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The Role of Cognitive Absorption in Recommender System Reuse

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Abstract: E-commerce is the trade of services and goods via electronic means such as the Internet. It is critical in today's business and user experience. Most current e-commerce websites employ various technologies such as recommender systems to provide customers with personalised recommendations. Taking this as a cue, this study investigates the effect of cognitive absorption to estimate the holistic experience of recommender systems on shoppers' intentions to reuse recommender systems. Data collected from 366 online shoppers were analysed using structural equation modelling to test the proposed hypotheses. The findings highlight that cognitive absorption directly and indirectly affects shoppers' behavioural intentions to reuse recommender systems. The results also exposed the moderating effect of gender on shoppers' behavioural intentions to reuse recommender systems. An importance-performance map analysis was also conducted to identify significant areas of improvement for e-vendors. This study contributes to advancing existing knowledge relevant to shoppers' behavioural intentions to reuse recommender systems. The study also provides e-vendor managers with insights into online shoppers' decision making.

Keywords: recommender systems; cognitive absorption; reuse intention; perceived usefulness; focused immersion; temporal dissociation; curiosity

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1. Introduction

Recommender systems (RSs) increasingly play an important role in enhancing shoppers' decision-making quality by providing personalised suggestions based on their needs and preferences [1,2]. They use complex techniques to consider information from a diverse set of inputs such as product information, design, function or category, and the personal information of shoppers, such as gender, age, or history of purchase, to generate personalised suggestions [3]. RSs have been important to the success of digital platforms such as Amazon, Netflix, Spotify, and Alibaba [4,5]. Despite their usefulness, a vital yet overlooked issue is whether consumers continue to use RSs after initial adoption [6]. The success and sustainability of a technology depend more on its continuous use than initial adoption [2,7–9], as evidenced by the quick decline of the Pokemon Go app after its initial success [9].

Research on RSs has primarily focused on initial adoption and improving item selection and ranking algorithms [7,10–14]; however, algorithms alone do not contribute to positive shopper perceptions [3]. Positive shopper perceptions are important as they drive business outcomes [15]. Particularly, perceived sales motives and the absence of convincing connections resulted in consumer dissatisfaction and distrust of RSs [16], and RSs are considered as tools to drive, engagement, insight, and innovation [4]. RSs can alter shoppers' decision making and behaviour [17,18]. Although some studies have investigated the impact of RSs on behavioural intentions [2,19–21], there is a lack of research on the effect of RSs on customer experience and the exploration of salient determinants that influence the

reuse of RSs. Studies that investigate RS reuse or continuous use intentions are somewhat recent [2,7,9,22] and they only investigate limited determinants of behavioural intentions to reuse RSs; salient determinants are yet to be explored. These findings suggest that the success and sustainability of RSs and e-commerce platforms requires an understanding of the shoppers' decision processes, particularly the effect of their perceptions and beliefs on behavioural intentions to use RSs. There remains a need to emphasise the potential effect of a shopper's interactions with RSs and their willingness to use/accept RSs [20]. To develop a strong RSs adoption, a recent study of RSs encouraged the exploration of users' cognitive absorption perceptions [23]. The impact of cognitive absorption in recommender systems is a sparse research area, and there is very little scientific understanding of how cognitive absorption contributes to the shoppers' behavioural intentions to reuse RSs or on the impact on shoppers' decision outcomes. This research aims to utilise cognitive absorption to estimate the holistic experience of RSs.

A growing body of research has raised concerns about the inconsistency in the precision of recommendations across genders [23–26]. Lack of empirical investigation on the impact of gender has been reported [27], despite the presence of substantial gender variations in online shopping speculated by IS scholars in terms of behaviours (e.g., online purchases) and attitudes (e.g., online trust) [28–30]. Limited empirical studies are available to reveal the effect of cognitive absorption on shoppers' behavioural intentions to reuse RSs across gender. This indicates the need to understand the effect of cognitive absorption across gender. The research reported in this paper aims to advance our understanding of the effect of cognitive absorption across gender.

In view of the above, the current research aimed to address this void in the literature by utilising a new theoretical lens. A research model was proposed by extending the technology acceptance model (TAM) by combining it with flow theory to estimate the holistic experience of RSs. The reuse of an IS determines its long-term sustainability and ultimate success [7–9]. As the sustainability and success of RSs depends upon their reuse, the main goal of the paper was to examine the role of shoppers' cognitive absorption perception on their behavioural intentions to reuse RSs. Part of the aim of this was to ascertain the moderating effect of gender across paths in the proposed conceptual model. This study further contributes methodologically by implementing modern PLS-SEM procedures such as PLS-MGA and PLS-IPMA, defying classical methods.

It is important to evaluate the predictors of the intentions to reuse RSs to achieve superior customer loyalty. Superior loyalty and growth amplify customer lifetime value [4] and ensure sustainability of RSs. In contrast to existing studies that focused primarily on the development of high-performance RSs, the finding of this research provide insight into the shoppers' perception and evaluation of RSs. This research also expands our understanding of RSs from the shoppers' perspectives.

2. Theoretical Background

2.1. Technology Acceptance Model (TAM)

IS usage and acceptance are widely investigated using TAM [2,19,31]. TAM encompasses two major instrumental factors: perceived ease of use (user attitude) and perceived usefulness (user belief) [32]. Perceived usefulness (PU) is one of TAM's core factors. Although prior research has revealed the TAM to be a robust and efficient model, the TAM uses only two instrumental factors (user attitude and user belief) to explain behavioural intentions.

2.1.1. Perceived Usefulness

Perceived usefulness is regarded as the extent to which shoppers believe that using RSs would enhance the achievement of their shopping tasks [32]. Several studies in the RSs literature used TAM to show recommendations increase shoppers' perceived usefulness [2,7,33,34]. RSs frequently provide convincing and extensive product-related information that may all be considered to be helpful in evaluating and analysing the

performance of various product attributes [2,33]. RSs provide appropriate cues to enhance the shoppers' utilitarian value, and this can lead to increased perceived usefulness [35]. Shoppers may view and assess the main qualities (e.g., brief descriptions and key features) and values of the product (e.g., price) immediately. By analysing the content provided by RSs, shoppers may determine which attributes are most essential and the different values for each attribute. This information is therefore perceived to be more useful by shoppers [2]. Ashraf et al. [7] studied the effects of customers' continuous trust, perceived confirmation, satisfaction with RSs, and perceived usefulness of RSs and found it subsequently affected their behavioural intentions to reuse RSs. Benlian et al. [2] suggested a model that linked RSs to four consumer beliefs (perceived ease of use, perceived usefulness, trust, and perceived affective quality) and found them to be important predictors of behavioural intentions to reuse RSs.

2.1.2. Perceived Ease of Use

A factor of TAM is the perceived ease of use, which means the extent to which the shoppers think the RS is free of physical and mental rigour [32]. The relevance of perceived ease of use is only noticeable if the nature of the task carried out in an information system is complex and needs special skills or knowledge. To purchase a product using a recommender system is a task that is free of physical and mental rigour. Evidence from a number of empirical studies pertaining to reuse intention has reported an inconsistent role for "perceived ease of use" [36,37]. Joo et al. [36] ascertained that there was no significance of "perceived ease of use" in the reuse of a mobile learning management system. For the reuse of Windows technology, Karahanna et al. [37] argued that "perceived ease of use" is not essential at the post-adoption stage. The research reported in this paper only focused on the people who were active shoppers at Amazon. The respondents were assumed to be already knowledgeable and were able to use RSs to buy a product. Some prior studies based on TAM and information system reuse intention have also ignored "perceived ease of use" in their research model [8,38]. Based on the above arguments and empirical evidence, the conceptual model proposed in the research to explore shoppers' intentions to reuse RSs has not incorporated perceived ease of use.

2.2. Flow Theory

In a flow state, people can appear so focused on their task that nothing else seemed to matter [39]. Flow theory can help scholars and professionals to understand customer experiences [40]. Flow is likely to occur during the product information process in the online shopping experience [41], which cannot be captured using traditional technology acceptance models.

Over the years, flow theory has been extended to a number of subject areas related to an online environment in order to understand the holistic or optimal experience [31,42,43]. Arguably, these arguments related to the online environment also apply to the context of RSs. Asserted by [44–47], in the current study, flow experience is predicted to function as an antecedent of shoppers' behavioural intentions to reuse RSs.

2.3. Cognitive Absorption

Cognitive absorption in information technology refers to an individual's holistic experience and complete involvement with information technology [39,43,48,49]. It was initially seen as a trait but is now considered both a trait and a state [50]. Cognitive absorption stems from the absorption characteristic and is a condition of profound involvement with information technology [51,52]. Cognitive absorption has been primarily used in information systems literature to study the formation of a user's intentions to use new technologies [23,49]. Key studies on cognitive absorption in IS are listed in Table 1. Several studies confirmed that cognitive absorption increased the perceived usefulness of information systems [51–55]. The prior literature into the impact of cognitive absorption on the intention to use has been inconsistent and contradictory. Lin [55] extended the

technology acceptance model (TAM) to estimate the influence of cognitive absorption on user beliefs and behavioural intentions and found that cognitive absorption significantly affects behavioural intentions through perceived ease of use and perceived usefulness of the virtual community. Zhu and Morosan [31] extended TAM with the constructs of cognitive absorption in the context of interactive mobile technologies in hotels and found cognitive absorption to be the most significant predictor of adoption attitudes and behaviour. Few studies have explored the direct effect of cognitive absorption on actual behaviour, with conflicting findings reported [53,55–57]. Shang et al. [53] concluded that cognitive absorption does not have a positive direct effect on actual behaviour, whereas Jia et al. [57] demonstrated that cognitive absorption influenced actual use, with deeper absorbed individuals having a significantly higher actual use of technology. Suki et al. [56] reported that online shopping behaviour was not directly affected by cognitive absorption, but Lee [54] concluded that it acted as an intrinsic motivator and affected perceived usefulness and perceived ease of use. Salimon et al. [52] demonstrated that cognitive absorption directly and positively impacted the perceived usefulness of e-learning platforms, and Ghasemaghaei [23] concluded that high product knowledge online shoppers perceived greater cognitive absorption with highly detailed RSs.

Table 1. Key studies focusing on cognitive absorption in IS.

Study	Focus (IS)	Direct Outcomes of Cognitive Absorption
[43]	Trust, experience and continuance intentions in the context of services (AI chatbots)	Positive effect on user experience, trust and technology continuance intentions
[52]	E-learning satisfaction and retention (E-learning platforms)	Positive effect on PU and PEOU
[58]	Mobile internet users' continuance intentions (Internet)	Positive effect on mobile internet services continuance intentions and PU
[23]	Intentions to use online in-depth RA in consumer shopping experience (Internet)	Positive effect on in-depth RA effectiveness and intentions to use the in-depth RA in their shopping experience
[54]	Impulse buying tendency in mobile shopping (Internet)	Positive effect on PU, PEOU, and impulse buying tendency in mobile shopping
[31]	Adoption of interactive mobile technologies (IMC) in hotels (Internet)	Positive effect on PU, PEOU, and IMC adoption attitudes and behaviour
[59]	Workplace collaboration in virtual worlds (virtual community website)	Positive effect on trust and adaptive use intentions
[55]	Intentions to use virtual communities (virtual community website)	Positive effect on PU and PEOU, but does not have a positive direct effect on the intentions to use
[56]	Internet shopping acceptance (Internet)	Positive effect on PU and PEOU, but does not have a positive direct effect on online shopping behaviour
[57]	Antecedents of problematic IS usage (Internet)	Positive effect on actual usage, problematic usage, and social/leisure use, but does not have a positive direct effect on social/work use
[53]	Online shopping beliefs and behaviour (Internet)	Positive effect on PU and PEOU, but do not have a positive direct effect on actual behaviour
[51]	Beliefs about IS usage (Internet)	Positive effect on PU and PEOU
[60]	IT adoption and software usage (Windows 95, Lotus 1-2-3)	Positive effect on PU

Note: PU: Perceived usefulness, PEOU: Perceived ease of use.

The research reported in this paper used cognitive absorption as a higher-order construct consisting of focused immersion (FI), temporal dissociation (TD), and curiosity (CU) as Zhu and Morosan [31] identify these dimensions as the core dimensions. The definition of focused immersion, temporal dissociation, and curiosity are as follows:

- Focused immersion is defined as "an immersed engagement when other important attentions are ignored" [43].
- Temporal dissociation is defined as "an engaged interaction without noticing the passage of time" [43].
- Curiosity is defined as "the user's expectation and cognitive curiosity to explore more in the interaction" [43].

In summary, studies exploring cognitive absorption's effect highlight the dynamic and diversified correlation between cognitive absorption and users' intentions to use IT, their beliefs, and their actual usage behaviour (see Table 1). No studies have been identified linking the investigation of consumers' intentions to reuse RSs on their holistic experience of the RSs, making necessary an improvement of the research on the topic. To fill the gap, the research reported in this paper utilised cognitive absorption to understand the effect of the holistic experience on perceived usefulness and their behavioural intentions to reuse recommender systems (RSs).

2.4. Intentions to Reuse Recommender Systems

In this research, behavioural intentions are referred to as the shoppers' intentions to reuse RSs. The current research used shoppers' intentions to reuse RSs to measure the impact of RS use on the decision outcomes. It has been widely used for research into business to consumer e-commerce [2,61,62]. Intentions to reuse RSs indicates the loyalty and satisfaction of customers [8]. Scholars have emphasised the importance of shoppers' intentions to reuse RSs and recognised that it is important for the success of RSs [2,7].

2.5. Moderating Effect of Gender

The effect of gender in the e-commerce setting is still very nascent [63]. Particularly in the RS literature, scholars have expressed concerns about inconsistencies in the accuracy of recommendations between different genders [24–26]. For instance, Mansoury et al. [24] argued that women get less accurate recommendations than men.

Previous studies have reported that online information searching differences exist between males and females [64]. In encoding information and solving problems, males and females use different socially cognitive attributes [65]; males are thought to emphasise task orientation, whereas females are regarded as having socially driven and people-oriented usage motives [66]. This means that, due to their gender, males and females can take unconscious or internalised actions. The user's interaction with RSs and cognitive absorption is significantly moderated by gender [23,67]. The cognitive absorption perception of females significantly increased when using an RS that provided high levels of detail. Males, on the other hand, have no differences in cognitive absorption perceptions irrespective of the type of RS [23].

3. Hypotheses Development and Research Model

TAM has been widely applied to understand shopper decision making, especially the adoption intentions of the RSs [2,19,31]. Prior research based on a generalised model such as the technology acceptance model (TAM) provides a limited explanation of behavioural intentions, as shoppers' decision-making processes include factors, such as online shopping experience, that perceived usefulness and ease of use alone do not capture. Although such generalised models have an important part to play in explaining technology acceptance, scholars often have to integrate multiple models or theories to develop a pertinent model. Prior studies have examined the TAM with the inclusion of constructs such as prior experience and training with technology [32], trust [19], gender [68], loyalty [69], playfulness [45],

and flow [44] to account for user characteristics and considering the nature of the online environments.

Due to the efficient decision supports that RSs tend to bring to e-shoppers, e-vendor managers should know ways to improve shoppers' immersive or flow experience to build a "convincing connection". The majority of previous research has investigated the significance of flow in e-commerce platforms [23,41,53,56,62]; several scholars have also integrated TAM and flow theory and found it an important predictor of behavioural intentions [44–47]. Lu et al. [47] highlighted the importance of intrinsic and extrinsic motivations in instant messaging (IM) adoptions. The study found that in addition to IM being seen as utilitarian and user-friendly, users desire an enjoyable and fun flow experience. Flow mediates the association between attitudinal factors and behavioural intentions and also directly affects behavioural intentions [46]. Li [45] integrated the elaboration likelihood model (ELM) and the TAM with flow theory constructs and found, compared with playfulness, a stronger effect for argument quality as well as source credibility on attitude and through this, an effect on behavioural intentions. Wang et al. [44] studied the user experience in the Chinese tourism industry and concluded that both motivation and flow components are responsible for developing behavioural intentions. Considering the nature of online shopping, the research model integrates the TAM with cognitive absorption, which is commonly referred to as a flow construct as a measure of holistic experience [43], to estimate the holistic experience of RSs.

The specific factors of the model and related hypotheses are detailed below.

3.1. The Relation between Cognitive Absorption and Perceived Usefulness

The association between cognitive absorption and perceived usefulness is a consequence of the idea of self-perception [70], wherein people strive to rationalise their behaviour and therefore decrease cognitive dissonance (i.e., attitudes, conflict beliefs, or behaviour) [53]. Cognitive absorption establishes an individual's beliefs that technology is instrumental or useful for the accomplishment of tasks [51]. Online purchasing depends on users experience of cognitive absorption, which positively relates to online shopping attitude and thus to actual behaviour [53]. According to the theories discussed above, it is believed that whilst an individual experiences pleasure and gratification from engaging with technological activities in a cognitive absorption state, their conflicts are decreased in a pleasurable and enjoyable state and they would perceive shopping with RSs as useful. Based on the above arguments, it is hypothesised that:

H1. *Shoppers' Cognitive Absorption Has a Direct and Positive Effect on the Perceived Usefulness of RSs. (CA → PU)*

3.2. The Relation between Perceived Usefulness and Behavioural Intentions to Reuse RSs

Drawing from the TAM model, the perceived usefulness of RSs has a direct impact on shoppers' behavioural intentions to reuse RSs [32]. The underlying assumption of the PU–BI relationship can be further explained based on the IS continuance model [8], which argues that IS continuance usage intentions depends on the satisfaction of a user, the extent of users' expectation confirmation, and post-adoption expectations in the form of perceived usefulness [8]. The perceived usefulness of IS was central to the use of both pre- and post-adoption stages, which significantly affected continued IS use by individuals [8]. Based on these models, it is hypothesised that:

H2. *Shoppers' perceived usefulness of RSs has a positive effect on behavioural intentions to reuse RSs. (PU → BI)*

3.3. The Relation between Cognitive Absorption and Behavioural Intentions to Reuse RSs

The association between cognitive absorption and behavioural intention to reuse RSs is based on the concept that flow can influence continuation intentions [71]. Consumers

experiencing cognitive absorption while utilising a website to purchase online may intend to return to the website in the future [53,72,73]. Consumers who experience greater intrinsic enjoyment are frequently keener to return [62]. The consumers' positive experience becomes a significant incentive for revisiting the site [74]. Increased user engagement contributes to a positive perspective to use the website in the future [75,76]. Chandra et al. [59] and Ghasemaghaei [23] detected that CA positively influenced the intentions to use the respective IS. Jumaan et al. [58] found CA to be the most resilient indicator of continuance intentions. Balakrishnan and Dwivedi [43] found that CA positively and significantly influenced technology continuation intentions. Based on these arguments, it is hypothesised that:

H3. *Shoppers' Cognitive Absorption has a Direct and Positive Effect on Behavioural Intentions to Reuse RSs. (CA → BI)*

3.4. The Relation between Cognitive Absorption, Perceived Usefulness, and Behavioural Intentions to Reuse RSs

In this study, the relationships proposed between cognitive absorption, perceived usefulness, and behavioural intentions indicates that there could be a mediation effect. No reliable evidence was identified on the mediation effect of the perceived usefulness of RSs on the relation between cognitive absorption and behavioural intentions to reuse RSs. Based on these arguments, the hypothesis is posited as:

H4. *Shoppers' Perceived Usefulness of RSs Mediates the Influence of Cognitive Absorption on Behavioural Intentions to Reuse. (CA → PU → BI)*

3.5. The Moderating Effect of Gender

Task orientation can refer to the completion of shopping tasks in the online shopping environment. That is, males are more likely than females to follow RSs without taking their content into account in detail, since they prefer to use efficient tools in order to complete the purchasing task [77]. Females, on the other hand, are more comprehensive processors while making judgments and show greater sensitivity to information [78]. Females are thus more likely than males to examine more carefully if the recommendations provided by RSs are helpful for the shopping task. It is vital to figure out the differential impact of gender on buying decisions and design gender-sensitive RSs. It is hypothesised that:

H5. *The strength of the relationship between the constructs is significantly different in males and females.*

The research model developed to empirically test the hypotheses in this research is shown in Figure 1.

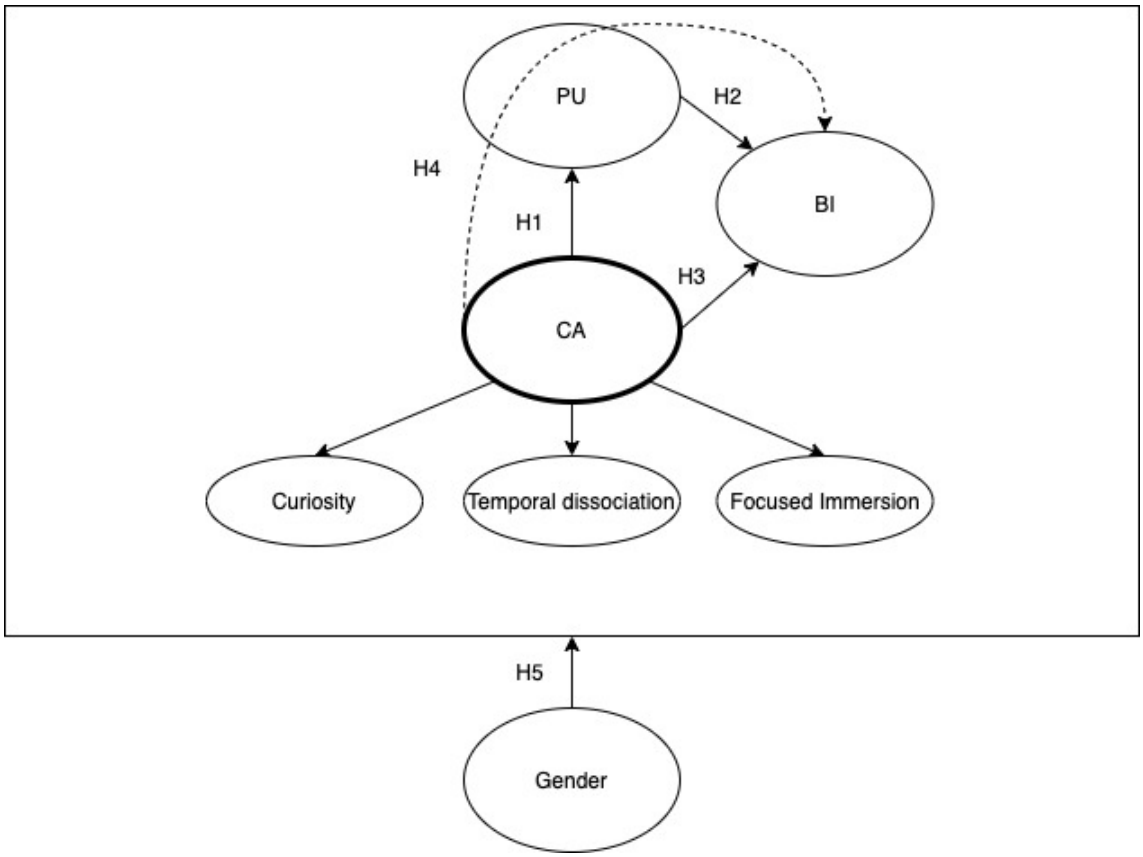


Figure 1. Research model. Note: PU: Perceived usefulness, CA: Cognitive absorption, BI: Behavioural intentions; CA is a is second-order construct. The dotted line indicates the path of indirect effect (CA → PU → BI).

4. Methodology

4.1. Data Collection and Descriptive Statistics

An online survey of Australian residents was conducted using the Zoho survey tool (survey.zoho.com). The research utilised the availability (or convenience sampling) method [79], the participants were recruited by Zoho. The following are the grounds for the use of the convenience sampling method: data may be collected quickly and frequently in an economical way [80] and was important to reach the participants during the COVID-19 pandemic. A quota was imposed to try to get an even split of male/female respondents. The recruitment decisions were designed to balance the goals of producing a broad, unadulterated sample and keeping the costs manageable [81]. The participants were asked if they have used RSs to purchase products on Amazon (See Appendix A). Only individuals who indicated that they had used RSs to purchase at least one item in the last six months of responding were allowed to take part. The usable sample consisted of 366 active Australian online shoppers at Amazon with different age groups. Table 2 shows the demographics of the respondents. Amazon shoppers were 49.7% male (N = 182) and 50.3% female (N = 184). A total of 33.6% of participants had a bachelor's degree as the highest educational level, 23.5% of participants had a certificate course, 10.7% of participants had a diploma, 25.1% had a master's degree, and 6.6% had a PhD degree. The participants have used the Internet on average for more than six years, purchased online for approximately four to five years, and used RSs for more than one year.

Table 2. Demographics.

Items		Frequency	%
Gender			
	Male	182	49.7
	Female	184	50.3
Age Group			
	Less than 20 years	16	4.4
	20–25 years	102	27.9
	26–35 years	104	28.4
	36–45 years	99	27
	Over 45 years	45	12.3
Marital Status			
	Single	156	42.6
	Married	191	52.2
	Divorced	10	2.7
	Other	9	2.5
Education			
	Certificate	86	23.5
	Diploma	39	10.7
	Bachelor Degree	123	33.6
	Master Degree	92	25.1
	Doctorate/PhD	24	6.6
	Other	2	0.5
Geographic Location			
	Victoria	114	31.1
	New South Wales	122	33.3
	Queensland	65	17.8
	Western Australia	32	8.7
	South Australia	15	4.1
	Australian Capital Territory	10	2.7
	Other	8	2.2

4.2. Measures

The instrument and scales used in this research were adopted from previously validated studies (See Appendix B). The measurements used a 5-point Likert rating scale system with endpoints "strongly disagree" (value of 1) to "strongly agree" (value of 5). The literature indicated that the 5-point scale is less complicated and increases reaction rate [82–84]. It is also the most widely used scale in marketing research [85]. Measures of the perceived usefulness construct included nine items and were adopted from Wang and Benbasat [19], the cognitive absorption construct comprised five items for focused immersion, three items for curiosity, and five items for temporal dissociation and was adopted from Zhu and Morosan [31]. Measures of the behavioural intentions construct included three items that were adopted from Benlian et al. [2].

4.3. Normality and Common Method Bias Test

Tests of normality was performed using Kolmogorov–Smirnov (KS) normality tests [86]. The outcome of Kolmogorov–Smirnov (KS) normality tests revealed the non-normal distribution of the data. Next, the common method bias (CMB) was assessed. The absence of CMB should be verified in social sciences research using survey methods [87]. CMB was evaluated by the inclusion of the marker variable, marital status, which is theoretically not linked to the dependent variable, using steps designated for PLS-SEM [88]. Each construct in the structural model was evaluated with and without a marker variable as an exogenous variable. The results reveal that there was low method variance in the proposed

model between the marker variable and the hypothesised variables. The significance of the relation between the variables did not change. Secondly, as guided by Kock [89], a more conservative approach for CMB assessment using a full collinearity test based on the variance inflation factor (VIF) was also conducted to test the CMB. The test revealed that the full collinearity VIFs of all latent variables were 1.000 to 2.398 and were lower than the threshold of 3.3 [89]. These results suggested that this research is unlikely to suffer from CMB.

4.4. Data Analysis

Statistical significance was analysed using PLS-SEM (SmartPLS v3.3.3) [90,91] due to the presence of a higher-order construct and non-normal distribution of data. The current research is exploratory and aims to assess moderation across multiple relationships, making PLS-SEM the preferred method for this research [92,93]. Also, PLS-SEM is regarded as a better choice when the data has non-normality issues [92]. The current software and algorithmic framework were adopted as they are more flexible, practical, comprehensible, and user-friendly [94]. Several scholars within their respective fields (e.g., management information systems, marketing, accounting, strategic management, and operations) have published studies summarising PLS-SEM use and the main reasons provided for application of PLS-SEM include the data distribution, exploratory nature, use of formative indicators, and sample size [95–99].

The study involves a reflective-reflective-type higher-order construct, i.e., cognitive absorption. The repeated indicators approach was adopted to estimate the model proposed in this paper [100]. The repeated indicator approach simultaneously estimated all constructs instead of individually estimating lower-order and higher-order dimensions [100]. It also avoided interpretive confusion by considering the whole nomological network (i.e., both the lower and higher-order constructs), which the two-stage approach does not consider [100]. As recommended in [101], "mode A" was used to estimate cognitive absorption. As per the guidelines of the approach, all the indicators of curiosity, focused immersion, and temporal dissociation were simultaneously assigned to the higher-order construct (cognitive absorption). Next, the assessment of the measurement model was conducted.

4.4.1. Assessment of the Measurement Model

First, the outer loadings of the items were assessed. All the indicators except for FI4, loaded more than the recommended value of 0.7 [102]. According to Campbell and Fiske [102], items loading below 0.7 should be dropped from the structure of the construct. As a result, FI4 was dropped. The average variance extracted (AVE) was used to assess the convergent validity. All the constructs obtained an AVE above the cut-off criterion of 0.5 [92]. AVE for cognitive absorption was computed as advised in [101]. Second, for internal consistency reliability, Cronbach's alpha and composite reliability (CR) were evaluated. All the values of Cronbach's alpha and composite reliability (CR) was found to be above the cut-off criterion of 0.7 [91]. Cronbach's alpha and composite reliability (CR) for cognitive absorption were computed as guided in [101]. Convergent validity and reliability were established (see Table 3).

Table 3. Measurement model parameters.

Constructs	α	CR	AVE
BI	0.878	0.925	0.804
CU	0.856	0.913	0.777
FI	0.852	0.898	0.647
TD	0.903	0.928	0.721
PU	0.923	0.936	0.618
CA *	0.895	0.934	0.824

Note: BI: Behavioural intentions, CU: Curiosity, FI: Focused immersion, PU: Perceived usefulness, CA: Cognitive absorption, TD: Temporal dissociation. * is used for higher-order constructs.

A new criterion called the heterotrait–monotrait (HTMT) ratios method was applied to estimate the discriminant validity, as it involves a stringent assessment [103]. HTMT values for cognitive absorption were computed as guided in Sarstedt et al. [101]. HTMT values (see Table 4) were within the cut-off criterion of 0.90, suggesting no significant discriminant validity issue [92].

Table 4. Discriminant validity (HTMT ratios).

	BI	**CU**	**FI**	**PU**	**CA ***	**TD**
BI						
CU	0.810					
FI	0.803	0.878				
PU	0.885	0.795	0.845			
CA *	0.756	-	-	0.728		
TD	0.694	0.843	0.783	0.662	-	

Note: BI: Behavioural intentions, CU: Curiosity, FI: Focused immersion, PU: Perceived usefulness, CA: Cognitive absorption, TD: Temporal dissociation. * is used for higher-order constructs.

Cross-loadings were also used to assess discriminant validity [104]. Table 5 illustrates that each item has been loaded higher onto its designated construct than its respective cross-loadings. Discriminant validity was deemed satisfactory. The measurement model analysis for the study was concluded. Next, the assessment of the structural model was conducted.

Table 5. Loadings and cross-loadings.

Constructs	**Items**	**Loadings and Cross-Loadings**				
		BI	CU	FI	TD	PU
BI	BI1	**0.883**	0.642	0.627	0.545	0.711
	BI2	**0.899**	0.628	0.668	0.546	0.719
	BI3	**0.908**	0.620	0.625	0.577	0.715
CU	CU1	0.638	**0.900**	0.685	0.663	0.645
	CU2	0.621	**0.882**	0.652	0.622	0.632
	CU3	0.599	0.862	**0.698**	0.679	0.598
FI	FI1	0.655	0.695	**0.873**	0.605	0.703
	FI2	0.650	0.681	**0.900**	0.646	0.707
	FI3	0.627	0.685	**0.881**	0.619	0.695
	FI5	0.564	0.634	**0.846**	0.603	0.595
TD	TD1	0.594	0.657	0.693	**0.830**	0.631
	TD2	0.443	0.581	0.543	**0.844**	0.437
	TD3	0.547	0.620	0.610	**0.864**	0.510
	TD4	0.495	0.639	0.565	**0.843**	0.479
	TD5	0.545	0.654	0.582	**0.864**	0.523
PU	PU1	0.591	0.526	0.548	0.456	**0.764**
	PU2	0.618	0.504	0.583	0.446	**0.781**
	PU3	0.632	0.514	0.563	0.405	**0.780**
	PU4	0.628	0.528	0.564	0.443	**0.800**
	PU5	0.644	0.583	0.636	0.516	**0.789**
	PU6	0.615	0.577	0.678	0.563	**0.749**
	PU7	0.647	0.628	0.651	0.561	**0.804**
	PU8	0.633	0.605	0.660	0.495	**0.815**
	PU9	0.626	0.535	0.562	0.408	**0.789**

Note: BI: Behavioural intentions, CU: Curiosity, FI: Focused immersion, TD: Temporal dissociation, PU: Perceived usefulness. The bold values are the indicator loading values corresponding to the constructs and others are cross-loading values.

4.4.2. Assessment of the Structural Model

The structural model aims at estimating the degree of significance of the path coefficient. To estimate this, a bootstrapping routine of 5000 sub-samples was performed [91]. The path coefficients, t-values, and significance of the paths are shown in Table 6. Figure 2

illustrates the output of the bootstrapping routine executed of the complete sample to establish a relationship between the latent constructs. The result revealed that all hypotheses were supported at a level $p < 0.001$ (see Table 6). There was a significant positive correlation between cognitive absorption and perceived usefulness, therefore supporting Hypothesis H1. The perceived usefulness had a significant positive correlation with BI. The result confirmed the support for H2. Cognitive absorption also had a significant and positive relation with BI, empirically supporting H3.

Table 6. Structural model assessment results.

	β	T Values	*p* Values
CA → PU *	0.764	30.911	0.000
PU → BI *	0.551	9.183	0.000
CA → BI *	0.743	27.195	0.000
Specific indirect effect			
CA → PU → BI *	0.421	8.695	0.000

Note: CA: Cognitive absorption, PU: Perceived usefulness, BI: Behavioural intentions. * Sig. at $p < 0.001$.

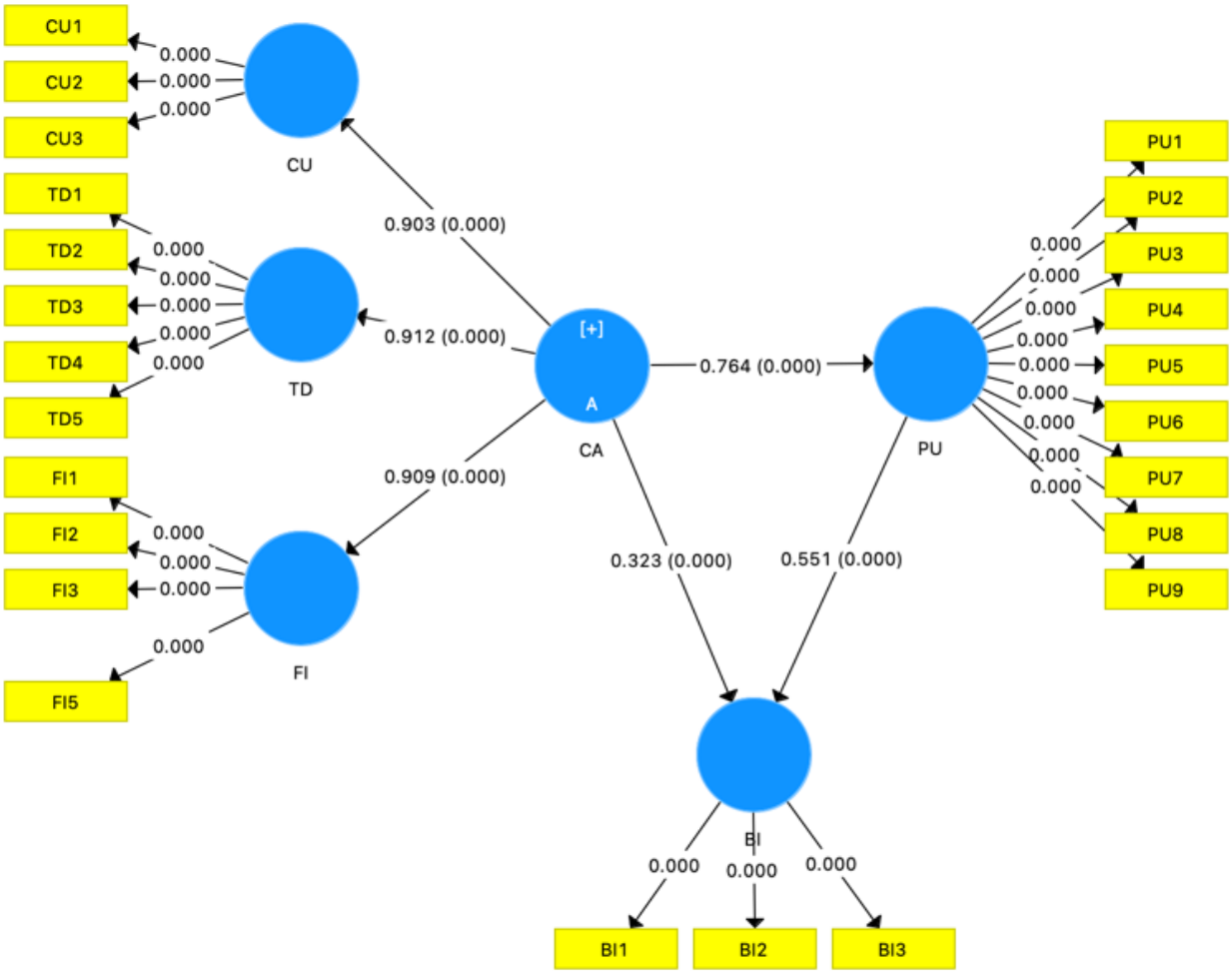


Figure 2. Measurement model (complete sample). Note: BI: Behavioural intentions, CU: Curiosity, FI: Focused immersion, PU: Perceived usefulness, CA: Cognitive absorption, TD: Temporal dissociation; (0.000) indicates all factor weights, indicator loadings and direct paths are (Sig. at $p < 0.001$).

4.4.3. Mediation Analysis

The study used the bootstrapping method to test the significance of the indirect effect. Bootstrapping allows the confidence interval to be estimated for factor stability.

The bootstrapping method is superior to the Sobel test, especially regarding type I and II error rates [105,106]. The bootstrapping method showed that the indirect effect of cognitive absorption on behavioural intentions to reuse RSs through perceived usefulness is significant (see Table 6). Both direct and indirect effects of cognitive absorption on BI have significant values resulting in complementary mediation [105]. The VAF method was also used to determine the magnitude of mediation [91]. VAF = indirect effect/total effect = $(0.764 \times 0.551)/0.743 = 0.56$. Based on the criterion, $0.2 \leq \text{VAF} \leq 0.8$ is considered partial mediation [91]. The VAF method confirmed perceived usefulness partially mediates the relationship between cognitive absorption and behavioural intentions to reuse RSs in the complete sample. H4 is supported based on the result of the mediation analysis.

4.4.4. Coefficient of Determinants (R^2) and Predictive Relevance (Q^2)

The coefficient of determinants (R^2) for two endogenous variables in this study were 0.583 for perceived usefulness and 0.679 for behavioural intentions to reuse RSs. This indicated a moderate predictive accuracy for perceived usefulness (with 58.3% of the variations in perceived usefulness being explained by cognitive absorption) and behavioural intentions to reuse RSs (with 67.9% of the variations in perceived usefulness being explained by perceived usefulness and cognitive absorption) [92]. Predictive relevance (Q^2) was obtained in SmartPLS 3 by running a blindfolding procedure with an omission distance of seven. The Q^2 was 0.539 for behavioural intentions to reuse RSs, which is above the cut-off criterion of 0.35, indicating high out-of-sample predictive relevance [92]. The predictive power of the model is said to be acceptable and accurate according to the guidelines in Hair et al. [92].

4.4.5. Multi-Group Analysis

The possible moderating effect of gender was examined using multi-group analysis (PLS-MGA) [107]. Prior to conducting the multi-group analysis, measurement invariance of composite models (MICOM) was estimated to check measurement invariance to ensure meaningful results [108]. MICOM is a three-step process. These steps check the configural invariance, compositional invariance, and equal mean and equal variance [108]. According to the guidelines, the establishment of configural invariance and compositional invariance, i.e., partial invariance, is sufficient to qualify for PLS-MGA. The first step of MICOM was attained by verifying that item, data treatment, and algorithm settings per model of measurement in male and female groups was identical. A permutation procedure was run to assess the results of the second and third steps of MICOM. The second step was to determine whether a composite correlates with male and female groups, which can be confirmed by assessing if the original correlation "C" was equal to the 5% quantile of Cu. In this case, compositional invariance was established. Finally, the third step was to assess whether the difference in the permutation-based confidence interval for mean and variance values contained zero [108]. In this case, full invariance was attained (see Table 7).

Table 7. MICOM results.

Step 1			**Step 2**			**Step 3(a)**			**Step 3(b)**		**Measurement Invariance**
Configurational invariance		C = 1	5% quantile of Cu	Compositional invariance	Differences (=0)	Confidence interval (CIs)—Mean value	Equal mean value	Difference (=0)	Confidence interval (CIs)—Variance value	Equal variance value	
BI	Yes	1	1	Yes	0.312	[−0.199; 0.201]	No	0.194	[−0.322; 0.308]	Yes	Full
CA	Yes	1	1	Yes	0.417	[−0.206; 0.202]	No	0.268	[−0.278; 0.275]	Yes	Full
PU	Yes	1	1	Yes	0.311	[−0.207; 0.199]	No	0.217	[−0.337; 0.330]	Yes	Full

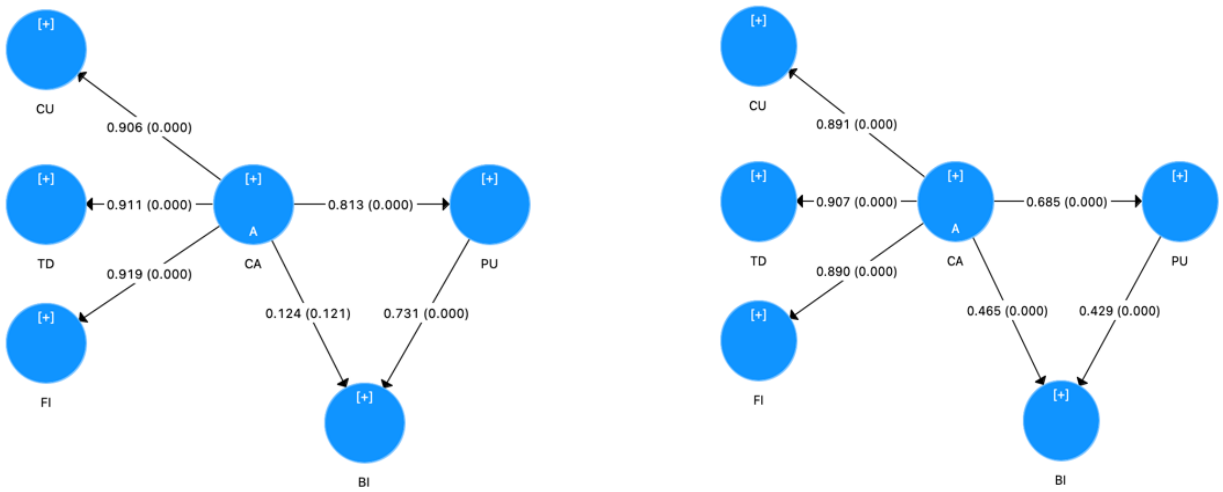
Note: CA: Cognitive absorption, PU: Perceived usefulness, BI: Behavioural intentions.

Following the establishment of full measurement invariance, PLS-MGA was performed using a 5000-bootstrapping resampling procedure to compare male and female samples. The PLS-MGA bootstrapping result revealed that the effect of cognitive absorption is significantly different across gender. The direct effect of cognitive absorption on behavioural intentions to reuse RSs was significant in the case of females but was insignificant in the case of males. The rest of the paths were significant in both the samples (see Table 8). Figure 3 illustrates the output of the PLS-MGA of male and female samples executed to establish a relationship between the latent constructs.

Table 8. PLS-MGA bootstrapping result.

	Male (n = 182)			Female (n = 184)		
Paths	**β**	**t-Values**	***p*-Values**	**β**	**t-Values**	***p*-Values**
CA → PU	0.813	25.810	0.000	0.685	16.841	0.000
PU → BI	0.731	9.676	0.000	0.429	5.891	0.000
CA → BI	0.124	1.559	0.119	0.465	6.157	0.000
Specific indirect effect						
CA → PU → BI	0.594	9.509	0.000	0.294	5.333	0.000

Note: BI: Behavioural intentions, PU: Perceived usefulness, CA: Cognitive absorption; (0.000) indicates (Sig. at $p < 0.001$).



Male Female

Figure 3. Measurement model (male and female samples). Note: (0.000) indicates (Sig. at $p < 0.001$).

The difference between men and women was estimated by the Welch–Satterthwaite test [91]. Table 9 illustrates the range in the path coefficients of both data sets (male and female). The result revealed a significant difference between two data sets across all paths in the proposed model, supporting H5.

Table 9. Results of the Welch–Satterthwaite test.

Paths	**Path Coefficients-Diff**	**t-Values**	***p*-Values**
CA → PU *	0.128	2.49	0.014
PU → BI *	0.302	2.889	0.004
CA → BI *	−0.341	3.114	0.002
Specific indirect effect			
CA → PU → BI **	0.300	3.617	0.000

Note: BI: Behavioural intentions PU: Perceived usefulness, CA: Cognitive absorption; * Sig at $p < 0.05$, ** Sig at $p < 0.001$.

4.4.6. Importance-Performance Map Analysis

The importance-performance map analysis (IPMA) provides an analysis dimension that takes into consideration the mean values of the latent variables' scores and extends to the reported PLS-SEM results of path coefficient estimates [109]. In particular, the IPMA checks the total impacts, which are important for constructing a construct with their performance indicated by their average latent variable scores. The aim is to recognise the elements that are most significant in the construct and thus have a high overall impact on the construct but low yield, i.e., the average latent variable scores are low [109].

The findings of the IPMA are based on two dimensions (i.e., importance and performance) (see Figure 4), which is essential to prioritise management activities [110]. In this study, the IPMA shows that the importance of the elements cognitive absorption and perceived usefulness is high because it has a total effect of 0.743 and 0.616, respectively. In fact, the performance of cognitive absorption and perceived usefulness are 63.38 and 68.65, respectively. It is worth noting that aspects related to cognitive absorption should be given more priority to further increase the performance of behavioural intentions to reuse RSs because it was of the greatest importance; however, it was low in performance in comparison to perceived usefulness.

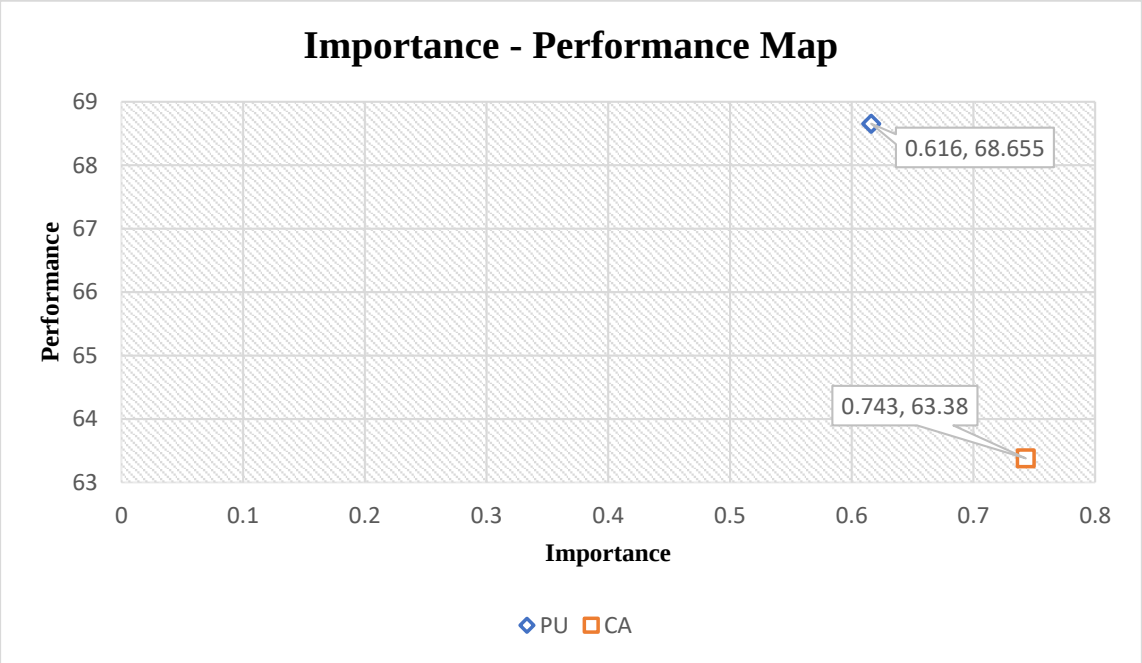


Figure 4. Result of importance-performance map analysis. Note: PU: Perceived usefulness, CA: Cognitive absorption.

5. Discussion

This study responds to the call for more empirical research by Xiao and Benbasat [14], in terms of RSs research. In the RSs literature, there is a dearth of studies on the influence of cognitive absorption, and little is known about how cognitive absorption affects consumers' behavioural intentions to reuse RSs or their decision outcomes. This study adds to a growing body of literature on factors influencing consumers' behavioural intentions to reuse recommender systems by highlighting the role of cognitive absorption. This study integrated TAM and flow theory to determine how cognitive absorption affects shoppers' behavioural intentions to reuse RSs. The study further examined the moderating effect of gender. PLS-IPMA was also performed to identify additional findings.

The findings on cognitive absorption indicated its significance not only in explaining the behavioural intentions but also the shoppers' perceived usefulness of recommender systems. Cognitive absorption increases the perceived usefulness of the recommender

system and behavioural intentions to reuse RSs. It indicated that as the shoppers' level of cognitive absorption increases, the usefulness belief for RSs is likely to be greatly positive. The finding is consistent with those of [52–54]. It was also found that cognitive absorption increases intentions to reuse RSs. The current study sustained the view of Balakrishnan and Dwivedi [43] that cognitive absorption can enhance technology continuation intentions.

The present study found that the perceived usefulness of RSs is positively linked with shoppers' behavioural intentions to reuse RSs. Although the examination of this relationship is not novel, the effects of these two constructs are unknown when TAM is integrated with flow theory to examine shoppers' behavioural intentions to reuse RSs.

The result of moderation analysis using PLS-MGA bootstrapping results and the Welch–Satterthwaite test revealed that the strength of the relationship between all the variables was significantly different in males and females. It was also identified that cognitive absorption did not have a significant direct effect on males' behavioural intentions to reuse RSs, which was consistent with Ghasemaghaei [23]. Another interesting finding was the result of mediation analysis that showed perceived usefulness could significantly induce an indirect effect between cognitive absorption and behavioural intentions to reuse RSs. The multi-group analysis revealed that perceived usefulness fully mediates the relation between cognitive absorption and behavioural intentions to reuse RSs in the case of males but only partially mediates in the case of females.

The results obtained from PLS-IPMA also indicated that cognitive absorption was more important than perceived usefulness. This was logical given the assumption that when interacting with RSs, shoppers' pleasure and enjoyment were more important than the beleif that using RSs would enhance the achievement of their shopping tasks. Cognitive absorption acting as a resilient predictor of behavioural intentions to reuse RSs was consistent with the existing literature in information systems [43,58].

6. Limitation and Future Research

The findings of this research are limited by the use of a cross-sectional survey design. It is suggested that the association of these factors is explored with a longitudinal design in future studies. The current study was restricted to Amazon as the e-vendor. Further studies may be conducted using a less famous e-vendor that uses RSs to analyse the causal relationships between factors presented in this study. This study used the method of availability (or convenience sampling) to locate respondents, thus the research results may not be generalised to the entire population. The random sampling method could be used in future research to obtain representative data to verify that the results of this study could still be sustained. The data for this research was collected only in Australia and, consequently, to better understand and generalisation of the current research findings, future research across different countries is encouraged.

7. Implications

This research adds significant contributions to the literature by empirically determining different influences of cognitive absorption and perceived usefulness on shoppers' intentions to reuse RSs. There has been little research on the impact of holistic consumer experience on behavioural intentions to reuse recommender systems [49], resulting in a lack of consensus, especially regarding the direct impact of the holistic consumer experience on behavioural intentions to reuse RSs. This research shows that a user's holistic experience, as measured by cognitive absorption, has a strong direct influence on behavioural intentions in the context of recommender systems. The research suggests that focusing on the overall experience of the user can lead to increased intentions to continue using recommender systems, thereby promoting their long-term success and sustainability. This research further emphasises the need for analysing intentions in relation to cognitive absorption in order to gain a more complete understanding of cognitive absorption's effect on behavioural intentions. The investigation of moderation effects caused by shopper gender differences was also another important contribution of this research. Although some previous studies

examined the role of gender, the effects of gender were not determined when the role of cognitive absorption and the reuse intentions were estimated. This study precisely estimated the moderation effect of gender across all paths proposed in the model, including indirect paths. The result of the moderation analysis demonstrated that the strength of correlation between the variables was significantly different in males and females. The finding of this study also indicated that cognitive absorption directly affected reuse intentions in females but not in males. The study complements the RSs literature by providing a holistic understanding of how and why RS reuse affects decision making.

From a practical standpoint, the research suggests that e-vendors should pay attention to consumers' overall experience with RSs. In particular, e-vendor managers must comprehend the key areas on which they must concentrate their efforts in order to improve the overall experience. The findings demonstrate that high levels of cognitive absorption in RSs are associated with an interaction dominated by curiosity, focused immersion, and temporal dissociation. The research suggests that e-vendors using RSs should also focus on improving RS usefulness. RSs should provide particular attention to the quality of the information recommended and e-vendors should establish adequate quality control mechanisms to improve shoppers' decision-making process. To enhance customer loyalty and ensure shoppers' needs are met, RSs should provide accurate, adequate, and reliable information.

In terms of methodology, this research is among the first to utilise PLS-MGA to investigate the moderating effect of gender on the shoppers' intentions to reuse RSs. The moderation analysis performed in this research recommends technology managers to incorporate gender-sensitive RSs. This is a novel study employing the latest techniques, such as PLS-IPMA, to identify the importance of elements in predicting shoppers' reuse intentions. More comprehensive knowledge of all factors importance and performance was demonstrated in additional findings provided by assessing the PLS-IPMA results.

8. Conclusions

This research investigated the role of the holistic experience on consumer behavioural intention to reuse recommender systems. The shopper's holistic experience with RSs in this research was denoted as cognitive absorption. The research used the technology acceptance model and flow theory to extend previous recommender systems research. The research highlighted the importance of increasing consumer cognitive absorption to increase their intentions to reuse RSs, which could result in long-term success and sustainability of recommender systems. This study contributes to the information system and consumer behaviour literature in the following perspectives. The present research fills an important gap in the RSs literature by placing special emphasis on explaining the effect of the shopper's holistic experience with RSs on their intentions to reuse RSs. The findings enrich the literature about cognitive absorption and offer insights on the determinants of shoppers' intentions to reuse RSs and its effect on decision outcomes. The findings also revealed that cognitive absorption significantly influences behavioural intentions to reuse in females more than males. These findings are timely and critical for the success of recommender systems.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data that support the findings of this study are available from the corresponding author upon reasonable request.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Instructions Provided to Participants: This study stated that recommender systems (RSs) are web-based technology that recommends tailored products or services to customers based on their past buying behaviour or their specified preferences or the preference of other like-minded customers.

Please note: Amazon typically uses recommender systems to offer recommendations under the labels "Frequently bought together" or "Compare to similar items" or "Customers who bought . . . also bought".

Appendix B

Table A1. Construct(s) and Measurement Item(s).

Construct	Item(s) and Measurement Item(s)	Sources
Perceived Usefulness (PU)	PU1: Using RS enabled me to find suitable <product> more quickly. PU2: Using RS improved the quality of analysis and searching I performed to find suitable <product>. PU3: Using RS made the search task for <product> easier to complete. PU4: Using RS enhanced my effectiveness in finding suitable <product>. PU5: Using RS gave me more control over the <product> search task. PU6: Using RS allowed me to accomplish more analysis than would otherwise have been possible. PU7: Using RS greatly enhanced the quality of my judgments. PU8: Using RS conveniently supported all the various types of analysis needed to find suitable <product>. PU9: Overall, I found RS useful in finding suitable <product>.	[19]
Cognitive Absorption (CA)	FI1: While using the RS, I am able to block out most other distractions. FI2: While using the RS, I am absorbed in what I am doing. FI3: While on the RS, I am immersed in the task I am performing. FI4: When on the RS, I get distracted by other attentions very easily. FI5: While on the RS, my attention does not get diverted very easily. TD1: Time appears to go by very quickly when I am using the RS. TD2: Sometimes I lose track of time when I am using the RS. TD3: Time flies when I am using the RS. TD4: Most times when I get on to the RS, I end up spending more time that I had planned. TD5: I often spend more time on the RS than I had intended. CU1: Using the RS excites my curiosity. CU2: Interacting with the RS makes me curious. CU3: Using the RS arouses my imagination.	[31]
Behavioural Intention (BI)	If you needed to purchase a similar product in the future, how likely is it that . . . BI1: . . . you would intend to continue using RS in the future? BI2: . . . you would predict your use of this RS to continue in the future? BI3: . . . you plan to continue using this RS in the future?	[2]

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