parking;	Convenience;
12	One-way aisles in parking lot;	Easy to use;
13	Covered outside walkways;	Safety;
14	Village sign with contrasted font and background at site entry/exit;	Easy recognition;
15	Traffic signs along site drive (e.g., watch pedestrians, speed limit);	Safety;
16	Fingerposts at site crossroads (e.g., road name and unit number information);	Easy-way finding;
17	Seat provision at the arrival court of community centre;	Social interaction;
18	Mailboxes at the arrival court of community centre;	Social interaction;
19	Posted community information in the bulletin board of community centre;	Keep informed; Social interaction;
20	Garden-based buffer separating drop-off areas of the community centre from site drive;	Safety;
21	Traffic signs at the arrival court of community centre (e.g., speed limit, no-parking);	Safety;
22	Covered porch extended over the drop-off area of community centre;	Safety;

		Easy pick-up; Social interaction;
23	Visual surveillance of the community centre arrival court from in-door;	Safety; Visibility;
24	Bollards for traffic control in heavy traffic area of village site (e.g., the community centre court);	Safety;
25	Provided lights at the community centre court;	Safety;
26	Barrier-free design at the community centre court (the arrive court is at grade with the site drive);	Safety;
27	The north-face orientation of villas/units;	Easy access and mobility; Energy and resource efficiency; Affordable living;
28	Fences and covered porch at the villa/unit entry area;	Safety; Privacy; Comfort;
29	Designed grass areas/gardens located between the villa/unit entry and site drive;	Social interaction; Safety; Privacy;
30	Barrier-free walkways connecting with outside neighbourhoods;	Social interaction; Privacy; Safety; A sense of community and neighbourhood;
31	Provided lights at villa/unit entry;	Easy access and mobility; Easy way-finding; Safety;
32	Provided unit number and name;	Easy way-finding;
33	Parking lots near residents' villa/unit;	Convenience;
34	The special treatment of parking lots with red colour;	Visibility;
35	The angled parking lot type;	Easy to use; Convenience;
36	Social areas (e.g., lakes, gardens, pavilions, natural walkways) at the middle of village site;	Social interaction; A sense of community and neighbourhood;
37	Provided amenities (e.g., lights, seats, BBQ facilities) at a covered pavilion near site social areas;	Safety; Social interaction;
38	Defined areas for residents' gardening;	Social interaction;
39	Located parking lots at the middle of site;	Easy to use;

40	Covered seating areas located at the intersection of village site;	Social interaction; Safety;
41	The presence of barrier-free walking paths within the vision of residents;	Easy access and mobility; Easy way-finding; Social interaction;
42	Design detailing along site walking paths (e.g., seats, lights);	Safety; Easy access and mobility; Social interaction;
43	Provision of diverse on-site facilities and their accessibility;	Social interaction;
44	Provision of diverse home care and community services and their accessibility;	Social interaction; Safety; Peace of mind;
45	Organization of social activities/events;	Social interaction;
46	Encouragement of community activities/events and participation;	Social interaction; Companionship;
47	Encouragement of visits from family members and friends;	Social interaction; Companionship;
48	Village sustainable improvement programs (e.g., resident satisfaction survey);	Continuous improvement; Social interaction;
49	Different entry options;	Affordable living; Respect;
50	Retaining five or ten percent of the in-going contribution under contract;	Affordable living;
51	Capital gains sharing under contract;	Capital gains sharing; Affordable living;
52	Transparent fee arrangements;	Transparent fee arrangements; Keep informed;
53	Diverse site entries/exits available due to large site;	Convenience;
54	No isolation of walkways from view;	Safety;
55	Site entries/exits near public transportation;	Social interaction; Convenience;
56	Barrier-free design at site entries/exits;	Easy access and mobility; Safety;
57	Separated walkways from site drive at site entries/exits;	Easy way-finding; Safety;

58	Loop-drive onsite;	Easy way-finding; Easy access and mobility;
59	Two-way drive onsite;	Safety; Easy way-finding;
60	Provided site map at site entry/exit;	Easy way-finding;
61	Marked and covered drop-off area with different colour and its separation from entry drive;	Easy pick-up; Safety;
62	Curb ramps to avoid slip of residents;	Safety; Easy access and mobility;
63	Barrier-free design of villa/unit entry;	Easy access and mobility; Safety;
64	Connected villa/unit entry with walkways and entry drive;	Social interaction; Easy access and mobility;
65	Unit access through a series of walkways to cluster and private walks;	A sense of community and neighbourhood; Privacy; Safety;
66	Unit orientation towards site activity areas;	Social interaction;
67	The ring site connection and transportation;	Easy way-finding; Convenience; Easy access and mobility;
68	Covered corridor with lighting connecting different parts of site;	Safety; Social interaction;
69	No exit fee under contract;	Affordable living;
70	Changed site entry from a major street to a minor street;	Safety;
71	Parking lots near on-site facilities;	Easy access and mobility; Convenience;
72	Available lighting at parking lots;	Safety;
73	Low growing plants at parking lots;	Safety;
74	Marked handicapped parking places for the disabled;	Convenience;
75	Social areas (e.g., lawn areas, gardens, mailbox) near units and on-site facilities;	Comfort; Social interaction;
76	Wide villa/unit entry for walker and wheelchairs access;	Easy access and mobility;
77	Provided lights along site drive;	Safety;
78	Curved walkways to increase aesthetics and improve pedestrian length;	Social interaction;

79	Provided seats at villa/unit entry;	Social interaction;
80	Located villas/units along on-site drive;	Easy way-finding;
81	Garden-based buffer between walkways and site drive;	Safety;
82	Provided curtain at villa/unit entry to avoid the direct sunlight and to form a shadow place;	Social interaction;
		Privacy;
		Energy and resource efficiency;
83	Unit/villa location viewing the central area of site;	Social interaction;
		Safety;
84	Perpendicular parking design;	Easy to use;
85	Provided reflecting mirrors at crossroad of village site;	Safety;
86	Separation of inward and outward-bound traffic at site entry;	Safety;
87	Provided site garbage bins for environment protection;	Waste management;
88	Detailing (e.g., handrails, lights) along walking paths;	Safety;
89	Covered seats at site entry/exit;	Social interaction;
90	Provided goals (mailboxes) along walkways;	Social interaction;
91	Outdoor elevators;	Convenience;
		Easy way-finding;
		Easy access and mobility;
92	Building entry system / Resident intercom system;	Safety;
93	Use of solar panels;	Use of green techniques;
		Energy and resource efficiency;
		Affordable living;
94	Provided mailbox areas at site entry/exit;	Social interaction;
95	Speed hump along site drive;	Safety;
96	Side gates of residential apartments to connect with social areas (e.g., garden areas);	Social interaction;
		Convenience;
97	Outdoor social space with a viewing deck within residential apartments;	Social interaction;
98	Orientation of site entry/exit towards a major street;	Easy recognition;
99	Defined small communities in a large village site;	Easy way-finding;
		A sense of community and neighbourhood;
		Social interaction;
100	Provided fence at dangerous areas;	Safety;
101	Provided bulletin boards in defined small communities of a large village;	Keeping informed
		A sense of community and neighbourhood;



		Social interaction;
<b>102</b>	Bus stop (covered areas, seats, and lights) near the community centre;	Social interaction;
		A sense of community and neighbourhood;
		Convenience;
<b>103</b>	Covered outdoor parking places with defined owners;	Convenience;
		Easy to use;
<b>104</b>	A covered social place in each defined small community of a large village;	Social interaction
		A sense of community and neighbourhood;
		Keeping informed;
		Privacy;
<b>105</b>	Waste recycling;	Waste management;
<b>106</b>	Provided detailing (e.g., mailbox, lights, emergency assemble point, seats) in each defined small community of a large village;	Social interaction;
		Safety;
<b>107</b>	Avoided grates and drainage structures in walkways;	Safety;
<b>108</b>	Available decorative planters and planting beds onsite;	Social interaction;
		Comfort;
<b>109</b>	Consistent inside and outside entry drive to reduce turns and promote fast-moving;	Convenience;
		Safety;
		Easy access and mobility;