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Identification of innovative technologies for store-based retailing – An evaluation of the status quo and of future retail practices

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Abstract

Novel technologies and application scenarios for store-based retailing are available in a large variety. The retailers' strategic focus and willingness to invest in these innovations is unclear to a certain point. This research paper aims to identify and evaluate technologies and application scenarios for brick-and-mortar retailing from Austrian retailing businesses' perspective. Beside a literature review to get an overview of retail technologies and their fields of application, semi-structured interviews were conducted in order to ascertain the status quo and to survey the relevance of technology use in store based retailing, as well as to assess its potential in the future. Qualitative data analysis has been processed, followed by an expert workshop with interdisciplinary retail technology and retailing experts to objectively validate the primary research findings.

Keywords: retail technology; digital transformation; digital retail; store-base retailing; expert interviews; qualitative survey;

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1. Introduction

For years, e-commerce companies have been successfully exploiting novel opportunities emerging from digitalization, while brick-and-mortar retailers lost ground. The resulting increase in online companies' revenues was consequently at the expense of store-based retailers. Considering the growing share of online sales, traditional retail is still the largest sales channel. However, online competitors – particularly globally operating e-commerce companies such as Amazon or Alibaba – became a major threat to brick-and-mortar retailers. The solution for them is nevertheless not to shut down their stores and become fully virtual (by launching an online platform), because evidence indicates that consumers prefer and demand hybrid-shopping models combining the advantages of retail stores with value-creating digital services [1, 2, 3, 4]. This means that in addition to transparency in terms of product data, customers demand access to additional information, such as test reports or product reviews from their own social networks. Personalized services are required to address customers more directly, as by means of personalized assistance functionalities an added value can be created, which again leads to a better shopping experience, higher customer satisfaction and thus stronger customer loyalty [5]. An increasing number of novel digital technologies and application scenarios is provided for store-based retailers with Europe still lagging behind Asia and the USA when it comes to implementation [6]. Companies like Walmart or Alibaba demonstrate the possibilities of digital technologies in store-based retailing leading to blurring lines between the different channels [5].

As the retail industry is a main pillar of the Austrian economy in terms of gross value added and employment figures, the digital transformation of retail companies is crucial in order to counteract revenue drain towards foreign international competitors. While Amazon, as one of the largest global e-commerce companies, can easily afford experiments such as the Amazon Go Store, smaller companies often lack this advantage. High capital expenditure for the implementation of innovative solutions together with high risk of a successful implementation as well as the uncertainty regarding customer acceptance and the lack of know-how often form impassable barriers even for established, stationary retail companies. Small and medium-sized companies in particular often lack the resources for a preliminary evaluation in this area.

Scholars as well as practitioners believe that retailing can benefit from these technological opportunities [7], although it is still unclear to a certain point, which digital technologies and application scenarios (e.g. smart shopping cart, self-checkout, smart shopping assistant, etc.) are the most promising for an implementation in particular retail stores. As the retailers' strategic focus to invest in innovative technologies is still under-researched, we took up this issue in our research initiative.

The remainder of this paper is structured as follows: Section 2 presents the research question and an overview of our research design. Subsequently the three steps of our research approach are described. In section 3 the results of our research approach are discussed. Implications and outlook are shown in section 4, followed by the limitations in section 5 and the conclusion in section 6.

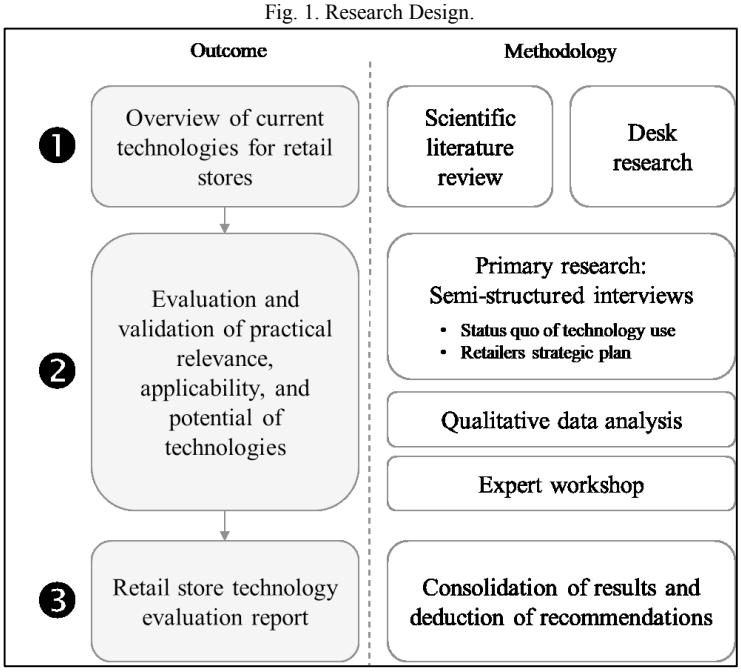
2. Research question and methodology

In order to close the aforementioned research gap, we propose the following research question:

RQ: Which currently available digital technologies and application scenarios hold a promising potential for implementation in Austrian retail stores from a business perspective?

The answers to these questions draw a more precise picture of future retail practices in store-based retailing in Austria. The corresponding research process consists of the three main steps (i) identification of innovative retail technologies, (ii) selection of relevant retail technologies including a validation, and (iii) consolidation of the findings. Our proceeding is crisply explained in this section due to limited space. The authors will be happy to provide more detailed information upon request. Figure 1 shows the research design, applied to identify and evaluate technologies and application scenarios for store-based retailing from Austrian retail businesses' perspective.

Fig. 1. Research Design.



2.1. Step 1: Identification of innovative retail technologies

Firstly, the focus was to identify current innovative concepts and technologies from both academic and applied literature holding promising potential for store-based retailing. Therefor, a comprehensive systematic literature review was conducted. The results were complemented by desk research on respective technology providers in order to include even completely new concepts in our technology overview. Finally, 42 different technologies and concepts could be identified, which were implemented in 74 different types of application scenarios.

2.2. Step 2: Selection of relevant retail technologies and validation

The technologies and their application scenarios show numerous possibilities providing improvements for retailers. The goal of this step was the selection of the most relevant ones from this large number of technologies. In order to determine the status of technology usage as well as the strategic orientation from a business perspective, we conducted expert interviews. Technologies can be used for different application scenarios and vice versa. To reduce the complexity, our focus in step 2 was on application scenarios. Based on these scenarios we created an interview guide. Ten managers from different Austrian retail companies in different retail sectors (e.g. grocery, fashion, electronics, etc.) were interviewed regarding current and planned implementation of digital technologies in their stores. The results were processed by a qualitative data analysis. For this purpose, the handwritten interview minutes were transcribed and summarized. In addition, the notes were checked and supplemented by the audio recordings taken from the interviews. To ensure a systematic, rule-driven qualitative data analysis, the revised and completed transcriptions were imported into an analysis software specialized in qualitative data evaluation. Supported by this software, the interview transcripts were coded according to the technologies and application scenarios identified during the interviews. The analysis resulted in a table showing the current status and future strategic direction of novel technologies and application scenarios in Austrian retail stores. An expert workshop with interdisciplinary retail technology and retailing experts was organized in order to validate the results from the interviews. Twelve experts from retailing, shop fitting, technology provision and academia participated in this process, resulting in a prioritization of the investigated application scenarios for store-based retailing (see section 3).

2.3. Step 3: Consolidation of the findings

In the final step, the results of the preceding steps were consolidated and recommendations for both persons in charge of technology selection and adoption in retail companies as well as technology provider for retail companies were derived in a retail store technology evaluation report (see section 3).

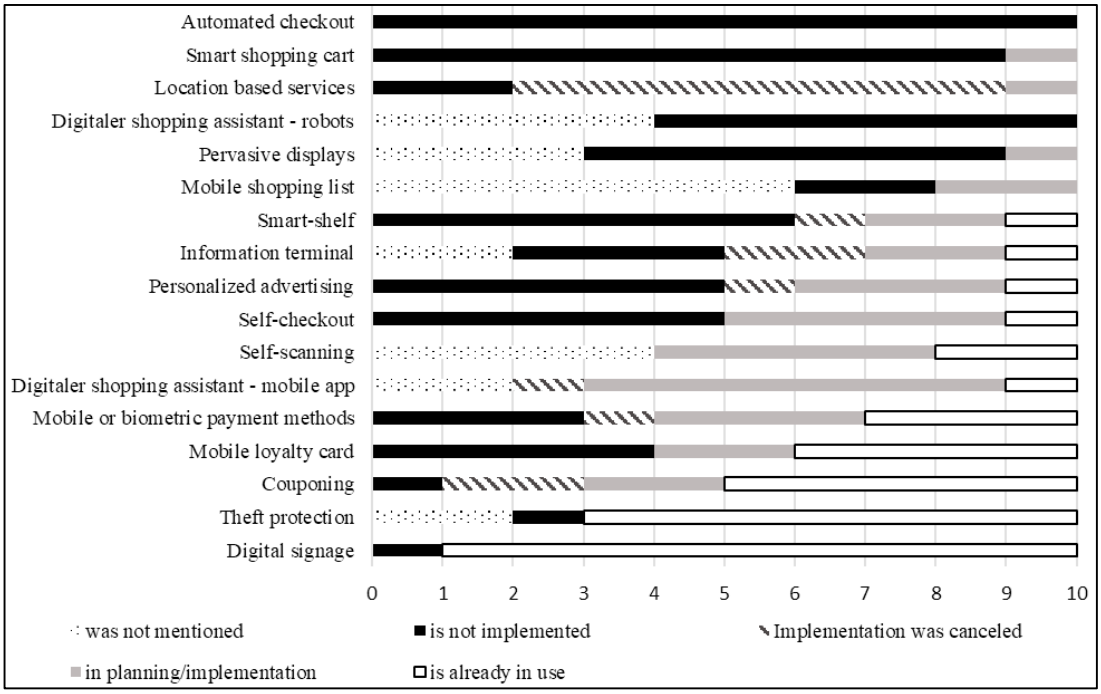
3. Discussion of the results

In this section, we discuss the results of the abovementioned research approach in detail and draw a picture of the business perspective on technology adoption in store based retailing in Austria.

3.1. Prospects from the business perspective

The following retail technologies and application scenarios were prioritized according to the frequency of their mentions resulting from the preceding literature review and therefore considered for primary research (in alphabetical order): automated checkout, couponing, digital signage, digital shopping assistant, information-terminal, location based services, mobile loyalty card, mobile or biometric payment methods, mobile shopping list, pervasive displays, personalized advertising, self-checkout, smart shopping cart, smart-shelf, and theft protection. Subsequently descriptions for each of them are provided. Following this, figure 2 gives an overview of the results of the expert interviews in which the status quo and future plans of Austrian retailers were evaluated. It shows the allocation of the individual scenarios and concepts to "was not mentioned", "is not implemented", "implementation has been canceled", "in planning/implementation", "is already in use" and provides provide an overview of the status quo in Austrian retail. The concept "digital shopping assistant" was split up in this figure, as the experts assessed the use of robots and mobile apps separately. Self-scanning and self-checkout were also assessed partly, which also resulted in a separation of this scenario in the figure. These findings will subsequently be compared with those of the expert workshop.

Fig. 2. Status quo and future perspectives of technology adoption in Austrian retail stores.



The **automated checkout** is characterized by an automatic identification of products to be purchased and that the payment process is triggered automatically when leaving the shop. [8, 9] In Austrian retail the automated checkout is

not used by any of the companies surveyed. The reasons for this are high implementation costs and the lack of know-how. In principle, however, the experts from the interviews as well as the experts from the workshop agree that as soon as the technology is ready for the market, which is in reasonable proportion to the investment costs, the automated checkout will be established. That is why it is necessary for Austrian trade not to lose ground in this area.

Couponing is defined as discounts or collective coupons, which the customer redeems via a mobile device at the next purchase or at an event. [10, 11] Among Austrian retailers, couponing is also widely used or planned to use it in near future.

Digital signages, displays providing multimedia content [12] is the most frequently used concept in Austrian retail companies. It is already used by nearly all companies.

The **digital shopping assistant** was considered to be a multifunctional app or a robot, that combines a wide range of application possibilities (e.g. information search, promotion finder, navigation, assistance for handicapped persons). [9, 13, 14, 15, 16] In the interviews where this concept was seen as an assisting robot, none of the companies is going to implement it. The willingness to implement an assistant in the form of a mobile application is completely different, because this concept is already in use or the realization is planned. In Austria, this solution will be implemented in the future in all sectors, because the combination of a shopping assistant and the concept of a self-checkout brings an added value for the customer.

Information terminals are stationary computer terminals with which the customer can interact and search for specific information about products or promotions or communicate via social media platforms. [5, 13, 17] Information terminals are mainly used in the electronics industry in Austria.

Location-based services are particularly interesting. They are services that create added values for the customer by linking the current location of a mobile device with location-specific information, communication and transaction options. [18] Only one of the interviewed companies is going to implement it, but there were seven that had already tested them, but the tests were aborted again. The reasons for this were mainly data protection issues and the high implementation costs, which make an implementation in Austria very difficult.

In retail, **loyalty cards** have existed for the last 10 to 15 years and played an important role in customer relationship activities. [19] Meanwhile, some companies are already using mobile versions of loyalty cards, as there are more possibilities to address the customer like a new touchpoint for communication. One concept that is often used in conjunction with loyalty cards is couponing.

There are some approaches to payment via biometric features, [20, 21] but above all the trend towards **mobile payment methods** is particularly noticeable. [14, 22, 23]. More than half of the interviewed companies will accept mobile payment methods in the future and offer the necessary infrastructure to carry them out, as 32% of Austrian shoppers already prefer this payment method. [24] Business and experts once again agree that the mobile device is playing an increasingly important role for retail.

Pervasive displays mean displays that can interact with the customer through movement. [10, 25] This concept and **mobile shopping lists** [5] were not mentioned in some interviews. This was because pervasive displays were not known, and mobile shopping lists were not considered. However, the majority of companies will not use it in the future either.

By **personalized advertising** the customer receives offers that are precisely tailored to his needs, preferences or buying behavior. [5, 11, 12] When it comes to personalized advertising according to experts from the workshop, for the customer this concept is much more important. There is agreement among some sectors, as this concept will be implemented by some of the companies interviewed in the near future.

Self-scanning is a concept where the customer scans the products to obtain information such as ingredients, batch or country of origin [5, 13, 26] but also a form of **self-checkout**, where the customer uses scanning devices to scan the products to be purchased and carries out the payment process independently. [22, 27] Both concepts are going to be implemented in more than half of the interviewed companies. The findings of the expert panel also show that self-checkout concepts have great potential for the future. Nevertheless, self-checkout solutions are only seen as interim solutions, the automated checkout is what the customer wants in the future. This applies especially to the younger/new generation, which is technology-savvy and expects digital experiences in the store. What is suitable for them is a digital assistant in combination with a self-scanning system all in form of an application for mobile devices. As Experts say that combining online and offline in a meaningful way will be one of the most important topics in the future and customers tend to use their own devices to perform their tasks rather than using a scanner provided by the store, a mobile application will constitute an important basis for future stores.

When it comes to **smart shopping carts**, only one of the surveyed companies has the plan to use them in their stationary retail spaces. Smart shopping carts are equipped normally with mobile devices, which are used to provide the customer with extended functions and information such as finding a way to the next products in their shopping list or even the possibility for carrying out the checkout process. [5, 9, 17] Despite the advantages that are already apparent from the literature, the other companies see no benefit in this scenario or are not yet convinced of the technological implementation. In addition, experts say, that a smart shopping cart can be especially useful in the FMCG (fast-moving consumer goods) sector, but in Austria customer acceptance is not yet known here.

The status quo on **smart shelves** differs in Austrian businesses. This concept is implemented by the surveyed companies in all implementation forms from "is not implemented" to "is already in use". Those companies that plan to use it or already use it are food retailers. However, the other sectors do not plan to use it in the future either, the experts see great potential in smart shelves, because it allows real-time inventory analysis or price changes, as well as the display of product information and thus combines advantages for the customer as well as for the company. [5, 28, 29]

When it comes to **theft protection** [27] in the Austrian retail sector, legal regulations and achieving a balance between security and simplicity of shopping are what difficulties, because anything that "blocks" the shopping experience reduces sales. In addition to classical security measures (e.g. showcases, security gates, security labels), the companies mainly rely on deterrence (e.g. cameras, presence of employees). Although theft protection was not mentioned in all interviews, it´s one of the most frequently used concepts. According to experts, theft protection is becoming increasingly important with the use of self-checkout solutions. Nevertheless, although no additional security measures have been implemented in this regard, companies registered no difference in shrinkage with or without self-checkout.

3.2. Store technology evaluation report

Experts assess the Austrian retail businesses status quo as “lagging behind” international developments. The reasons for this are, on the one hand, the lower willingness to take risks of retailers and, on the other hand, the fact that Austrian consumers are more conservative. In addition, the population density in Austrian cities is noticeably lower than in China or America, and thus the implementation of new technologies has a longer amortization period, as potentially fewer users can use the technology. However, within Europe, Austrian retail businesses keep pace and managers are willing to decide on necessary investments in order not to lose sight of international retail operation standards. In order to support the Austrian retail industry in making decisions on the right use of technology at in stores, we identified the five most promising application scenarios for the future, which resulted from the findings shown above:

Table 1: Most promising application scenarios for Austrian retail businesses.

Concept	Description
Digital shopping assistant	A multifunctional app or a robot, that combines a wide range of application possibilities. (e.g. information search, promotion finder, navigation)
Self-checkout	The customer scans the desired products himself and carries out the payment process independently
Smart shelf	Shelves to allow for real-time inventory analysis or price changes, as well as the display of product information
Mobile/biometric payment methods	Payment through mobile device or biometric characteristics
Automated checkout	The products to be purchased are recognized automatically, the payment process is triggered automatically when leaving the shop

The automated checkout is one of the most promising retail technologies. Experts agree that once a customer has completed an automated checkout, he or she will appreciate it in Austrian stores as well. However, it does not necessarily have to be implemented in the same form as the "Amazon Go" store in Seattle, as this is also not the be-all and end-all. Therefore, there is still time to implement a sustainable solution for customer as well as for the company. Currently, however, high implementation costs are the reason why Austrian retailers do not yet risk implementation. Mobile and biometric payment methods are already less risky here. In addition to the various implementation options that already exist, the payment method using smartphones via NFC has proven to be promising in all retail local industries. Customers are here increasingly taking advantage of the mobile method. Smart shelves also bring many advantages, which means that they have to be included in our ranking from an expert point of view. Real-time inventory analysis and price changes on the one hand and the display of product information combines advantages for the customer as well as for the company making it an essential tool for especially FMCG goods. The fact that it has advantages when customers take over processes in the company can be confirmed by self-checkout solutions. According to experts, mobile devices will play a particularly important role in the future. In addition to the checkout, the customer's entire shopping process can be supported with mobile devices. Providing product information or offering navigation is one big thing, but it also creates a new touchpoint that the company can use to communicate directly with its customers. In addition to experts, retailers have already recognized the high potential of this multifunctional devices for store-based usage. Mobile devices are considered to have great potential as they serve as a basis of many different application scenarios (payment, checkout, shopping assistant, ...). Consumers use the smartphone as their preferred digital device and thus as their preferred access to all digital information. Before and after shopping and especially during shopping in stationary retail. If customers organize their lives with their mobile phone, then retail must also take place on it. Thus, it is important to successfully integrate these devices into the daily shopping routine of local customers in order to build a foundation for the desired digitalization of store-based retail.

4. Implications and Outlook

This is the first study that analyses relevance, applicability and fit of retail technologies and application scenarios in Austrian companies. The underlying applied research approach captures the status-quo in retail business practice concerning novel retail technologies and concepts based on current literature. The study also addresses the issue of exploiting the possibilities of digitalization and technologies and gives guidance for retailers towards a future “retail technology stack” at the store level.

The practical relevance of the present research is legitimated by the obvious need of Austrian retail companies for guidance regarding the selection of suitable technologies in order to realize those application scenarios demanded by their customers. Implications provide an enhanced knowledge of novel retail technologies and application scenarios that have to be taken into account in strategic decision making.

Having evaluated the business perspective of retail technology adoption, future research has to focus on technology acceptance by users including customers as well as sales staff.

5. Limitations

One Limitation lies in the country-specific sample and respective retail business environment. This paper focuses explicitly on the status quo and outlook for use of technology in Austrian retail. A cross-border investigation should also be considered. In addition, only the companies' point of view on the usefulness of the technologies and concepts was surveyed. In further consequence it would be important to shed light on customer acceptance and their assessment. Only if the new technologies are also accepted by their users their implementation leads to the desired success. User acceptance could be evaluated by appropriate technology tests in companies or in laboratory environments.

6. Conclusion

Within this paper, the authors provided a status quo and outlook of digital technologies and application scenarios for brick-and-mortar retailing from Austrian retailing businesses' perspective. In addition to a systematic literature review to identify new and innovative concepts for the stationary retail, interviews were conducted with experts to ascertain the status quo and outlook for the Austrian retail sector. In order to validate the results, an expert workshop was conducted.

The results show that Austrian companies have recognized the importance of a hybrid shopping model in order to offer their customers a seamless shopping experience and are therefore willing to invest in digital in-store technologies. In addition to digital signage and different payment methods, they are particularly concerned with digital shopping assistants. Experts agree that the support of customers through mobile devices has great potential, as it combines the opportunity of integrating various functions like obtaining product information or supporting the checkout process. Self-checkout solutions are already available in Austria but only seen as an interim solution by experts. In the future, companies will rely on concepts of automated checkout. At present, however, companies are still reluctant regarding investments in this area. Above all, mobile devices are considered to have great potential as they serve as the basis for many different technology concepts.

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