



OPEN ACCESS

EDITED BY

Nadia Magnenat Thalmann,
University of Geneva, Switzerland

REVIEWED BY

Hongfeng Zhu,
Hunan Institute of Science and Technology,
China
Yingna Chao,
Hunan Vocational College for Nationalities,
China

*CORRESPONDENCE

Sophia Elsholz,
✉ s.elsholz@tu-berlin.de

RECEIVED 09 October 2025

REVISED 10 November 2025

ACCEPTED 17 November 2025

PUBLISHED 11 December 2025

CITATION

Elsholz S, Nguyen D and Zarnekow R (2025)
Identifying barriers and solution strategies for
retailers' adoption of virtual reality shopping –
an experts' perspective.
Front. Virtual Real. 6:1721321.
doi: 10.3389/frvir.2025.1721321

COPYRIGHT

© 2025 Elsholz, Nguyen and Zarnekow. This is
an open-access article distributed under the
terms of the [Creative Commons Attribution
License \(CC BY\)](#). The use, distribution or
reproduction in other forums is permitted,
provided the original author(s) and the
copyright owner(s) are credited and that the
original publication in this journal is cited, in
accordance with accepted academic practice.
No use, distribution or reproduction is
permitted which does not comply with these
terms.

Identifying barriers and solution strategies for retailers' adoption of virtual reality shopping – an experts' perspective

Sophia Elsholz*, Danny Nguyen and Rüdiger Zarnekow

Chair of Information and Communication Management, Technical University of Berlin, Berlin, Germany

Despite the potential advantages of virtual reality (VR) shopping in providing novel and immersive user experiences, retailers are reluctant to implement actual applications. Current commercial applications are more akin to marketing instruments than actual stores with purchase possibilities, revealing that current potentials are yet to be recognized by the market. However, research concerning the retailers' perspective is scarce. The present article thus seeks to identify reasons for the market's reluctance and to propose potential solutions. Based on the technology-organization-environment (TOE) model and several TOE-related theories, such as the Diffusion of Innovation, we conducted interviews with market experts that revealed the most salient factors for the reluctance, including the cost of the technology, unrecognized values for customers, and the high implementation expenses for organizations. Our research contributes to the ongoing discourse on the potential of virtual reality to shape humans' digital lives by revealing several barriers and solution strategies for the introduction of VR retail applications.

KEYWORDS

VR, virtual reality, TOE, retail, e-commerce

1 Introduction

As the distribution of e-commerce is on a continuous rise, the concept of virtual reality (VR) shopping is also becoming increasingly relevant. VR shopping combines the advantages of physical shopping with those of online shopping, providing users with immersive and engaging experiences that exceed other shopping media in several aspects, especially hedonic and instrumental aspects (Xi et al., 2024; Xi and Hamari, 2021). In contrast to conventional shopping media, VR shopping offers customers multi-sensory information, allowing them to immerse themselves in multifaceted environments. Rather than 2D images found on traditional websites, VR shopping presents 3D models of products, helping customers to imagine how certain products look in real life (Speicher et al., 2018). This realistic experience can be achieved without the need to visit physical stores – saving customers time and travel expenses. Unlike physical stores with limited capacity and opening hours, VR stores are accessible at any time. These features can ultimately lead to a higher purchase intention (Mayring and Fenzl, 2019; Park et al., 2018) and increase positive feelings among users (Lau and Lee, 2019).

Despite the theoretical advantages of VR shopping, the market has been reluctant to implement and offer VR shopping applications. A taxonomy by Elsholz et al. (2025b) revealed that there are only a few applications on the market currently. Furthermore, they

observed that existing applications are more akin to a proof of concept for demonstration rather than fully functional stores.

Despite the substantial body of research on the consumers' perspective of VR shopping (Erensoy et al., 2024; Xi and Hamari, 2021), research on the retailers' perspective remains limited. Instead, given the current state of research, factors influencing the adoption can only be derived from related technologies or extracted from articles regarding the consumer perspective that mention retailers' barriers as an aside. However, such an examination is necessary to identify the factors deterring e-commerce enterprises from implementing and offering VR shopping applications. Moreover, there exist no guidelines with strategies to overcome potential barriers in the adoption. We want to close this research gap through a qualitative study. To this end, we interviewed experts in the fields of VR and retail, including university professors/post-docs, VR developers, and store managers. Our aim is to address the following two research questions:

RQ1: What barriers contribute to the slow adoption of VR in the retail sector?

RQ2: What are potential strategies to overcome these barriers?

Due to the limited research in this area, we applied an explorative approach based on semi-structured interviews. In order to develop a guideline for the interviews, we relied on the technology-organization-environment (TOE) model (Tornatzky et al., 1990). The model divides factors influencing an organizations' adoption of innovative technologies into the three categories of technology, the organization itself, and the organization's environment. Furthermore, we include several TOE-related theories into our research, such as Diffusion of Innovation (Rogers, 1995), Resistance to Change Theory (Oreg, 2003), and Stakeholder Theory (Freeman, 2010). These theories help us to understand the adoption of VR shopping.

To answer our two research questions, we first provide a summary of the research on VR shopping, the TOE-model, and related theories in Section 2. Further, we explain how we prepared the interviews, collected the data, and analyzed it in Section 3. We then proceed with presenting our results regarding barriers and solution strategies in Section 4 followed by a discussion of the results in Section 5. Finally, we present limitations and future research opportunities in Section 6.

2 Theoretical background

2.1 VR shopping

The advent of VR shopping represents a novel approach for the selection and purchase of goods. For that purpose, users can wear so-called head-mounted displays (HMDs), glasses that are worn on the head and project slightly different pictures to both eyes, creating the feeling of being in another environment (Rolland and Hua, 2005). In the shopping context, whole stores can be recreated. Examples are grocery stores (Lombart et al., 2019), clothing stores (Morotti et al., 2020), or furniture stores (Speicher et al., 2018).

However, recent research has shifted the focus to the consumer perspective of VR shopping. Compared to other, more conventional, shopping media, VR provides immersive experiences that provide real-time sensory experiences (Flavián et al., 2019). In addition to

visual representations, VR environments can provide users with haptic, acoustic, and olfactory stimuli (Xi and Hamari, 2021). It was found that VR shops evoke both utilitarianism and hedonism through the provision of a high efficiency and escapism (Pizzi et al., 2019). In comparison to an immersive desktop shop, customers in a VR store exhibited higher levels of hedonism, utilitarianism, and user experience (Ricci et al., 2023). For an immersive furniture store, study participants expressed mostly positive feedback regarding their acceptance, satisfaction, and perceived realism (Fiorentino et al., 2022). The advantages of VR experiences can then, in turn, lead to higher purchase intentions (Mayring and Fenzl, 2019; Park et al., 2018).

In contrast, the retailer's perspective is less understood. Some studies mention reasons for the low adoption rate of VR in the retail sector. However, these studies are primarily focused on the consumer perspective. For instance, the high implementation and maintenance costs are mentioned in literature (Park et al., 2018; Xi and Hamari, 2021). Additionally, the comfort of the headsets (Xi and Hamari, 2021), uncertain profitability (Berman and Pollack, 2021), and missing know-how (Alkarney and Almakki, 2022) pose significant challenges for the implementation. VR applications also restrict the target audience, because of higher risk factors for some groups, such as the elderly and children (Xi and Hamari, 2021) and cyber sickness (Xi and Hamari, 2021).

In their taxonomy, Elsholz et al. (2025b) compared different places of usage for immersive VR applications. Of the 13 applications featured in the article, 11 were implemented for at-home usage, while the remaining two were only available in-store. Consequently, we endeavored to cover both solutions in the interviews, contingent on the expertise of the experts. Moreover, they propose that the reasons why enterprises have not yet adopted VR shopping require further exploration. With the present study, we aim to build on their findings and identify reasons for reluctance.

2.2 TOE model

In this article, we rely on the TOE model, which identifies how organizations implement and adopt technological innovations (Tornatzky et al., 1990). The TOE model defines three interacting contexts for the adoption: technology, which is related to the characteristics of the technology itself, such as complexity and compatibility. The second context, the organization, encompasses characteristics of the enterprises, such as size, culture, and structure. Thirdly, the organization's environmental circumstances exert a substantial influence on the adoption of innovative technologies. This category includes competition and market trends.

2.2.1 Related theories

While the TOE model functions as a general framework for our study, several research theories form its foundation. These theories can help identify relevant factors that influence the VR shopping adoption in the areas of technology, organization, and environment.

One fundamental theory of the distribution of new technology is Rogers' Diffusion of Innovations (Rogers, 1995). According to Rogers, a technology is first adopted by innovators. These are willing to take risks, because there is little knowledge about the profitability of a new product. Early adopters and the early majority

then follow these innovators. Lastly, late majority enterprises and laggards adopt innovations after their competitors and demonstrate minimal opinion leadership. According to Rogers, five innovation characteristics influence the diffusion of innovations: compatibility, trialability, relative advantage, observability, and complexity (Rogers, 1995). These five factors could play a major role in the adoption of VR shopping. Another model describing the typical course of how the public and organizations typically perceive new technologies is the hype cycle (Fenn and Raskino, 2008). After an innovation trigger, a new idea or technology, comes the peak of inflated expectations where euphoria leads to many pilot projects, some of which are successful and some of which fail. VR shopping seems to have reached this phase several years ago. The idea has been around for a while, and several pilot projects have been conducted. However, most of them failed and were not pursued further (Elsholz et al., 2025a). According to Gartner, after the peak of inflated expectations comes the trough of disillusionment, the slope of enlightenment, and finally the plateau of productivity. At this stage, the technology is mature and provides real economic benefits (Fenn and Raskino, 2008).

Similar to the technology section, Rogers' Diffusion of Innovations also aims to explain the organizational processes that are related to the adoption of new technologies. Rogers defines five stages of the innovation process: awareness, persuasion, decision, implementation, and continuation (Rogers, 1995). In the first phase, organizations are exposed to a new technology. Several enterprises were interested in the VR shopping concept, including Ikea, Amazon, and Alibaba. In the next stage, they develop an interest and seek out information about the innovation. After deciding to implement an innovation, based on its perceived advantages and disadvantages, organizations begin to implement the technology. Finally, enterprises decide whether to continue using the technology or not (Rogers, 1995). In this stage of the diffusion process, many enterprises hesitate to continue using VR shopping technology and reject the project. While there are some VR stores on the market, most of them are outdated and no longer supported (Elsholz et al., 2025a). However, once enterprises decide to implement innovations, there can arise strong resistance among employees, as stated in the Resistance to Change Theory (Oreg, 2003). According to this theory, individuals may react differently to changes. A possible reason to resist change is routine-seeking, which in the case of VR shopping would be the routine of conventional online stores. Furthermore, changes can evoke emotional reactions, such as fear or stress. Another issue is focusing on short-term comfort instead of concentrating on long-term advantages. While VR shopping would require a significant initial investment, the potential long-term revenue is possibly overlooked. Finally, some employees may have difficulty changing their perspective due to cognitive rigidity (Oreg, 2003). VR shopping, being a new phenomenon that has barely been introduced to the market, could evoke such resistance.

Enterprises operate in a dynamic environment with several stakeholders who influence their decisions and actions. According to the Stakeholder Theory, organizations are embedded in networks of relationships that affect their long-term success (Freeman, 2010). Stakeholders are individuals or groups that influence or are influenced by the activities of organizations. Examples of stakeholders include customers, employees, investors, and the government. To increase legitimacy, reduce conflicts, and foster

innovations, enterprises need to incorporate the needs and interests of their stakeholders (Freeman, 2010). In the context of this study, especially the customers of enterprises may influence the adoption of VR shopping applications because customer demand drives the adoption (Rogers, 1995). Rogers describes the relative advantage of an innovation as one of the main factors that influence adoption. Once customers see the clear benefits of VR shopping applications, they are more likely to demand them, leading to a faster adoption. In addition to stakeholders, other enterprises also have a significant influence on organizations. Enterprises in similar fields tend to become more similar over time, even if this similarity does not lead to a higher efficiency (DiMaggio and Powell, 2000). This is called Institutional Isomorphism. The reason for this is expected to lie in a higher legitimacy, acceptance, and social pressure within their environment. Regarding the adoption of VR technology, enterprises hesitate to introduce new applications because of their competitors who also rely on conventional stores.

2.2.2 TOE research in retail and VR

The TOE model is not specialized on any specific technology or industry. Instead, it can be adapted to any particular circumstances. For the technology of augmented reality (AR) shopping, the TOE model was applied in a quantitative survey (Chandra & Kumar, 2018). The authors tested the impact of seven factors on e-commerce firms' intention to adopt AR, revealing that technological competence, relative advantage, top-management support, and consumer readiness significantly influence the adoption intention. However, in contrast to this study, we opted for a qualitative approach to be more open to further aspects for each TOE category instead of relying on pre-defined aspects. Especially in this under-researched field, this exploratory approach enabled the identification of numerous barriers and solution strategies.

Similarly, there are already first approaches that identify factors influencing the adoption of VR using the TOE framework. Regarding the adoption of the metaverse by firms in general, Zheng et al. (2024) identified several factors influencing the decision-making time and speed of Chinese small and medium enterprises. These factors include organizational complexity, perceived usefulness, and collaborations with prominent intermediaries. In the context of VR adoption in the tourism industry, Sousa et al. (2024) found out that the main challenges are a perceived lack of usefulness, limited experience, and the costly introduction of VR solutions.

3 Methodology

3.1 Preparation

In the initial phase of the interview preparation, we developed an interview guideline that contains two sections, each corresponding to one of the research questions. The first interview section aimed to identify the barriers impeding the adoption of VR, while the second section aimed to examine strategies to dissolve them. We divided the barriers into three parts: technology, organization, and environment, which were derived from the TOE model. This structure served as a preliminary framework, with adjustments made to align with the flow of the interviews in certain cases.

TABLE 1 Overview of the interviews.

Interview	Job description	Experience	Duration (in min)
P1	Post-doctoral researcher on psychological responses to XR	Master's degree in marketing and e-business, senior scientist since 2024	15
P2	Professor for e-commerce and digital innovation	Masters's degree in business informatics, professor since 2021	25
R1	CEO of an e-commerce enterprise selling clothing	CEO since 2023	15
R2	Store manager of a hardware store	CEO since more than 10 years	13
R3	Store manager of a grocery store	Deputy store manager since 2017 and store manager since 2019	13
V1	VR developer, creative director, and consultant	CEO and experience in digital innovation since 2010	37
V2	Self-employed VR developer, creator, and vice president of an XR association	Developer since 2015 and vice president of the XR association since 2021	25
V3	Founder and CEO of VR development company, consultant	CEO, developer, and consultant since 2015	23
V4	Co-founder and CEO of a VR creative development studio	CEO since 2006	33

To identify suitable interview partners, we relied on a purposive sampling method (Etikan, 2016). To this end, we looked for experts with specialized knowledge in e-commerce, VR, or both. During the expert selection process, we paid attention to a heterogeneous sample regarding the job field. This includes professors/post-docs, retail experts, and VR developers to achieve a multifaceted perspective. We then contacted approximately 80 individuals via email or in person and asked for their permission to interview them. Beforehand, they were informed about the purpose and general topic of the interviews. Of the 80 individuals, we received 10 positive responses. However, one of the experts later withdrew his consent for the interview to be published. The interviews were conducted in early 2025. We decided to not provide the interview guideline in advance to ensure a natural interview process and avoid preconceived answers and opinions.

Conducting the interviews in a semi-structured manner allowed us to ask follow-up questions whenever something was unclear, or when we required additional information. However, we ensured that barriers in all three TOE categories and solution strategies were covered in every interview to guarantee comparability between them. In cases where experts expressed uncertainty regarding barriers in one of the TOE categories, we presented some examples derived from prior literature in VR shopping related areas, such as the barriers proposed in Section 2.

3.2 Data collection and analysis

When selecting the medium for conducting the interviews, we were guided by the experts' preference. Although we proposed using video platforms such as Zoom, one expert preferred to conduct the interview via telephone. We hence conducted eight video call interviews and one phone interview (P2). To ensure the anonymity of the interviewees, we omit their names. However, we provide job descriptions and their experiences for all experts, as illustrated in Table 1. The identifiers correspond to the interviewees' job fields: P for professors/post-docs, R for retail experts, and V for VR developers.

All interviews were recorded with prior consent and subsequently transcribed in their original languages. In this stage

of the process, we omitted filler words and parts of the conversation that do not contribute to the objectives of this study.

In the data analysis phase, we coded the transcripts according to a qualitative content analysis (Mayring, 2010) that focuses on identifying core statements and essential components of the interviews. This approach enables us to establish inductive and deductive categories (Mayring and Fenzl, 2019). We started with inductive categories, namely, barriers in the TOE categories technology, organization, and environment as well as strategies to overcome adoption barriers. These inductive categories are directly related to the interview guideline and our two research questions. Furthermore, we inductively defined second-level categories for the solution strategies that are also aligned to the TOE categories. We then transitioned to a deductive coding process, with the objective of identifying text paragraphs that can be classified into our predefined inductive categories. These barriers and solution strategies served as first-level codes. In total, we extracted 51 first-level codes with a total of 138 appearances. After extracting the first-level codes, we constructed broader categories. These second-level codes summarize several barriers at once. The initial 51 first-level codes were summarized into 17 second-level codes. For strategies to overcome the barriers, we decided to use the TOE categories as second-level codes instead of summarizing categories as we did for the barriers. We chose this approach because the number of first-level codes was much lower than for the barriers, and the strategies were more heterogeneous. Two researchers conducted the deductive coding individually. Afterwards the codes were compared and differences in the coding were discussed to avoid biases.

4 Results

4.1 Barriers in the implementation of VR shopping applications

In the following, we will explain the main barriers of the retailers' adoption of VR shopping, categorized through the TOE model.

TABLE 2 Technological barriers in the adoption of VR shopping.

Second-level code	First-level code	#	Example quote
Hardware constraints	Missing haptics	3	"So that you might also touch it, because you have several senses and only visual cues are not enough, one also needs haptic feedback. So that you can also touch the product and know what material it is made of." (R1)
	Low comfort	3	"[For] the traditional headsets, you notice them even after half an hour. At some point it hurts and you might even sweat." (P2)
	Low processing power	2	"I could imagine that in the VR sector insufficient computing power is a problem. We all know that websites with 360 experiences take extremely long to load." (R1)
	Low battery life	1	"When you put VR glasses out there, acceptance is very high. [...] but then at some point they realize that the glasses need to be charged." (V2)
	Latency issues	1	"And for me, it's enough to see, for example, that this png is much too large for the page and causes the page to load a second longer. For me then, that one second is a reason that could prevent customers from buying something or not." (R1)
Health-related constraints	Sanitary issues	4	"When I'm wearing VR glasses in a store and see that three customers have already worn them before me, then I might not even want to put them on for hygienic reasons. Of course, they are always cleaned, but it's a very personal space that you're exposing there." (P1)
	Cyber sickness	3	Others may have been unlucky and felt sick to their stomach the first time, saying: 'Stay away from me with those things!' It's the first experience that determines how well it's actually accepted." (V3)
	Eye issues	1	"Or you might be concerned about your eyes, because the display of the glasses is extremely close to your eyes." (R3)
High cost and expenses	Acquisition cost and expenses	7	"So I see the non-existent and expensive technology - the actual equipment, so to speak - as a major technical obstacle. It takes far too much money to provide this." (R2)
	Maintenance cost and expenses	3	"There are also additional maintenance costs, as one has to maintain the equipment appropriately." (R2)
Low value	Missing value	8	"What direct added value do I have when I enter virtual reality? What is the difference to the real thing?" (P2)
Software constraints	Complex handling	3	"[It requires] still an effort compared to a click on a website to put on such a headset. [...] I'm busy for 3 min or even longer until the whole thing works." (V3)

4.1.1 Technology

The technology section refers to barriers in the adoption that are associated with the current development of the VR technology. Table 2 lists all first-level and second-level codes in this field.

The first technological challenge pertains to current hardware limitations that are relevant for at-home and in-store solutions. In contrast to the possibility to physically touch products during brick-and-mortar store shopping, in VR there is no such possibility (R1, R2, P2). "So that you might also touch it, because you have several senses and only visual cues are not enough, one also needs haptic feedback. So that you can also touch the product and know what material it is made of." (R1). Another challenge is the comfort of the headsets (P2, V3, V4). The headsets' weight and their tight fit around the head can significantly reduce the experience: "[For] the traditional headsets, you notice them even after half an hour. At some point it hurts and you might even sweat" (P2). Additional challenges include in the processing power of the headsets when loading large amounts of data, particularly for outdated devices (R1, V1), a battery that needs frequent recharging to provide an optimal user experience (V2), and latency issues (R1).

Another group of technological challenges relates to the users' health. Especially for in-store settings, where several users wear the same headsets, hygiene plays a major role (R3, P1, V2, V3). "When I'm wearing VR glasses in a store and see that three customers have already worn them before me, then I might not even want to put them

on for hygienic reasons. Of course, they are always cleaned, but it's a very personal space that you're exposing there." (P1). As with all virtual applications, the phenomenon of cyber sickness, characterized through discomfort due to the perceived motion, can emerge and deter potential home users and store customers from using headsets (P1, P2, V3). "Others may have been unlucky and felt sick to their stomach the first time, saying: 'Stay away from me with those things!' It's the first experience that determines how well it's actually accepted." (V3).

As with any technology, the cost and expenses associated with their acquisition (R1, R2, R3, V1, V2, V3, V4) and maintenance (R2, P2, V2) play significant roles for their acceptance by enterprises. The acceptance of at-home solutions for the public is related to the hardware price, because it directly impacts the number of headsets that are in circulation. Enterprises that want to offer VR experiences in-store must also consider the upfront hardware purchases necessary for these experiences. "So I see the non-existent and expensive technology - the actual equipment, so to speak - as a major technical obstacle. It takes far too much money to provide this" (R2).

The technological barrier that has been mentioned most frequently is the missing value for the technology. It appears that customers and retailers alike encounter difficulties in recognizing the added value of VR shopping applications or in determining its usefulness in at-home or in-store contexts (R2, R3, P1, P2, V1, V2,

TABLE 3 Organizational barriers in the adoption of VR shopping.

Second-level code	First-level code	#	Example quote
Unsuitable organizational strategy	"Nice-to-have", not "must-have"	5	"It's just a solution for which there is not really a problem. It is simply a 'nice-to-have'. Definitely not a 'must-have'. It's a nice accessory [...]" (R1)
	Not suitable to enterprise strategy	3	"[The most relevant barrier is] the strategic assessment of whether there is real added value for virtual reality. Especially if you want to use it in combination." (P2)
	Not suitable to enterprise structure	1	"Then you'll probably have to restructure the entire company." (R3)
	Capacity issues	1	"You also need the appropriate software for it, so you have to develop it and release it to the market, which is also very expensive to develop. In my opinion, there simply is not the capacity to say, 'okay, it's worth using this VR.'" (R2)
Knowledge constraints	Support from trained employees necessary	6	"You have to be familiar with it, there always has to be a person there to check [the system] or help the customers. This position has to be created first and, in the worst case, this person is absent for the other activities that are actually much more important." (R3)
	Missing expertise/know-how	5	"I think know-how is still one of the biggest brakes on the whole thing at the moment. People are simply far too slow to realize that there is an incredible amount of speed in development." (V2)
	Missing research	1	"It's certainly possible to get the money for it somewhere, but [...] you would probably have to do a lot of research beforehand to figure out how to implement it." (R3)
High costs for enterprises	Low cost-value	6	"Well, let me put it this way: since I'm now on the employer side myself, I can tell you that costs are always an issue, regardless of the field. So the cost-benefit question definitely arises in this area because, as I said, I cannot think of any application off the top of my head." (R2)
	Low profitability	4	"This brings us to profitability, when there is a primary customer benefit that needs to be demonstrated first. Then, of course, the company has to consider: 'Can I generate a real contribution margin advantage through this customer benefit?'" (P2)
Employee constraints	Resistance within the organization/low employee acceptance	6	"Then you also need people who are familiar with it, who are behind it, who drive the whole thing forward. That does not happen through individual employees in stationary retail." (V3)
	Fear of employees losing their jobs	1	"But when it comes to replacing the consultant now. When it means, for example, that the app could take away the entire shopping experience, from check-in to product selection to payment for the product." (V1)
Space constraints	Not enough space within shops	3	"But only at the end did it become clear that the stores were not designed to have something digital like that. They wanted a cool display, which would be nice, but there's no room! They've packed everything full of random stuff." (V1)

V3, V4). "That's why the question for private customers who are out and about in retail is: 'What direct added value do I have when I enter virtual reality? What is the difference to the real thing?' (P2). "There just has to be a use case that actually works and is worthwhile. So far there is not one, certainly not one that makes sense, that is also profitable and you can see exactly how much growth in customers [...] can be achieved" (V3).

Finally, the complex handling of VR software presents a significant technological barrier for home users and store customers (V1, V3, V4). For example, the setup can be challenging (V4), and guardians must be marked on the floor (V3), which is "still an effort compared to a click on a website to put on such a headset. [...] I'm busy for 3 min or even longer until the whole thing works" (V3).

4.1.2 Organization

The second category, organization, encompasses all barriers that occur within the retailers' enterprises. An overview of these is provided in Table 3.

A significant number of barriers within the organization are related to their current strategy. Hence, many experts expressed that VR technology for both contexts, at-home and in-store, is a "nice-to-

have", rather than a "must-have" (R1, R2, R3, V1, V4). "It's just a solution for which there is not really a problem. It is simply a 'nice-to-have'. Definitely not a 'must-have'. It's a nice accessory [...]" (R1). Furthermore, the experts concur that the technology does not align with the enterprise strategies (P2, V1, V4) or change their opinion on their strategy after a trial: "Everything is about what's new. So you end up in a kind of cycle of technology being integrated or trialed. And then just after the trial, they want something else. They're not interested in that. Now that's one of the issues." (V4). Moreover, the enterprise structure (R3) and their capacity (R2) have the potential to impede the adoption of VR technology for retail purposes.

In addition to the strategy of the enterprises not aligning with the introduction of VR shopping, the majority of experts assume knowledge constraints within the organizations. First, trained employees need to provide assistance to customers who wish to engage with in-store VR shopping experiences (R2, R3, P1, P2, V2, V3). "You have to be familiar with it, there always has to be a person there to check [the system] or help the customers. This position has to be created first and, in the worst case, this person is absent for the other activities that are actually much more important." (R3). Furthermore, expertise in the enterprise as a whole, besides the

TABLE 4 Environmental barriers in the adoption of VR shopping.

Second-level code	First-level code	#	Example quote
Missing standards and laws	Data protection issues	5	"I mean, in German-speaking countries it's particularly common to have a thousand thoughts and worries. In other countries it's perhaps less severe, but I could imagine that in the context in which we find ourselves." (P1)
	Missing standards	2	"And then we're back to standardization again, because suddenly it's only available for a different device and not for my glasses, because HTC Vive built it back then and since it's not standardized, I cannot use it on my Meta Quest now. Of course, that's no fun at all for the end customer." (V2)
	Unclear legal situation	1	"Then the question is, how should the purchase be treated legally? Does it take place in the virtual space or only at the checkout? Where does the transfer of dangerous goods take place from a legal perspective? Is it a virtual space where I log in to a brick-and-mortar store, or do I do it from home as a potential alternative sales channel?" (P2)
	Gatekeeping	1	"Apple has always been a gatekeeper. [...] and that's even worse in the VR sector. You have the metastore, which is very difficult to get onto, and even then, your projects are promoted by meta within the store and are not simply openly visible in the [store] library." (V2)
Market constraints	No competition	4	"I do not think anyone has done this before, at least not that I know of. So it does not seem to be that easy." (R3)
	Risk due to unexplored benefits	3	"The investment decisions are often used against the technology, even if it could add value the risk is still higher" (P1)
	Missing demand	2	"Well, I would say that, generally speaking, there is no demand for it. [...], for example, if you print on mugs or something like that, you do not need 3D animation or virtual reality to visualize it." (R1)
	Missing market diversity	1	"[The most decisive obstacle is] actually a combination of insufficient diversity of devices on the market, or rather that it is essentially a monopoly with meta." (V2)
Consumer constraints	Low technological affinity of the elderly	4	"I think it would only be difficult for older people. I'm talking about people who are over 60, perhaps. It would be problematic for them if you said, I only have VR stores like this. They will not be able to go shopping because they will not be able to cope." (R3)
	Low technology acceptance	4	"Then, in my opinion, there is certainly a lack of acceptance. I think it will definitely appeal to the younger generation, but I can see that acceptance will be difficult among the over-40s, at least initially, when it comes to entering the market." (R2)
	Unfamiliarity	2	"And the problem we have is that entering a virtual reality is difficult for most people to grasp. In other words, even if we imagine that the technology largely works smoothly in terms of control and in itself, so to speak, I still always have the unfamiliarity of being in this situation when I simply put on a headset." (P2)
Wrong time	Time has yet not come	1	"I think it's feasible, just not necessarily in our time right now." (R3)
	VR hype dropped off	1	"VR, there's a big VR revolution, the hype curve shot up. But it has dropped back down to a much more kind of sustainable level than where it was." (V4)
	Uncertain times (economical and crisis)	1	"We live in very uncertain times, economically speaking, regardless of crises. Of course, wars play a role in this. That's why it's an uncertain time, and economically speaking, things are not necessarily better. But I think people are taking a closer look at what they're spending their money on at the moment." (V2)

customer guidance, is imperative for the development and maintenance of at-home or in-store solutions (P1, P2, V1, V2, V4). "I think know-how is still one of the biggest brakes on the whole thing at the moment. People are simply far too slow to realize that there is an incredible amount of speed in development" (V2). R3 posits that the use cases of VR in the e-commerce domain have not been sufficiently investigated.

In addition to the initial hardware cost of the technology, as discussed in the technology section, the enterprises face other expenses. Many experts have expressed skepticism regarding the implementation costs of at-home and in-store VR shopping applications, as it is uncertain whether the costs can be justified by the potential value (R2, R3, P1, V1, V3, V4). Furthermore, the profitability of VR shopping applications is unclear (P1, P2, V1, V3). "This brings us to profitability, when there is a primary customer

benefit that needs to be demonstrated first. Then, of course, the company has to consider: 'Can I generate a real contribution margin advantage through this customer benefit?'" (P2).

In many enterprises, the employees exhibit resistance to changes which may result in a lack of acceptance of VR as a new retailing channel (R2, R3, P1, V1, V3, V4). "Then you also need people who are familiar with it, who are behind it, who drive the whole thing forward. That does not happen through individual employees in stationary retail." (V3) Furthermore, some employees may fear losing their jobs due to technological advancements (V1). VR apps have the potential to replace the entire shopping process, including check-in, product selection, and payment, all of which are otherwise carried out by employees in brick-and-mortar stores (V1). With the ability to provide a realistic in-store experience at home via an HMD, customers may be less incentivized to visit physical stores.

Another barrier faced by stationary retailers are space constraints (R2, P1, V1). The space in brick-and-mortar stores is often limited as well as costly and is often already occupied for the display of their products. *“But only at the end did it become clear that the stores were not designed to have something digital like that. They wanted a cool display, which would be nice, but there’s no room! They’ve packed everything full of random stuff.”* (V1).

4.1.3 Environment

The environment section summarizes all factors regarding standards, the market, and consumers, as illustrated in [Table 4](#).

Missing standards and laws are key challenges within the context of an enterprises’ environment. Especially in Europe, there are numerous data protection concerns (R1, P1, P2, V1, V3). Potential customers may have inquiries regarding the necessity of registration to experience VR shopping, or whether usage data is tracked (V3). This is especially relevant for at-home solutions, as lots of personal data from the same person could be tracked over time. *“I mean, in German-speaking countries it’s particularly common to have a thousand thoughts and worries. In other countries it’s perhaps less severe, but I could imagine that in the context in which we find ourselves.”* (P1). Furthermore, the experts expressed a desire for more stringent standards regarding the application production process, which is individual and dependent on the utilized platform (V1, V2). Additionally, there is a need for greater transparency in the legal framework governing purchase agreement (P2). The gatekeeping of various platforms by, e.g., Meta and Apple, poses another significant barrier that developers and consumers must confront (V2). Easy deployment across several platforms is especially important for at-home solutions, where customers have a wide selection of possible headsets.

Several market constraints must also be considered. According to the interviewees, the most important issue is the absence of competition, as there is a lack of other firms offering comprehensive VR stores for both at-home and in-store solutions (R2, R3, P1, P2), making it less appealing for enterprises to be the first to enter the market. *“I do not think anyone has done this before, at least not that I know of. So it does not seem to be that easy”* (R3). *“If [other companies] can derive a direct contribution margin value advantage from it [...] that will then actually [...] trigger competitive pressure and then more and more companies will also use corresponding technologies”* (P2). Due to the limited overall distribution of the VR shopping technology, an implementation would pose significant risks (R2, P1, V1). In contrast, the benefits of other technologies have been more thoroughly researched and understood. Since the trajectory of VR is unclear, *“the investment decisions are often used against the technology, even if it could add value the risk is still higher”* (P1). Furthermore, a low overall customer demand further delays decisions towards the adoption of VR shopping (R1, V1). Another market constraint, as proposed by V2, is a low market diversity, as Meta has a monopolistic position and can therefore control the market.

Some consumer constraints also influence the environment retailers operate in. On the one hand, the target group for both kinds of VR shopping solutions is limited due to the elderly’s generally lower technological affinity (R1, R2, R3, V1). *“I think it would only be difficult for older people. I’m talking about people who are over 60, perhaps. It would be problematic for them if you said, I*

only have VR stores like this. They will not be able to go shopping because they will not be able to cope” (R3). However, the younger generations may encounter challenges in their acceptance of the technology as well (R2, P2, V2, V3). In particular, because they lack familiarity with VR shopping (P2, V2). *“And the problem we have is that entering a virtual reality is difficult for most people to grasp. In other words, even if we imagine that the technology largely works smoothly in terms of control and in itself, so to speak, I still always have the unfamiliarity of being in this situation when I simply put on a headset”* (P2).

Some of the experts are convinced that the present moment is not ideal for the introduction of any VR shopping applications. There are several reasons for this. While R3 believes that the time has not yet come, V4 expressed that its *“hype curve shot up. But it has dropped back down to a much more sustainable level than where it was”* (V4). Additionally, during a period of crisis and economic decline, customers become more discerning about their expenditure (V2).

4.2 Solution strategies to overcome barriers

In addition to identifying barriers in the adoption of VR shopping, the interviews revealed numerous strategies to overcome them. An overview of the proposed strategies can be found in [Table 5](#).

4.2.1 Technology

In order to overcome technological barriers associated with the adoption of VR shopping, the experts have proposed two strategies. The first strategy is to improve the usability of the headsets, particularly through minimizing the latency (R1) and offering a simplified setup process for the guardian and lenses (V3). Furthermore, V2 proposed a reduction in the cost of headsets, which could be achieved by offering a reduced functionality. *“We also need more diversity of devices that are perhaps significantly cheaper and have a much more limited range of functions, but do exactly what people want to do with them. Sometimes there’s a lot more in the devices than you need”* (V2). Both solution strategies are relevant for at-home and in-store applications as set-up processes and hardware costs concern all VR users.

4.2.2 Organization

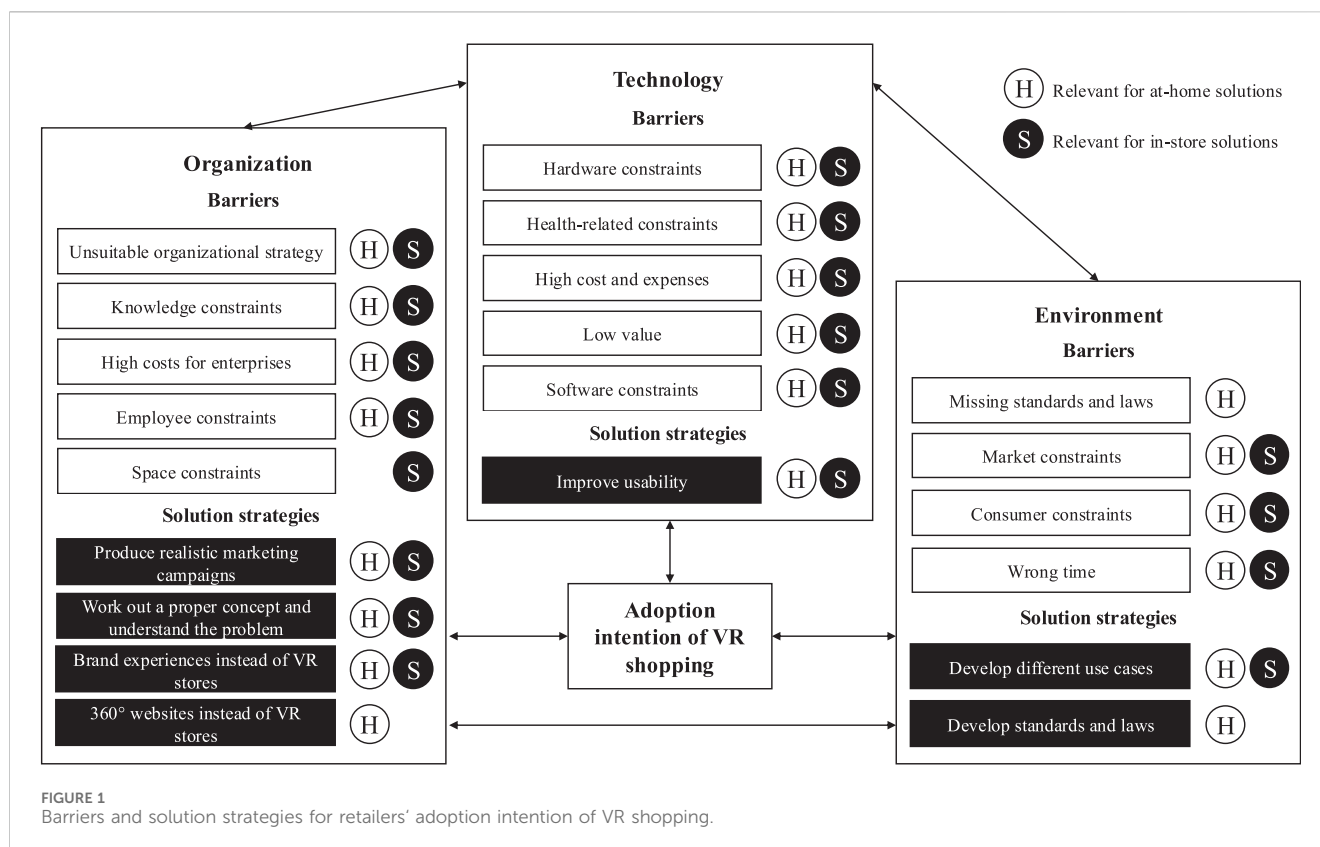
Organizations can also contribute to the adoption of VR shopping. For instance, they could produce more realistic advertisements for VR applications of any kind (V1, V2, V4). According to V4, the marketing industry contributed to the low adoption rate by persuading customers that VR *“is going to make gold out of water. And then when it does not make gold out of water. Sounds surprised that no one wants to go anywhere near it”* (V4). Moreover, the recent marketing campaigns were exaggerated, evoking unrealistic expectations among consumers. *“It does not always have to leave your mouth agape. [...] It’s a bit over-advertised in some places, but in others it’s not emphasized at all what things could really be effective and useful with the device without blowing you away straight away”* (V2). Before VR shopping can become widely adopted, it is imperative to first develop a comprehensive understanding of the problem and then work out a concept that

TABLE 5 Solution strategies to overcome adoption challenges of VR shopping.

Second-level code	First-level code	#	Example quote
Technology	Improve usability	2	"I probably have to pull a guardian onto the floor and adjust the lenses, and I'm busy for 3 minutes or even longer until the whole thing works. That puts people off. The less friction there is in using it, the greater the acceptance will be." (V3)
	Decrease price and lower functionality	1	"We also need more diversity of devices that are perhaps significantly cheaper and have a much more limited range of functions, but do exactly what people want to do with them. Sometimes there's a lot more in the devices than you need." (V2)
Organization	Produce realistic marketing campaigns	3	"It does not always have to leave your mouth agape. [...] It's a bit over-advertised in some places, but in others it's not emphasized at all what things could really be effective and useful with the device without blowing you away straight away." (V2)
	Work out a proper concept and understand the problem	3	"I believe it is important to first understand the problem in order to understand virtual reality can actually solve that problem in a way that is superior to other problem-solving strategies." (P1)
	Brand experiences instead of stores	3	"So at trade fairs and events, it's one thing, it can work well there, the brand experience can work quite well. But it also has the particularity that it is limited in time. I'm talking about 1 day to 1 week, if it's a major event, or maybe 10 days. And then you also have the space and the opportunity to set up the technology, and you also have staff on hand to supervise the whole thing." (V3)
	360° websites instead of VR stores	2	"But what works well and what many people do, of course, are 360° presentations. This is also content that can be integrated directly into the website, where I can perhaps walk through the virtual salesroom and have a kind of virtual exhibition and can really present my products in a fancy environment and do a bit of brand presentation in this way." (V3)
	Integration into enterprise strategy	1	"VR could therefore initially be used solely as a marketing tool. After that, if possible, it could be integrated into the business strategy step by step." (V1)
	Implement applications to arouse customer interest	1	"If you were to introduce it, it would definitely be an incentive for many customers to go there and take a look." (R3)
	Offer better hygiene	1	"Hygiene is a challenge, of course. This means that care has to be taken to counteract this. We either work with face masks or, as a rule, with disposable paper covers that you put over the device. But of course, that's not the most attractive solution either." (V3)
Environment	Develop different use cases	4	"For example, when I look at services, when I go into the area of virtual presentations, i.e., in the education sector or a learning setting, where virtuality is really helpful. But when it comes to the pure sale of goods, i.e., classic consumer goods, you have to ask: What is it really useful for or is it really the combination with certain services that help me?" (P2)
	Develop standards and laws	2	"One option is to force manufacturers to open up their stores so that everything can run on all devices. This gatekeeping, where people can only buy what I make available in my own stores, is, in my opinion, flawed and outdated." (V2)
	Develop an understanding of consumers	1	"I'm an old school marketing director, so I had it beaten into me by people who were older, wiser and better than me, that it was all about understanding the consumer. But in the tech world. It seems to be enough just to say "VR" or "AI" or "metaverse". It seems to be enough just to talk about the technology without genuinely realizing or understanding that the technology is a facilitation tool. It's a delivery device." (V4)
	Acceptance needs time	1	"It's just the way it is, it takes time. Acceptance takes time. It takes time to develop the content. It took time for the glasses to reach a level that is really good. When I compare that [technology to the past], when I think of a headset from 2014, I think: 'For God's sake, how did we put up with that?' It's gotten really good now and it's getting better and better." (V3)

outlines the integration of VR (R3, P1, V4). "I believe it is important to first understand the problem in order to understand whether virtual reality can actually solve that problem in a way that is superior to other problem-solving strategies." (P1). Several experts expressed that VR is a better marketing tool than an actual store (V1, V3, V4). One example is developing brand experiences, for instance for exhibitions, where retailers have space and staff to guide potential customers (V3). Another possibility is using non-immersive VR on the retailers' websites for at-home usage, instead of applications for HMDs. This would be much cheaper and lower the barriers for adoption on both sites, customers and

retailers (R1, V3). "But what works well and what many people do, of course, are 360° presentations. This is also content that can be integrated directly into the website, where I can perhaps walk through the virtual salesroom and have a kind of virtual exhibition and can really present my products in a fancy environment and do a bit of brand presentation in this way" (V3). Other strategies that were offered by the experts in the field of the organizations include integrating VR shops into the current enterprise strategy (V1), introducing VR stores to arouse customer interest (R3), and improving hygiene for headsets that are worn by multiple customers in-store (V3).



4.2.3 Environment

The majority of the experts expressed that they would suggest other VR use cases than shopping (P1, P2, V2, V4). These include the use cases for individuals with physical limitations (P1), educational contexts (P1, P2), and medicine (V2). “For example, when I look at services, when I go into the area of virtual presentations, i.e., in the education sector or a learning setting, where virtuality is really helpful. But when it comes to the pure sale of goods, i.e., classic consumer goods, you have to ask: What is it really useful for or is it really the combination with certain services that help me?” (P2). Two solution strategies for the development of standards and laws for at-home solutions were mentioned. On the one hand, gatekeeping by companies such as Meta and Apple should be prohibited (V2). On the other hand, European headsets that align with European data protection laws should be promoted (V2). Moreover, a mature understanding of customers’ needs is necessary, prior to developing VR shopping applications (V4). This could be achieved through further research in this field. As with any new technology, acceptance takes time. “It’s just the way it is, it takes time. Acceptance takes time. It takes time to develop the content. It took time for the glasses to reach a level that is really good. When I compare that [technology to the past], when I think of a headset from 2014, I think: ‘For God’s sake, how did we put up with that?’ It’s gotten really good now and it’s getting better and better” (V3).

5 Discussion

The investigation of VR shopping adoption among retailers revealed several barriers and solution strategies which are

summarized in Figure 1 according to the TOE framework. Only codes with more than one appearance were included to ensure reliability. White fields present barriers, while the black fields represent possible solution strategies. The arrows linking the categories and the adoption intention demonstrate the interconnected nature and mutual dependence of the categories. Furthermore, we demonstrated whether barriers and solution strategies are relevant in the context of at-home (white circle) or in-store (black circle) solutions.

5.1 General discussion and practical contributions

Most of the barriers regarding VR shopping highlighted in consumer literature were confirmed by the interviews with the experts. A mapping of solution strategies to related barriers is depicted in Table 6.

The extant literature on VR shopping has highlighted several technological barriers to its adoption. The implementation and maintenance costs are especially significant barriers (Park et al., 2018; Xi and Hamari, 2021). The vast majority of experts concur that the cost of current headsets is a major challenge in the adoption. Especially the Apple Vision Pro, that costs 3499 USD, could deter potential customers from acquiring a headset (V1). However, the experts suggested that stores could rely on 360° websites, which are considered non-immersive VR. These environments would lower the barriers, as customers can visit them without the need for HMDs (R1, V3). Companies such as Hugo Boss, Ralph Lauren, and Lacoste already offer such stores. Implementing 360° stores solves not only

TABLE 6 Summary of barriers and solution strategies in the context of VR shopping.

Barrier	Solution strategy
High cost and expenses (T) Space constraints (O) Health-related issues (T)	360° websites instead of stores (O)
Complex handling (T)	Simple setup processes for guardians (T) Reduce latency (T)
Missing haptics (T)	Provide additional material samples (T)
Low value (T) Unrealistic expectations (O)	Produce realistic marketing campaigns (O)
Low value for some industries (T)	Focus on industries with high potential (O) Brand experiences instead of stores (O)
Health-related issues (T)	Disposable paper masks (T) Disinfection after each usage (T)
Data protection issues (E)	Support the production of european headsets (E)
Gatekeeping (E)	Stronger antitrust enforcement (E)
High risks (E)	Be a pioneer and offer VR stores (O) Incorporate instrumental and hedonic elements (O)

the cost problem and health-related problems, but also hardware-related problems, such as the space issues that enterprises have (R2, P1, V1). Besides the high cost of VR technology, its current usability poses significant issues for its adoption (R1, P2, V1, V2, V3, V4). Low processing power and high latency increase the likelihood of cyber sickness (Martirossov and Kopecek, 2017). However, the usability could be improved by simplifying the setup processes for guardians (V3) and reducing latency (R2). According to the experts, especially the elderly struggle with the complex handling due to their lower technological proficiency (R1, R2, R3, V1). These improvements should lead to higher customer adoption rates and, consequently, more potential users of VR stores. Another problem of the VR technology is the missing haptic feedback. While customers can touch the objects in-store with their hands, VR controllers do not offer this possibility (R1, R2, P2). However, there are first approaches in the literature on how to solve this problem. For instance, Fiorentino et al. (2022) provide material samples to their customers, so that they can feel the texture of furniture surfaces. In practice, it could make sense to combine virtual furniture stores together with material sample books to provide an immersive and realistic shopping experience for individuals with reduced mobility or individuals who live far away from furniture stores.

Furthermore, nearly all experts mentioned that customers might not recognize the added value of VR stores. The value of a technology, particularly its relative advantage, plays a significant role in firms' intention to adopt AR (Chandra & Kumar, 2018). One solution to better communicate the added value to customers is to create realistic marketing campaigns. Current campaigns promise an experience that cannot be delivered (V1, V2, V4). Consequently, when customers try the headsets, they may be disappointed. Realistic campaigns, on the other hand, would transparently inform customers about the features and benefits of VR shopping experiences (V1, V2, V4). In addition to the customers not recognizing the value of VR shopping experiences, enterprises have difficulties with this, too. When a technology is not

considered valuable and is seen as a “nice-to-have” rather than a “must-have”, enterprises are unwilling to allocate space for VR experiences or build up internal knowledge. However, the experts also mentioned that the perceived value depends on the industry. While there are relatively few use cases for VR shops for grocery stores (R3) or hardware stores (R2), some experts proposed a higher potential for furniture stores (R1, R2). Customers could browse through virtual furniture stores to achieve a better sense of how certain pieces would look in three dimensions. Understanding the customers and their preferences is, however, of major importance prior to introducing VR stores (V4). Additionally, while the experts deem the value of actual VR stores to be limited, they instead suggest to use VR stores as marketing tool and to offer immersive brand experiences to customers (V1, V3, V4). Some brands have already implemented such strategies (Elsholz et al., 2025a). Most notably, exhibitions offer space and staff for presenting these VR brand experiences (V3). However, when headsets are offered to customers in stores or at exhibitions, proper sanitary standards must be guaranteed (R3, P1, V2, V3). Approaches that are already applied are to offer more hygienic disposable paper masks or covers that can easily be disinfected with alcohol (V3).

Another frequently mentioned barrier in the interviews were data protection concerns (R1, P1, P2, V1, V3). Customers fear that headsets track data that could be used for purposes other than controlling the headsets themselves. European customers are especially concerned about their privacy, because the headsets are made by American companies. One solution to this problem would be to support the production of European headsets (V2). Moreover, companies such as Meta and Apple gatekeep the market, which makes it more difficult for companies to simultaneously deploy their applications on different devices. Such monopolistic practices should be met by stronger antitrust enforcement (V2). Some of the experts mentioned that introducing VR shopping involves a high risk (R2, P1, V1), as enterprises that introduce full VR stores would be pioneers (Elsholz et al., 2025a). Currently, there are hardly any examples, suggesting that there is no competition in the market (R2,

R3, P1, P2). However, being a pioneer could be highly beneficial for retailers, as they could be the first on the market. The literature has shown that VR stores can surpass the acceptance of and interest in traditional solutions, especially with regard to the instrumental and hedonic aspects (Xi et al., 2024). One expert believes that customers would be interested in trying out a VR solution in-store once it is offered (R3).

5.2 Theoretical contributions

With our study, we contribute to the ongoing discussion about the usage of VR technologies in a retail context. While literature reviews highlight the potential of such scenarios (Xi and Hamari, 2021), a market analysis shows that only few applications exist on the market, which mostly are brand experiences without the option to complete transactions (Elsholz et al., 2025a). Our qualitative study identified several technological, organizational, and environmental barriers and solution strategies to adopting VR shopping. These confirm several TOE-related theories which were introduced in Section 2.2.1.

Regarding the technology, it seems that VR in general and VR shopping in particular have reached different levels of technological maturity, based on the technology hype cycle (Fenn and Raskino, 2008). VR in general has left the hype cycle (Wohlgemant et al., 2020) and has presumably reached the plateau of productivity, providing real added value for industries such as gaming (Stecula, 2022). However, the VR shopping niche appears to be somewhere between the peak of inflated expectations and the trough of disillusionment. Some experts expressed that users have high expectations and become disappointed when trying out actual applications, which in part is due to unrealistic commercials. A reasonable first step to increase the maturity of VR shopping applications would be to identify practical use cases and to produce more honest and down-to-earth commercials. A similar difference between general VR technologies and VR shopping applications may also be evident in the context of Diffusion of Innovations (Rogers, 1995). Although many enterprises are already investing in VR solutions for consumers and professionals, VR shopping applications are not currently the focus of these enterprises, and only a few innovators are involved (Elsholz et al., 2025a). According to the Diffusion of Innovation theory, this is expected to depend on several technological characteristics. Most of these characteristics were verified in our interviews. According to the experts, enterprises and customers have not yet recognized the relative advantage of VR shopping. Consequently, enterprises focus more on conventional retail media. Furthermore, implementing and maintaining VR applications is complex, and most enterprises have limited VR knowledge. Compatibility with the enterprise strategy is another barrier highlighted by the experts. These barriers should be investigated in the future. The experts proposed strategies such as communicating the advantages of VR shopping through realistic campaigns, simplifying the usage of VR devices, and adapting the enterprise strategies. These strategies could provide initial approaches to increase the adoption of VR shopping.

When organizations decide to use new technologies, they go through different stages, as proposed in the Diffusion of Innovation

(Rogers, 1995). Similar to the hype cycle and the technology diffusion, enterprises are at different stages in their adoption of general VR and VR shopping. Many enterprises have decided to implement VR applications, especially in the gaming context (Stecula, 2022). Various applications are available to download in app stores and are maintained by enterprises (Elsholz et al., 2025b). However, enterprises have low awareness of VR shopping according to the interviews. Some of the experts believe that it is difficult to imagine use cases for such applications, suggesting that only specific industries would benefit, e.g., the furniture industry. Enterprises that implemented VR shopping applications, such as Ikea and Amazon, mostly abandoned their pilot projects. This underscores the great uncertainty surrounding VR shopping applications. According to the Resistance to Change theory, employees are influenced by different factors, such as routine-seeking behavior, emotional reactions, and short-term comfort, which hinder acceptance of changes. Our experts are in agreement on this. They mentioned that employees might fear losing their jobs and generally reject VR shopping. Instead, they prefer using and offering conventional retail streams. However, convincing them of meaningful use cases is crucial to fostering adoption. To overcome the employees' resistance, they should be incorporated into the change process early on, have role models, and receive training and coaching.

According to the stakeholder theory, organizations operate in dynamic environments in which the needs of many different groups must be incorporated into organizational decisions (Freeman, 2010). Our interviews revealed several environmental factors influencing enterprises' intention to adopt VR shopping. First of all, customer demand is a strong driver of adoption. Currently, however, demand is low, so enterprises have little to no incentive to act as pioneers in this area. Other environmental forces include legislation and VR providers. The existence of two large, gatekeeping vendors makes it very difficult for others to enter and monopolize the market. Finally, the competitors have a significant influence on adoption decisions. According to the Institutional Isomorphism Theory, enterprises in the same field tend to resemble each other to increase legitimacy, acceptance, and social pressure (DiMaggio and Powell, 2000). This can also be seen in the VR shopping market. Since there are no real standards or archetypes, enterprises hesitate to implement these applications and instead stick to conventional retail streams that are already accepted.

In conclusion, we can say that various factors in three fields - technology, organization, and environment - hinder enterprises from implementing VR shopping applications. By identifying these factors and combining them with the proposed solution strategies, we provide a valuable resource for the future exploration of VR shopping adoption exploration.

6 Limitations and future research

In our study, we encountered several limitations. The first limitation pertains to the selection of experts. While we initially contacted approximately 80 individuals, only 10 consented to participate in the interview. Furthermore, one expert withdrew their permission to use the data after the interview. Given the limited sample size of nine experts, the reliability of the results could be limited. Although our sample was within established

boundaries (Hennink and Kaiser, 2022), it is at the lower limit of their recommendations. However, during the interview analysis, most of the main categories, i.e., the second-level codes for the barriers and the first-level codes for the solution strategies, were established after only five to six interviews. Most of the remaining interviews confirmed the first- and second-level codes that had already been established and only a few new codes appeared later on, implying a theoretical saturation (Strauss and Corbin, 1998). In addition, all our experts are from Europe, which restricts the generalizability of the findings to other regions. For instance, barriers related to data protection may not be relevant in other regions, given the stringent regulations imposed by the EU. Nevertheless, the other barriers are more generic and applicable to other regions, too.

However, these limitations also provide opportunities for future research. Firstly, given the qualitative nature of our investigation, we propose to test the framework quantitatively through a large-scale survey, following a similar approach to that employed by Chandra & Kumar (2018), who examined the influence of different TOE factors on the adoption intention of AR shopping. As our study identifies a variety of significant barriers, it provides an appropriate basis for a survey. A quantitative validation of the results would further support the understanding of these barriers to the adoption and help to develop suitable solution strategies. Furthermore, our analysis revealed many more challenges (113 total mentions) than solution strategies (25 total mentions). This is natural since the existence of evident solution strategies would have already reduced existing barriers. However, we propose that the development of solution strategies should be attended to with greater attention in future research. Solution strategies for organizational and environmental barriers are rare and should hence be the focus of future research. Finally, our interviews showed that VR stores could serve as an innovative marketing instrument, despite customers and enterprises not perceiving their added value. However, the role of VR as a marketing instrument for retailers has received comparatively little attention in existing research, as the prevailing focus has been on VR stores with purchase possibilities. For the future, we recommend that the acceptance and impact of VR brand experiences should be thoroughly researched.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical approval was not required for the studies involving humans because in this study we only conducted interviews with

experts. There was no risk of harm for anyone. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

SE: Validation, Methodology, Visualization, Formal Analysis, Conceptualization, Supervision, Writing – review and editing, Writing – original draft. DN: Methodology, Conceptualization, Formal Analysis, Data curation, Investigation, Writing – review and editing. RZ: Writing – review and editing, Supervision.

Funding

The authors declare that financial support was received for the research and/or publication of this article. We acknowledge support by the Open Access Publication Fund of TU Berlin.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The authors declare that Generative AI was used in the creation of this manuscript. The tool DeepL was used to check and correct the language of the manuscript. Additionally, ChatGPT was used for some general questions regarding the background of the paper, however not for the generation of text.

Any alternative text (alt text) provided alongside figures in this article has been generated by Frontiers with the support of artificial intelligence and reasonable efforts have been made to ensure accuracy, including review by the authors wherever possible. If you identify any issues, please contact us.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

References

- Alkarney, W., and Almakki, R. (2022). Factors affecting the intention to use virtual stores: perspectives of consumers in Saudi Arabia. *Mob. Inf. Syst.* 2022, 1–24. doi:10.1155/2022/8340406
- Berman, B., and Pollack, D. (2021). Strategies for the successful implementation of augmented reality. *Bus. Horizons* 64 (5), 621–630. doi:10.1016/j.bushor.2021.02.027

- Chandra, S., and Kumar, K. N. (2018). Exploring factors influencing organizational adoption of augmented reality in E-Commerce: Empirical analysis using technology–organization–environment model. *J. Electron. Commer. Res.* 19 (3), 143–166. doi:10.1016/S0742-3322(00)17011-1
- DiMaggio, P. J., and Powell, W. W. (2000). The iron cage revisited institutional isomorphism and collective rationality in organizational fields. *Adv. Strategic Manag.* 17, 143–166. doi:10.1016/S0742-3322(00)17011-1
- Elsholz, S., Korbel, J. J., Pham, K., and Zarnekow, R. (2025a). From immersive worlds to virtual showrooms: a taxonomy of virtual reality shopping applications. *Front. Virtual Real.* 6, 1558475. doi:10.3389/frvir.2025.1558475
- Elsholz, S., Pham, K., and Zarnekow, R. (2025b). A taxonomy of virtual reality sports applications. *Virtual Real.* 29 (1), 16. doi:10.1007/s10055-024-01090-0
- Erensoy, A., Mathrani, A., Schnack, A., Elms, J., and Baghaei, N. (2024). Consumer behavior in immersive virtual reality retail environments: a systematic literature review using the stimuli-organisms-responses (S-O-r) model. *J. Consumer Behav.* 23 (6), 2781–2811. doi:10.1002/cb.2374
- Etikan, I. (2016). Comparison of convenience sampling and purposive sampling. *Am. J. Theor. Appl. Statistics* 5 (1), 1. doi:10.11648/j.ajtas.20160501.11
- Fenn, J., and Raskino, M. (2008). *Mastering the hype cycle: how to choose the right innovation at the right time*. United States: Harvard Business Press.
- Fiorentino, M., Ricci, M., Evangelista, A., Manghisi, V. M., and Uva, A. E. (2022). A multi-sensory In-Store virtual reality customer journey for retailing: a field study in a furniture flagship Store. *Future Internet* 14 (12), 381. doi:10.3390/fi14120381
- Flavián, C., Ibáñez-Sánchez, S., and Orús, C. (2019). The impact of virtual, augmented and mixed reality technologies on the customer experience. *J. Bus. Res.* 100, 547–560. doi:10.1016/j.jbusres.2018.10.050
- Freeman, R. E. (2010). *Strategic management: a stakeholder approach*. England: Cambridge University Press.
- Hennink, M., and Kaiser, B. N. (2022). Sample sizes for saturation in qualitative research: a systematic review of empirical tests. *Soc. Sci. and Med.* 292, 114523. doi:10.1016/j.socscimed.2021.114523
- Lau, K. W., and Lee, P. Y. (2019). Shopping in virtual reality: a study on consumers' shopping experience in a stereoscopic virtual reality. *Virtual Reality* 23 (3), 255–268. doi:10.1007/s10055-018-0362-3
- Lombart, C., Millan, E., Normand, J.-M., Verhulst, A., Labbé-Pinlon, B., and Moreau, G. (2019). Consumer perceptions and purchase behavior toward imperfect fruits and vegetables in an immersive virtual reality grocery store. *J. Retail. Consumer Serv.* 48, 28–40. doi:10.1016/j.jretconser.2019.01.010
- Martirosov, S., and Kopecek, P. (2017). "Cyber Sickness in Virtual Reality-Literature Review" in *Annals of DAAAM & Proceedings*, 28. doi:10.2507/28th.daaam.proceedings.101
- Mayring, P. (2010). "Qualitative inhaltsanalyse," in *Handbuch Qualitative Forschung in der Psychologie*. Editors G. Mey and K. Mruck (Germany: VS Verlag für Sozialwissenschaften), 601–613. doi:10.1007/978-3-531-92052-8_42
- Mayring, P., and Fenzl, T. (2019). "Qualitative inhaltsanalyse," in *Handbuch Methoden der empirischen Sozialforschung*. Editors N. Baur and J. Blasius (Fachmedien Wiesbaden: Springer), 633–648. doi:10.1007/978-3-658-21308-4_42
- Morotti, E., Donatiello, L., and Marfia, G. (2020). "Fostering fashion retail experiences through virtual reality and voice assistants," in *2020 IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW)*, Atlanta, GA, USA, 22–26 March 2020 (IEEE), 338–342.
- Oreg, S. (2003). Resistance to change: developing an individual differences measure. *J. Appl. Psychol.* 88 (4), 680–693. doi:10.1037/0021-9010.88.4.680
- Park, M., Im, H., and Kim, D. Y. (2018). Feasibility and user experience of virtual reality fashion stores. *Fash. Text.* 5 (1), 32. doi:10.1186/s40691-018-0149-x
- Pizzi, G., Scarpi, D., Pichierri, M., and Vannucci, V. (2019). Virtual reality, real reactions? comparing consumers' perceptions and shopping orientation across physical and virtual-reality retail stores. *Comput. Hum. Behav.* 96, 1–12. doi:10.1016/j.chb.2019.02.008
- Ricci, M., Evangelista, A., Di Roma, A., and Fiorentino, M. (2023). Immersive and desktop virtual reality in virtual fashion stores: a comparison between shopping experiences. *Virtual Real.* 27 (3), 2281–2296. doi:10.1007/s10055-023-00806-y
- Rogers, E. M. (1995). *Diffusion of innovations*. United States: Free Press.
- Rolland, J. P., and Hua, H. (2005). *Head-mounted display systems*. United States: Encyclopedia of Optical Engineering.
- Sousa, N., Alén, E., Losada, N., and Melo, M. (2024). Breaking barriers: unveiling challenges in virtual reality adoption for tourism business managers. *Tour. Hosp. Manag.* 30 (2), 269–282. doi:10.20867/thm.30.2.10
- Speicher, M., Hell, P., Daiber, F., Simeone, A., and Krüger, A. (2018). "A virtual reality shopping experience using the apartment metaphor," in *Proceedings of the 2018 international conference on advanced visual interfaces*, 1–9. doi:10.1145/3206505.3206518
- Stecula, K. (2022). Virtual reality applications market analysis—on the example of steam digital platform. *Informatics* 9 (4), 100. doi:10.3390/informatics9040100
- Strauss, A. L., and Corbin, J. M. (1998). *Basics of qualitative research: techniques and procedures for developing grounded theory*. 2nd ed. United States: Sage Publications.
- Tornatzky, L. G., Fleischer, M., and Chakrabarti, A. K. (1990). *The processes of technological innovation*. United States: Lexington Books.
- Wohlgenannt, I., Simons, A., and Stieglitz, S. (2020). Virtual reality. *Bus. and Inf. Syst. Eng.* 62 (5), 455–461. doi:10.1007/s12599-020-00658-9
- Xi, N., and Hamari, J. (2021). Shopping in virtual reality: a literature review and future agenda. *J. Bus. Res.* 134, 37–58. doi:10.1016/j.jbusres.2021.04.075
- Xi, N., Chen, J., Gama, F., Korkeila, H., and Hamari, J. (2024). Acceptance of the metaverse: a laboratory experiment on augmented and virtual reality shopping. *Internet Res.* 34 (7), 82–117. doi:10.1108/INTR-05-2022-0334
- Zheng, J., Zhang, J. Z., Au, K. M., Storey, V. C., Wang, H., and Yang, Y. (2024). Shaping innovation pathways: metaverse application configurations in high-technology small- and medium-sized enterprises. *Decis. Support Syst.* 187, 114336. doi:10.1016/j.dss.2024.11433