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Examining Human Interactions with Smart Retail Technology: A Hybrid SEM- fsQCA Investigation

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ABSTRACT

As technologies evolve, businesses have focused on enhancing human interactions beyond simple satisfaction. This new research builds on recent exploratory work, responding to calls for testing antecedents and consequences of Smart Retail Technology (SRT) interactions. An online survey was administered to 338 respondents. In addition to structural equation modelling (SEM), fuzzy set Qualitative Comparative Analysis (fsQCA) was employed to identify value outcomes. Results demonstrate that the more individuals perceive a business's technologies to be distinctive, the more likely they are to interact with those technologies. Respondents' innovativeness was positively associated with their intentions to interact with SRT. The fsQCA outcomes offer an understanding of the types of individuals who perceive value through SRT interaction. Findings offer managerial implications and extend current knowledge about adopting interactive technologies. This is the first study to contribute a comprehensive SRT model that examines the inter-relationships between antecedents and consequences of interacting with SRT.

KEYWORDS

Smart retail technology; human interaction; consumer perceptions; value; perceived risk

1. Introduction

The adoption of Smart Retail Technology (SRT) has increased not only in response to the COVID-19 pandemic (Pantano & Willems, 2022) but also to fulfil the needs of technology-dependent individuals seeking novelty, control and frictionless interactions (Fazal-e-Hasan et al., 2021; Lee et al., 2021). SRT refers to intelligent applications that provide cost-effective, efficient and standardised business processes to individuals and may take various forms, such as self-serve checkouts/m-POS (Ramos de Luna et al., 2023; Zhu et al., 2013), beacons (Roy et al., 2017), smart shopping carts, augmented reality (AR) applications (Khashan et al., 2023; Moorhouse et al., 2018), smart mirrors (Hwang et al., 2023), interactive displays, virtual reality technologies (Bonetti et al., 2018; Zaki et al., 2023), shopping assistants and retail apps (Flacandji & Vlad, 2022; Lee et al., 2023). Accordingly, businesses are leveraging SRT to: (1) create engaging environments; (2) provide hyper-personalised interactions; (3) develop competitive advantage; and (4) better understand the customer journey through service touchpoints. Hence, it is vital for businesses to understand how individuals interact with SRT (Riedel & Mulcahy, 2019).

Research on SRT is only now emerging, warranting a thorough examination of its antecedents and consequences (Fazal-e-Hasan et al., 2021; Gupta et al., 2022; Pantano & Willems, 2022; Ramos de Luna et al., 2023). The present research builds on recent exploratory work and responds to calls for empirically testing antecedents and consequences of SRT (Priporas, 2020; Priporas et al., 2017). Specifically, Flacandji and Vlad (2022) suggested researchers should examine the "shopping value" attained through SRT, while Wu and Cheng (2018) called for empirical work to examine experiential relationships and perceived risk with SRT. While previous studies have highlighted the perceived value of SRT for both users and businesses (Moorhouse et al., 2018; Noh et al., 2014), this new work examines the precursors to, and influences of, this value. Currently, gaps remain in understanding whether an individual's perceptions of their own "innovativeness" and a business's "distinctiveness" affect their intentions to use and interact with SRT. These variables have not been previously examined as antecedents to the intention to use and interact with SRT. Further, despite SRT offering a variety of benefits (see Pantano et al., 2018; Pantano & Willems, 2022), like any new technology, SRT may also elicit user uncertainty and perceptions of risk,

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which may mitigate the value individuals perceive from using SRT. Chen and Chang (2023) note in their study limitations that "payment risk" may emerge as a barrier to the adoption of SRT, suggesting future research should consider the impact of perceived risk. Similarly, Adel (2023) suggested that an enhanced understanding of the inherent risks is vital to understanding the adoption of "fast evolving" smart retail technologies. This current research seeks to address these gaps.

Research has previously identified "self-continuity" as a key motive of individuals seeking to maintain a clear sense of "self" (Berger & Heath, 2007; Stokburger-Sauer et al., 2012; Talaifar & Swann, 2020). This need for a consistent sense of "self" is increasingly met through assessments of congruity between the individual's sense of self and their perceptions of commercial entities, that is, retail businesses (Bhattacharya & Sen, 2003; Escalas & Bettman, 2003). Simply, an individual who considers themselves to be "innovative" will be more likely to use and engage with innovative technologies (i.e., smart watches, smart toys), and to patronise businesses that are considered distinct based on the extent of their technological uniqueness (i.e., Amazon Go) (Cui et al., 2022; Zhang et al., 2020). Thus, the first aim of this current research is to examine these relationships. Further, new technology, such as SRT, may also elicit user perceptions of risk (Adapa et al., 2020; Chen & Chang, 2023; Li et al., 2021). Such uncertainty may moderate an individual's rate of interaction, adoption and (dis)satisfaction, thus limiting the commercial benefits of the technology, impeding perceptions of value (Wu & Cheng, 2018). Therefore, the second aim of this research is to measure the extent to which an individual's perception of risk moderates the value they perceive from SRT. Methodologically, this current work responds to previous exploratory studies of interactions with SRT that have called for future studies to employ larger samples, quantitative methods and measures to examine more closely consumer interactions with SRT (Priporas, 2020; Priporas et al., 2017). Further, the current study employs the fuzzy set Qualitative Comparative Analysis (fsQCA) technique (Liu et al., 2017) to supplement the online survey design. This technique has recently gained popularity in technology adoption and interaction research (Chuah et al., 2021; Dahabiyeh et al., 2023; Foroughi et al., 2023) and complements structural equation modelling SEM/PLS analysis in many studies (Fang et al., 2016; Yueh et al., 2016).

2. Theoretical background

Traditionally, it has been claimed that individuals will adopt smart retail technology to increase their sense of control, save time and improve efficiencies (Adapa et al., 2020; Fazal-e-Hasan et al., 2021). These practical and utilitarian drivers also explain the adoption of smart banking technologies and online shopping (Mortimer et al., 2015). However, researchers are now turning their attention to investigating possible "psychological" mechanisms that go beyond such traditional and utilitarian models of technology adoption (Pantano & Dennis, 2019; Roy et al., 2018). In continuing this focus, this is the first study to develop a social identity theory lens to examine the antecedents (individuals' perceived innovativeness, perceived business distinctiveness) that motivate usage intentions and interactions with SRT, and perceived value of SRT. The work also examines the moderating role of perceived risk within this model.

Individuals "need" to know themselves and feel relatively distinct or unique from others. Literature consistently finds, if an individual considers themselves to be "innovative," they will engage with brands, businesses or technologies that enable them to portray that "identity" to others. This need for self-identification is driven by social identity theory (Brewer, 1991; Małecka et al., 2022). Kunda (1999) attests to self-continuity (or self-verification) as a key motive for individuals' desire to maintain a clear sense of "self." This need for a consistent "sense of self" – as being "innovative" – is attained through assessments of perceived congruity between one's sense of self and one's sense of an entity's attributes (Bhattacharya & Sen, 2003). Fundamentally, an individual will adopt, interact with and use SRT because, in doing so, they construct, or reconstruct, an image of themselves in social settings as being innovative.

Further, it has long been recognised that individuals strive to distinguish themselves from others in social contexts (Tajfel & Turner, 2004). Snyder and Fromkin (1977) seminal work of uniqueness positions this need to be different as a key component driving self-esteem. This idea is developed further in work by Brewer's (1991), which suggests that individuals attempt to connect with entities, i.e., innovative and distinct organisations that satisfy both needs – self-identity and distinctiveness. In the context of this work, individuals will be more drawn to a business considered "distinctive" than to others, which enables them to construct their identity.

3. Literature review and hypotheses development

A business's distinctiveness refers to how an individual perceives its identity to be "unique" compared to that of its competitors (Stokburger-Sauer et al., 2012). Individuals differentiate businesses on two broad dimensions: "newness" and "meaningfulness" (Shams et al., 2015). Newness is the relative difference between a business's "new" and "previous" offerings. Meaningfulness is the degree to which an individual perceives a business offering as useful, for example, for its superior functionality or product features. In this study, we integrate the theory of uniqueness (Tian et al., 2001) and the Technology Acceptance Model (TAM) (Davis, 1989) to postulate that an individual's perception of a business's distinctiveness through SRT relates positively to their intentions to use and interact with the SRT. The theory of uniqueness is defined as an individual's pursuit of differentness relative to others that is achieved through acquiring and utilising goods or services to develop and enhance their personal and social identity (Tian et al., 2001). Based on the theory, it is expected that individuals will be willing to purchase from or patronise a business in a way that is consistent with their self-concept and the degree of their pursuit of "differentness."

Businesses may also offer "distinctiveness" through SRT to assist individuals in making choices between competing businesses. The application of SRT is vital in this context because individuals may be uncertain about specific technologies, and this uncertainty may lead to higher perceptions of risk regarding the quality or distinctiveness of the business. Based on identity theory, it is argued that a distinctive (because of employing SRT) business may encourage individuals to think of their identity as distinctively related to other social class members or groups (Fujita et al., 2018). When consumers perceive a business to be distinctive due to SRT, it is a positive disconfirmation for themselves, and they are more likely to develop intentions to use and interact with SRT in the future to keep their identity alive as consumers of a distinctive, novel and innovative brand. Based on the above discussion, we hypothesise:

H1. Perceived business distinctiveness through an SRT is positively associated with intentions to use the SRT.

H2. Perceived business distinctiveness through an SRT is positively associated with interaction with the SRT.

An individual's "innovativeness" is the extent to which they are relatively early in adopting new technology, products or ideas compared to others (Chao et al., 2012). In the context of SRT, we define individual innovativeness as the propensity to be attracted to new SRT more quickly than others. The core theoretical premise of the relationship between an individual's innovativeness and their propensity to use SRT is that "innovativeness" leads to risk-taking behaviour and greater receptivity to new ideas. In recent research on innovativeness, Truong et al. (2017) point out that innovative individuals are less likely to engage in risk-reduction strategies, and their venturesomeness may lead them to become early adopters of new technologies and products. Thakur and Srivastava (2015) provide evidence of the negative effect of innovativeness on perceived risk in online services (Chi et al., 2021). However, innovative individuals need far less cognitive effort to comprehend and evaluate alternative technologies because of their receptiveness to new ideas and technology readiness. According to Adil et al. (2022), innovative individuals consider the associated complexity of using technology to be less difficult than do others. Due to the benefits of SRT and its competitive advantages over traditional transacting, an innovator naturally tends to adopt innovations, such as using SRT and interacting with it. Based on the above discussion, we hypothesise:

H3. Individual innovativeness is positively associated with interaction with SRT.

H4. Individual innovativeness is positively associated with intentions to use SRT.

In a retail environment, positive shopping experiences are delivered through hedonic value dimensions of shopping enjoyment, novelty, and entertainment and utilitarian value dimensions such as convenience (Mortimer et al., 2024). Fall et al. (2021) identified that the utilitarian and hedonic value dimensions significantly affect individuals' evaluations of virtual and immersion technologies within the retail environment (Zaki et al., 2023). Shopping value orientations developed towards SRT potentially enhance individuals' experiences (Lemon & Verhoef, 2016), enjoyment (Tussyadiah et al., 2018) and engagement (Fan et al., 2020). Mortimer et al. (2024) found that in-store experiential events were significantly associated with individual shopping behaviour intentions. Similarly, Tsai et al. (2010) found that relative advantage, supply chain integration and organisational readiness enhance individuals' adoption intentions for radio-frequency identification technology in Taiwanese retail stores. Studies in diverse contexts have also demonstrated that commitment, enjoyment, usefulness, convenience, timeliness and effectiveness are associated with intentions and perceived value (Flacandji & Vlad, 2022; Petkus, 2010; Schrage et al., 2022). In light of the discussion above, we hypothesise:

H5. Intention to use an SRT is positively associated with perceived shopping value.

Interaction with SRT is defined as an individual's intentional use of SRT in a way that achieves their transactional goals (Priporas, 2020; Priporas et al., 2017). Individuals' interactions with SRT enhance overall experience through the cognitive dimension of meeting consumption goals (Roy et al., 2017). Nike's new flagship store in New York provides a good example of how SRT is implemented to help attain such goals. For instance, an individual may want to locate a specific product and make a transaction quickly (Wade, 2018). SRT enhances interaction and engagement by providing real-time feedback and constant monitoring. This results in increased interaction between individuals and retailers (Fan et al., 2020; Pantano, 2014). To take another example, Sephora launched a number of connected stores in France with immersive technology by integrating a virtual "lookbook" with the virtual artist service. This innovative SRT allows individuals to virtually try on different make-up products without actual application (Wade, 2018). Studies have outlined the positive influence of incorporating technologies on individuals' experiences and interactions (Ameen et al., 2021). As presented above, we argue that intentions to interact with SRT are positively associated with individual shopping value (Chouk & Mani, 2019). Accordingly, we hypothesise:

H6. Interaction with SRT is positively associated with perceived shopping value.

3.1. Perceived risk in using SRT

Perceived risk in using SRT refers to uncertainty and unfavourable consequences of expectations (Piehler et al., 2019). Individuals subjectively appraise the performance and effort associated with interacting with SRT. Often, discrepancies exist between an individual's judgement of the SRT and its actual performance. This discrepancy increases the risk associated with interacting with the SRT in the business environment (Namahoot & Laohavichien, 2018). In other words, perceptions of risk associated with interacting with the SRT affect individuals' confidence in their decisions

about using the SRT (Mukherjee & Chatterjee, 2021). Consequently, the value associated with interacting with the SRT will likely diminish. Based on this argument, and with the support of this well-established link, the following hypotheses are proposed:

H7. Perceived risk influences (negatively) the relationship between intention to use the SRT and its perceived value.

H8. Perceived risk influences (negatively) the relationship between interaction with the SRT and its perceived value.

We integrate all hypotheses and present the conceptual model in Figure 1.

4. Methodology

4.1. Sample

A marketing research firm was engaged to identify and access a representative sample of individuals, who were subsequently presented with an online survey. In the period of June–July 2023, a total of 338 completed surveys were received (56% male/44% female). The majority of respondents fell within the age categories of 20 to 39 years (60.4%) and 40 to 54 years (27.3%), with 5% aged 18 to 24 years and 7.4% being 55 years of age or older. In total, 31.1% of respondents had a high school education as their highest level of educational achievement, and 68.9% had a university education. Respondents reported income as follows: 51.5% earned USD35,000 or less; 30.7% earned USD35,001 to USD65,000; and 17.8% earned USD65,001 or more. Most respondents visit their preferred retail business once a month, and more than 80% used SRT (self-service checkouts) at least once a week.

4.2. Pilot testing

Before distributing the online survey to the representative sample of respondents, the survey was reviewed by two qualified academics for completeness and accuracy. The survey was then sent to $n = 36$ undergraduate students, who were screened to ensure they had used SRT in the past two weeks. These students were asked to clarify ambiguous items. Minor changes were made to the flow of the survey (items per page). Finally, the survey was assessed and approved for use by the university's independent ethics department.

4.3. Data collection

The collection of data was facilitated by a marketing research firm, who distributed the online survey to a representative sample of respondents. Before being presented with the randomised items of the focal constructs, the respondents were carefully selected for having utilised an SRT in a retail environment within the previous week. Previously validated scales were used to measure "perceived business distinctiveness" (Riemenschneider et al., 2021), individual innovativeness (Aldahdouh et al., 2019; Hendarman & Cantner, 2018), intentions to use SRT (Fazal-e-Hasan et al., 2021), interaction with SRT (Fazal-e-Hasan et al., 2021; Teo, 2014), perceived risk (Fazal-e-Hasan et al., 2021) and perceived value (Chen & Dubinsky, 2003; Fazal-e-Hasan et al., 2021). All items were measured using a 7-point Likert scale and adapted to suit the context.

4.4. Quality checks and biases

Data integrity was assured in several ways. All survey items were randomised to mitigate testing effects. A duration check was included to remove participants who answered the survey too quickly, and data cleaning removed respondents who answered items consistently throughout the survey. Non-response bias was mitigated by designing a short survey ($n = 17$ items, plus demographics), survey completion time was under six minutes, the marketing research company incentivised respondents and any incomplete surveys were discarded before analysis. Two integrity-check questions and a marker variable were added to ensure the veracity of responses and to control for common method bias (CMB) (see Fuller et al., 2016). CMB was examined with Harman's single-factor test, with results indicating that the variance extracted by the first factor accounted for only 25.16% of the variance, mitigating CMB (Podsakoff et al., 2003). Table 1 provides items, loadings, standard error and z-values.

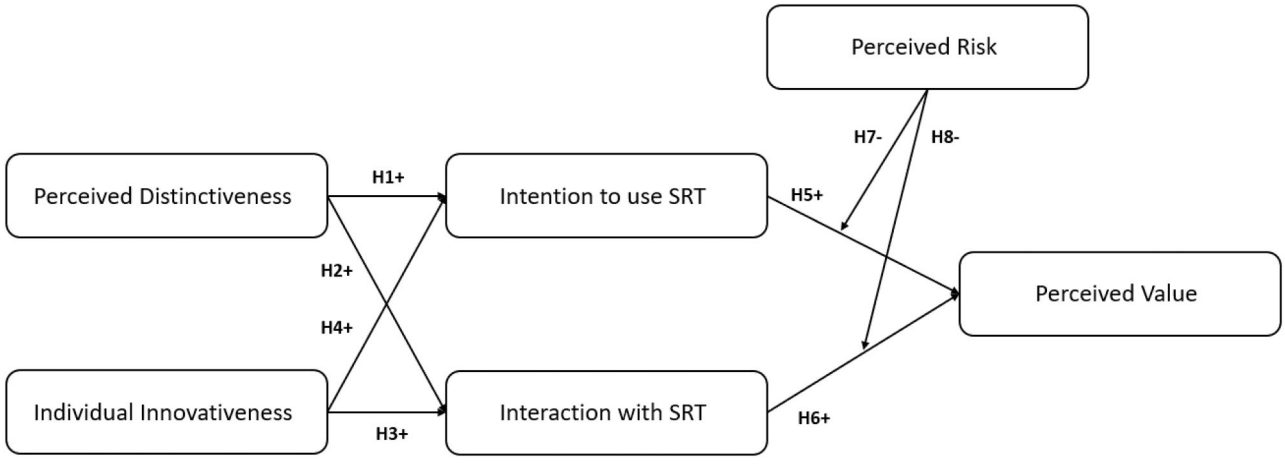

Figure 1. Conceptual model.

Table 1. Items, loadings, standard error and z-values.

Constructs	Items	Estimate	S.E.	Z values
Perceived value of SRT	When I use SRTs, I feel excited.	.761	1	
1				
2	When I use SRTs, I am able to immerse in the experience.	.874	.070	16.045
3	When I use SRTs, I enjoy the experience no matter what.	.831	.066	15.371
Perceived business distinctiveness	A business with SRTs is unique.	.801	1	
1				
2	A business with SRTs is distinctive	.712	.064	12.836
3	A business with SRTs is different.	.816	.072	14.461
Intentions to use SRT	Given a chance, I intend to use the SRT in the future	.868	1	
1				
2	I will frequently use the SRT in the future.	.830	.043	19.135
3	I intend to use the SRT in my next shopping trip.	.901	.047	21.587
Interaction with SRT	I feel fully engaged with the business environment when I use the SRT.	.722	1	
1				
2	I feel connected with the business space when I use the SRT.	.764	.088	12.761
3	I feel that it is a very interactive experience when I use the SRT.	.846	.086	13.702
Individual innovativeness	In general, I am the first in my circle to try out a new things like SRT.	.915	1	
1				
2	In general, I am the first in my group of friends to know the names of the SRTs in the vicinity.	.862	.041	22.989
3	I will go to a new business to try SRT even if I haven't heard anything about the business from friends.	.906	.039	25.387
Perceived risk	I feel uncertain about how to effectively use the SRT.	.764	1	
1				
2	I don't know what is expected of me if I use the SRT.	.786	.091	11.929

Model Fit Indices: **CMIN**= 179.865; **DF**= 104; **CMIN/DF**= 1.729; **CFI**= 0.979; **TLI** = 0.972; **RMSEA**= 0.047.

Table 2. Composite reliability, average variance extracted and inter-factor correlation.

	CR	AVE	1	2	3	4	5	6
1-Perceived value of SRT	0.863	0.678	0.823					
2-Perceived business distinctiveness	0.821	0.605	0.581	0.778				
3-Individual innovativeness	0.923	0.800	0.671	0.432	0.895			
4-Intentons to use SRT	0.901	0.751	0.519	0.619	0.526	0.867		
5-Interaction to SRT	0.822	0.607	0.607	0.596	0.479	0.636	0.779	
6-Perceived risk	0.751	0.601	0.594	0.559	0.418	0.674	0.691	0.775

5. Results

5.1. Measurement model

The fit indices demonstrated that the study's confirmatory factor analysis (CFA) was acceptable (see Table 1). Table 1 reveals that all item loadings are significant ($p < .01$), with an AVE of .50 or higher, demonstrating convergent validity (Gerbing & Anderson, 1988). The inter-factor correlation matrix is displayed in Table 2, and it is lower than the respective factor's square root of the AVE value, establishing discriminant validity (Fornell & Larcker, 1981). Furthermore, Table 2 displays composite reliability scores of .75 or higher, indicating good reliability according to Nunnally and Bernstein (1994).

5.2. Structural model and hypotheses testing

All eight hypotheses were tested using SEM. Through this process, we examined the key factors affecting the dependent variable. The results showed that the model fit was acceptable, as indicated by the fit indices in Table 3. Of the eight hypotheses, six were accepted.

5.3. Testing the mediation effects using bootstrapping

AMOS 27 was used to perform a bootstrapping analysis to test the mediating effects of intentions to use SRT and interaction with SRT. An estimated path significance and direct effects were accessed before examining the bias-corrected confidence intervals of 95% to determine the significance of indirect effects. We used 5,000 bootstrap samples to test the significant indirect effects of intentions to use SRT and interaction with SRT on the relationship between relevant independent and dependent variables. As also shown in Table 3, our findings are statistically significant ($p < .01$) and provide evidence for the mediation of the variables outlined in our model.

5.4. Testing moderation using slope analysis

The moderating role of perceived risk was further tested in this study. Table 3 demonstrates that perceived risk does not moderate the effect of interaction with and intentions to use SRT on perceived shopping value (H7 and H8). We examine these findings in detail in the discussion section.

5.5. FsQCA analysis

Additional analysis of the collected data was undertaken to explore the configurations of variables leading to "perceived value." Various configurations of conditions leading to higher levels of interaction with SRT are presented in Table 4. Following the convention of other fsQCA studies (Dahabiyeh et al., 2023; Foroughi et al., 2023) in this study, a black circle

Table 3. Path analysis and indirect effects.

Hypothesis	Beta estimates P-Value	T-value	Supported
H1: Perceived business distinctiveness→ Intention to use SRT	.519***	8.411	✓
H2: Perceived business distinctiveness→ Interaction with SRT	.517***	7.382	✓
H3: Individual innovativeness→ Intention to use SRT	.317***	5.873	✓
H4: Individual innovativeness→ Interaction with SRT	.316***	5.287	✓
H5: Intention to use SRT→ Perceived Value	.245***	3.946	✓
H6: Interaction with SRT→ Perceived Value	.539***	7.219	✓
H7: Intention to use SRT* Perceived risk→ Perceived Value	.009$^{0.89}$	0.140	No
H8: Interaction with SRT* Perceived Risk→ Perceived Value	.089$^{0.17}$	1.389	No
Indirect effects	**Point estimate**	**(95% CI) Bootstrapping (Lower bound-Upper bound)**	
Perceived business distinctiveness → intentions to use SRT→ Perceived value through SRT	.281***	(.193–.379)	
Individual innovativeness→ intentions to use SRT→ Perceived value through SRT	.201***	(.123–293)	
Perceived business distinctiveness → Interaction to SRT→ Perceived value through SRT	.340***	(.232–.451)	
Individual innovativeness→ Interaction to SRT→ Perceived value through SRT	.245***	(.133–.376)	
R^2 values			
Intention to use SRT= 0.512			
Interaction with SRT= 0.508			
Perceived Value= 0.473			

($n = 338$), *** values are significant at $p < .001$, ***Model Fit Indices***: **CMIN**= 299.734; **DF**= 107; **CMIN/DF**= 2.801; **CFI**= 0.945; **TLI** = 0.930; **RMSEA**= 0.073.

Table 4. Configurations leading to higher perceived shopping value.

Configuration number	1	2	3
Perceived Risk	●	●	
Individual innovativeness	●	●	●
Perceived business distinctiveness	●		●
Interaction with SRT		●	●
Intention to use SRT	●	●	●
Unique coverage	0.50	0.39	0.40
Consistency	0.945	0.921	0.923
Solution coverage	0.688		
Solution consistency	0.813		

(●) is used to show the presence of a condition and an open circle (⊗) the absence of a condition. The consistency threshold of 0.075 that is suggested in the literature (Ragin, 2008) has been considered in all tables. As can be seen in the tables, all of the solutions and configurations reported below are of sufficient consistency.

As seen in Table 4, the two factors of individual "innovativeness" and "intentions to use SRT" are common among all three factors leading to higher perceived value. Each of the solutions, however, lacks one of the factors of "perceived risk," "business distinctiveness" and "interaction with SRT." These three absent factors can be used to identify each of the found configurations. The first configuration is related to individuals who do not have any previous interactions with, or experience in, using SRT, but still see value in using the technology. We call this group "tech-novice." The second group do not consider the the business itself a motivator for using or interacting with SRT, but do see value in using the technology. This group is referred to as "tech-savvies," who love to use technology and see value in using it without having any consideration about the business itself. Finally, the third group are "risk-takers," who (unlike the other two groups) do not perceive any risk in using or interacting with the technology and see high value in the technology itself.

6. Discussion

Many businesses have implemented smart technologies to improve efficiency and improve experiences (Adapa et al., 2018; Pantano & Willems, 2022). Using SRT, such as biometric payments, beacons, touch screens, interactive displays and "just walk-out" technologies, provides value through not just interactivity but also increased levels of convenience, accessibility and control (Grewal et al., 2020; Lin, 2022). As SRT becomes more prevalent across business, transport and education, scholars and practitioners will continue to explore how it impacts individuals' perceptions of value and the commercial environment (Bruni & Piccarozzi, 2022; Fazal-e-Hasan et al., 2021). Accordingly, this new work contributes to the growing body of research on SRT by examining the effects of business distinctiveness and individuals' innovativeness on perceived value, and the moderating impact of perceived risk.

H_1 and H_2 indicate that individuals are more inclined to interact with SRT and use these technologies if they perceive the business to be distinctive. This finding is supported by Brewer's (1991) theory of optimal distinctiveness, which suggests that individuals will attempt to connect with entities that satisfy both needs – self-identity and distinctiveness. Hence, this research confirms that individuals will patronise a retail business considered "distinctive," which enables them to construct their identity. Further, if SRT can deliver personalised, timely information uniquely and innovatively (e.g., beacon-driven push notifications), individuals will identify strongly with innovative businesses and be more likely to interact with SRT provided by those businesses. This finding builds on past research demonstrating that business distinctiveness increases an individual's identification with that business and their intentions to patronise those businesses (Yoshida et al., 2021). H_3 and H_4 indicate that an individual's innovativeness positively impacts their intentions to use and interact with SRT. The result of fsQCA analysis also highlights innovativeness as a critical factor. An individual's innovativeness is relevant to SRT, where innovation is perpetual and often found to be a significant determinant of the adoption of new technology (Truong et al., 2017). The findings corroborate previous research regarding the effect of innovativeness on the adoption of mobile commerce, drone delivery services and new

technology products (Esfahani & Reynolds, 2021). This new research confirms that individuals who consider themselves to be "innovative" will use and engage with innovative technologies and patronise retail businesses that are considered distinct based on the extent of their technological uniqueness (Cui et al., 2022; Zhang et al., 2020).

H_5 and H_6 demonstrate that an individual's perception of value using SRT is determined by the intentions to use SRT and interactions with SRT. These findings extend previous research on the role of smart technology in enhancing human experiences of and engagement with businesses and service providers (Mulcahy et al., 2019). In addition, these findings are consistent with those of Collier and Kimes (2013), who demonstrated that interacting with SRT contributes to positive perceptions of value. Interestingly, the findings indicate that perceived risk did not moderate the effects of intentions to use (H_7) or interaction with (H_8) SRT on perceived value. These findings contradict those of Lin (2022), who found that risk perception negatively impacted consumers' perceptions of shopping value. Research has previously identified that individuals who consider themselves "innovative" tend also to be "risk tolerant" toward adopting new technologies, social media and m-banking apps (Fan, 2022; Wasiuzzaman & Edalat, 2016). The current findings address the limitations in previous works (see Adel, 2023; Chen & Chang, 2023), whose authors called for an examination of the inherent risks in adopting SRT; however, it should be acknowledged that more research is needed to validate all dimensions of perceived risk as a moderator (de Oliveira Santini et al., 2021).

6.1. Implications for theory

The present study contributes new knowledge and builds on prior research by investigating the causes and effects of perceived value through SRT. While previous studies have highlighted the perceived value of SRT for both users and businesses (Dacko, 2017; Moorhouse et al., 2018; Noh et al., 2014; Pantano et al., 2022), this new work examines the precursors to, and influences of, this value. The factors, namely "individuals" innovativeness' and "business's distinctiveness" determining a user's perceived value, have been largely ignored within the SRT literature. The present study contributes to this stream of literature by examining the underlying process by which perceived business distinctiveness influences individuals' evaluation, intentions to use and interact with SRT. Past studies have suggested that along with technological factors, individual factors also influence individuals' intentions to use or interact with technology (Walczuch et al., 2007; Wu & Ke, 2015). The present study contributes to this literature by demonstrating that innovativeness positively influences individuals' interaction with and intentions to use SRT. While past studies have identified the role of risk and ambiguity in technology adoption (Dahabiyeh et al., 2020), scant research has examined how it shapes an individual's perception of SRT. The present study illustrates that perceived risk does not influence a "highly innovative" individual's interaction with and intentions to use SRT. Finally, from a theoretical perspective, the current work aligns with the tenets of social identity theory – the need for self-identification, and the theory of uniqueness – that is, the need to be different (Brewer, 1991; Kunda, 1999; Małecka et al., 2022). This new work proffers that individuals will attempt to connect with entities that satisfy both needs – innovativeness and distinctiveness.

6.2. Implications for practice

While individuals are more likely to develop a positive attitude toward a business that implements SRT and to consider such businesses distinctive and unique, risks in using and interacting with these technologies remain present. Research has indicated that the adoption of SRT in a service setting positively enhances the social image of individuals, assisting them to attain a specific social status within their "in-groups." The penetration of SRT across service roles also relieves frontline team members from repetitive, mundane tasks, enabling them to undertake more challenging and stimulating service roles. Businesses might mitigate risks by implementing SRT that works collaboratively with individuals, such as co-creation of value, thereby allowing the customer to utilise the SRT to customise their consumption experience, promotional offer or product. It was found that business distinctiveness through SRT plays a key role in determining an individual's intentions to interact with and use SRT. Therefore, businesses should leverage SRT to build a distinct identity. For example, Amazon Go identifies that its stores are different from its competitors by having no queue or checkout (Lin, 2022). Doing so will encourage positive associations and build emotional bonds with consumers. Furthermore, because individual innovativeness is a significant predictor of interaction with and intentions to use SRT, businesses should better understand the effects of personality traits and develop various engagement strategies based on the degree to which individuals are innovative (Chang & Chen, 2021). Finally, this new research identifies that perceived risk moderates the impact of individuals' interactions with, and intentions to use, SRT on perceived value. As a result, businesses need to ensure that employees are available to help individuals during the early introduction and adoption phase. Ultimately, if businesses are to maximise the value of SRT, they should carefully integrate SRT into existing systems.

7. Limitations and future research

While this study presents a model to analyse the connections between the causes and outcomes of SRT along with the influence of perceived risk, certain limitations need to be considered. First, the demographic variables are not explored in depth to investigate the influence of the moderator variable (risk) on perceived value. For example, future research could investigate how age, income level or education impact risk and intentions to use and interact with SRT. Additionally, this study only collected cross-sectional data, so any longitudinal effects cannot be accounted for. It would

be interesting to examine whether perceptions of "business distinctiveness" or "risk" diminish over time. This study focuses on one commonly used SRT, "self-service checkout," rather than a range of SRT. It would be interesting to examine these tested relationships with emerging SRT, such as smart mirrors, beacons and AR. Other outcomes, such as brand equity, loyalty, trust and image, were not examined, hence opportunities exist to examine these important business outcomes. Additionally, future research could explore how users engage with SRT on social media platforms and the features of SRT that capture user attention.

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