The Future of Grocery Stores: Omnichannel and AI technologies and Next-Generation Brick-and-Mortar Grocery Stores

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Dissertation written under the supervision of

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Abstract

In recent years the grocery retail industry has been experiencing tremendous change, driven mainly by advances in technology. Traditional brick-and-mortar grocery stores are under threat from industry disruptors who incorporate new technologies into their business models and operate with online channels. Therefore, this paper introduces omnichannel and artificial intelligence (AI) use cases as factors influencing the future success of brick-and-mortar grocery stores. To identify critical drivers for success, semi-structured expert interviews were conducted to discover how grocers can implement an omnichannel strategy and combine various AI technologies to remain competitive. Furthermore, a customer survey tested the acceptance of specific use cases and scrutinized the resulting increase or decrease in shopping frequency due to omnichannel in conjunction with AI. The analysis indicates an upcoming change in the grocery industry. A move towards a combination of an online and offline world is rising. Moreover, use cases like online shopping, personalized prices and offers, and cashier-free checkouts have the highest potential to increase the points-of-delight by consumers while grocery shopping. Therefore, grocers must adopt an omnichannel strategy and incorporate several AI-driven technologies to increase profits and remain competitive.

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Sumário

Nos últimos anos, a indústria retalhista de mercearia tem vindo a sofrer mudanças tremendas, impulsionadas principalmente pelos avanços da tecnologia. As mercearias tradicionais de tijolo e cimento estão ameaçadas pelos disruptores da indústria que incorporam novas tecnologias nos seus modelos de negócio e operam com canais em linha. Por conseguinte, este documento introduz casos de uso omnichannel e de inteligência social (AI) como factores que influenciam o sucesso futuro das mercearias de tijolo e de marfim. Para identificar factores críticos para o sucesso, foram realizadas entrevistas semi-estruturadas com peritos para descobrir como os merceeiros podem implementar uma estratégia de omnichannel e com-bine várias tecnologias de AI para se manterem competitivos. Além disso, um inquérito aos clientes testou a aceitação de casos específicos de uso e examinou o aumento ou diminuição da frequência de compras resultante devido ao omnichannel em conjunto com a AI. A análise indica uma próxima mudança na indústria de mercearia. Está a aumentar uma tendência para uma combinação de um mundo online e offline. Além disso, casos de utilização como as compras online, preços e ofertas personalizadas, e caixas sem caixa têm o potencial mais elevado para aumentar os pontos de venda dos consumidores enquanto fazem compras de mercearia. Por conseguinte, os merceeiros devem adoptar uma estratégia omnichannel e incorporar várias tecnologias impulsionadas pela AI para aumentar os lucros e permanecer competitivos.

Título: O Futuro das Mercearias: Tecnologias Omnichannel e AI e Mercearias Brick-and-Mortar de Próxima Geração

Autor: Clemens Neurauter

Palavras-chave: Retalho, Mercearia, Mercearias, Lojas de Tijolo e Morte, Omnichannel, Inteligência Artificial, Aprendizagem de Máquinas,

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Table of Abbreviation

AI	Artificial intelligence
AR	Augmented reality
CEO	Chief executive officer
e.g.,	Exempli gratia – for example
GPS	Global positioning system
i.e.,	Id est – that is
IT	Information technology
ML	Machine learning
QR	Quick response
TAM	Technology acceptance model
USD	United States dollar
YoY	Year on year

1 Introduction

The grocery retail industry is one of the biggest retail industries in the world. By 2024, its expected market value in leading European economies (i.e., Germany, UK, France) rises to 901 billion USD (Statista, 2022). Nonetheless, the industry itself is experiencing tremendous change. The way society is used to shopping for groceries will change with the lifted differentiation between an offline and an online world (Kamel et al., 2021). Thereby, following an omnichannel strategy is the trend for the future. Omnichannel is a combination of online and offline channels and brings new digital initiatives and technologies to light while shopping (BCG, 2022). Technologies with the most impact in modern retail are artificial intelligence (AI), machine learning (ML), and advanced analytics. Mainly, traditional brick-and-mortar supermarkets can leverage those technologies to improve the omnichannel experience for supermarkets by engaging customers more through online presence (Läubli et al., 2021; Shankar, 2018).

The COVID-19 pandemic presented the opportunity for grocers to jump on the train of online commerce. With one lockdown after the other and continued social distancing in place, consumers increasingly consider shopping online to limit the risk of potential infections (Sabolcik, 2021). During the pandemic, the demand for online grocery shopping grew enormously across all leading European economies. For example, in the UK, it increased by about 9 percent in the first quarter of 2020 (Duthoit, 2021). Furthermore, most surveyed customers in the UK, Germany, France, Italy, and Spain stated that they intend to keep their shopping behavior post-COVID with more online ordering, door-step delivery, or more frequent in-store pick-up (Günday et al., 2020) since this type of shopping offers more convenience to consumers (Herbert et al., 2021).

1.1 Problem Statement

The retail industry has changed dramatically in the last two decades with the emergence of online channels. Those online channels had a massive impact across different retail sectors, and retailers' business models have been affected as the channel mix changed (Sorescu et al., 2011). However, the impact on food retailing has not been as disruptive as in other industries, such as the travel industry. With the integration of new online sales channels (e.g., mobile channels and social media) the retail landscape continues to change and incumbent brick-and-mortar players

must adjust their capabilities to remain a right-to-play (Savastano et al., 2019). The industry is experiencing a move towards omnichannel retailing (Rigby, 2011; Schedlbauer, 2020). Omnichannel retailing is a seamless, integrated sales experience that merges the advantages of brick-and-mortar stores with the information-rich experience of online stores (Nielsen, 2010). Consumers who shop via omnichannel are more profitable to companies since they spend more than an average shopper does (Deloitte, 2014).

Furthermore, retailers can raise brand awareness, increase customer loyalty and ultimately create value through omnichannel (Hoogveld & Koster, 2016). However, besides all the advantages, integrating an omnichannel strategy can come with challenges, like orchestrating smooth internal processes and adapting organizational structures and corporate culture (Gitter et al., 2020). As the technological development keeps moving forward, grocers can think of combining an omnichannel with other technologies to expand the market, engage customers more intensively and increase profits. A powerful way to integrate omnichannel into existing sales channels is through smartphone apps (Brynjolfsson et al., 2013).

The technological approaches (AI, ML, and advanced analytics) allow grocers to make data-driven decisions and to work more efficiently and effectively. AI applications can be used in different domains, ranging from inventory management, forecasting product demand, pricing, and personalizing offers (Verscheueren et al., 2021). For a grocer to implement those features, it is essential to collect data from customers through an app, customers constantly use on every trip to the store. On the customer side, AI and ML technologies offer more transparency in prices, make grocery shopping more personalized, and create a better experience overall. Through those initiatives, consumers have more touchpoints with grocery stores and at the same time, more opportunities to collect information before the purchase (Kuijpers et al., 2018).

In practice, use cases for omnichannel and AI exist already. The most prominent omnichannel use case is online ordering, door-step delivery, in-store, or curbside pickup. Similar things apply to AI use cases, where specific algorithms can predict prices and promotions for consumers (Shankar et al., 2021). Nevertheless, incorporating both (omnichannel and AI) is not very common in supermarkets yet. In theory, researchers claim that omnichannel in conjunction with AI is the driving force for the future success of brick-and-mortar stores. However, grocers are lacking behind this trend, and there is little evidence of grocery chains having success with it (Verscheueren et al., 2021). Therefore, this research paper aims to look behind the curtain and

investigate the future success potential of omnichannel and AI technologies in physical grocery stores. Additionally, the advantages and challenges of those technologies are outlined, and practical use cases showcase how the customer experience can be improved.

Based on use cases and supporting literature, this research paper aims to answer the following research question:

> *Research question 1 (RQ1) – How can supermarkets use omnichannel and AI to drive points-of-delight along the omnichannel user journey?*

Furthermore, in light of the trends mentioned above, this thesis also aims to answer a second research question:

> *Research question 2 (RQ2) - Is an omnichannel customer shopping experience, in conjunction with AI an enabler of future grocery brick-and-mortar success?*

1.2 Methods

To answer *RQ1* and *RQ2,* this paper relies on three methods: (1) a Literature Review outlining the theory and current research on omnichannel and AI technologies for grocery retail, (2) a customer survey, testing the acceptance of technology, and (3) expert interviews, to find out if omnichannel customer experience in conjunction with AI enables the future success of brick-and-mortar supermarkets.

The Literature Review (Chapter 2) provides a theoretical background on how grocers can implement an omnichannel strategy and use AI to succeed in the future. To provide a better understanding, use cases (Chapter 2.5) are developed to showcase how grocers can use the technology and enrich customer's experiences alongside the customer journey. The survey (Chapter 3) tests general shopping habits and focuses on how attractive a particular use case and the resulting feature (e.g., app feature like online ordering) for a consumer is. Besides this, the survey asks consumers whether those omnichannel and AI technologies would increase their shopping frequency. With statistical analysis and simple regression, this research describes the impact of an omnichannel and the subsequent use of app features on the shopping frequency and which feature is most attractive. The variable shopping frequency was chosen as in previous studies, it is easier to test for frequency which indicates loyalty (Mauri, 2003). Expert interviews

(Chapter 3) with grocers, industry consultants and analysts, professors, and food venture capital analysts are conducted to collect additional information from the grocer's side. With a predefined interview guideline, data is collected on challenges, advantages, and future potential of omnichannel and AI technologies alongside the customer journey.

2 Literature Review

This Literature Review examines the grocery industry and how new strategies, such as omnichannel, in conjunction with technology, impact the customer experience and grocer strategies. Further, it looks at the development of industry trends, the theoretical background of an omnichannel strategy, and its implications. Additionally, the technology terms AI, ML, and advanced analytics are examined more closely. Finally, the implementation of omnichannel and AI is described alongside the customer journey in the form of use cases. With the information collected and the outlined use cases, scenarios for the potential future of physical grocery stores will be developed.

2.1 The grocery industry

The food retail industry is a highly competitive and challenging industry. It is one of the biggest industries in the world and has a market value in western Europe of approximately 530 million USD in 2020 (Euromonitor International, 2021). In a YoY comparison from 2019 to 2020, grocery retail grew 10.4 percent in Europe (Verscheueren et al., 2021). Additionally, IDG (Institute of Grocery Distribution) forecasts that the grocery industry in Europe will account for at least 16 percent of global grocery sales by the end of 2022 (John, 2018).

Looking at the European grocery industry, it is a consolidated landscape. Consolidation of an industry happens when two or more companies merge as one company and is linked to almost every industry as they mature and grow (Deans et al., 2002). Consolidation became the standard model for growth in the grocery industry, where grocers merge with other grocers (Hendrickson et al., 2001). Three big brands have more than 50 percent of the total market share in the UK. Tesco, for example, owns 27 percent of the market, Sainsbury's has 15 percent market share, and Asda 14 percent (Savills Commercial Research, 2021).

2.2 Current industry trends

Even before the start of the COVID-19 pandemic, the grocery industry was in turmoil. Profitability and growth were on a downward trend due to higher costs, lack of productivity, and price competition in the market. Grocers needed to act and change the way they made money or otherwise lose revenues to growing discounters or other industry disrupters, such as rapid grocery delivery operators (e.g., Flink or Gorillas in Germany) (Kuijpers et al., 2018). The way

consumers procure groceries switched to more online shopping, and the demand for a more convenient experience grew. On the grocer's side, constant technological development created new opportunities to meet the needs of customers and secure steady revenues (Begley et al., 2020; Kuijpers et al., 2018).

According to a McKinsey survey (Herbert et al., 2021), 62 percent of those surveyed changed their shopping behavior since the beginning of the pandemic and almost 80 percent intend to keep this behavior going forward. Most consumers switched to different retailers and brands and, when possible, bought food and household products in online stores. Overall, the online grocery business in Europe experienced a significant growth of 55 percent in 2021 (Herbert et al., 2021). Both customers behaviors and habits, also preferences, changed. Nowadays, a consumer wants to shop anywhere and preferably anytime, enabled by apps available for smartphones. In addition, a recent study from BCG (Abraham et al., 2019) discusses the importance of personalization in retail. If a customer had a tailored experience with individual discounts or promotions, he or she was more inclined to buy more products and likely to pay more than originally intended (Abraham et al., 2019).

Using the omnichannel approach, grocers can incorporate various AI algorithms and advanced analytics tools to automate and augment processes. For instance, technology allows consumers a quick and cashier-free checkout, in-store navigation or personalized promotions (Läubli et al., 2021; Reinartz et al., 2019). As the adoption rate towards online shopping in Europe increases, following an omnichannel strategy is a decisive factor for future success of grocers' (Gerckens et al., 2021). Developing mobile apps for online shopping having products delivered or even picking them up at curbside locations boosts convenience in the shopping experience (Läubli et al., 2021).

Technology Acceptance Model (TAM)

As the future of the grocery industry is driven by technology, it is crucial that consumers adapt to technological changes. The TAM is a theoretical model introduced by Davis (1989) to explain an individual's acceptance of new technologies (Lou & Li, 2017). The TAM proposes that perceived usefulness and perceived ease of use explain adoption of new technologies. Perceived usefulness is defined as to what extent a new technology has utility to perform a required task while perceived ease of use pertains to the extent the use of technology would be free of effort (Davis, 1989). Looking at the future of grocery stores, offering a smooth, user friendly

experience that customers find valuable or useful is key. As recent studies show, there is a positive relationship between perceived usefulness and perceived ease of use when shopping for food online. (Bauerová & Klepek, 2018).

2.3 Omnichannel approach

The retail sector has changed in recent years, primarily caused by strong technological developments and digitalization of the industry (Ying et al., 2021). Digitalization refers to the transformation from analog to digital (e.g., shift from shopping in stores to online shopping) as well as a simplification of new value creation approaches (Hagberg et al., 2016). This transformation radically changed how retailers, suppliers, and customers interact with each other. As a result, online commerce today is not a novelty; it has become an essential element for retailers to remain competitive (Reinartz et al., 2019).

When discussing online presence in retail, scholars refer to either multichannel or omnichannel retailing. Multichannel defines the use of more than one selling channel or medium such as the internet, retail outlets, or television and it implies a division between a physical store and online. Additionally, multichannel revolves around the product (Stone et al., 2002). Omnichannel on the other hand, is a seamless, integrated sales experience that merges the advantages of brick-and-mortar stores with the information-rich experience of online stores. Furthermore, an omnichannel puts the customer at the core of the process (Neslin et al., 2006). A real omnichannel shopping experience implies that a single purchase transaction can span more than one channel. A customer, for example, can buy a product online (e.g., from a mobile app) and he or she can pick it up at the physical store. A retailer can expand those services to click and collect, order in-store and get it delivered or order online and return it in-store. In addition, customers can obtain information about products and their availability, receive personalized offers and individual price promotions, to name a few advantages of omnichannel. The most prominent way to implement omnichannel is through apps on mobile devices With all these activities, customers leave a digital trace that grocers can tap into (Piotrowicz & Cuthbertson, 2014).

2.3.1 Challenges for omnichannel approach

Implementing a new strategy for a business comes with obstacles. In literature, there are many different definitions of strategy. Mintzberg (1987) states that *"strategy is a plan—some sort of*

consciously intended course of action, a guideline […]" (Mintzberg, 1987, p. 1). Strategy is not only an explicit plan but also a guide that has its roots in every decision and choice a company makes. Therefore, it is vital to have a solid strategy that ensures short- and long-term success in a competitive landscape and defines every step to avoid mistakes (Van Den Steena, 2017).

Integrating a fully online and offline shopping experience requires changes in terms of infrastructure (e.g., physical store and warehouse needs to be equipped with new equipment), staff and their expertise, as well as strategy. An omnichannel relies on excellent IT (i.e., information technology) specialists who help execute the respective project. Overall, retailers should not forget the primary purpose of omnichannel: creating a seamless shopping experience across the physical and online world, where both parties have benefits (Frazer & Stiehler, 2014; Piotrowicz & Cuthbertson, 2014). Therefore, the customer must always be placed at the core of company activities, requiring a different approach to ways of working (Hoogveld & Koster, 2016). Also, organizational structure and strategy need to be adapted accordingly and the various touchpoints with customers and across internal departments well-orchestrated. (Diconium, 2021).

2.3.2 Omnichannel in light of management theories

An omnichannel strategy allows grocers to bridge the gap between online and offline by creating a seamless experience across several channels (Schedlbauer, 2020). Recent statistics indicate that people who shop online not only shop more often but are also likely to spend up to two to two and half times more compared to regular shoppers (Novosel, 2021). The omnichannel approach is already well disseminated in some retail sectors but not yet in the grocery industry.

The grocery industry is fast-changing and struggles with low margins on products. Also, establishing a loyal customer base and simultaneously following a competitive pricing strategy is not easy to juggle as grocers want to be competitive for a long time. In the past, grocers leveraged a lot from economies of scale, as they could buy bigger quantities and had more bargaining power over producers (Christensen, 2001). But as the industry became more consolidated, leveraging economies of scale was no longer seen as a competitive advantage. Not only has the

perception of competitive advantage changed, scholars also point to other ways companies acquire competitive advantage (Barreto, 2010). There have been different views on how competition works and affects the firm. Schumpeter (1942) describes a cycle of "creative destruction" whereby firms get overtaken by innovative entrants (Schumpeter, 1976). In a highly competitive environment like the grocery industry, relying only on capabilities is not sufficient to maintain a competitive advantage. A firm's resources and capabilities should not be static but dynamic (Barreto, 2010). Dynamic capabilities theory builds upon the resource-based view (RBV) (Kraaijenbrink et al., 2009). Thus, dynamic capabilities are *"the firm's ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments"* (Teece, Pisano and Shuen, 1997, p. 516). However, dynamic capabilities cannot be seen as a plenary theory for competitive advantage, but they do offer a valuable perspective for long-term competitiveness of a firm in fast-changing industries (Barreto, 2010).

A company well-adapted to changes in the environment is Starbucks. It has a solid omnichannel strategy considered the best in the retail sector (Wallace, n.d.). To better communicate with customers and discover their needs, Starbucks developed a mobile app offering special discounts and free drinks for regular users. With every purchase, a customer gets rewarded with stars, and once a certain number of stars is reached, there are promotions and discounts. This keeps customers engaged and gives Starbucks the opportunity to collect data about customers as they navigate the app. Additionally, a member can use the app to order prior to entering a store, save favorite drinks, or use it as a wallet to make checkouts more convenient (Honigmann, 2022; Starbucks, 2022).

The Starbucks example shows how omnichannel services can be implemented. For the grocery industry, other services apart from reward programs can be offered. A few grocers, like Rewe or Migro, developed apps where customers can select products online and pick them up in the store or have them delivered to their home addresses. These examples apply technology to enhance and simplify the customer journey. In the next Chapter, AI and advanced analytics are introduced, explaining how they can provide better engagement and simplification inside a store (Verscheueren et al., 2021).

2.4 Applications of Artificial Intelligence techniques for the grocery industry

This section outlines the technological background of advanced analytics, AI, and ML. Further, this paper looks at how these technologies can be applied in grocery stores and what the respective advantages are. AI, ML, and advanced analytics are heavily discussed topics today and provide potential benefits for grocers in the future. For the retail sector, it is estimated that AI's annual value is globally at $400 to $800 billion (D'Auria et al., 2021).

Advanced Analytics

Advanced analytics refers to semi-autonomous or fully autonomous data investigation using highly trained techniques and tools. These advanced analytics techniques encompass several practices from data mining to machine learning, forecasting, predictions, pattern matching, and statistical analysis, to name a few. Advanced analytics may be viewed as a broad term that encompasses many technologies in the field of AI, deploying techniques to help companies with decision-making (Gartner, 2022).

2.4.1 Artificial Intelligence (AI)

The term AI was introduced in the early 1950s by Alan Turing in the form of an "Imitation Game," where an interrogator attempts to distinguish a machine from a human-based on responses to questions. Even at that time, Turing believed machines would be able to rival humans in exhibiting what we take to be intelligence (Turing, 1950). McCarty (2007) defines AI as

> *"[…] the science and engineering of making intelligent machines, especially intelligent computer programs. It is related to the similar task of using computers to understand human intelligence, but AI does not have to confine itself to methods that are biologically observable." (McCarthy, 2007, p. 2).*

In other words, AI is the ability for computers and machines to think like humans, perform human-like tasks and support decision making (Copeland, 2022).

To better grasp the concept of AI and how it works, AI can be seen as part of a framework where AI, ML, and advanced analytics play together. Figure 1 displays a generic framework of AI in retail (Shankar, 2019).

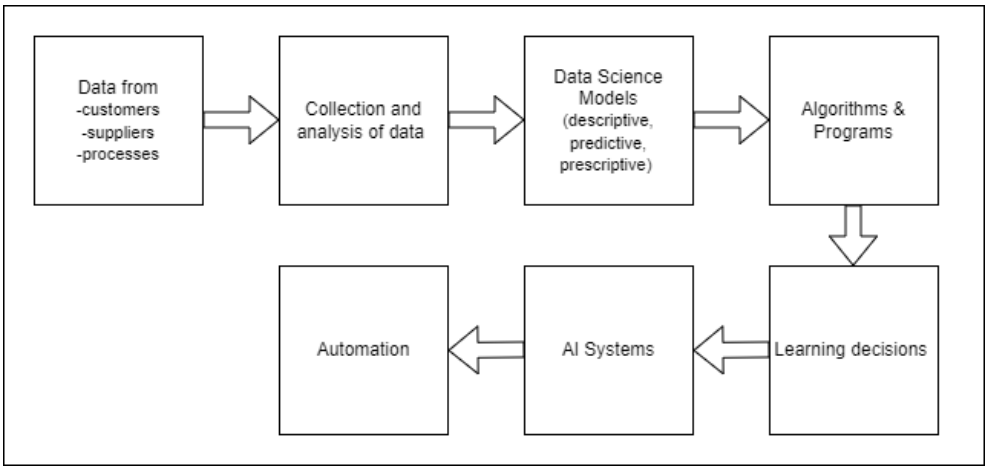

Figure 1 - *AI Framework*

Source: own illustration based on (Shankar, 2018)

The framework (Figure 1) begins with data. Grocers need to constantly collect data from customers across all channels and touchpoints. In the next step descriptive, predictive, and prescriptive data science models are developed to help the decision-making process. Then, diverse algorithms are programmed for the respective models. A few of these are ML models which learn from the data to subsequently make predictive decisions. Additionally, also other models and algorithms like deep learning or neural networks exist - these are beyond the scope of this paper and less relevant for the omnichannel phenomenon. After training and learning and applying the appropriate AI system, the process of finding a decision can be automated in many cases. Continuous development and advancement of algorithms appear in the form of different data types – numeric data, text data, voice data, and visual data (Shankar, 2018).

2.4.2 Machine Learning (ML)

AI and ML are often taken to be the same thing and used interchangeably, even though they are distinct concepts. ML is a subset of AI (Satavisa, 2021) and entails algorithms that learn on their own with historical data, identifying patterns, and improving performance. These patterns are then used to make predictions. A good example is the Google search. As is the case for AI, in ML, data is the foundation for a model to work. ML itself has many applications and its use cases are constantly developing. For instance, ML can uncover insights, enhance user experience, and anticipate customer behavior (Ray, 2019; Senders et al., 2018).

2.4.3 Relevance of AI, ML, and advanced analytics in grocery stores

The technological tools (AI, ML, and advanced analytics) mentioned above are no longer novel techniques. According to Gartner (2017) market research, big retail players like Amazon or Walmart are "AI Leaders," and big European grocery chains like Carrefour, Aldi, and Lidl are "AI Niche Players" meaning those companies use little AI technology in their processes. Therefore, it is more critical that grocers invest in new technology (Weber & Schütte, 2019).

On the demand side, AI can be introduced to understand customer behavior better, make product recommendations, simplify and advance the in-store experience, and to better manage customer service (Shankar, 2018; Shankar et al., 2021). For instance, one way to use AI for a better customer understanding is through an omnichannel strategy executed with mobile apps, as mentioned in *Section 2.3*. Different ML and AI models (either predictive or prescriptive) make it easier for grocers to make product recommendations based on prior purchases (e.g., historical sales data). Additionally, advanced analytics tools allow grocers to recommend prices and forecast customers' purchases (D'Auria et al., 2021; Grewal et al., 2017). A more detailed description of the implementation of omnichannel and the incorporation of AI will be discussed with use cases in the last section of this literature review.

2.5 Customer journey in physical grocery stores

The customer journey tells the story of a customer's experience from the first contact with the organization until the stage where the customer and organization have a lasting relationship (Verhoef et al., 2009). Another definition of a customer journey is the following: A customer journey can be seen as a sequence of events where a customer collects information, purchases, and interacts with the organization's products or services. It encompasses all the interactions amongst organizations and customers at any touchpoint of the journey (Meyer & Schwager, 2007). The classic customer journey is changing with the rise of omnichannel and mobile shopping. It is necessary to understand which part of the customer journey the shopper engages in an omnichannel experience (Harris et al., 2020; Lemon & Verhoef, 2016).

Having a visual representation of a customer journey helps organizations tell the story across all touchpoints. Customer journey mapping is hence the process of designing the journey a customer goes through when interacting with products or services (Micheaux & Bosio, 2019).

To understand the customer journey of shoppers in a grocery store, Figure 2 provides an overview of a such a journey in a supermarket.

2.5.1 Customer journey in an omnichannel driven brick-and-mortar grocery store

The following chapter applies the omnichannel approach and various AI technologies to a new, more complex customer journey (Figure 2). As displayed in Figure 2, through the presence of mobile apps, a grocer has more touchpoints throughout the entire journey (Harris et al., 2020). To better understand how AI technologies and the use of omnichannel can be applied in grocery stores going forward, use cases are developed to depict the future customer journey in grocery stores.

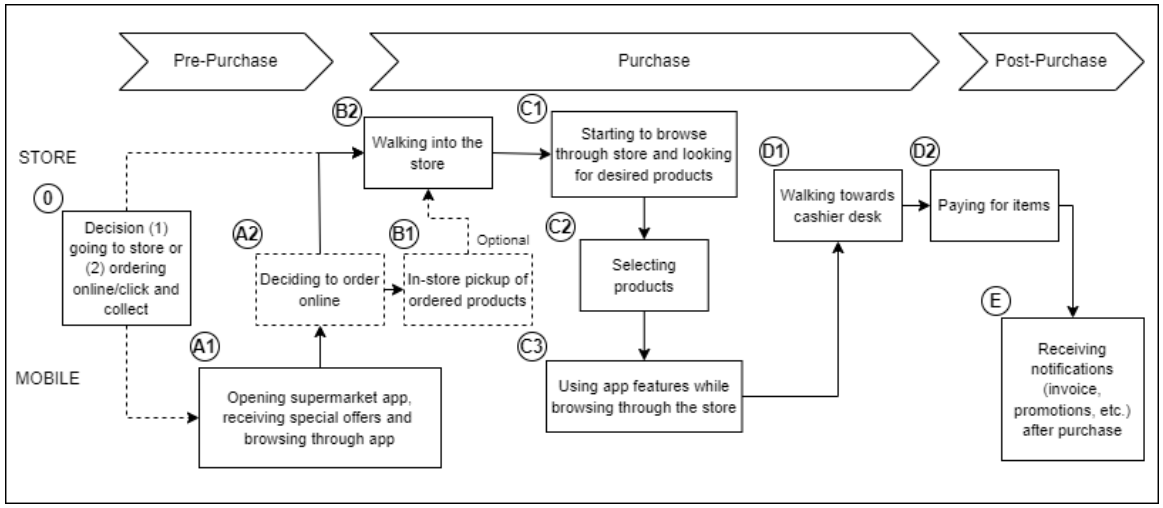

***Figure 2** - Customer journey in an omnichannel driven grocery store*
Source: own illustration

2.5.2 Examples of omnichannel and AI use cases in brick-and-mortar grocery stores

The definition of use cases comes from IT and concerns a written description of a user performing a task on a digital device (Jacobson et al., 2011). The examples provided are real-life examples from industry pioneers. The goal is to enhance the customer experience while at the same time simplifying the shopping and making it more convenient. Each step, from pre-purchase to post purchase will be described separately. The uses cases describe the customer journey of the future and depict how customers can engage with AI-driven technology along the journey.

2.5.2.1 Use case A – Pre-purchase

Beginning with the pre-purchasing phase, the customer journey with an omnichannel approach starts before a customer enters the store. First, a customer decides between three options, (1) walking directly into the store and starting to shop, (2) ordering online via an app and picking-up the products at the store or (3) getting the order delivered to the home address. For all there mentioned options, a customer first downloads the app of the grocery store onto a mobile device (e.g., smart phone). Then the user creates an account with all relevant personal details, like home address, email address and adds payment information. The latter is a convenient feature the app as a customer can pay seamlessly at a later stage in the process. Once an account is created, the omnichannel shopping experience can begin. Features include online shopping (i.e., the option for customers to directly place an order), in-store navigation (i.e., easy navigation and search for location of products in store), shopping list creation, personalized promotions and prices and convenient payment and checkout processes. A more detailed description about these features, follows in the use cases below (Mazumder & Elliot, 2022).

Once a customer logs into the app, he/she can browse through the store's assortment anywhere and anytime. When a customer places an order online, the customer can then decide if the order should be delivered to the stored home address or picked up later in the physical store (i.e., "click and collect"). At this juncture, the store's warehouse systems receive a notification and depending on the customer's choice for receiving the product (i.e., delivery or pickup) the store staff starts to assemble the order. Also, the customer receives updates about the order status. This order gets stored in the grocer's database and an AI-enabled algorithm can offer special promotions and prices for the customer's next purchase based on past purchasing behavior. Using historical data, a ML algorithm gets trained to detect patterns from a customer's shopping habits. The more purchases a customer makes, the better the algorithm predicts what products the customer desires and therefore offers more suitable promotions (Grewal et al., 2020; Sabolcik, 2021).

2.5.2.2 Use case B 1 and B2 – store entrance

Use Case B1

In a grocery store of the future, a customer has two options when walking towards a store: (1) entering the store and shopping for groceries there or (2) picking up the online of ordered products. If a customer decides to pick up the placed order, he or she simply walks to the designated

area where the pick spot is located. There the customer identifies himself/herself with a unique order number or a generated QR-code on the app, grabs the ordered goods, and leaves the store. If a customer realizes he/she forgot something to add to the order, he/she can simply walk into the store and look for it (Netguru, 2020).

Use Case B2

If a customer decides in step 0 to directly go to the store, he/she must first identify himself/herself before entering. This is done by scanning the customer's unique QR-code at the entrance gate, whereupon the gate opens. Once scanned, the store system knows which customer entered the store. Possessing this information is valuable, primarily by collecting data on aisles the customer visits (i.e., collecting GPS data) and offering promotions directly in the app and alerting the customer in real-time tailored to behavior (Grewal et al., 2020).

The technology used is very similar to gates at airports. Here, travelers simply take out their phone, place the screen above the tablet on the gate, and the system scans the code. Once a valid account is detected in a supermarket, the gate opens, and the customer can start browsing. Once inside, cameras and sensors in the ceiling can follow the customer's movement (Polacco & Backes, 2018).

2.5.2.3 Use case C – in-store behavior

At this point of the customer journey, the customer generally shops the same way as he/she does in traditional brick-and-mortar stores but can use additional features to enhance the experience. As described in *Use Case B2,* a modern grocery store is equipped with cameras and sensors programmed to detect different movements inside the store. Also, the interior equipment of a grocery store changes. Shelves where products are stored are equipped with scales and sensors to detect whether a product gets removed or selected by a customer or restocked by staff. These shelves, sensors, and cameras are connected and enable data storage on what product a customer takes from a shelf or puts back. When picking a desired product, the system recognizes this via cameras and special tags on products and adds it to a virtual shopping cart stored in the cloud (Qian et al., 2009)). Through the combination of computer vision (i.e., cameras, sensors) and prescriptive AI algorithms, the system adds the product in real-time to the customer's virtual cart, and this is visible to the customer via his/her app (Ives et al., 2019).

Another convenient aspect that an omnichannel approach provides is in-store navigation. This has the advantage of showing the fastest way to products and simultaneously saves time as shopping can be done more efficiently. Built-in sensors on shelves send data points on the location of a product to the customer's app. For instance, a customer can use the search function in the app to look up the exact location of a product. A store map will lead the way for the customer (Makarov, 2020). With augmented reality (AR) and AI, a real-life picture of the store gets displayed on the phone, and navigation arrows lead the customer to the desired product. There are also less advanced systems that simply draw a line on a grocery store map that a customer follows. This way, grocers can give customers a more unique shopping experience. Additionally, this may be linked with voice-over technology which dictates the way to the desired product. This feature is particularly relevant for bigger brick-and-mortar grocery stores (Mappedin, 2022).

Another feature enabled through AI is the creation of a shopping list in the app. Even before entering a store (*Use Case A*), a customer can develop a shopping list in the dedicated section of the app. While browsing through the assortment online, he/she can select products and then decide whether to add them to the shopping cart or shopping list. This task does not require a lot of advanced technologies. Through incorporating AI, though, it is possible to train an ML algorithm on past purchases and leverage the data collected to propose new shopping lists. As mentioned in *Use Case A*, every customer's purchase gets stored in the store's database. Thus, an algorithm can detect a pattern, make forecasts, and recommends items to be automatically to the shopping list (Grewal et al., 2020). An additional application of AI for the creation of shopping lists is to identify products based on cooking recipes stored online. A customer can enter the desired dish to cook, a shopping list will then be generated based on ingredients needed (Davidsson, 2021).

2.5.2.4 Use case D – the payment process

As in any supermarket, the last step of the shopping journey is paying at the cashier's desk. In a grocery store of the future, which is equipped with advanced technologies, this process can change drastically. There is an advanced technique created by Amazon which involves no check-out (Polacco & Backes, 2018). Amazon launched this in selected Amazon Go stores as the so-called "just walk out" technology. From the customer perspective, the process is simple – after entering the store by scanning a personal QR code linked to the customer's Amazon

account, he/she selects the desired products and simply walks out of the store. From the grocer's perspective, the technology for this is complex, and Amazon uses various AI algorithms (i.e., ML, deep learning), computer vision (i.e., cameras and sensors), and sensor fusion technology, much like the operating systems of self-driving cars. Cameras and sensors, which are mounted to the deck or shelves, as described in *Use Case B and C,* make this possible.

With this novel technique, a customer no longer queues for checkout and can leave the store, saving time and making the entire shopping experience faster and more relaxed. Payment is directly handled via the app, which is registered at the entrance. As soon as a customer walks through the exit gate, the "just walk out" technology adds up the customer's virtual shopping cart. Depending on the payment method deposited in the profile, the customer's credit card or account is charged and an invoice is sent straight to the app (Amazon, 2022; Grant, 2021).

2.5.2.5 Use case E – post-purchase

After buying groceries, a customer can review his/her purchase via the invoice on the app. As mentioned earlier, every customer's purchase gets stored in the grocer's database and on the customer's profile. This constant collection of data makes it possible for grocers to personalize future offers for customers. With advanced analytics tools and ML algorithms, grocers can also better forecast demand based on historical data. Therefore, the predictive models can calculate when it is beneficial to give a certain customer promotion on products and when not. Additionally, advanced analytics tools can help the process of creating shopping lists that make the next shopping trip more convenient for customers (D'Auria et al., 2021; Schultz, 2020)

The use cases A-E outlined in the section above build the basis for our data collection. In the following sections, we analyze the AI-driven use cases associated with creating an omnichannel experience and the appeal of those use cases to grocers and customers with interviews and a consumer survey. The results provide an overview of the customer experience for grocery shopping in the future and discuss the feasibility of providing an omnichannel experience.

3 Methodology

This chapter outlines the methodological steps followed in this study to answer the research questions defined in Chapter 1. There are different techniques used to carry out research for a master thesis. The research design chosen in this study is a mix of qualitative and quantitative research. The selected research design serves as a guide and ensures that the methods selected match the research aim (Fisher, 2010). Combining both research elements helps fill a potential gap compared to relying solely on one approach (Almeida et al., 2017). Therefore, interviews with different industry experts were conducted, and a survey was sent to consumers.

3.1 Qualitative research

For the research purpose of this work, this paper conducted semi-structured expert interviews to understand better how industry experts (i.e., grocers, industry consultants, research analysts) see the future development of grocery stores and how grocers can leverage digital initiatives. Semi-structured interviews are among the most used methods for qualitative research and offer a very in-depth assessment of practical insights. They provide the advantage of all interviewees responding to the same questions, but during the interview, follow-up questions can be asked (Kallio et al., 2016). Furthermore, an interviewer can steer the conversation in a specific direction to get the desired answers and can clarify unclear issues during the interview. In general, interviews help to collect primary data and detailed information about the research topic (Sofaer, 1999).

The secondary data outlined in Chapter 2 provides a fundamental overview of topics like omnichannel, AI, and potential use cases. With the primary data collected from experts, the research tries to extend existing literature to answer how supermarkets can incorporate an omnichannel strategy, what challenges they face and what use cases are relevant according to experts' opinions.

3.1.1 Interview data collection

Since the interviews were semi-structured, all interviewees received a guideline before the conversation. A detailed description of the guideline can be found in Appendix A1. To obtain a variety of opinions and insights from different perspectives on new digital initiatives in grocery retail, interviews with experts from different areas were conducted. The interview partners were

chosen based on their job position within their respective companies, expertise, and specialization in a particular field. Expert opinions were obtained from a CEO of a food retail company, a study program director and a founder of an e-commerce start-up, an analyst at a food venture capital fund, an analyst at a research agency, the head of purchases of a supermarket chain, as well as two consultants, one of a boutique consultancy and one manager of a big consulting firm. Additionally, a CEO of a food manufacturing company was interviewed. The wide range of expertise allowed to collect opinions on trends and future potential of AI technologies and omnichannel relevance. Each interview lasted between 40 and 80 minutes and was recorded with the participants' permission. For simplification, interviewees will be referred to as experts A to H throughout this paper. A description of the interviewees can be found in Appendix A2.

3.1.2 Interview evaluation approach

The qualitative content analysis represents the meaning contained in the text in so-called categories, which are themselves organized in a system (Ramsenthaler, 2013). The interview guideline was set up using an inductive approach to define categories that resemble the outlined literature (Thomas, 2006). An inductive category development sets up categories from the material, analyses essential aspects, and draws conclusions based on predefined categories. The defined categories help look for specific patterns in interviewees' responses (Mayring, 2000). The results were analyzed through qualitative content analysis following Mayring (2000). Aspects of utmost relevance were selected and matched to the respective category. The selection of categories are (1) challenges, (2) advantages, (3) potential, and (4) horizon. The responses matching a category were described and merged into a table. The analysis table with all categories and responses can be found in Appendix A3, A4.

3.2 Quantitative Research

A survey was sent to consumers to study the customer acceptance of new digital initiatives and the resulting increase in shopping frequency. Surveys provide a high level of general capability in representing a large population. A survey can gather data from the target audience about their opinions and beliefs. Through surveys, many data can be collected and therefore offer a very high representativity, which helps find statistically significant results (Swanson & Holton, 2005).

With the primary data collected through a customer survey, the paper aims to extend existing literature and answer to what extent consumers seek more convenience, are interested in omni-channel, and if certain use cases increase customer shopping frequency. This paper tests for shopping frequency as it indicates loyalty to a business (Mauri, 2003).

3.2.1 Customer survey data collection

The survey was set up with Qualtrics and covered seven questions. Generally, all consumers who shop for groceries themselves are relevant for this study. The survey tests for acceptance of online shopping, demand for convenience, and increase in shopping frequency through omnichannel and AI. A Likert scale supports the examination to test the attractiveness and likelihood of a specific feature increasing shopping frequency in grocery stores (i.e., use cases described in Chapter 2, such as cashier-free checkout). The entire survey with all questions can be found in Appendix B1.

Within the survey period, a total of 155 responses were collected. Of those responses, only 140 are valid as 15 participants did not finish the survey. Another 5 participants are discarded since they do not shop for groceries. This results in 135 valid responses, which represent the baseline of the analysis. For the study, the *age* variable was of interest since existing studies claim that at a certain age (above 60), the acceptance of online shopping and new technology decreases (Peek et al., 2014). On the other hand, this paper includes all participants in the age group 51-70 years old not to lose significant results. Participants above 70 years are considered outliers. Additionally, the variables of *country* and the *living area* are highly relevant since the digital initiatives usually have higher acceptance in urban areas first (Vogels, 2021).

Figure 3 displays the age category and gender amongst participants. 62% of participants are between 18 and 30 years old, with 42% female and 57% male, and one participant prefers not to reveal the gender. As the figure displays, only a small share of participants is older than 70 years.

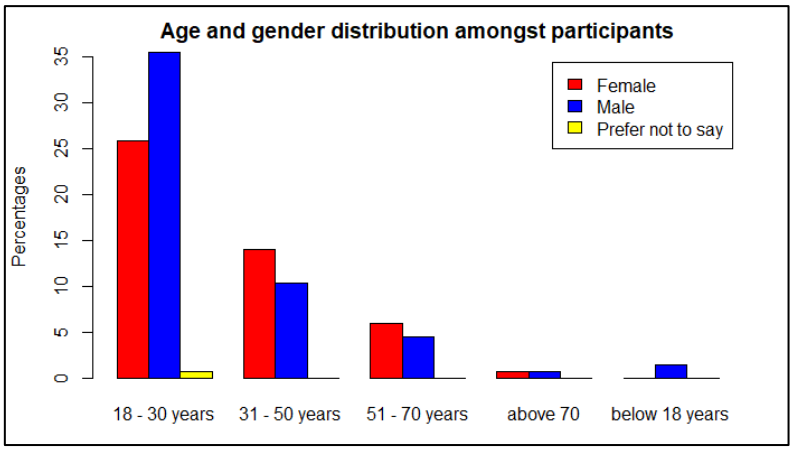

Figure 3 - *Age and gender distribution of participants*

Source: own illustration in RStudio

Figure 4 displays the area of living amongst participants. More than 50% of surveyed people live in urban areas across 16 different countries. The countries of residence among participants were Austria (51), Germany (36), Portugal (26), Netherlands (4), Belgium (3), and others (15) (Appendix B2). Since the category "prefer not to say" only accounts for one response each in the variables *gender* and *living area*, further analysis discards those responses.

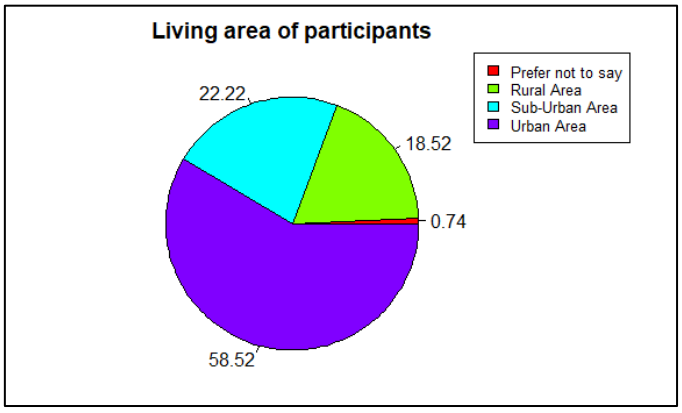

Figure 4 *- Participants living area*

Source: own illustration in RStudio

3.2.2 Hypothesis development

The survey supports the research in answering the research question (RQ1) defined in Chapter 1. Based on RQ1, hypotheses are developed to investigate further how supermarkets can use omnichannel and AI to drive the point-of-delight along the customer journey. The hypotheses

stated below are derived from existing literature discussed in Chapter 2. Recent studies suggest that omnichannel retailing increases the likelihood of grocers making additional sales (Deloitte, 2014).

Thus, the first hypothesis states that:

Hypothesis 1 (H1): the use of omnichannel retailing increases the shopping frequency among customers

Recent studies show that the acceptance of new technology is higher in urban areas than in rural areas (Vogels, 2021). Additionally, studies claim that younger people have a higher point-of-delight for new digital initiatives (Phan & Daim, 2011). Therefore, the second hypothesis claims that:

Hypothesis 2 (H2): Younger people living in urban areas have a higher acceptance of new technological initiatives

The use cases explained in Chapter 2.5 describe to what extent a specific technology changes the shopping experience towards more convenience. Since convenience became increasingly more important for consumers ever since the pandemic (Herbert et al., 2021), the final hypothesis states that:

Hypothesis 3 (H3): A cashier-free checkout in a supermarket is the most preferred feature as it increases convenience

4 Analysis

The following chapter provides an in-depth analysis of the qualitative and quantitative results. The arguments outlined in the literature are backed up by experts' opinions and customer survey data. To get an overview of the data set, RStudio outputs of descriptive statistics are displayed in Appendix C1.

4.1 Online trend

Due to steady growth in digitalization and the continuous development of new technologies, the demand for online grocery shopping and its benefits are rising. According to Expert B, consumers are ready for a new way of grocery shopping. Technological trends driven by AI and ML push shopping toward more convenience, personalization, and automation (Expert D, F). Overall, all experts confirm that the grocer's online presence and leveraging technology are significant enablers for future success. Following this trend gives brick-and-mortar grocers the chance to remain competitive and increase profits. According to the survey results, consumers currently spend more money in physical stores compared to online stores. Out of €100 to spend, a person spends an average of €86 in supermarkets, merely €11 on online grocery, and less than €5 on click and collect (Appendix C2). These numbers support Expert E's argument that *"[...] the physical in grocery retail is still highly important. It accounts for 90-95% of sales in Europe.*"

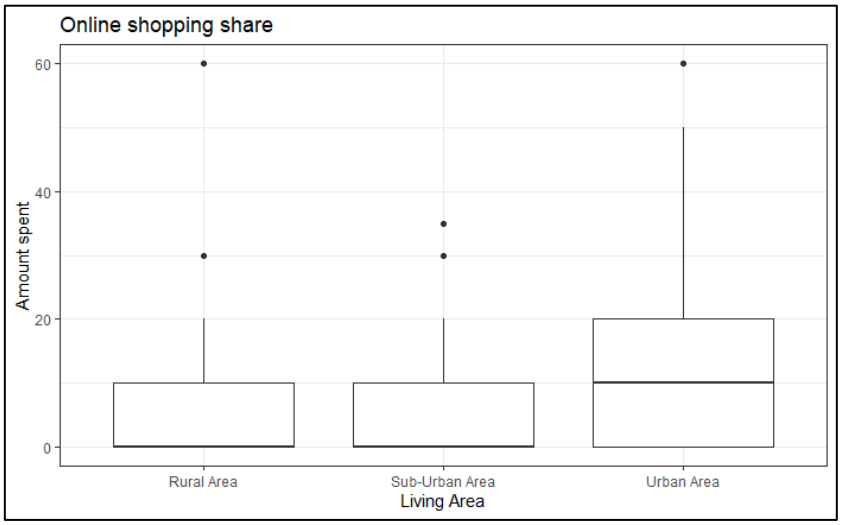

Figure 5 - Share of online shopping

Source: own illustration in RStudio

Looking at the boxplot displayed in Figure 5, the willingness to buy food online is higher in urban living areas compared to others. The median of the category urban area averages approximately €11, compared to rural and sub-urban areas, where the median is around €0. Most surveyed people living in rural and sub-urban areas spend more money in supermarkets than online shops. A justification for this might be that online shopping offers are more frequent in urban areas compared to rural areas. A more in-depth analysis of the online shopping use case is provided in section 4.3.3.

As Expert H claims, consumers seek more convenience when shopping for groceries in the future. A simple regression is used to test the dependence of convenience by means of the independent variables *age* and *living area*. The variable *age* got modified, and a dummy variable with two groups instead of four was created. 0 stands for everyone below 30 years and 1 for everyone above 30 years. The variable living area is a categorical variable with three categories (1) rural area, (2) sub-urban area, and (3) urban area. Therefore, this regression model can be found in Table 1 and Appendix C3.

Table 1 *- Regression Output 1*

*Convenience = β0 + β1*Living Area + β2*Age (dummy variable)*			
Coefficient	Estimate	Std. Error	Indication
Constant	75.702	5.035	***
Sub-Urban Area	- 8.829	5.728	
Urban Area	4.254	5.179	
Age (above 30)	- 8.679	4.095	**

The constant in regression model 1 indicates that a person under 30 years living in a rural area values convenience on average with 76%. This can be said at a significance level of $\alpha = 1\%$, as indicated by the three stars. The coefficient *Age (above 30)* means that on average, people who are older than 30 value convenience by 9% less than younger people. This can be said at the 5% significance level. Increasing convenience by 1%, a person under 30 living in an urban area values convenience by 4.3% more compared to someone living in rural areas, ceteris paribus. The corresponding R^2 is 11.7% indicating a low proportion of variance for the dependent variable (*convenience)* that is explained by two independent variables. The related reasoning for the non-significant results can be found in the limitations (Chapter 5.3) and Appendix C9.

4.2 Omnichannel

4.2.1 Omnichannel opportunities and advantages

Omnichannel has high relevance in today's retail landscape and originates from the evolution of retail (Expert B & E). Creating a smooth experience across channels without differentiating between the online and offline world is crucial for future success (Expert A). Grocers can benefit from various advantages like retaining customers and boosting loyalty (Expert C, H). Experts also confirmed that consumers spend more money on online and in-store shopping than just shopping in stores, which is a significant advantage. Six out of eight experts agreed that retailers have more touchpoints with customers through an omnichannel, meaning more ways to connect and communicate with consumers and place advertisements on multiple occasions. This results in more opportunities to sell to consumers (Expert F). Moreover, Expert B comments that omnichannel is not just a trend; it is something a customer expects from retailers.

All experts' opinions regarding advantages differ. One expert claims omnichannel offers only advantages for consumers, and retailers must deal with all challenges (Expert B). Other experts believe omnichannel benefits both consumers as well as retailers. On the one hand, consumers can profit from a seamless shopping experience by having more transparency in prices, personalization, convenience, and simplifications alongside the customer journey. On the other hand, a grocer can extend the assortment through omnichannel, enlarge the customer base, and reach new customers (Expert C). Furthermore, also manufacturers agree that omnichannel brings more advantages for grocers (Expert G).

Since omnichannel involves new technologies and the trend is moving fast, established organizations are too slow in adapting to new business models, as Expert D claims. Therefore, companies can join forces with start-ups that provide digital solutions and enormously benefit from their know-how and technological expertise. Moreover, Expert E knows from retail giants like Walmart that in-house incubator programs are beneficial in the transition and implementation of omnichannel.

> *"Some grocery giants have their own incubators that support them to make such transitions to e-commerce." (Expert E)*

4.2.2 Omnichannel challenges and disadvantages

Figure 6 provides an overview of the most frequently mentioned challenges, and hurdles retailers deal with when implementing omnichannel.

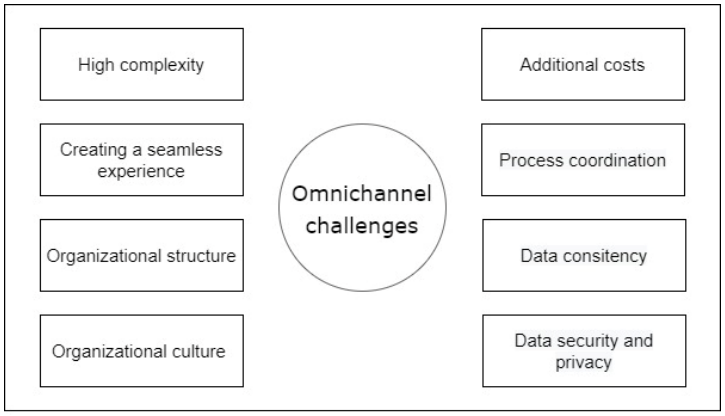

Figure 6 - Omnichannel challenges

Source: own illustration

Firstly, implementing omnichannel adds a layer of complexity to internal processes and the customer journey (Expert C, E). Secondly, building a seamless experience across channels is relatively complex. It requires courage and the organization's will to change (Expert B). To set up an omnichannel, a company needs to start from scratch and include every department of the organization (Expert A). Communication between departments is essential for a well-functioning omnichannel strategy (Expert H). Five out of eight experts point out that companies need to be aware of cultural and structural changes inside the organization. To succeed in omnichannel, rethinking the model, changing the culture, and adapting to new processes need to be in order (Expert E). Neglecting those facts might lead to complete failure. Omnichannel not only creates work at first but also adds costs to the company. Creating consistency across channels involves expenses and takes time and resources (Expert D). Especially for the food industry, the logistical process is complex since grocers work with perishable goods (Expert F). Furthermore, to give consumers the best experience, having data consistency in all departments is crucial.

Experts also have concerns about data security and privacy when talking about omnichannel. Consumers must disclose many personal data through the strong online presence and the opportunities to offer consumers tailored offers. Experts B and C worry about too strict data privacy regulations on the part of the EU, which may prevent omnichannel from exploding its full

potential. On the other hand, Expert E does not worry about data privacy and argues that nowadays, everything is based on data, and people are very negligent regarding the security of their personal data. Therefore, Expert E believes that governments will adopt the regulations in the future.

4.3 Use cases for omnichannel

This section of the analysis discusses the AI-driven use cases a grocer can implement into omnichannel. It compares how attractive consumers perceive a use case and how likely it is to increase shopping frequency if executed by a grocer. First, the change will be compared without the influence of external variables. In a second analysis, the variables *living area* and *age* are considered.

Figure 7 displays all use cases queried in the survey. The use cases are ranked according to the share of extreme attractiveness, indicated by the dark blue color. At first glance, it is evident that the level of attractiveness is relatively high amongst all use cases.

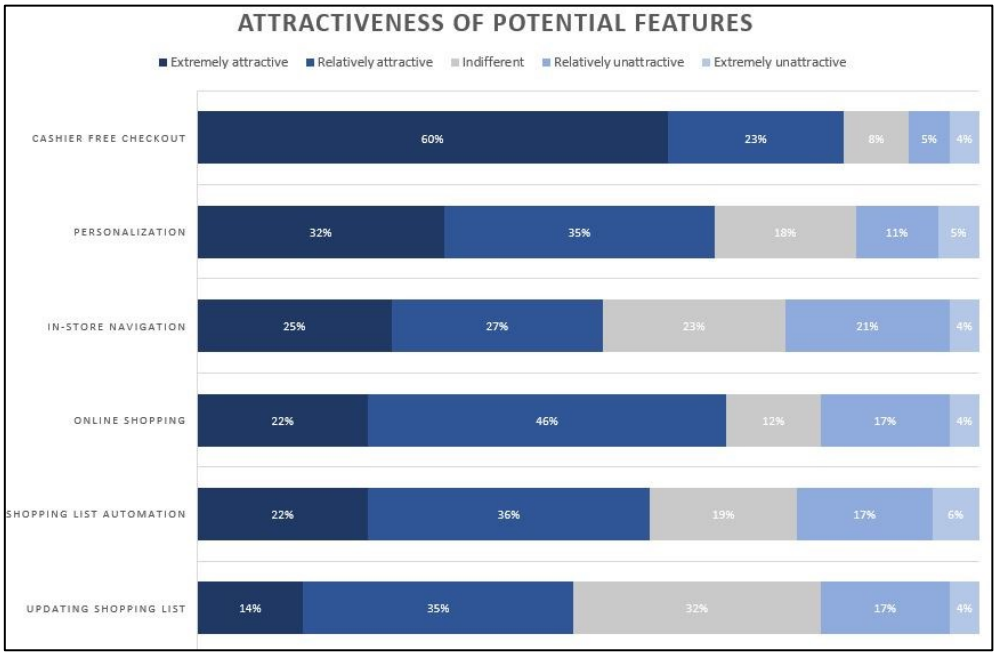

Figure 7 - Attractiveness of features in percent (%)

Source: own illustration in Excel

Fisher's exact tests are carried out to test whether there is a statistically significant correlation between the *living area*, *age*, and increased shopping frequency driven by certain use cases.

Since Likert scale data is considered ordinal data, the convention of traditional parametric tests is violated here. Instead, nonparametric tests are performed. These tests do not assume a normal distribution of variables (de Winter & Dodou, 2010). Furthermore, it is essential to mention that the mean is not meaningful when analyzing Likert scale data. Instead, the median provides more accurate information at first glance (Golicher, 2017). Independence tests like Chi-squared or Fisher's tests assess if there is a statistically significant relationship between observed frequencies in one or more categories (Pearson, 1997). Generally, Chi-squared tests are used for this type of data; however, since a few values in the contingency table are less than 5, the literature suggests using the Fisher's test instead (Bower, 2003). An example of a contingency table can be found in Appendix C4.

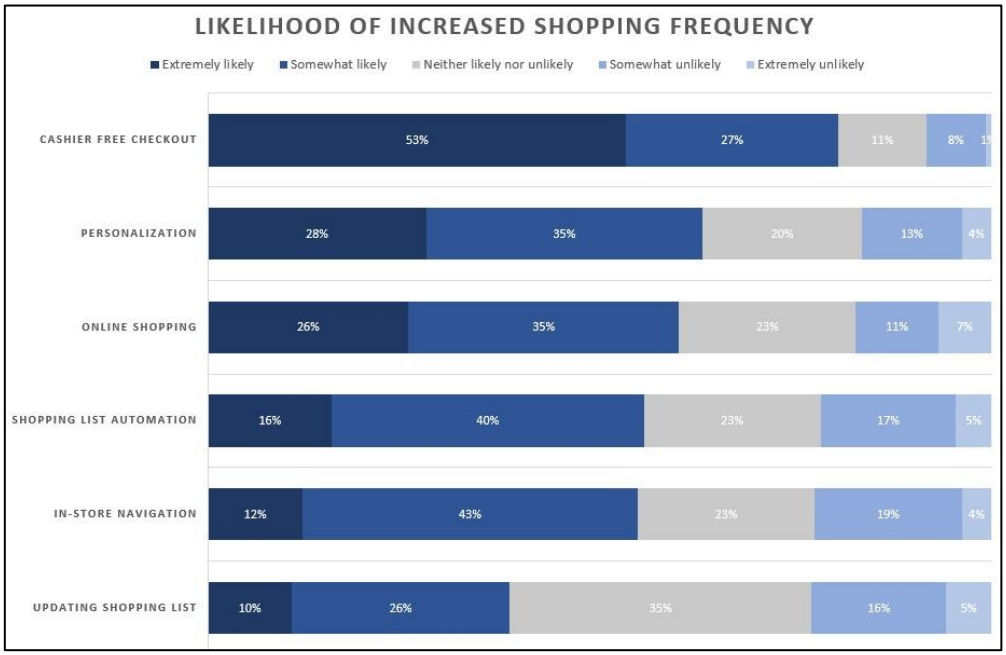

Figure 8 - Increased shopping frequency

Source: own illustration in Excel

Figure 8 showcases an increase or decrease in shopping frequency after implementing one of the six features. The dark blue colors indicate an extreme likelihood, and the light blue color an extreme unlikelihood. To find significant results, Figure 7 and Figure 8 are compared in the following. By solely looking at the correlation matrix in Appendix C5, a positive correlation between the attractiveness of a use case and the increased shopping frequency by a use case can be seen. The more attractive a use case is, the more it increases the shopping frequency. The correlations of all use cases are positive and range between 0.59 and 0.69

The following null hypotheses are developed to test if the increased shopping frequency is significant in dependence on *living area* and *age*. These hypotheses derive from the *H2* set in Chapter 3 and are discussed in the following.

H0: Increased shopping frequency driven by Feature X is not dependent on living area
H1: Increased shopping frequency driven by Feature X is dependent on living area

H0: Increased shopping frequency driven by Feature X is not dependent on age
H1: Increased shopping frequency driven by Feature X is dependent on age

4.3.1 Cashier-free checkout

Cashier-free checkout is the use case with the highest potential of all. All experts confirmed the additional convenience boost this feature brings in the future is enormous. Expert A argues that the feature enhances convenience since no one wants to wait in line at cashier desks. Additionally, the use case allows customers to leave the store faster (Expert C). Furthermore, Expert H supports both arguments and adds that cashier-free checkouts are gaining popularity and will come into practice soon. It is the most significant AI-powered trend in grocery retail (Expert E), even though the technology is complex and requires high investment costs (Expert F). Despite all the convenience aspects, cashier-free checkouts bring to the table, it is not affordable for most companies (Expert C). Moreover, some experts have concerns about the acceptance rate of such technologies in rural areas. *"Some people are used to waiting in line and still prefer personal contact with cashiers" (Expert D).* Also, Expert A agrees with this argument and adds therefore their company refrains from using such technologies until now.

Nevertheless, consumers value cashier-free checkouts most. Almost two-thirds of surveyed customers see the "just walk through" technology as extremely attractive (Figure 7). This is by far the highest share of any use case. One can assume that waiting in long lines and wasting time at the cashier's desk is a nuisance for consumers. Therefore approximately 4% consider this feature extremely unattractive. Also, the likelihood of increased shopping frequency showcases it is extremely likely that a cashier-free checkout in supermarkets increases customers' shopping frequency. 80% indicate it is extremely or somewhat likely.

Performing the Fisher's exact test checking for the dependence of *living area* and *age*, the following has resulted. To decide whether to reject or fail to reject the null hypothesis, a significance level of α 0.05 (5%) for all tests is selected. The p-value of the first test (*living area*) is 0.53, and for the second test, 0.35. Therefore, one fails to reject both null hypotheses, and neither living area nor age influences an increased shopping frequency through cashier-free checkouts. Also, the following Figure 9 shows there is no significant difference between the age and the increased shopping frequency through this use case.

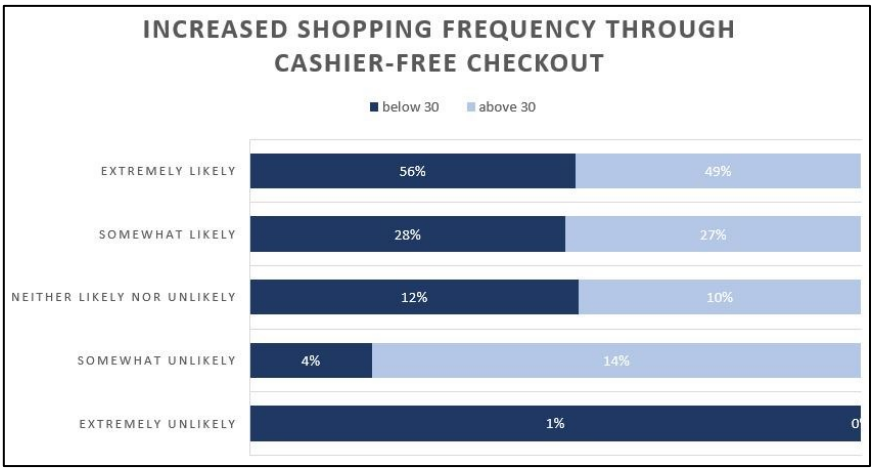

***Figure 9** - Increased shopping frequency through cashier-free checkout*

Source: own illustration in Excel

4.3.2 Personalization of prices and offers

Omnichannel offers customers completely new opportunities in terms of personalization. Personalizing prices and offers adds more transparency and increases the appreciation of customers. According to all experts, personalization is an upcoming trend and tremendously increases the convenience level. Additionally, a grocer can benefit from data collection to make data-driven decisions based on consumer behavior (Expert A). Furthermore, the immense amount of data allows grocers to forecast demand (Expert B, H) and thus reduce food waste (Expert F). Also, a customer wants a more personalized experience and offers (Expert E). The younger generation primarily seeks more individualization and wants everything to be more personalized and unique (Expert D).

The survey showcases similar results. 32% of surveyed consumers find personalization extremely attractive and 35% relatively attractive. Merely 5% state personalization is extremely

unattractive. Comparing this with the likelihood of increased shopping frequency through different personalization initiatives, Figure 8 shows a slight decrease. Personalization still ranks as the second favorite feature, but only 28% find it extremely likely that personalization initiatives would increase the shopping frequency.

Considering the variables of *living area* and *age*, there is also no statistically significant result stating that one of those variables significantly influences the increased shopping frequency. The corresponding p-values of Fisher's exact test amount to 0.24 for the dependence on *the living area* and 0.56 for the dependence on *age* (Appendix C6). The p-values are higher than the significance level of 0.05. Thus, one fails to reject the null hypotheses. Meaning that *living area* (Figure 10) or *age* has no statistically strong influence on shopping frequency. All three living areas have a similar share of a possible increase in shopping frequency.

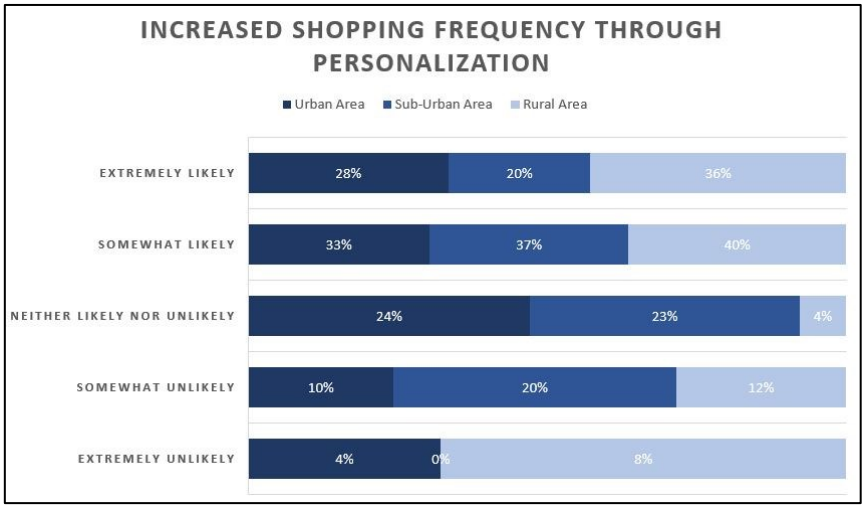

Figure 10 *- Personalization per living area*

Source: own illustration in Excel

4.3.3 Online shopping, home delivery, and click-and-collect

As discussed in section 4.1, the trend toward online shopping is rising, and experts see a lot of potential in online options through omnichannel implementation. The data also indicates a trend towards buying groceries online or using the click-and-collect option, although the numbers are relatively small. Looking at Figure 7, more than half of surveyed people generally find the opportunity to shop online, get the food delivered or pick it up at stores attractive. Comparing this result with Figure 8, online shopping is the third-best feature when it comes to increased

shopping frequency within this thesis' survey. For approximately 26% of consumers, it is extremely likely that the shopping frequency increases once a grocer offers such a feature. Interviewed experts agree that online shopping and home delivery will be coming as additional sales channels into grocery stores in the near future. However, expert opinions differ regarding the potential of click and collect. Experts B and F argue that click-and-collect was very helpful during the pandemic, but the trend will vanish soon because it is simply not convenient enough. On the other hand, Expert E thinks the optional pick-up time supports the click-and-collect growth, and not paying for delivery is an attractive offer.

Since the survey asked customers how much they spend on online groceries, a linear regression with the two independent variables, *living area,* and *age*, is carried out. The living area is split into three categories, (1) rural area, (2) sub-urban area, and (3) urban area. The variable *age* is divided into below 30 and above 30. The results indicate low significance levels of coefficients, and the respective R^2 is very low (6.6%). Thus, the output of regression two is shown in Appendix C7 as well as the reasoning for non-significant values is highlighted in Chapter 5.3 and Appendix C10.

The Fisher's exact test is carried out to confirm the *H0* hypotheses developed above. The corresponding p-value of the first test's p-value = 0.70. Therefore, one fails to reject the null hypothesis, meaning the increased shopping frequency driven by online shopping is not dependent on living area. The same is true for the second hypothesis, which states that an increased shopping frequency driven by online shopping is not dependent on age. Here the p-value = 0.33, and one fails to reject the null hypothesis. A detailed result of both tests can be found in Appendix C8.

4.3.4 In-store navigation

The in-store navigation use case is a very novel one. It involves modern and innovative technologies, like AI algorithms and AR technologies. This feature generally has the potential to increase the convenience level while shopping. However, expert opinions differ as they state it is a feature without much potential. As Expert C argues, in-store navigation has no considerable future potential since a retailer wants customers to browse through the ails in stores. Expert H has a similar opinion saying it is a *"[…] very novel feature, but the question is, is it necessary?" (Expert H)*

Two Experts also support the idea saying this feature might work in bigger grocery retail stores in rural or sub-urban areas. However, in urban areas, it is not necessary.

Contrary to expert opinions, consumers of this thesis' survey rate the in-store navigation with a very high level of attractiveness and rank it in third place. Around 25% think it is extremely attractive, and 27% find it relatively attractive (Figure 7). However, also the share of indifferent customers is high at 23%. Looking at the likelihood of this feature increasing the shopping frequency, it stands out that only 12% rank it best (Figure 8). Nonetheless, the share of people saying it is somewhat likely, that this feature increases shopping frequency almost doubled (43%). A Fisher's exact test is carried out to investigate further the experts' claim that an increase in shopping frequency driven by in-store navigation depends on the living area. The result shows a high p-value of 0.44. Since the p-value is larger than the significance level of $\alpha = 0.05$, we fail to reject the null hypothesis. As a result, there is no statistically significant dependence between the increased shopping frequency of in-store navigation and the living area.

4.3.5 Automated shopping list

Another feature often discussed as a convenience booster is an algorithm that creates automated and personalized shopping lists based on historical purchases. Experts do not have extreme opinions regarding this use case. Some experts briefly mentioned it is valid and makes customers' shopping journey more convenient; others did not comment on it. Expert A's company has an algorithm deployed that creates automated shopping lists based on previous purchases for wholesale customers but not for end consumers (Expert A).

Regarding the attractiveness of both use cases, Figure 7 shows that (1) the automated shopping list and (2) the individual shopping list are the least attractive ones. (1) 22% indicate an extremely high attractiveness, and 36% think an automated shopping list is relatively attractive. Also, 6% value this feature as extremely unattractive. Looking at the likelihood of increased shopping frequency (Figure 8), fewer people see it as extremely likely. The share of people seeing it as somewhat likely, increased by 7%. (2) The feature of updating shopping lists individually is ranked last in both questions. Almost one-third of consumers say they are indifferent in terms of attractiveness. Comparing the graphs in Figure 11 shows that all "positive" answers in the left chart moved to the indifferent or "negative" options in the right chart, resulting in a more minor increase in shopping frequency compared to other use cases. Moreover, the median

shows most answers are located around the neutral option, implying no substantial added value for consumers.

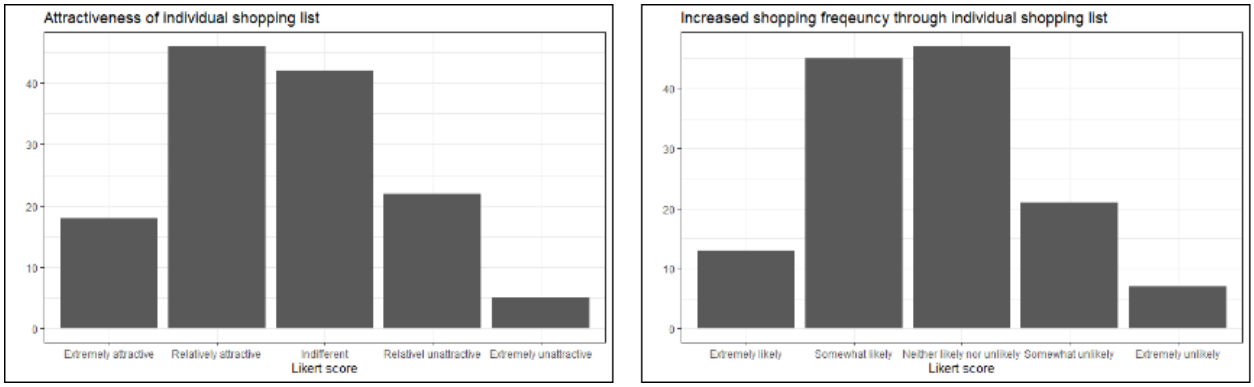

Figure 11 *– Increased shopping frequency driven through shopping list creation*
Source: own illustration in RStudio

4.4 Time horizon until deployment

Lastly, since all analyzed use cases are novel, they require advanced technologies, like AI and ML, and perfect coordination of processes inside a company. It is not easy to generalize when these use cases are implemented in brick-and-mortar stores.

> *"You cannot generalize it and say in 5 years grocery stores are like this or that. It depends on the operating market. […] also, the technology involved […] ". (Expert E)*

Every market is at a different stage regarding omnichannel and AI technologies inside supermarkets. As of right now, the UK is the most advanced in terms of omnichannel and AI implementation in physical grocery stores in Europe. Here certain use cases may be deployed as early as two years from now (Expert E). Austria, for instance is currently on the leap from multichannel to cross-channel (Expert B), and it might take some years until the grocery industry moves towards omnichannel (Expert G). Expert E clearly pointed out that a grocer cannot randomly deploy new technologies. The market and its customers need to be ready for change.

5 Discussion

5.1 Main findings

The analysis chapter showed that omnichannel is the new keyword in the grocery industry. Experts and literature (Schedlbauer, 2020) clearly state that there is no way to avoid omnichannel if a grocer wants to be successful in the future. Since it is already a significant trend, transitioning to an omnichannel does not lead to a competitive advantage. Instead, it is a requirement for retailers to serve customers in the future. In line with Jocevski et al. (2019), setting up an omnichannel adds a layer of complexity and comes with challenges, as it adds costs and complexity. The entire business model, from organizational structure to processes and logistics, needs to be adapted. Once a company successfully implements omnichannel, all its advantages can be exploited. The most prominent benefit for retailers is the increase in sales and profit. This is also confirmed with literature and interviewed experts (Bell et al., 2014; Gerckens et al., 2021). First, more customers can be reached, and second, customers buy more when shopping online and in-store.

On the customer side, omnichannel increases the convenience and simplification level along the user journey. The results from experts and survey build on the evidence of recent magazine articles and papers (Burns, 2020; Paige, 2021) by arguing that consumers seek a convenient shopping experience. The data collected with this paper contributes to a clearer understanding of the importance of convenience. On average, consumers of this thesis' survey valued convenience very highly (72 points out of 100). Nonetheless, it was astonishing that neither the customer's *age* nor the *living area* significantly influenced the result. Thus, it stands to reason consumers highly value convenience, independent of external influences.

The use cases presented show a way forward for supermarkets to implement omnichannel in conjunction with AI technologies and, at the same time, drive the points-of-delight along the user journey. Overall, most presented use cases are attractive to consumers. Moreover, the results indicate a relatively high likelihood of increasing shopping frequency once a grocer implements a specific use case. Three use cases in particular show promising results: (1) cashier-free checkout, (2) personalization, and (3) ordering food online. However, since the potential increase in shopping frequency is marginal, it is difficult to draw substantial conclusions. In addition, it is once more surprising that neither the *living area* nor the *age* of consumers has significant influence on an increased shopping frequency, independent of the use case. While

previous research (Peek et al., 2014; Vogels, 2021) stated that living area and age influence technology acceptance, the results also demonstrate non-statistical significance at a use case level.

For a grocer to remain competitive and increase profits, implementing an e-commerce sales channel is crucial (Deloitte, 2014; Verscheueren et al., 2021). Once omnichannel is established, the physical store should remain at the heart of operations. Nonetheless, experts and literature advise grocers to move towards more online presence (Galante et al., 2013). The same applies to the personalization use case. Personalization increases performance, enhances customer satisfaction, and results in higher profits (Arora et al., 2021). As the survey results showcase, getting personalized prices, offers and promotions is a factor for increased shopping frequency in the future. Lastly, a cashier-free checkout increases the convenience level tremendously. Building on the increased importance of convenience, such technology increases the points-of-delight alongside the user journey. Moreover, it will raise a grocer's success rate since customers highly value such features.

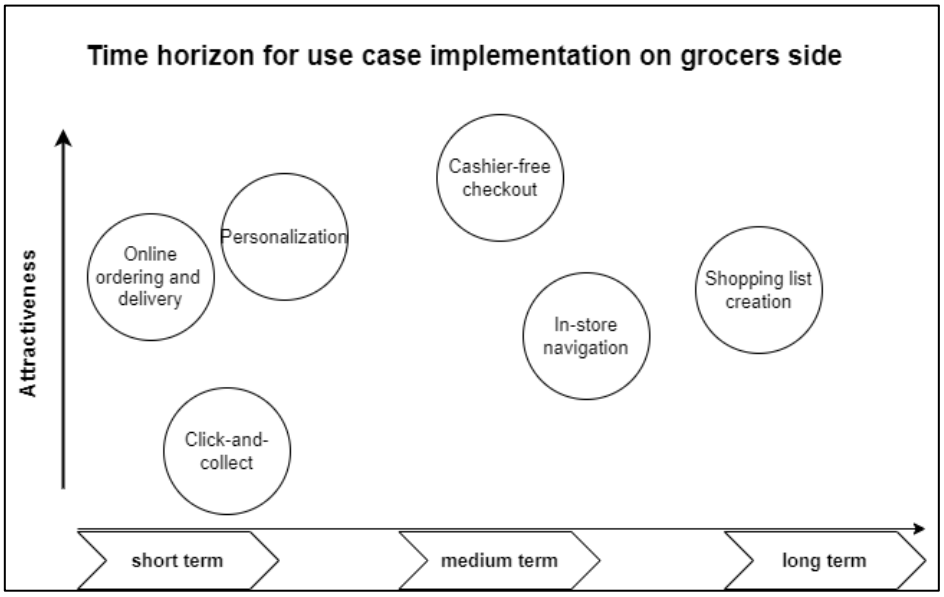

Figure 12 *– Time horizon for use case implementation*

Source: own illustration

Figure 12 displays the suggested time frame a grocer can implement specific use cases concerning the attractiveness according to the customer's opinion. The use cases on the left side indicate a more vital need for grocers to implement. First, establishing an outstanding online

presence is as essential as incorporating related AI technologies to personalize prices and offers. Once the transition is successful, a cashier-free checkout process can be considered. The derivation of Figure 12 can be explained with the Eisenhower matrix (Appendix D1). The Eisenhower matrix shows on the x-axis the urgency (here need for adoption) and on the y-axis the importance of a use case (here attractiveness).

5.2 Implications for grocery stores of the future

The conducted research has specific implications for retailers in the future. To remain competitive in grocery retail, a shift towards omnichannel is inevitable while simultaneously adapting the management approach. As Christensen (2001) discussed, solely relying on economies of scale is not sufficient. Instead, companies can differentiate themselves by focusing on their dynamic capabilities and deploying them in the right places (Barreto, 2010). The results fit with the dynamic capabilities theory of Teece, Pisano and Shuen (1997) by saying that a company must possess a certain degree of propensity to adapt capabilities in fast-changing environments (Teece et al., 1997).

Further, integrating desired AI technologies into the omnichannel customer journey is essential. The different technologies give grocers the possibility to decide for themselves which of the use cases to implement. A supermarket can decide for themselves whether to implement a single use case or a combination of use cases. However, online shopping and personalization are amongst the most desired ones. Implementing features like a cashier-free checkout process increases the convenience level but requires enormous investment costs. Moreover, the results imply that one use case alone is insufficient to raise the points-of-delight. Therefore, it is fundamental to implement omnichannel and find the right combination of technologies for the future success of brick-and-mortar grocery stores.

Both *RQ1* and *RQ2* can be answered with the literature discussed initially, the insights and opinions gathered from experts and the analysis data. Introducing mobile apps with various features, like online shops resulting in personalization options and equipping the store with AI-based technologies, will drive the point-of-delight along an omnichannel user journey. Moreover, creating a seamless experience where customers can shop online and in the physical store increases sales. Combining this with a flawless symbiosis of AI technologies increases future success rates for brick-and-mortar grocery stores. Further, with the data obtained, *H1* and *H3*

can confidently be confirmed by statistically proving omnichannel increases sales, and a cashier-free checkout increases convenience. Nonetheless, *H2* could not be accepted with the data analyzed, as results show no significant value-added.

5.3 Limitations

The thesis' research framework is subject to several limitations, which need to be addressed in further studies. Firstly, the qualitative approach was constrained due to the ongoing pandemic. Although substantial insights were obtained to a great extent, personal contact would have facilitated the process of capturing meaningful insights. As the range of experts relied to a small extent on private network, most of the interviewed experts were from the DACH region (Germany, Austria, and Switzerland). Thus, the scope of experts' knowledge was limited to their respective markets. Hence, some arguments could not be transferred to the entire European market. Also, every market is different, and trends cannot be generalized.

Secondly, the survey results are not showing any statistical significance. This may be due to the sample size and can be attributed to the failed assumption tests needed for linear regression (Appendix C9, C10). More observations and an adjusted survey setup would allow for different regression models and other statistical analyses to achieve better results in future studies. Thirdly, a selection bias could have impacted the result's reliability. Some proposed technologies, like online shopping and home delivery, have not been introduced in certain countries. Consumers might have never been in contact with the selected use cases and therefore do not have a strong opinion on their advantages and disadvantages. Fourthly, the issue that occurs when performing Chi-squared or Fisher's test is that the approximation to the test statistic distribution relies on the counts being roughly normally distributed. In the case of the survey's data, the size of some observations is too small, and therefore the test does not deliver accurate results.

6 Conclusion

The way brick-and-mortar grocery stores earn money nowadays is no longer contemporary. Traditional grocery stores are under threat of new disrupters, and grocers need to adapt their business model to remain a right-to-play. By investigating the factors influencing grocery retail, it is clear that grocers need to be online present in the future. Since physical stores will always remain present and at the heart of the business, grocers must follow an omnichannel strategy. Thereby, companies can merge advantages of the physical and the online world. Omnichannel helps grocers to remain competitive as it allows them to enlarge their customer base. Moreover, through a combination of online and offline channels, customers intend to spend more, resulting in higher profits. Further, incorporating AI-driven technologies along the customer journey increases shopping frequency independent of consumers' age or living are. The research's results imply that grocers should introduce a specific combination of use cases. Firstly, implementing online shopping, home delivery options, and personalizing prices and offers heavily influence brick-and-mortars' future profits. Further, features like cashier-free checkouts or in-store navigation influence customer satisfaction while shopping. Thus, to confirm *RQ2,* omnichannel in conjunction with AI technologies is the driving force for the future success of brick-and-mortar grocery stores. Additionally, *RQ1* can be answered by saying, this transition increases the points-of-delight along the customer journey.

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Appendix A - Interviews

Appendix A1 – Interview Guideline

Introduction: Please introduce yourself first. Where do you work and what is your role inside the company?

Omnichannel trend:

- What are the key trends in the grocery retail industry?
- Is omni-channel an important trend in the grocery retail industry? Why?
- What are the key advantages/ disadvantages of omni-channel?
- What are current roadblocks for the implementation of effective omni-channel experiences
- How do you think the omni-channel customer journey of the future will look like?

AI to enhance omni-channel experience:

- What are keyways groceries can leverage AI to improve the omni-channel experience?
- Which of the use-cases are already implemented/ in the pipeline at your company?
- For the below AI use-cases along the omni-channel customer journey, how would you rate the attractiveness and ease of implementation for a brick-and-mortar grocery
    - Online ordering/delivery/click and collect
    - Personalization (pricing and promotion)
    - Cashier free checkouts (“just-walk-out” technology)
- What time horizon would you predict until those technologies come to tuition in grocery stores?

Appendix A2 – Interview partner overview

Reference ID	Expert Name	Company	Job Position	Description
A	Christof Kastner	KASTNER GRUPPE	CEO of Kastner Gruppe	Kastner Gruppe is a leading food wholesaler and retailer in eastern Austria. Mr. Kastner worked his entire life in this industry.
B	Rainer Neuwirth	myProduct.at	CEO of myproduct.at & head of master program “e–commerce”	Myproduct.at sells products directly form manufactures to consumers via a transparent, sustainable, and easy way. Mr. Neuwirth is a lecturer at FH Wiener Neustadt
C	Maximilian Reiter	Maximilian Reiter Consulting	CEO of Maximilian Reiter Consulting	Consulting firm which supports companies with innovation and digitalization in the food industry. Mr. Reiter already worked several years in the industry with strong attention to digitalization.
D	Dennis Grimm	FoodLabs	Junior Analyst	Food Labs is a German VC fund which invests in early stage and series A food start-ups. Gorillas is part of their investment portfolio.
E	Maxime Delacour	IGD	Senior Retail Analyst	Institute of Grocery Distribution focuses on understanding and uncovering rich insights and data in the industry. Mr. Delacour focuses on the European market and discounters.
F	Michael Lamm	MPREIS	Head of purchase and category manager	MPREIS is a leading supermarket in western Austria. Company has a strong focus on regional products and innovation.
G	Thomas Schwarz	11er elfer AUSTRIA	CEO of 11er	11er is a food manufacturing company, producing mainly potato products. The company delivers directly to supermarkets and wholesalers.
H	Wander Hoolboom	BAIN & COMPANY	Manager, focused on growth equity	Mr. Hoolboom was recently part in a project which focused on implementing new supply chain technologies for a big European retailer.

Appendix A3 – Interview codes

Industry Trends	
Category	**Description**
Trend	- *New technologies and digitalization* - *AI, ML, and big data make it possible to offer new ways of shopping* - *Personalization, dynamic pricing, and automation offer more convenience* - *Trends which affect consumer behavior* - *Trend towards more online shopping increases* - *Consumers accept a new way of receiving a product* - *Pandemic pushed trend towards online* - *Physical stores are still very important* - *Trend affects not only retailers but also manufacturers*
Omnichannel	
Category	**Description**
Opportunity/Relevance	- *No differentiation between online and offline* - *Offers great opportunity for future success* - *Creating a seamless experience offers opportunities to increase sales* - *Omnichannel has a high relevance in today's retail business* - *Helps to retain customers and increase their loyalty* - *New ways of communicating with customers and advertising them* - *Offers opportunity to increase performance* - *Trend resulting based on the evolution of retail* - *Consumers have less time to shop* - *Not too relevant for manufacturer*
Advantages	- *More advantages on customer side compared to grocers' side* - *Through omnichannel, grocers can offer a bigger assortment* - *Reach new customers* - *Create a bigger customer base* - *Creating omnichannel presence by investing in start-ups or joint ventures* - *Benefitting from in-house incubators*
Disadvantages	- *Data security, data privacy and data rights*

	- *Huge complexity*
Challenges	- *Creating and building a seamless experience* - *Adapting culture and structure* - *High resource, time, and investment costs* - *Channels need to work together – "no-line"* - *Coordinating touchpoints inside the organization* - *Clear guidelines are often missing* - *Data consistency* - *Establishing a well-functioning logistical process* - *Lacking flexibility* - *Lack in process coordination* - *"Playing catch-up"*
Omnichannel & AI use cases alongside customer journey	
Category	**Description**
Goals	- *Increase convenience alongside customer journey* - *Fast and simple purchases* - *Extend the customer journey* - *With AI support retain customers, increase loyalty and revenues* - *Collecting more information on customers* - *Physical store remains at the heart of operations* - *No complexity* - *More communication*
Potential	- *Experts see lots of potential in personalization and cashier-free check-outs* - *Can be accomplished through an AI, ML algorithms and advanced analytics tool* - *Important is data availability* - *Retailers are the driving force for growth and change*
No potential	- *Experts had different views on some use cases alongside the customer journey* - *The customer is not ready* - *Technology is too advanced* - *Certain habits are deeply rooted*

	- *High investment costs* - *Unnecessary feature*
Alternatives	- *Besides the discussed use cases experts mentioned other use case where omnichannel and AI increase convenience*
Horizon	- *Hard to generalize the time horizon* - *Depending on country and market*

Appendix A4 – Interview summary

Interview – Kastner Christof, date 31.03.2022 – Expert A

Omnichannel

Kastner tries not to differentiate between online and offline. As Mr. Kastner said, they try to use the expression "no-line" meaning there is nothing in-between online and offline (opportunity/relevance). **It must be a seamless process where the entire organization, ever entity and every process is integrative (challenges).** The approach when using omnichannel should be integrative. Kastner uses the omnichannel already since a few years but mostly offer those services to their wholesale clients. **Offering omnichannel is a must have for future success according to Mr. Kastner (opportunity/relevance)**. **However, the integration process of an omnichannel takes some time. It is important that you build the perfect omnichannel from scratch and not start the integration in one department and see how this works and then moving onto the next one. This is only leads to failure (challenges)** according to Mr. Kastner. Inside the industry Kastner was the first to implement omnichannel and their customers approve it. Even though, Kastner focusses more in the wholesale part on omnichannel, this does not exclude the fact that omnichannel is crucial in the food retail industry, wholesale, and retail.

Omnichannel customer journey is clearly about simplicity and convenience and thereby connecting several technologies to make this possible (goals). The company works together a lot with start-ups that developed such tools to make the customer journey more convenient, especially in the wholesale part. **Their goal is that through all the technologies and additional services along the customer journey, they want to retain the customers for the long run. Meaning to build up a very loyal customer base, both in retail and wholesale (advantage)**.

Omnichannel and AI alongside customer journey

Mr. Kastner sees a lot of potential in the use cases explained. **For instance, cashier free checkouts boost convenience a lot since no one likes to wait in line and personalization of various things is important for future success (potential)**. **For their retail stores the entire omnichannel and AI technology is not this relevant since, those stores are located on the countryside and their customers prefer the personal contact with grocers so in the case of the retail stores this is not very relevant (no potential).** For wholesale on the other side AI is the big future. Kastner already incorporated AI algorithms in their web shop, that recommend products based on previous purchases and additionally creates shopping lists with products that a

restaurant for example always uses. **Personalization along the customer journey, is also a big trend for Mr. Kastner in the future. According to his opinion we can personalize everything and make shopping just much more convenient. The implementation of personalized promotions is not too difficult you just need to analyse the data and thus make recommendations with technological support (potential). But a very big potential Kastner sees is in the analytical part. Since grocers collect lots of data from customers, companies can really leverage from that information and make decisions based on this (potential). The implementation of AI and all is very expensive at first but in the long run it pays off if you can retain customers through this and increase their loyalty (goal).** Kastner has some very interesting things in their pipeline, like AR features and different kinds of shopping list creations but unfortunately those trends are more focussed on wholesale.

Interview – Rainer Neuwirth, 05.04.2022 – Expert B

Key trends in retail are mostly driven through digitalization and new technologies (trend). In Mr. Neuwirth's opinion those trends **affect a lot the consumer behaviour (trend)** and how customers can benefit from it. But also, at the same time retailers can leverage from those technologies, and this is an exciting topic, **to increase their revenue (trend, opportunity/relevance)**. On the customer side not only the behaviour changes but also the way a customer comes to a decision, through different ways of product search and information collection. **Retailers realized they can make big revenues online as well and therefore need to establish online presence to get customers into the store (opportunity/relevance)**. Additionally, a customer comes "more prepared" into the store as he/she collects more information and knows more about products and services which makes comparability easier for a customer. Also, **AR, AI, ML, big data, automated payment stuff and personalization are trends (trend)** for Neuwirth.

Omnichannel

Omnichannel is not only a trend, but also probably the thing a customer expects from a retailer (opportunity/relevance). There are like 4 levels of sales channels, social channel, multichannel, cross-channel and omnichannel and the grocery industry in Austria for example is on the leap towards cross-channel. **Meaning physical stores started to establish online presence but the channels are not communicating together which is immensely important for a well-functioning omnichannel strategy (challenges)**. A reason why this is not working well in Austrian grocery stores, is that the technology employed is not made for this seamless experience yet. Those retailers use product management systems that are individual systems for each department, and they do not communicate with each other. Thus, the Austrian grocery industry lacks a bit behind the big omnichannel trend. **Setting up an omnichannel strategy is doable but so far only a few big players successfully implemented it (challenges)**. It not only requires enterprise resource planning systems, but it also requires cashier/payment systems and CRM systems and this is quite expensive. According to Mr. **Neuwirth omnichannel only has advantages for the customer**. **One disadvantage which comes to mind is data privacy, since EU regulations are very strict, and this might be another challenge (disadvantage)**. Looking at the company's side, implementing an omnichannel comes with a lot of challenges as the customer is in the centre of operations and has several touchpoints with the company. **Despite big investments and a perfect coordination within the departments the biggest challenge for a company is the culture and thereby change management. An omnichannel strategy requires complete changes in the organizations structure and the will and courage to follow this strategy (challenges).** Additionally, clear guidelines, well thought through structures and consistency across all departments. For example, sales processes need be

changed and there cannot be a differentiation between online and offline or regional boundaries. Every person inside a company needs to be part of it. With clear guidelines it is doable for a company.

Omnichannel and AI alongside customer journey

When looking omnichannel and AI or other technologies alongside the customer journey there are a lot of opportunities. Personalization, AI, and AR are big players. At Mr Neuwirth's university they research new ways how to make an online shop even more convenient with AR or sensorics. Especially for food, there are research teams that test if electromagnets can transmit taste to a customer**. If we look at a store now it is for everyone the same, no matter the age, sex etc. It is already common that online store architectures are suited to one's preferences. I get previously bought products and discounts, new offers or offers I might be interested in. What has not changed so far is the architecture of the store itself. There is lots of potential in in-store architecture (alternatives).** There are digital price tags on shelves, and special offers on screens for customers inside the store but why not personalize the in-store architecture. Imagine a store knows I have a gluten allergy. **A store which is equipped with sensors and cameras tracks my moves and can light up products in red that contain gluten for example (alternatives). Shopping in the future has to be fast and simple, and those personalization features enable it (goal)**. Biggest key word is personalization. But from a company's perspective controlling is also a huge buzzword. Since a **retailer can collect many datapoints from consumers they can forecast the demand for certain products and with historic data offer personalized offers to interested customers (potential).** There are still a few in-store technologies in the market but at the same time a few got removed again. **Here it is important to know your customer base, are my consumers innovators and early adopters, meaning do they like to play with technology or are my consumers more into a personal contact with store staff (goal)**. Nevertheless, technologies like cashier free checkouts and so, will come in the long run since technology is always more and more working towards this direction. Mr. Neuwirth believes that personalization and the use cases that involve a more personalized experience will boom because even if a customer does not use it a customer comes to the store. **Important to remember is the customer base a grocer is facing and then can decide where to upgrade (goal).**

myProduc.at uses ML technologies in their product ordering, meaning their entire process is automated. It only gets reviewed by a person, but the rest is automated. One thing Mr. Neuwirth mentioned regarding the new customer journey, according to him "click-and-collect" has no future in the grocery industry. According to him, if someone already orders online, why would I want to pick it up myself, I rather have it delivered. In other stores like IKEA, it has more potential.

Pre-purchase is a huge topic. All the information I can give a customer before entering the store is huge. There are great ML and AI models already at the market that send the right information to customers and somehow know which customer could be interested in this or not. Hence, the decision process for a customer to walk into a store or not can be supported through ML algorithms. Implementation of such technologies is not easy again. **Same here goes for omnichannel challenges as mentioned before, the needed data has to be consistent across all touchpoints, like prices, pictures, product information and many more and ultimately, I need the data rights for it (challenges).** In the purchase phase it is about information delivery either through a smart phone or screens. And the checkout process sooner or later is a huge factor to boost convenience. **Overall, the customer journey becomes bigger, not just walking into the store, buying, and leaving, the whole pre-purchase and post-purchase phase becomes**

more important (goal). To close our discussion, one use case which has very little potential is click-and-collect. **When you already can order online and have it delivered, why should I leave my place to go pick some groceries up in the store? (no potential)**

Interview – Maximilian Reiter, 05.04.2022 – Expert C

There are a lot of industry trends regarding sustainability of products and assortment but also sustainability in retail industry itself, from architecture, energy and mostly logistic topics there are lots of trends towards this direction. More concrete though, according to Mr. Reiter there is a **big trend towards electronic price tags on shelfs, meaning dynamic pricing and pricing products more individual (trend)** since technology is capable of this and it is more affordable for companies today. And most certainly the trend towards omnichannel is immense. The trend exists since a couple of years already, however, it is a big challenge to implement all this, and this is a reason why it is not this present in the grocery industry right now. **As a result of this trend is the trend towards online shopping and everything that comes with it from ordering, delivery, click-and-collect pickup etc (trend)**. With the technology there are also trends and **AI is probably a huge force, for forecasting sales, orders and availability (trend)**. This supports the grocer enormous and secures future success.

Omnichannel

Generally speaking, one big advantage omnichannel offers is a grocer can enrich the assortment (advantage). A grocer can beyond the assortment in a physical store increase the assortment when being online but also the customer base can increase since a customer from a different city for instance can shop in the online store and gets it delivered. Additionally, **if a supermarket offers a seamless and good omnichannel a company can retain more customers compared to a company that has a no or only a weak omnichannel (opportunity/relevance)**. It offers way more flexibility to customers. Furthermore, it gives companies the **opportunity to advertise someone online, who would never walk into my store (opportunity/relevance)**. And **the market and customer base get bigger for me (advantage)**. On the other hand, a disadvantage for an omnichannel is its complexity. For a grocer who has different branches and different warehouses it more **complex to implement omnichannel compared to a grocer with only one warehouse (disadvantage)**. If someone orders something online from a central warehouse it simple to commission goods but if you have warehouses at the store and the availability varies between the warehouses the logistical process behind is complex. **Especially for the food industry the logistical process behind it is complex since you work with perishable goods. Where do I prepare the orders? How do I handle returns? What are prices? When to add delivery fees? What happens with returned products? Can I sell them in a store? Those are all obstacles that make the omnichannel approach this challenging for grocers (challenges)**. For example, when implementing only a "lite" version of omnichannel where a customers have the option for click and collect and not more than it would be easier to implement. **But a real seamless omnichannel experience is much more complex and harder to implement for grocers (disadvantage)**. **"The holy grail" for a omnichannel customer journey is seamless that it works constantly across all touchpoints. Mr. Reiter knows not a lot of companies where this perfectly works (challenges).**

Omnichannel and AI alongside customer journey

AI, big data, and all this is a key technology for the future and its potential is huge. A small example which would benefit a grocer a lot is forecasting. With ML algorithm a company can forecast the availability of products in the shelves or in warehouses. This can be used to counteract running out of stock on desired products or ordering too much of unwanted products. And this also has sustainability advantages. Demand-driven ordering is a sustainability driver. For the customer perspective Mr. Reiter sees personalization as a huge driver for future convenience. Personalization of offers, prices etc in dependence of someone's location. **This is where omnichannel can show its strengths in combination with AI. Based on historic purchases it possible to get personalized offers and similar things but the app could also collect motion data. The app detects that you are close to a store and based on previous purchases it knows you could want some beer. Therefore, the app sends you a push notification, with a beer offer and gives you directions to the nearest store. This one example for a AI driven feature which boosts convenience (alternative). There are lots of other in-store features some with potential others with no potential. In Mr. Reiter's opinion in-store navigation probably has no big future potential since a grocer wants to customers to browse through the store and occasionally buy products they never buy (no potential)** Augmented shopping cart (having a shopping list on the shopping cart or a customer connects to shopping cart and gets offers displayed) and things like this have potential **but unfortunately the EU data privacy regulations have put a strong damper on the whole thing (disadvantage)**. And oftentimes those things were not very practical in his opinion. As soon as a customer needed to download an app is often unattractive. **Obviously, one thing which boosts convenience is a faster checkout, but this depends on the area a grocer operates. And the technology used there is highly advanced and is right now not affordable for companies (potential/no potential).**

Lastly, Mr. Reiter recommended not to use an app, instead of a web-application. Because customer is inclined not to download lots of apps since people have lots of apps on their phone. The willingness to download goes towards 0 and it is also easier to develop and is more resistant against different OS-systems.

Interview – Dennis Grimm, 06.04.2022 -Expert D

The current trends according to Mr. Grimm are alternative proteins, alternative diary meaning mostly plant-based food alternatives. Another trend is the societal view on sustainability in the food industry. Either when shopping for groceries but also in the preparation of food. **Another major trend is how food, or the product reaches its customers. We saw it with Gorillas and Flink during and even before the pandemic, there was a big acceptance for a new way of grocery shopping (trend)** and getting products delivered thus delivery or online grocery is a big player for the future. Especially, the younger generation has a different view on these trends and are major drivers for their future growth. Lastly, the digitalisation of the food supply chain is becoming more and more important. Society itself again is a driver for this trend, since the technology exists so consumers are more or less familiar with it and secondly, consumers want to know more about the products origin and ingredients.

Omnichannel

For example, if we look at the German market, Flink is a rapid grocery delivery company but is backed by REWE. Lidl and Aldi also have their online store already**. So, there is a trend towards omnichannel, no doubt but right now those established companies struggle a bit (trend)**. Lidl and Aldi for **instance struggle with their fresh products when selling them**

online and will probably have to rely on start-ups which operate 100% online (challenges). Additionally, in his personal opinion, there will be consolidation of online grocery delivery companies in the German speaking market and **mostly established companies profit from investing in start-ups, joint ventures (advantages)** or building their own organisation inside their company. **A reason why they struggle is the innovators dilemma (challenges).** Online shops are present since some years and customers accept it, thus the need is here. Management missed the trend a bit, huge corporations work slowly, and digitalization took time. Furthermore, target customers always went into the store. So, a roadblock and a reason why REWE, etc. are not there yet is because they missed the innovation. **COVID-19 pushed the industry towards a new direction and with lockdowns after other consumers started to stay at home and have the food delivered (trend)**. Therefore, without the pandemic the trend would not be this huge and those grocers would not need to play catch up. **Looking at the business model of Gorillas, there are so many challenges and obstacles to offering same day delivery, having a flawless supply chain, how many drivers do you need, how to structure warehouses all those things were doable for a company like Gorillas but for established brands completely reshaping their structure and processes takes time, money and resources. Impossible for a big group (challenges).**

Omnichannel and AI alongside customer journey

Alongside the customer journey there are already interesting technologies. **The personalization trend for promotions exists since decades (potential).** We know it in the concept of payback cards where grocers tried to collect information about customers, and they get bonus points for some purchases. And grocers track movements inside a store and stuff, but the acceptance of those attempts was not that big. For a grocer's perspective there is a nice AI based technology which collects data from warehouses and stores and can predict how a typical Monday in Berlin looks like. Meaning it can predict how full certain shelves need to be based on historic data. This makes it easier for grocers to forecast how many products in each store are needed. **The only issue is data protection (disadvantage).** Probably in German those technologies will not find place in grocery stores yet but in "dark stores" from Gorillas it is already a functioning technology. **Cahier-free checkout has lots of potential for sure, but according to Mr. Grimm it is too early. Some people are used to waiting in line and still prefer personal contact with cashiers (no potential). Personalization and individualization are especially in the generation Z a big trend. Younger people want everything to be more individualized and make their shopping more unique (potential)**. What Mr. Grimm sees through personalization is another possibility. Since a store only offers personalization for customers they can operate in a smaller store. Meaning the store itself is smaller and offers basic products and products which are offered to certain customers. Stores in certain areas are smaller and do not offer every product of every brand. They offer smaller assortments but additionally also products the grocer offers to customer. Of course, the personalization needs to be done broadly to many customers in this area, otherwise it's not rentable but this way of shopping can be doable. Those pop-up stores are probably inside a city and there is the adoption rate bigger and more profitable.

Interview Maxime Delacour, 26.04.2020 – Expert E

Every market is on a different stage when it comes to omnichannel, online or e-commerce. **Digitalization is the main trend in the grocery industry. Omnichannel and online are getting more attention from grocers (trend)**. But bigger trend is sustainability in lots of different aspects it's a massive topic. Sustainability is driving decisions when grocers are transforming

the model it has to be sustainable and data and technology can help supporting that, in improving supply chain, in building stores, when you do delivery AI can help with that. **Actually, what is interesting is the physical in grocery retail is still highly important. It accounts for 90-95% of sales in Europe. Even if online is growing rapidly, it is about how to make the store more efficient, more sustainable. In data and technology what is highly important is increasing efficiency and the customer experience, they are linked together (trend).** How do you ensure to use tech that will help staff and retailers to save time and spend more time on customer service. How can you maximise portability for stores, there are also technologies that support grocers with that. The sustainability one is overarching and its longer and looks how grocers can benefit from new implementations in the long run. **We believe data and technology is a key enabler for the future of retail (trend)**. Everything is dictating by data as it helps you understanding faster what your shopper, or your store seeks.

Omnichannel

What retailers are doing in the future is forming partnerships with start-ups for example. As they witness that some things they cannot do alone as a company so basically, they partner with digital specific companies. Some grocery giants have their own incubators that support them to make such transitions to e-commerce (advantage). **Omnichannel is important because of the evolution of the retail industry (relevance/opportunity).** Basically, the store is still important, but people are spending more time online. **Creating that environment to have a seamless ecosystem to move between different channels, either its online or the supermarket is more common. (opportunity/relevance) The biggest challenge though retailers are facing, is to create a consistency across channels (challenge).** Even Tesco offer already omnichannel, but it is still not consistent. What is shaping omnichannel is the consumer behaviour and the shopping habits, we are moving towards more online but how is it connected to the physical store. **Additionally, what we experience is that in omnichannel the physical store remains at the heart of that, and it will be an enabler for online (goals).** Like it will prepare the order for example. **Most grocers are following that trend but you need to have robust online or e-commerce systems. But it adds cost as you are investing in new channels (challenge). Its adding cost at the moment (challenge)** The difficulty for retailers at the moment is to have that robust set of data, because data is at the heart of it. Lots of retailers are still not there in terms of data like Aldi. **You need to change the model which is a massive job. They used to be very simple organisations and now need to rethink the model, change the culture adapt to new processes. It is a lengthy and costly process for those companies to go through (challenge).**

Definitely a huge advantage for omnichannel is that shoppers spend more on online shopping and in-store rather than just shopping in stores. (advantage) Because they grab the shopper at more touchpoints so you will increase the portion to sell them something, not only once but maybe three or four times. You have more touchpoints which results in more opportunities to sell (opportunity/relevance). It creates sort of a good quality service to the customer. **It is a good way to attract customers and retain them because you deliver a service that is very unique. (opportunity/relevance) From a sales point of view, once you have it sorted out it adds more value and its profitable. (advantage) Data security and privacy can be a hurdle for grocers in the future yes, as you need a good legal department to make sure that everything complies with regulations, so it adds costs again (disadvantage)**. It is a hurdle and again will add a layer of complexity.

The omnichannel customer journey is a more complex and less logical. You can start in various direction and don't necessary complete the purchase. You start online, put everything in a cart but then go to the store and open an app again and buy in the store. (disadvantage) The customer journey map displays it very good the complexity that awaits grocers.

Omnichannel and AI alongside customer journey

From a trend point of view there two points that improve the omnichannel customer journey. What can you do to be more efficient and how to improve the experience. Competition is getting tougher and online or grocery e-commerce is not profitable, especially home delivery, click and collect is roughly square. **AI here can help to improve stock monitoring and forecasting (goal)**. Also in customer support, through chat robots which already exist but for sure can be improved. Biggest thing where AI helps is to tailor offers. **As a customer you want a personalized experience and offer. You don't want a voucher or coupon for a stake if you're vegetarian (potential).** So, AI is at the moment powering that. Pulling a massive amount of data from shoppers is helpful to feed AI algorithms and to make offers even better. But for that data is decisive. It's a transition of how to make it more efficient and for a shopper its better experience.

First of all, those things need to be easy. If it far too complex no one will use it, it's too much trouble. Especially, if you do something as easy as grocery shopping you don't want to use your brain a lot (goal). In-store navigation is probably something nice to have. We are not sure if this is necessary, especially for your local store since you know where everything is stored (no potential). **Yes, the cashier free checkout at stores is accelerating again and again and this is powered by AI. So, this is very complex though but for sure we'll see it in the future (potential).** A great alternative to this is also from Amazon. **You have the gates at the entrance like in every other Amazon Go store, but you can also shop for groceries if you don't have a smartphone or no Amazon account. It basically works like every supermarket but for those who want to have all the technology they can use it (alternative)**. **Click and collect can have a future especially you transfer the cost of delivery to the user (potential).** If you look at the UK and France those are the biggest online markets in Europe. But two different models. UK has home delivery and the majority of France's online sales come through click and collect. There is cultural history behind it as well as the population density. It is profitable as they will not lose money with that, and it is more flexible for customers. **You cannot generalize it and say in 5 years grocery stores are like this or that. It depends on the operating market. In the UK some technologies might be implemented in 3 years but in Spain for example it could take 7 to 10 years. So, it depends on the market but also the technology involved. Like easy checkouts can be here in 2 years (horizon).**

Interview Michael Lamm, 02.05.2022 – Expert F

There are currently lots of trends in food retail. First of all, from a category managers perspective there are different trends regarding dietary supplements, vegan products and ethnic food trends in terms of product ranges. Like some manufacturers expand product ranges to be more sustainable, healthier (vegan), etc. **But also, the convenience aspect becomes more attention. Convenience in two ways, in the way of products, like more healthy ready meals that do not require lots of preparation time, and convenience whilst shopping in a grocery store (trend). But also, everything regarding online delivery became more and more important "thanks" to the pandemic. So, there is also a big shift, maybe not this huge in western Austria but in general yes (trend).**

Omnichannel

Exactly, omnichannel becomes also more important with the trend towards more online as mentioned before. **It is important because consumers have less and less time for shopping. (opportunity/relevance)** A customer does not spend as much time in physical stores compared to the past. There are probably several reasons for it, and one is for sure that consumers buy products they are very familiar with online, especially non-fresh products. The local supermarket has the strength to sell fresh products, like fruits and vegetables at the store. This is also because consumers like to buy such products with their eyes, meaning before buying tomatoes online, I rather touch, feel and see them with my eyes. **This is currently also a struggle for the set up of online stores since fruits and vegetables do not have very long shelf life (disadvantage).** Omnichannel overall has lots of advantages**. A big one is definitely that more potential buyers can be addressed. On the on hand typical consumers that shop online, probably more present in metropolitan areas and cities. But also, on the other hand regular consumers that are typically not familiar with computers and online (advantage)**. **Disadvantage though is once a customer was disappointed with his/her order, the online purchase can quickly shift to a different retailer, discontinuation of online orders, or an extreme amount of work is required by the retailer to fix it (disadvantage).** The online process is also very complex. **The logistical process behind this operation needs to be flawless (challenge).** This obviously adds costs for the retailer since a certain portion of processes needs to be adapted. Also, a delay in delivery results again in poor customer satisfaction. Since we operate a lot in rural areas this is a difficult and challenging process and requires lots of resources.

Well as already briefly discussed before, omnichannel has lots of challenges in the logistical part (challenges). **Especially, in the food industry it is difficult to not generate too much waste. Specific products, I call them now uncomplicated products like, soft drinks, or cleaning material get shopped online quite frequently but for fresh products people like to go to the store (challenges). For a company it requires lots of changes in the internal processes and structure. To get every department onboard is challenging (challenge)**. Sometimes the demand for some products is higher in online stores compared to the physical store. Finding the correct balance is tough. Small errors creep in quickly and finding them is difficult. Additionally, since MPREIS is operating not only in urban areas but also rural areas, we require a minimum order value and sometimes consumers are not willing to pay for it. As of right now, online delivery is for us not profitable.

Omnichannel and AI alongside customer journey

The customer journey in the future will change 100%. We experience it already with the trend towards more online presence. **A consumer simply has more ways to connect with us and the other way round. We can tailor offers for a them and they give us information on what to promote (goals).** This will also be crucial in the future since without data we cannot really make the systems and the technology work. **I believe personalization is getting more and more important, we see it in cities but for us it is a step-by-step process to have everything up and running. (potential) In my opinion the demand for click-and-collect will decrease more and more. Once the online delivery option works well, people rather prefer this than picking everything up at the store. (no potential) Regarding other aspects I am not an expert on this but based on the uses cases I am sure self-checkout is the biggest keyword in the future. (potential)** The technology is complex yes but the benefit from is huge. For us

in Austria it may take a while since our customer base is smaller compared to Germany for example but in the future even in the cities in western Austria, we will see cashier free check-outs.

Regarding the time frame it is hard to say. **For MPREIS probably 4 years to have more online presence and to really have things worked out (horizon).**

Interview Thomas Schwartz, 05.05.2022 – Expert G

The industry is experiencing many different trends. A bigger one that we as manufacturers experience is the trend towards vegetarian or vegan products. Furthermore, consumers value regional products more and more, whereby many consumers do not like to pay the surcharge. **Apart from trends that just affect food itself is the trend towards online sales and the delivery. However, lots of people are still struggling with the implementation (trend)**. Not only on the company's side, but also on the consumer side. I still want to choose my fruits and vegetables myself and not let someone pick them for me. **Overall, the shift towards online is a trend that cannot be stopped in the long run. Those are trends which in one way or another affect as manufacturers (trend).**

We as a company have not dealt with it in detail since we are solely producers of specific products. **From our position, maybe there are certain fields where it truly makes sense but since we do not sell directly to consumers it makes not this much sense (opportunity/relevance)**. Additionally, for the purposes of omnichannel our company is probably too small, and we do not have the brand awareness yet**. On the manufacturers side, it requires a company that is willing to invest money and to see the outcome, whether it is profitable or not and how can we coordinate the processes (challenges)**. As of now, I don't see omnichannel. It might come but how strongly we as manufacturers are affected by it is again out of our scope.

I believe that people who did not grow up with technology are more likely to stick to their shopping habits and will probably not adapt new trends. However, younger generation who is faced with all those technologies, more less on a daily basis is more likely to adapt to it (potential).

Selling customer data, we acquired ourselves to retailers is in my opinion not happening anytime soon. Retailers for example, already have a much bigger customer base so I don't how much we could contribute to it (no potential). For example, we were in contact with Amazon a few years ago to sell our products via their platform. Amazon didn't even consider selling our products since the number of products we tried to sell was simply too small.

If we would consider implementing something to show more online presence, we would need an additional department which would solely focus on establishing a great experience for consumers (disadvantage). But at the same time retailers would not be happy if we would sell directly to end consumers. Theoretically speaking it would be an interesting approach but practically it would not make sense from a producer's perspective.

If the trend develops towards the omnichannel, I believe that retailers itself are the drivers for us producers (goals). They would tell us that their systems are developed like this and that and therefore your packing, product size, etc. needs to be like this in order to work with our processes. **To conclude here, I guess that we must adapt to the retailers claims. Moreover, in my opinion it is difficult to make something like this work on the manufacturers side**

in the food industry (potential). There is no culture of recension/feedback. For Adidas for instance, it would make total sense. An end consumer can buy shoes online via their store and in another stage, Adidas can sell customer data about certain shoe preferences to different retailers who sell the shoes then either in-store or online. Those products are high interest products. Groceries are low interest products and consumers do not identify themselves strongly with groceries.

Regarding time horizon, I believe some use cases like online shopping are already in place. However, they are not frequently used. Overall, it is hard to put a number on this. Let's say it like this, if we look at the mobile phone market it took this one game changer product/service/business model that really transformed the market. **I believe if it would be possible to create something like a game changer business model for grocery delivery, where companies do not have to go through a lot to have online presence and sync processes then the adoption rate would be very high (goals).**

Interview Wander Hoolboom, 10.05.2022 – Expert H

The grocery retailing market in Europe is quickly changing and evolving with consumers wanting more convenience and a world of ultra-convenience. **Therefore, I see a strong trend towards creating more convenience for consumers while they are shopping (trend)**. Additionally, with that we have seen new business models emerging like online shopping but also thinks like quick commerce, with the rise of players like Gorillas, Flink and Get-ir. Thus, **I also see a strong trend in online shopping (trend). Most retail industries already implemented some sort of online stores and I believe the resent pandemic showed that it is possible for grocers to implement online retail for groceries (trend).**

Omnichannel

For retailers to defend their position in the market, one next step for them will be to invest in an excellence omnichannel experience to basically improve the whole customer experience (opportunity/relevance). As I mentioned before, consumers seek for more convenience and omnichannel for instance is a way to deliver more convenience (advantage). Additionally, the grocery industry is an industry which cannot waive physical stores. It is not like in other industries where you can be successful without it. People still want to see, feel, and touch things. That is why according to my opinion omnichannel is a key trend in grocery retail since it combines both worlds and brings lots of advantages. **One advantage I see, and I believe in today's digital world it is crucial, is the opportunity to collect lots of information on consumers (advantage).** And I believe this gives lots of potential to grocers. **We experienced it while working on our recent project, it was astonishing how well you can benefit from technology if you have lots of different data points (potential)**. **Another advantage is that I can address more people and enrich my customer base (advantage).**

On the other hand, omnichannel brings some disadvantages with it. **As far as I know, setting up new sales channels always comes with hurdles (disadvantage). The difficulty of aligning all internal processes to take full advantage of all the features of an online order is difficult (challenges).** Secondly, having the stock always up to date online and in-store is difficult. That is why also the internal communication is immensely important. Imagine a retailer

has several shops and several warehouses, spread around the country, the job of having everything aligned is rough. But again, I believe this is a challenge grocers need to face to really be successful and defend their position in the market.

Omnichannel and AI alongside customer journey

I mean if we now investigate today's world, the US retailers appear to be a bit ahead, but we also see European grocers starting to implement omnichannel use cases. I believe companies can highly benefit from AI technologies. **For instance, collecting more information on customers, I can better predict their shopping behaviour and combine this with other external variables like weather (goal). Secondly, due to the high amount of data points I can train specific algorithms to better forecast demand and use the data to personalize prices and offers (potential)**. In my opinion grocers can leverage a lot of AI technologies and especially in the supply chain. But there are also different use cases for consumers. Use cases that improve the convenience level on the customers side are huge. I know for example Walmart and Amazon are pioneers in the US. Amazon has their super smart retail stores, and the stores are equipped with lots of technologies which is amazing for consumers. **But I also experienced different loyalty programs which are all linked to an app. A customer gets unique and special discounts depending on previous purchases displayed on their mobile phone (goal).** Another use case I just recently read something about, is from Mark-and-Spencer's. **They created with AR some kind of in-store navigation app where it guides you to a desired product. I think this is a cool and very novel feature, but the question is, is it necessary? (no potential).** I always go to my local store for groceries and would never use this feature. Like mentioned in the beginning, online shopping and everything that comes with it is increasing convenience. **I guess a grocer can combine specific technologies together which are all linked to an app and thereby increase convenience (alternative)**. **For sure, a major convenience booster is cashier-free checkout (potential).** There is a lot of technology involved and super complicated, but this is the future.

The customer journey, once omnichannel is implemented will be different, I am certain. **Comparing the customer journey to other industries I believe that we are more engaged along the shopping process (goals).** We know that the algorithms work and deliver promising stuff, so once a grocer implements personalization for instance, the customer journey changes. **We are way more connected with grocers and occasionally spend more time interacting with them. We spend more time browsing our phone and looking for offers**. So, I believe for us consumers it will not be much different, we just have more options to buy stuff. **However, for a grocer it is more complex to be consistent throughout the complete journey (challenge).**

For a grocer to grow the next 5 to 6 years are important (horizon). As everything keeps on developing and progressing a grocer needs to adapt to new technologies. So, it is critical for grocers to invest in this and build a leading position.

Appendix B – Survey

Appendix B1 – Survey questions

Question 1: Do you generally shop for groceries yourself?

Yes No

Question 2: How often do you shop for groceries in general?

Every day, Every second day, Once a week, Two times a week, Once every two weeks

Question 3: Where do you typically shop for groceries?

Please allocate 100 € across the channels listed below by typing in the respective amount.

Supermarket X

Online ordering X

Click-and-collect X

Question 4: Imagine that the future grocery store requires you to have an app from a supermarket chain installed on your phone to shop for groceries in a physical store. How many apps of different supermarket chains would you be willing to download?

1 App, 2-3 Apps, 3-4 Apps, more than 4 Apps, no Apps

Question 5: How important is convenience for you when going for groceries?

Convenience: Easy to find products, no long queues, comfortable shopping environment, simple shopping experience, etc.

Please use the slide bar below to indicate the level of importance.

Slide bar from 0 to 100

Question 6: Imagine a supermarket developed an app and incorporated several features. Please rate the attractiveness of the features below according to your own personal preferences.

	Very attractive	Relatively attractive	Indifferent	Relatively unattractive	Very unattractive
Online ordering and delivery/in-store pick up	o	o	o	o	o
Personalized promotions, offers & price	o	o	o	o	o
Automatic, individualized shopping list creation based on past purchases	o	o	o	o	o
App feature where you can drag items from an online shop to your shopping list	o	o	o	o	o
In-store navigation that guides you to the location of your desired products	o	o	o	o	o
Cashier-free checkouts ("just walk out"), no waiting in line, payments get done via an app	o	o	o	o	o

Question 7: Would you increase your shopping frequency at a given store, if the store would offer the features listed below?

	Extremely likely	Somewhat likely	Neither likely nor unlikely	Somewhat unlikely	Extremely unlikely
Online ordering and delivery/in-store pick up	o	o	o	o	o
Personalized promotions, offers & price	o	o	o	o	o
Automatic, individualized shopping list creation based on past purchases	o	o	o	o	o
App feature where you can drag items from an online shop to your shopping list	o	o	o	o	o
In-store navigation that guides you to the location of your desired products	o	o	o	o	o
Cashier-free checkouts ("just walk out"), no waiting in line, payments get done via an app	o	o	o	o	o

Question 8: Would you describe yourself as a loyal customer when going for groceries?

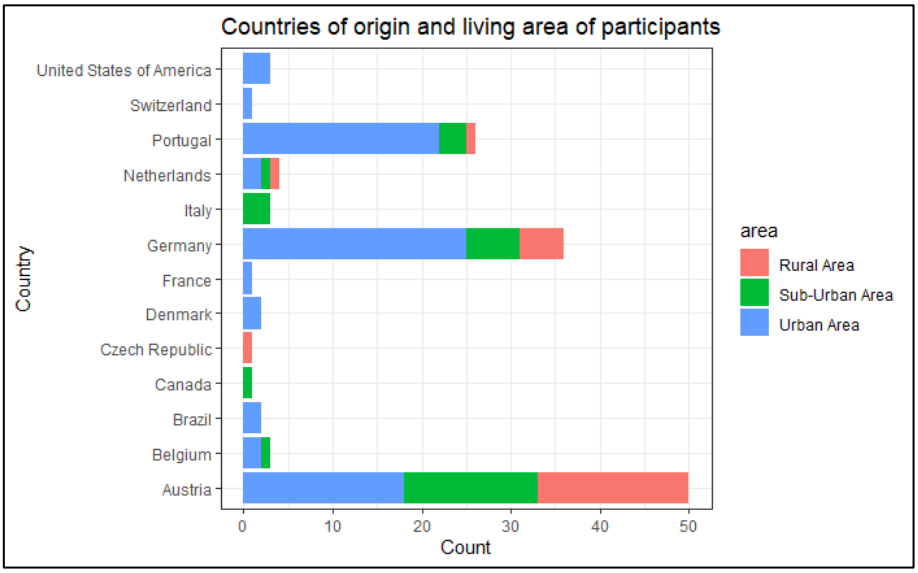
I do 20% of grocery shopping at the same place/brand

I do 40% of grocery shopping at the same place/brand

I do 60% of grocery shopping at the same place/brand

I do 80% or more of grocery shopping at the same place/brand

Appendix B2 – Countries of origin and living area



Appendix C – Analysis

Appendix C1 – Data overview

```
groc_shopping                  times     supermarket        online      click_collect                  apps
No :  5       Every day           : 9   Min.   : 10.00   Min.   : 0.00   Min.   : 0.000   1 App           :32
Yes:135       Every second day    :37   1st Qu.: 80.00   1st Qu.: 0.00   1st Qu.: 0.000   2 - 3 Apps      :76
              Once a week         :36   Median : 92.50   Median : 2.50   Median : 0.000   3 - 4 Apps      :13
              Once every two weeks:16   Mean   : 85.53   Mean   :10.84   Mean   : 3.636   more than 4 Apps: 2
              Two times a week    :42   3rd Qu.:100.00   3rd Qu.:20.00   3rd Qu.: 0.000   no Apps         :17
                                        Max.   :100.00   Max.   :60.00   Max.   :70.000

 convenience     attractive_f1   attractive_f2   attractive_f3   attractive_f4   attractive_f5   attractive_f6
Min.   : 10.00   Min.   :1.000   Min.   :1.000   Min.   :1.000   Min.   :1.000   Min.   :1.000   Min.   :1.000
1st Qu.: 65.75   1st Qu.:2.000   1st Qu.:1.000   1st Qu.:2.000   1st Qu.:2.000   1st Qu.:2.000   1st Qu.:1.000
Median : 77.00   Median :2.000   Median :2.000   Median :2.000   Median :3.000   Median :2.000   Median :1.000
Mean   : 72.89   Mean   :2.393   Mean   :2.293   Mean   :2.557   Mean   :2.657   Mean   :2.557   Mean   :1.743
3rd Qu.: 87.25   3rd Qu.:3.000   3rd Qu.:3.000   3rd Qu.:3.250   3rd Qu.:3.000   3rd Qu.:4.000   3rd Qu.:2.000
Max.   :100.00   Max.   :5.000   Max.   :5.000   Max.   :5.000   Max.   :5.000   Max.   :5.000   Max.   :5.000

 frequency_f1    frequency_f2    frequency_f3    frequency_f4    frequency_f5    frequency_f6       loyal
Min.   :1.000   Min.   :1.000   Min.   :1.000   Min.   :1.000   Min.   :1.000   Min.   :1.000   Min.   :1.000
1st Qu.:2.000   1st Qu.:1.000   1st Qu.:2.000   1st Qu.:2.000   1st Qu.:2.000   1st Qu.:1.000   1st Qu.:3.000
Median :2.000   Median :2.000   Median :2.000   Median :3.000   Median :2.000   Median :1.000   Median :3.000
Mean   :2.429   Mean   :2.336   Mean   :2.593   Mean   :2.779   Mean   :2.621   Mean   :1.786   Mean   :3.114
3rd Qu.:3.000   3rd Qu.:3.000   3rd Qu.:3.000   3rd Qu.:3.000   3rd Qu.:3.000   3rd Qu.:2.000   3rd Qu.:4.000
Max.   :5.000   Max.   :5.000   Max.   :5.000   Max.   :5.000   Max.   :5.000   Max.   :5.000   Max.   :4.000

             gender         age                    area          country
Female          :64   18 - 30 :88   Prefer not to say: 1   Austria    :54
Male            :75   31 - 50 :34   Rural Area       :25   Germany    :36
Prefer not to say: 1   51 - 70 :14   Sub-Urban Area   :32   Portugal   :27
                       above 70: 2   Urban Area       :82   Netherlands: 4
                       below 18: 2                          Belgium    : 3
                                                            Italy      : 3
                                                            (other)    :13
```

```
============================================================
Statistic      Mean  St. Dev. Min Pctl(25) Median Pctl(75) Max
------------------------------------------------------------
supermarket   85.585  18.819  10     80       90     100    100
online        10.867  14.111   0      0        5      20     60
click_collect  3.548  10.550   0      0        0       0     70
convenience   72.852  22.193  10   67.5       77    87.5    100
attractive_f1  2.370   1.125   1      2        2       3      5
attractive_f2  2.259   1.172   1      1        2       3      5
attractive_f3  2.526   1.202   1      2        2       3      5
attractive_f4  2.637   1.048   1      2        3       3      5
attractive_f5  2.541   1.196   1      2        2     3.5      5
attractive_f6  1.711   1.071   1      1        1       2      5
frequency_f1   2.400   1.173   1    1.5        2       3      5
frequency_f2   2.311   1.123   1      1        2       3      5
frequency_f3   2.563   1.090   1      2        2       3      5
frequency_f4   2.741   1.029   1      2        3       3      5
frequency_f5   2.607   1.059   1      2        2       3      5
frequency_f6   1.763   0.979   1      1        1       2      5
loyal          3.148   0.877   1      3        3       4      4
------------------------------------------------------------
```

Appendix C2 – Amount spent supermarket, online, click-and-collect

```
 supermarket        online      click_collect
Min.   : 10.00   Min.   : 0.00   Min.   : 0.000
1st Qu.: 80.00   1st Qu.: 0.00   1st Qu.: 0.000
Median : 92.50   Median : 2.50   Median : 0.000
Mean   : 85.53   Mean   :10.84   Mean   : 3.636
3rd Qu.:100.00   3rd Qu.:20.00   3rd Qu.: 0.000
Max.   :100.00   Max.   :60.00   Max.   :70.000
```

Appendix C3 – Regression model 1

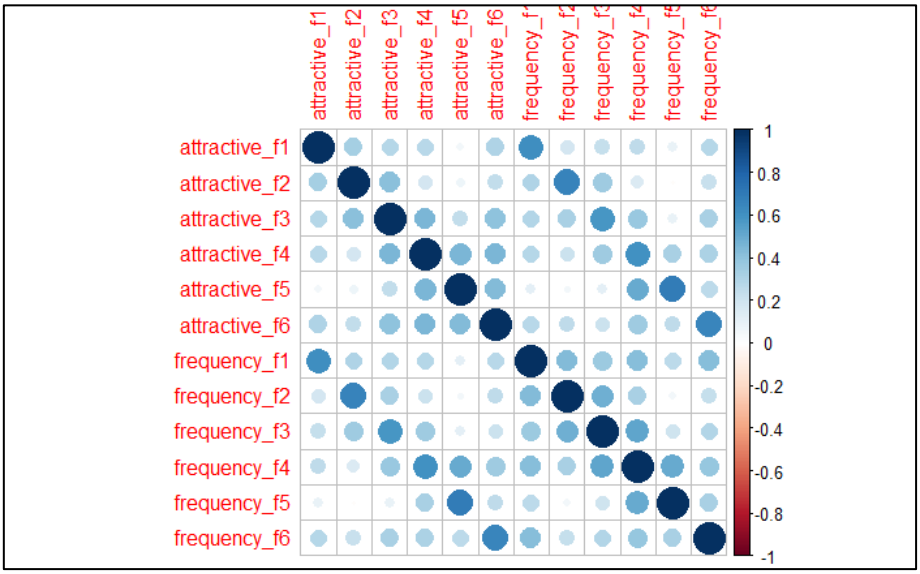
	Dependent variable:
	convenience
areaSub-Urban Area	-8.829
	(5.728)
areaUrban Area	4.254
	(5.179)
factor(age_2)1	-8.679**
	(4.095)
Constant	75.702***
	(5.035)
Observations	133
R2	0.117
Adjusted R2	0.096
Residual Std. Error	20.974 (df = 129)
F Statistic	5.697*** (df = 3; 129)
Note:	*p<0.1; **p<0.05; ***p<0.01

Appendix C4 - Contingency table of online/age and online/living area

	Prefer not to say	Rural Area	Sub-Urban Area	Urban Area
Extremely likely	0	5	6	23
Somewhat likely	0	11	8	27
Neither likely nor unlikely	0	4	9	17
Somewhat unlikely	0	3	5	6
Extremely unlikely	0	2	2	5

	18 - 30	31 - 50	51 - 70	above 70	below 18
Extremely likely	18	11	2	1	2
Somewhat likely	26	13	7	0	0
Neither likely nor unlikely	23	5	2	0	0
Somewhat unlikely	10	2	1	1	0
Extremely unlikely	5	2	2	0	0

Appendix C5 – Correlation matrix and table



		Attractiveness of use case					
		Online shopping	Personalization	Shopping list automation	Updating shopping list	In-store navigation	Cashier-free checkout
Increase shopping frequency	Online shopping	**0.61**	0.3	0.29	0.29	0.12	0.27
	Personalization	0.19	**0.67**	0.33	0.21	0.05	0.26
	Shopping list automation	0.23	0.35	**0.59**	0.35	0.12	0.22
	Updating shopping list	0.25	0.15	0.37	**0.61**	0.5	0.36
	In-store navigation	0.1	-0.02	0.1	0.32	**0.69**	0.26
	Cashier-free checkout	0.28	0.22	0.32	0.31	0.26	**0.66**

Appendix C6 – Fisher's exact test for personalization

```
        Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)

data:  pers_1
p-value = 0.2374
alternative hypothesis: two.sided


        Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)

data:  pers_2
p-value = 0.5697
alternative hypothesis: two.sided
```

Appendix C7 – Regression model 2

	Dependent variable:
	online
areaSub-Urban Area	-0.449
	(3.779)
areaUrban Area	7.195**
	(3.417)
factor(age_2)1	0.282
	(2.702)
Constant	6.808**
	(3.322)
Observations	133
R2	0.066
Adjusted R2	0.044
Residual Std. Error	13.838 (df = 129)
F Statistic	3.032** (df = 3; 129)
Note:	*p<0.1; **p<0.05; ***p<0.01

Appendix C8 – Fisher's exact test for online shopping

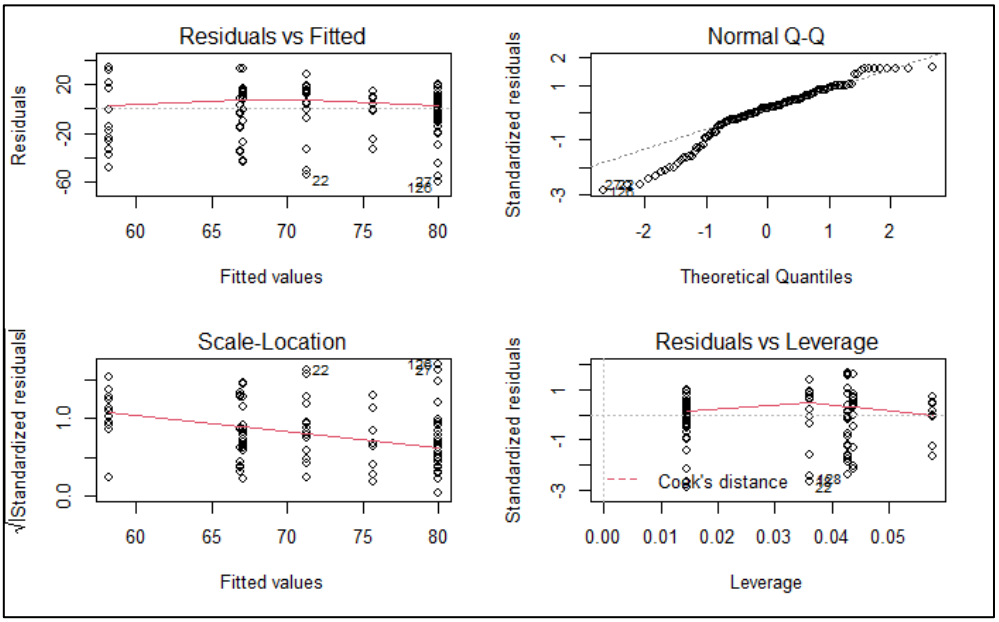
```
        Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)

data:  online_1
p-value = 0.7076
alternative hypothesis: two.sided


        Fisher's Exact Test for Count Data with simulated p-value (based on 2000 replicates)

data:  online_2
p-value = 0.3288
alternative hypothesis: two.sided
```

Appendix C9 – Assumption tests regression model 1



Assumption 1: Linearity of the data is violated, values are not linear distributed (Graph 1, top left)

Assumption 3: Residual Errors Have a Mean Value of Zero, which is violated (Graph 1)

Assumption 4: The residuals are not equally squared around the red line (Graph 3) meaning residuals do not have constant variance

Assumption 2: Predictors are independent and observed with negligible error (Graph 2, top right) – assumption is met here

```
lag Autocorrelation D-W Statistic p-value
  1       0.0691005      1.850005   0.366
Alternative hypothesis: rho != 0
```

H0: Errors are not auto correlated with themselves

P-value > 0.05 fail to reject meaning the independence assumption is correct

Assumption 5: Testing for heteroskedasticity

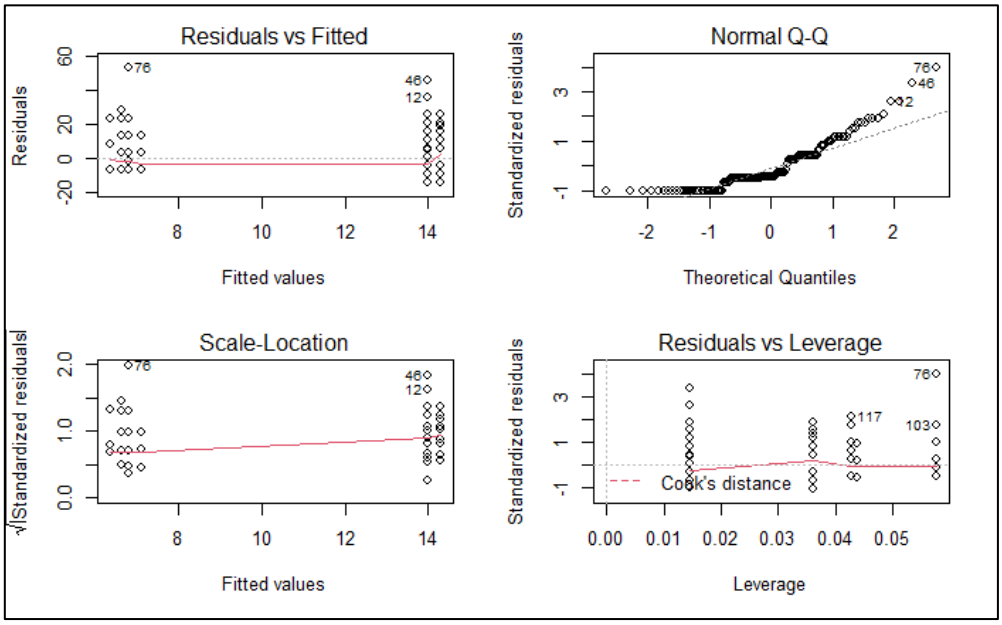
```
        studentized Breusch-Pagan test

data:  lm_8
BP = 9.3119, df = 3, p-value = 0.02542
```

H0: Heteroskedasticity is present

P-value < 0.05 – reject null hypothesis, meaning the data is homoscedastic

Appendix C10 – Assumption tests regression model 2



Assumption 1: Linearity of the data is violated, values are not linear distributed (Graph 1, top left)

Assumption 3: Residual Errors Have a Mean Value of Zero, which is violated (Graph 1)

Assumption 4: The residuals are not equally squared around the red line (Graph 3) meaning residuals do not have constant variance

Assumption 2: Predictors are independent and observed with negligible error (Graph 2, top right) – assumption is violated

```
 lag Autocorrelation D-W Statistic p-value
   1      -0.1809343          2.36   0.038
 Alternative hypothesis: rho != 0
```

H0: Errors are not auto correlated with themselves

P-value < 0.05 reject null hypothesis meaning errors are auto correlated

Assumption 5: Testing for heteroskedasticity

```
        studentized Breusch-Pagan test

data:  lm_3
BP = 3.3732, df = 3, p-value = 0.3376
```

H0: Heteroskedasticity is present

P-value > 0.05 – fail to reject null hypothesis, meaning the data is heteroskedastic

Appendix D – Discussion

Appendix D1 – Eisenhower matrix