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Delivering virtual value: The role of virtual value creation in e-grocery business models and resulting implications for today's grocery retail firms

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Dissertation written under the supervision of Prof. Peter V. Rajsingh with the collaboration of industry expert Prof. André Pinho

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Abstract

Title: Delivering virtual value: The role of virtual value creation in e-grocery business models and resulting implications for today's grocery retail firms

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Keywords: *Retail, Grocery, E-Grocery, Virtual Value Creation, Virtual Value Chain, Artificial Intelligence, Robotics, Machine Learning, Fast-Moving Consumer Goods*

In recent years, the e-commerce sector across industries has grown rapidly, with the e-grocery market yet to produce any clear winners. This was mainly due to high customer expectations and substantial commercial difficulties, making it very complicated to profitably serve the market. With the ongoing Covid-19 pandemic, the e-grocery field has experienced particular attention and growth. The UK's Ocado is regarded as an exception in the e-grocery sector due to its pioneering position in robotic automation and Artificial Intelligence (AI), its ongoing transformation to a global solutions business as well as extraordinary share performance, recently making it the most valuable grocer in the UK. To identify distinctive components of e-groceries along the value chain, customer expectations were discovered through surveys, after which commercial difficulties were identified using expert interviews. Further, the Ocado model was analyzed, which allowed to illustrate how it addresses expectations and difficulties by leveraging the virtual value chain (VVC). It became clear that Ocado achieves cost-decreasing and differentiation advantages by building a value matrix, enabling it to profitably serve the market. The study therefore lays out that virtual value creation is becoming an increasingly important component in grocery retailing. Subsequently, scenarios for uptake of VVC adoption among stakeholders in the retail sector were created. The outcome suggests that a business-as-usual scenario in VVC uptake is most likely. In this case, firms will ramp up their IT operating budgets by 2-5% p.a., responding to new realities in both physical and online retail.

Resumo

Title: Fornecer Valor Virtual: O papel da criação de valor virtual nos modelos de negócio de e-grocery e as implicações resultantes para as empresas retalhistas de mercearia de hoje

Author: Marc Bierganz

Keywords: *Retalho, Mercearia, E-Grocery, Criação de Valor Virtual, Cadeia de Valor Virtual, Intelligence Artificial, Robótica, Aprendizagem de Máquinas, Bens de Consumo de Movimento Rápido*

Nos últimos anos, o setor de comércio eletrónico cresceu rapidamente, embora a e-grocery ainda não tenha evidenciado nenhum vencedor claro. Isto deve-se maioritariamente às altas expectativas dos clientes aliadas a dificuldades comerciais, tornando complicado atender o mercado de forma lucrativa. Com o desenrolar da Covid 19, o setor de e-grocery tem recebido particular atenção e evidenciado crescimento. A Ocado UK é considerada excecional na indústria de comércio eletrónico devido à sua posição pioneira em automação robótica e inteligência artificial (IA) e pela sua contínua transformação num negócio de soluções globais, tornando-a recentemente a mercearia mais valiosa do Reino Unido. De forma a identificar os distintos componentes de e-grocery na sua cadeia de valor, as expectativas dos clientes foram primeiro determinadas através de inquéritos, sendo posteriormente identificadas possíveis dificuldades comerciais através de entrevistas com especialistas. Além disso, o modelo Ocado foi analisado, com um foco na forma como aborda as expectativas e dificuldades de utilização da cadeia de valor virtual (VVC). Como resultado, o estudo conclui que a criação de valor virtual se está a tornar um componente cada vez mais importante na comercialização de alimentos, sendo então gerados cenários para a aceitação do uso do VVC pelas partes interessadas no setor. O resultado indica que o mais provável é um cenário de adoção na lógica de negócios como o habitual. Neste caso, as empresas aumentarão os seus orçamentos operacionais de TI em 2 a 5% ao ano, em resposta às novas realidades.

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List of abbreviations

AI	Artificial Intelligence
BM	Business Model
CAC	Customer Acquisition Cost
CAGR	Compound Annual Growth Rate
CEO	Chief Executive Officer
CFC	Customer Fulfillment Center
CIA	Central Intelligence Agency
CLV	Customer Lifetime Value
CTR	Click-Through Rate
EBITDA	Earnings before Interest, Tax, Depreciation, and Amortization
ERP	Enterprise Resource Planning
FIFO	First-In, First-Out
FMCG	Fast Moving Consumer Goods
GDP	Gross Domestic Product
GPS	Global Positioning System
HBS	Harvard Business School
ICT	Information & Communication Technology
IT	Information Technology
ML	Machine Learning
MOV	Minimum Order Value
MS	Microsoft
NASA	National Aeronautics and Space Administration
PLC	Public limited company
POC	Proof of concept
PVC	Physical value chain
RBV	Resource-based view
SKU	Stock-keeping unit
SQL	Structured Query Language
UK	United Kingdom
US	United States of America
USP	Unique Selling Proposition
VVC	Virtual Value Chain

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1 Introduction

In most countries, the grocery retail industry is highly centralized. In Germany, four major players – Edeka (with a market share of 24.3%), Rewe (17.8%), the Schwarz Group (16.4%), and Aldi (Süd and Nord with 11.7%) – account for 70.2% of grocery sales (Nielsen, 2020). In the UK, a country with comparable demographics, the top three grocers account for 56.2% of overall grocery revenues (Kantar, 2020).

Despite the massive size of the grocery market, online sales are still relatively low compared to online sales in other retail sectors. For example, worldwide online fashion retail sales accounted for 27% in 2018 and were projected to rise to 36% by 2022 (Meena, 2018). Yet grocery e-commerce represented only 3.4% of grocery sales in 2019 (Mercatus, 2020). The US's Streamline, Webvan, and Homegrocer are among dozens of players which have tried to be e-grocery pure-plays but failed for various reasons. Nevertheless, there is evidence that there is demand for online groceries. Whereas apparel is bought online by 50% of US citizens, this figure is only 8% for groceries, but at the same time 53% of them have stated that they would shop groceries online with fewer hassles (Jensen, 2018).

Ocado is an up-and-coming pure-play online grocer from the UK that seems to be going against the trend. It has managed to establish a profitable grocery delivery business using integrated technology in all parts of its value chain (Jensen, 2018). Ocado's proof of concept (POC) has gained further traction by selling the "Ocado Smart Platform" (OSP) system to grocers in Europe, Asia, North America, and Oceania (Jensen, 2018). The POC[1] suggests a breakthrough business model, leveraging technology to overcome previous hurdles and creating a digital e-grocery system that works.

In view of upcoming changes, the present study investigates the role of virtual value creation in e-grocery business models and its implications for industry stakeholders in a four-stage analysis. First, customer expectations, commercial hurdles, patterns, similarities, and differences among e-grocers representing the business model are analyzed by way of a literature review, customer surveys, and semi-structured expert interviews. In particular, surveys are used to deductively analyze customer attitudes towards key aspects of grocery e-commerce, while semi-structured expert interviews are used for an inductive analysis of commercial barriers to grocery e-commerce. The literature review points to theoretical findings, disruptors, and the latest, up-to-date retail research. Based on the above, the following first research question is investigated: *"What are core elements of the e-commerce grocery business model that entrants have tried with limited success?" (RQ1)*

[1] All abbreviations are explained in the list of abbreviations

Second, the extent to which Ocado solves problems that caused other e-grocers to fail is investigated through an in-depth analysis of company information. This analysis answers the second research question: *"How is Ocado's tech-driven model different from earlier iterations?" (RQ2)*

Third, a virtual value chain (VVC) analysis is applied to the Ocado model, which ultimately allows for answering a third research question: *"To what extent is the Ocado model enriched by virtual value creation?" (RQ3)*

Finally, the fourth research question reflects upon whether the VVC, as adopted by Ocado, is a potential source of core transformations in the e-grocery field in general: *"What level of virtual value creation can be anticipated among grocery firms and what is the resulting impact for the industry's structure?" (RQ4)* This question is answered in a discussion of all previous findings.

After answering the research questions, the discussion section incorporates both a critical examination of the results and what they mean to the overall industry. Finally, the limitations of the methodology, data sources, and overall approach are mentioned to contextualize the study.

This study adds value to research on the grocery retail industry, identifying key components of strategic change in this commercial area. On an academic level, the thesis advances understanding of technology and innovation in retail. Furthermore, the findings can be used by executives to promote innovation in companies and for making investment decisions. A holistic overview is provided through scenario analysis on primary stakeholders (e-grocery pure-players, wholesalers, small-and medium-sized retailers, and fast-moving consumer goods (FMCG) brands), secondary stakeholders (customers and suppliers), and influencers (legislators and technological advancement). Aspects of this thesis may further be transferrable to other retail sectors seeking to bring about technological disruption.

2 Literature review

This literature review examines the history, changes, and peculiarities of the grocery retail industry. It aims to explain the development of retail up to the present day, with particular emphasis on how novel e-commerce schemes create value in the sector.

2.1 Investigation of the (e-)grocery retail industry

2.1.1 The development of grocery retail to date

The history of food retail goes back over 1000 years, when food was one of the commodities traded on markets. In the centuries that followed, there were several eras of food retail (Stanton, 2018). Retailers date back to the "corner store era," when many small stores popped up to directly supply specific neighborhoods. The small stores carried only a few items procured from wholesalers. These stores did not offer fresh goods, which were handled by butchers, fishmongers, and bakeries, and were called "dry grocers" (Stanton, 2018). Dry grocers were the backbone of retailing until the mid-1800s when the chain store era began, a transition based on the greater bargaining power achieved through cooperative bulk-purchasing arrangements (Stanton, 2018). A prominent example was the Great Atlantic and Pacific Tea Company, which operated under the brand "A&P" until 2015 (Abrams, 2015). In the same era, John Wanamaker coined the one-price system (Hollander, 1955). This approach cut buyers' bargaining power and increased the efficiency and comfort of clerks in stores (Tadajewski, 2009).

The next significant change was the self-service concept, which gave customers the freedom to take items themselves and, above all, necessitated the creation of differentiated brands to distinguish firms from the competition (Stanton, 2018). This interpretation corresponds to Park and Srinivasan (1994), who have argued that brands help customers make purchase decisions in increasingly clustered retail environments. Moreover, self-service spawned the impulse buying phenomenon (Stanton, 2018), a psychological characteristic constituting a powerful and consistent urge to buy something immediately (Rook, 1987). This soon accounted for up to 60% of purchases (Inman, 2004). Until 1947, the UK had just ten self-service shops in the entire country (Hamlett et al., 2008). This retail paradigm experienced rapid growth, due to its success with consumers (Regan, 1960), and forms the basis for today's supermarkets.

After 1960, the grocery sector experienced a significant move towards consolidation. For example, "the big four" (Tesco, Sainsbury's, Morrison's and Asda) dominated in the UK, while similar shifts were visible in other developed economies (Stanton, 2018). Emerging from the turbulent war years, the contentment era was considerably calmer. The period brought about

slotting (charging suppliers fees for product placement) and numerous other fees that still exist (Copple, 2002).

Another paradigm shift was the move away from these fee-based revenues. With this change, supermarkets began basing their revenue streams on margins from "selling food" instead of "buying food and charging fees." The German "hard discounter" Aldi is an excellent example of how a retailer creates economies of scale, buying at lower prices and passing on the savings to consumers (Brandes & Brandes, 2004). The shift was also accompanied by the introduction of store-owned labels, which cannibalized traditional approaches (Stanton, 2018). Increasing pressure also reflected the fact that non-food stores, including Walmart, began selling food. Other new store formats, such as the convenience store and the dollar store, aiming at novel niches, were predecessors of the prepared food era. Having previously looked for every customer "with a penny and a pulse," companies now had to develop a concrete unique selling proposition (USP) to survive.

The "online era" came next, including bricks-and-mortar, no-checkout stores (Polacco & Backes, 2018) and grocery deliveries ordered online (Goldman Sachs, 2020a). Consequently, the retail industry is again between two eras. The phenomenon can be explained with the concept of the s-curve, which describes the life cycle of technological innovations. There is slow progress at the beginning of a new technology, then an inflection point, after which there is exponential growth once a critical mass of adopters is achieved (Foster, 1986). The theory is illustrated in Figure 1, indicating the three phases of "incubation," "rapid growth," and "maturity."

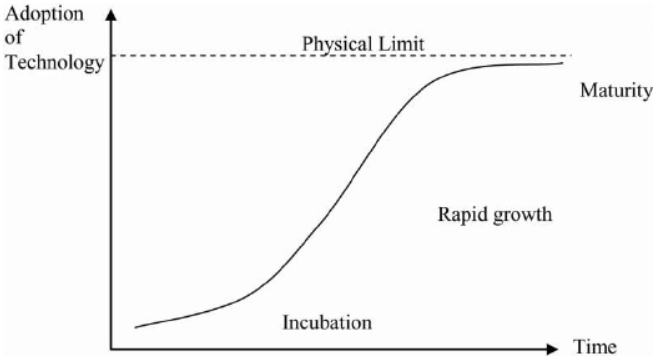

Figure 1 - The technology s-curve
(Source: Foster, 1986)

Foster (1986) has argued that an s-curve analysis can illustrate the magnitude of potential threats, suggesting when a possible attack on one's product may occur. This is also true for online grocery delivery, which is now attacking physical grocers' core business.

2.1.2 Socio-economic perspectives on the e-grocery market

In the past two decades, grocery retail has seen tremendous change throughout the world, with a rapidly increasing number of online grocery shoppers (Kureshi & Thomas, 2019). Chu et al. (2010) and Gupta and Kim (2010) have argued that online grocery retailing provides distinct distribution benefits: greater accessibility, greater convenience, and time-saving. Melis et al. (2016) found that lack of physical proximity to stores and time constraints caused consumers to switch from offline to online grocery shopping. Kapferer & Bastien (2009) have proposed that grocery shopping connotes taste, prosperity, and lifestyle. Miller (1998) claimed that consumer perceptions of their mundane tasks influenced how households procure groceries. Also, transformation at the household level, leading to the reframing of norms and promoting changes in consumption practices (de Kervenoael et al., 2013; Jackson et al., 2006), is regarded as a critical driver. Online grocery shopping was initially more appealing to the young and time-constrained population, who found shopping via smartphone convenient (Sinha et al., 2015). Also, pre-purchase behavior online was a determinant of the volume of grocery purchases (de Kervenoael et al., 2013). Finally, van Droogenbroeck and van Hove (2017) found that single-person households used grocery shopping as a social event, compared to households with more adults with full-time jobs.

E-grocery is a highly attractive market, characterized by large sales volumes, regular shopping patterns, and strong underlying growth (Mason, 2019). However, given the many "pure-play" online grocery start-ups going out of business (Delaney-Klinger et al., 2003), the sector represents severe challenges for profitability. Even Amazon Fresh, the e-commerce giant's grocery delivery division, is far from profitable in specific markets it has entered (Meck, 2019). Many established grocery retailers have also struggled to adapt thoroughly. Their online logistics solutions around in-store picking (Jensen, 2018) appear as mostly defensive moves that seek to avoid heavy upfront investment. Furthermore, the online business cannibalizes their traditional store businesses. Also, grocery retail companies tend to be large and publicly traded (Kantar, 2020; Nielsen, 2020), which makes them susceptible to the innovator's dilemma (Christensen, 1997). It describes how incumbents cater customers' current needs until the end of the product's s-curve and at some point cannot keep up with new entrants' disruptive innovations.

Vanelslander et al. (2013, p. 243) have argued: "Although e-commerce has been multiplying as a sales channel for the past decade, reaching and maintaining profitability has sometimes proven difficult. This is especially true for the segment of the sales of online grocery items." Boyer and

Hult (2005, p. 658) have stated that "the biggest question for future research involves the profitability of this channel."

Ocado Retail is an outlier in this regard. The online delivery supermarket of the Ocado Group turned a profit in 2011[2] (Jensen, 2018) which has continued to grow ever since. Goldman Sachs (2020b) reported earnings before interest, tax, depreciation and amortization (EBITDA) of €35 million in fiscal year (FY) 2019 and projected growth to €113 million in 2021 in view of continuing tailwinds from the Covid-19 pandemic. Whereas growth estimates were not precisely met due to capacity constraints, Ocado still reported a pre-exceptional EBITDA of £73.1 million[3], with "Retail" and "UK Solutions & Logistics" as the main sources of income.[4]

2.2 Sources of value creation in e-businesses

In the following, different views on value creation are discussed in the context of e-business and grocery retail. In this course, both strategic management theory and novel notions on value creation are investigated.

2.2.1 Management theory on value creation

In the innovative field of e-grocery, *Schumpeterian innovation* (Schumpeter, 1942) is worth investigating. Schumpeter (1934) framed new goods or production methods, new markets, new supply sources, and reorganization of industries as sources of innovation. As Stanton (2018) has argued, new supply sources and markets explain developments such as consolidation, and thus, value creation in the retail industry to date.

Furthermore, technological innovation is a major driver of retail's "migration to e-commerce" (Goldman Sachs (2020a). Introducing the notion of "creative destruction," Schumpeter (1942) argued that certain rents become available to entrepreneurs following technological change. These "Schumpeterian rents" only decline when innovations become established in economic life (Schumpeter, 1942). Innovative e-retailers are capturing these Schumpeterian rents[5] today. Furthermore, Schumpeter's theory, where innovation is the source of value creation, also applies to offline retail. New store layouts and the subsequent advent of impulse buying, with

[2] EBITDA which most accurately reflects earnings from ongoing business activity, thus represents profitability here

[3] Appendix 1: Ocado Group Consolidated Income Statement 2020

[4] Appendix 2: Disaggregation of 2020 Ocado Group Revenues

[5] Appendix 3: 5Y stock performance of Amazon, Alibaba, and Ocado vs. the S&P 500 Index

corresponding spikes in revenues, constitute a prominent example from the past (Stanton, 2018; Inman et al., 2014).

Nevertheless, Schumpeterian innovation does not exhaustively explain value creation in (e-)retailing. Amit & Zott (2001) have argued that virtual markets broaden the notion of innovation by extending firm and industry boundaries, fostering new forms of collaboration, and involving new exchange mechanisms and unique transaction methods. From this point of view, innovation is a catalyst rather than the single source for value creation.

The resource-based view (RBV) sees the firm as a bundle of resources and capabilities. Thus, various researchers have stated that gathering unique combinations of complementary and specialized resources and capabilities may lead to value creation (Barney, 1991; Penrose, 1959; Peteraf, 1993; Wernerfelt, 1984). This view holds for the retail sector in many respects. For Walmart, a company that has created substantial shareholder value for decades, logistics information systems and the "ability to develop and operate units at the right locations" (Walton, 2020, p.9) are notable complementary assets. As an extension to the RBV, Teece et al. (1997) have stated that dynamic capabilities (coordination, integration, reconfiguration, and transformation process) enable firms to create and capture Schumpeterian rents.

While it explains a substantial portion of physical retail, the RBV is hardly able to fully explain value creation in e-grocery. In e-businesses, value-creating processes are subject to increased value migration reducing the sustainability of newly created value. The migration is due to higher mobility among information-based resources and capabilities (R&C). Also, virtual markets offer alternatives to the control or ownership of R&C (Amit & Zott, 2001). By contrast, Dierickx and Cool (1989) have found that time compression diseconomies[6] are a significant barrier to the imitation of R&C. Thus, the RBV perhaps does not fully explain value-creation mechanisms in e-grocery.

Strategic networks are defined as stable inter-organizational ties which are strategically important to participating firms. They may take forms such as strategic alliances, joint ventures, or long-term buyer-supplier partnerships. Strategic networks enable access to information, markets, and technologies (Gulati et al., 2000). They furthermore offer the potential to share risks, generate economies of scale and scope (Katz & Shapiro, 1985; Shapiro & Varian, 1999), share knowledge, and facilitate learning (Anand & Khanna, 2000; J. H. Dyer & Singh, 1998; J. Dyer & Nobeoka, 2000). For retailing, strategic networks have always been of great

[6] When time allowed to develop a competence shortens, the cost of developing the competence will increase exponentially.

importance, considering the impact of purchasing cooperatives on the early retailer landscape (Stanton, 2018).

Despite the relevance of the network perspective for understanding e-business, for example, proposing scalability advantages, it may not fully explain how e-businesses enabling transactions in new and unique ways create value. According to Amit and Zott (2001), strategic network theory and the formal tools provided by network analysis (e.g., notions of network density, centrality, and network externalities) only partially explain the value creation potential of a company with an innovative transaction method. At this point, ride-hailing services such as Uber serve as an example. For instance, they generate part of their value through network-based economies of scale (affordable access to a vast number of drivers) and risk-sharing (low marginal cost for the employment of new drivers). Yet, the nature of transactions and the way users' pain points are systematically addressed (Cramer & Krueger, 2016) appear to account for a larger portion of value creation. Thus, the literature indicates that virtual markets, with their unprecedented reach, connectivity, and low-cost information processing power, open entirely new possibilities for value creation.

Transaction cost economics hence addresses the question why firms internalize transactions that might otherwise be conducted in markets (Coase, 1937). Grocery retailers essentially are intermediaries, as they act to improve the efficiency of the exchange process, providing time, place, and possession utilities (Alderson, & Clewett, 1954). A transaction is where one stage of activity terminates and another begins. Williamson identified transaction efficiency as a major source of value, adding that reputation, trust, and transactional experience can lower the cost of idiosyncratic exchanges (Williamson, 1979, 1983). Since one of the main effects of transacting over the internet, or in any highly networked environment, is the reduction in transaction costs it engenders (Dyer, 1997), the transaction cost approach informs the understanding of value creation in e-business. Furthermore, it is important to the retail industry as well, since low margins and severe competition call for high efficiency across firms' operations.

Nevertheless, a focus on cost minimization by single parties would neglect the interdependence between exchange parties and joint value maximization (Zajac & Olsen, 1993). That being said, value in e-business is not solely attributable to efficiency. For instance, Bain & Company (2019) has suggested that value in retailing is also based on product differentiation and customer experience.

Porter's (1985) *value chain framework* is the best-known theory that explains sources of value creation and describes five primary activities: inbound logistics, operations, outbound logistics,

marketing and sales, and service. Differentiation along every step of the value chain is a source of value. It is generated through activities resulting in products and services that lower buyers' costs or raise buyers' performance (Amit & Zott, 2001). This understanding is particularly applicable to the retail sector, which has to pay special attention to differentiation, not least in marketing and sales activities (Stanton, 2018). With regard to the context of e-business, Porter & Millar (1985) have suggested that information technology creates value by supporting such differentiation strategies. Stabell & Fjeldstad (1998) have argued that the value chain model is more suitable for analyzing production and manufacturing firms. Amit & Zott (2001) have supported this view by stating that the main transactions of e-businesses involve processing information flows.

Sviokla & Rayport (1995) proposed a virtual value chain, in addition to the physical value chain (PVC), that includes a sequence of gathering, organizing, selecting, synthesizing, and distributing information. The VVC is regarded as a suitable analytical tool for this study, given that it better corresponds to the realities of virtual markets (Amit & Zott, 2001).

2.2.2 Fundamentals of e-business models

To start, new information and communication technologies (Dubosson-Torbay et al., 2002; Timmers, 1998) are framed as the antecedents of e-commerce BMs. This idea is reflected among today's e-grocery businesses, which are only made possible by information and communications technology (ICT) such as broadband connectivity, global position systems (GPS) and digital devices.

Pricing systems (Tapscott et al., 2000) and revenue mechanisms (Rappa, 2001) are deemed the instruments business models (BMs) employ to influence outcomes. This understanding is by no means outdated, as the future "everything-as-a-service" economy is visible in an increasing number of industries (Goldman Sachs, 2019). In addition to offering products as a service (Cusumano et al., 2006), new pricing mechanisms are also used in the classic service sector to influence outcomes. E-scooter rentals are current examples, offering weekly or monthly mobility passes in addition to single bookings (Lime, 2019), thus fueling customer lock-in.

In the past, e-business models already replaced their traditional predecessors several times. One example is Netflix, which rendered the stationary video store business obsolete with a subscription-based streaming service (CNNBusiness, 2020). The foregoing examples confirm the potential of e-business models to influence industry structures (Applegate, 2001; McPhillips & Merlo, 2008), rules of competition (Applegate, 2001; Tapscott et al., 2000), and value capture (Clemons, 2009; Pauwels & Weiss, 2008).

Amit & Zott (2011), after further investigation of the field, proposed "sources of value creation in e-business." [7] The theory suggests transaction efficiency as one of the primary value drivers of e-business, which is consistent with transaction cost theory (Williamson, 1975, 1989, 1983). It further reinforces that the greater the transaction efficiency gains enabled by a particular e-business, the lower the costs, and hence the more valuable it will be.

Furthermore, providing complementary outputs to customers (Brandenburger & Nalebuff, 1996) is viewed as value-creating. Also, the model stresses lock-in as another critical value driver, given the extent to which customers are motivated to engage in repeat transactions and how strategic partners have incentives to maintain and improve their associations (Amit & Zott, 2001). Loyalty programs (Varian, 1999) and the option of creating virtual communities (Hagel & Armstrong, 1997) are among the levers that e-businesses can use to bind participants and thus create value. Whereas loyalty programs represent a mechanism to increase switching costs (Williamson, 1975), virtual communities leverage positive network externalities (Katz & Shapiro, 1985). Elevated switching costs are beneficial, since they ultimately improve customer lifetime value (CLV), an important metric in retailing (Kumar et al., 2006), which correlates with firm valuation (Berger et al., 2006).

Finally, novelty pertains to the value-creation potential of innovations articulated by Schumpeter (1934). For example, the first-mover advantages of e-business innovators (Lieberman & Montgomery, 1988) can drive value.

2.2.3 Value creation through optimized decision-making

Half of the decisions made in organizations fail, making failure far more prevalent than expected (Nutt, 2002). Therefore, Meyer et al. (2016) propose that it may seem logical to insist on decision-making that is solely based on facts. Yet, this is constrained by the fact that data are about the present and the past, while decisions are concerned with the (uncertain) future. For it to be useful, Meyer et al. (2016) propose that historical information should be translated, with judgment, into possible outcomes and their probabilities.

Practically, this use case suggests the employment of an enterprise resource planning (ERP) system or other means of technological support in decision-making. These systems are even more important in e-businesses, given the evidence of strong complementary effects between ERP and e-business technologies in creating business value (Hsu, 2013). Now, artificial

[7] Appendix 4: "Sources of value creation in e-business"

intelligence (AI), as a more multifaceted type of decision support system, is regarded as the "new runtime of a business" (Iansiti & Lakhani, 2020, p.2).

Artificial intelligence often refers to the automation of intelligent behavior, that is, human intelligence exhibited by machines (Negnevitsky, 2005). In the field of machine intelligence, Alan Turing and John von Neumann are deemed to be the most important representatives. Von Neumann contributed significantly to the field by proposing the von Neumann architecture[8] (von Neumann, 1945), stochastic computing (von Neumann, 1962) and, most importantly, the theory of self-reproducing automata (von Neumann, 1966). The latter is particularly important for AI as it is defined today, as it compares computing machines with the human nervous system. The Turing test, earlier named the imitation game (Turing, 1950), is an important landmark that questions the capacity of machines to imitate human behavior. The test is passed when a machine is able to appear human vis-á-vis humans asking a machine to perform a given task. It is further notable that computers were invented as an attempt to fully automate calculation (Swade, 2000), whereas Google and NASA now claim to have reached quantum supremacy (NASA, 2019). This indicates how AI experienced a significant paradigm shift to use cases of ever-increasing complexity.

New business value through AI is attainable on three dimensions. First, AI transforms human-machine relationships to free value-creating time for humans. Second, "intelligent automation of process change" will set the scene for the reimagination of business models and processes. Third, enhancing large data analytics, evolving algorithms with transactional data faster, and combining data in new ways will help firms to discover trends and attain deep insights (Accenture (2017)

Iansiti and Lakhani (2020) have suggested that AI-driven firms are able to eliminate traditional constraints. Ultimately, this enables the emergence of a completely different kind of firm, with data pipeline, algorithms, an experimentation platform for algorithm testing and infrastructure as key components to a "decision factory" at its core.

Machine learning (ML), a subset of AI, encompasses computational methods using experience to improve performance or to make accurate predictions (Chalup et al., 2007). The basic idea of ML is to predict future data and uncover patterns by developing accurate algorithms, models, and techniques (Mohri et al., 2018).

[8] Appendix 5: Simplified visualization of a von Neumann architecture

Sutton & Barto (2018) identified supervised learning, unsupervised learning, and reinforcement learning as the major fields of ML. In supervised learning, an algorithm uses training data and human feedback to learn the relationship between given inputs and outputs. In unsupervised learning, algorithms explore input data without being given an explicit output variable. In reinforcement learning (Matarić, 1997), an algorithm learns to perform tasks simply by trying to maximize the rewards it receives for its actions.

In the context of e-grocery, industrial robots can play a significant role. These types of robots include robotic arms and swarm robots (Alvarez et al., 2016). Robotic arms are mostly used for singular tasks such as grabbing, lifting, and drilling (Wongphati et al., 2012)[9] Swarm robotics is inspired by the observation of social insects and uses a novel approach for the coordination of large numbers of robots (Erol, 2005). As order fulfillment of all kinds (e.g., at Alibaba, Ocado, Amazon) includes vast numbers of products and their picking and packing, both robotics types can be employed in these areas.

[9] Appendix 6: Use cases of robotic arms

3 Methodology

In the present study, customer surveys (3.1), expert interviews (3.2), a VVC analysis (3.3), and a scenario analysis (3.4) were conducted to gain the required insights.

3.1 Surveys on customer expectations

3.1.1 Survey data collection

To study customer expectations with regard to grocery home deliveries, a survey was used for the deductive analysis. Hypotheses were derived from the existing literature for empirical testing. Determinants of customer expectations were inspired by the paper “Understanding shoppers' expectations of online grocery retail” (Wilson-Jeanselme & Reynolds, 2006). The authors had conducted a study to determine specific dimensions' value-add for individual players in the UK's online grocery market. The sample was taken from high-income profiles, suggesting a tendency towards high-margin products and services. It targeted women between 27 and 50 years as the main respondents. The discovered determinants (e.g., quality, delivery time reliability) remained the same, but for the present study, a broader sample was required. Also, the re-conducted survey covered more variables across the value chain.

The survey was designed to catch a broader range of expectations, that is, to learn what service quality the mass market expects, which is why the targeted audience was not significantly delimited. To obtain statistically significant outcomes, a total of 293 responses was captured.

3.1.2 Survey data analysis

After obtaining 293 responses, the data were first cleaned according to pre-defined key variables. Participants needed to be from the European continent, between 18 and 65 years of age, and pass the survey attention check. The age variable was of interest, since studies have suggested a significant drop in online purchases for consumers aged over 65 years (Coppola, 2017). The geographical scope was chosen, since the UK alone is an outlier in e-grocery shopping adoption, but is close to the European average in many respects, such as the GDP per capita (Eurostat, 2016) and population density (CIA World Factbook, 2020). A total of 31 participants was rejected because of the failed attention check and another five participants were filtered out because of their country of origin. Therefore, 253 valid responses remained.

Next, the descriptive statistics were determined, that is, the mean, median, minimum, and maximum for all tested dimensions. All categories (e.g., delivery time, reliability) were visualized using histograms, area charts, or other forms of illustration. To ensure consistency, all statistical analyses were run in RStudio and the findings were plotted using MS Excel.

3.2 Expert interviews on commercial difficulties

3.2.1 Interview data collection

Interviews are among the most common methods to obtain qualitative data. In less structured interviews, compared to highly structured surveys, the person being interviewed is more a participant in meaning making than a source from whom information is retrieved (DiCicco-Bloom & Crabtree, 2006) To obtain expert views on the commercial difficulties of grocery home deliveries, semi-structured interviews were employed.

Semi-structured interviews were initially organized around a range of predetermined open-ended questions. Other questions could emerge from the dialogue between the interviewer and the interviewees. The individual interview allowed for an in-depth assessment of an interviewee's social and personal features. In health care, this type of interview is employed to co-create meaning with interviewees (Mayring, 2000). To obtain a variety of opinions regarding the commercial challenges of grocery deliveries, the semi-structured interviews were conducted with experts from different areas. Expert opinions were obtained from delivery start-ups, traditional corporate grocers, general industry experts (e.g., retail consultants) and private equity firms funding retail companies. This allowed for a look at both similarities among them and individual views due to, for example, different backgrounds.

The interview participants were chosen based on their specialization, experience, and job positions within the retail industry. The interviewees were contacted via LinkedIn, eMail, or personal contacts. Due to the ongoing Covid-19 pandemic, all interviews were conducted online – either through Zoom, Microsoft Teams, or Google Hangouts. The interviews took between 30 and 90 minutes and were conducted both in German and English. All conversations were recorded with interviewees' permission and later transcribed and translated by the interviewer.

3.2.2 Interview data analysis

The main idea of qualitative content analysis is to preserve the advantages of quantitative content analysis and to transfer and further develop these to qualitative-interpretative steps of analysis (Becker & Lißmann, 1973). The object of this type of analysis can be any recorded communication, including transcripts of interviews. Yet content analysis only assesses the manifest content of the material. Krippendorff (1969) split the levels of qualitative content into the themes and main ideas of the text, that is, the primary content and context information, or the latent content. Krippendorff (1969, p. 103) has described content analysis as "the use of replicable and valid method for making specific inferences from text to other states or properties of its source."

The interview questionnaire was designed using inductive category development, as it was of central interest to develop categories as close as possible to the material. This in turn enabled the consistent formulation of the literature and analysis throughout the study.

After formulating a definition criterion based on the theoretical background and research question, the material was analyzed and categories were deduced. Using a feedback loop, these categories were revised, eventually reduced to main categories, and checked for reliability. Because the research question allows for the appraisal of quantitative aspects, for example, the frequency of coded categories could be analyzed.[10]

To interpret the results in quantitative steps of analysis, the findings were subjected to category intensity definitions. The definitions manifested certain levels of intensity for statements drawn from interviews.[11] For each level, a definition, an example, and certain coding rules were defined prior to conducting the interviews. This coding agenda, in line with Mayring (2000), later allowed for processing the interview findings using a frequency analysis of keywords, where keywords with higher intensity ratings received a higher weighting in the derived theory.

3.3 Virtual value chain analysis of Ocado

Initially, a comparison of several grocers was conducted to identify a suitable object of study. The literature review further indicated that the VVC (Figure 2) proposed by Sviokla & Rayport (1995) is more suitable for virtual markets (Amit & Zott, 2001) than Porter's (1985) value chain framework.

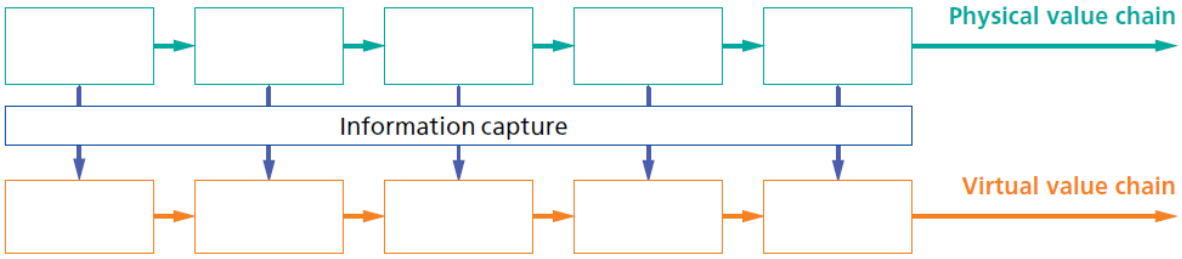

Figure 2 – The virtual value chain
(Source: Sviokla & Rayport, 1995)

"With an integrated information underlay in place, companies can begin to perform value-adding activities more efficiently and effectively through and with information." (Sviokla & Rayport, 1995, p.18) In other words, steps in the PVC are mirrored. Figure 3 illustrates how

[10] Appendix 7: Inductive category development for semi-structured interviews

[11] Appendix 8: Coding agenda

firms can create new markets and new relationships by applying the five generic, value-adding steps to each activity in the virtual value chain. (Sviokla & Rayport, 1995)

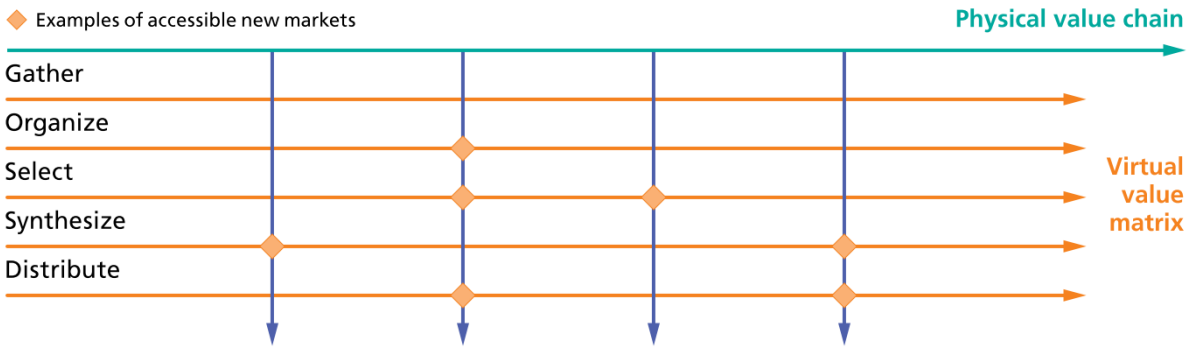

Figure 3 - New markets and relationships through a virtual value matrix
(Source: Sviokla & Rayport, 1995)

To investigate Ocado, the object of study, and compare it to businesses that have previously failed in e-grocery, all step of its PVC and VVC were analyzed.

3.4 Scenario analysis

Finally, all findings were consolidated to provide the context of the entire retail industry. Following Schoemaker (1995), scenario analysis was applied to depict the potential implications that arise in retailing. Scenario planning is useful due to "its ability to capture a whole range of possibilities in rich detail," enabling managers to "construct a series of scenarios that will help to compensate for the usual errors in decision-making – overconfidence and tunnel vision" (Schoemaker, 1995, p.25) Thus, evidence and insights from the literature, customers, businesses, industry experts, and the present study were combined into a holistic picture. This final assumption on "the future of retail" was depicted in a conservative, a business-as-usual, and an exponential scenario. Also, all scenarios and attached likelihoods were split into timely horizons of one to two years, five years, and 10 years.

4 Analysis

In the following sections, the difficulties of e-grocery are analyzed (4.1), exemplary solutions currently applied are outlined (4.2), and the role of the VVC is investigated (4.3) in this context.

4.1 Potential difficulties of grocery home deliveries

4.1.1 Investigation of customer expectations

A survey was created to discover customers' expectations regarding online grocery shopping. Of the 253 verified[12] participants, 159 (or 63%) were male, and 94 (or 37%) were female.[13][14] The average age of participants was 33.58 years, ranging from 18 to 64 years. The countries of residence among participants were France (30), the UK (177), Germany (36), the Netherlands (9), and Belgium (1).

Starting with *Pre-Sales*,[15] it can be said that online acceptance is given. This is reflected in the fact that 252 out of 253 participants have bought online and 226, or ~89%, have bought groceries online. To get people on board, free delivery offers (128), coupon value offers (49), convenience (19), and Covid-19 (16) were the most significant influences. In addition, the remaining 11% are "rather likely" to try e-grocery shopping.

In *Purchasing*, all customer expectations regarding the portfolio were laid out. Of the four categories "Ambient, non-fresh products," "Chilled products," "Frozen products," and "Ambient, fresh products," the average respondent requires finding 2.98 categories when ordering online, with relatively even demand distribution among the categories. Furthermore, the range of organics in the offering is at least "moderately important" for 79% or respondents, and still "rather" or "very important" for 45% of respondents. The survey suggests that the average respondent regards this variable as more than "moderately important." In terms of other assortment types, the survey found that 54% of respondents, if only offered a single option of potatoes, would be "somewhat dissatisfied" or "extremely dissatisfied." The same demanding picture is drawn in terms of preferred and expected milk types. Apart from the fact that six different milk types are "somewhat" demanded, the average respondent expects a 3.55 multiple

[12] Verification of participants is described in section 3.1.2

[13] Appendix 9-20: All demographic variables, visualized and statistically assessed

[14] Appendix 21: The e-grocery value chain

[15] Appendix 22-42: All visualizations and statistics for different phases of the value chain

of what they buy to be available for this category. Also, it is worth mentioning that only ~9% said it is "rather unlikely" or "very unlikely" that they would buy private labels.

In *Ordering*, the major question is how long people want to spend on the ordering interface (i.e., the app or website) and what, apart from assortment, they want to find there. Respondents on average expected to spend up to 26.29 minutes ordering on the app or website. Also, the necessity of having a "special offer" section, a "new products" section and a help-line number were tested. A "special offer" section seems to be by far the most important factor of the three for respondents, as 64% stated that it is either "rather important" or "very important."

In the *Fulfillment* stage, where goods are picked and packed in (dark-)stores or warehouses, there are no actual touchpoints with the customer, which is why it was skipped at this point. The next phase is the *Delivery* stage, where goods are taken to customers' homes. Here, the acceptable delivery time is the first major consideration. The survey revealed that respondents are on average willing to wait up to 34.54 h, slightly less than 1.5 days, for their deliveries. In addition, the average willingness to pay for the eventual delivery charge is €3.59, that is, no more than ~2.2% of Ocado's €160 average basket value. Furthermore, the average respondent assumes to be charged no fees from €29.58 of basket value. Respondents accept no more than 27.09 minutes of deviation from planned delivery times, which means tight windows for grocers to deliver goods to customers. Finally, emission-free delivery is regarded as "rather important" or "very important" by 40% of respondents.

In *After-Sales*, the key aspect of groceries is the perceived quality by the customer. It is noteworthy that, on average, respondents expect the quality of delivered groceries to be slightly higher than in the case of in-store purchases: 89% stated that they expect the quality to be the same or higher. This is surprising, given that 67% of consumers not buying online go to stores to ensure the quality of goods (Morgan Stanley, 2016). Accordingly, 65% of respondents stated they would "probably not" or "definitely not" be willing to accept lower quality caused by the delivery process.

In general, it is noteworthy that the willingness to pay for online deliveries compared to in-store purchases is almost equal (-0.055%), signifying that consumers do not want to pay a premium for savings in terms of time and effort. Also, 55% of respondents consider overall sustainability as "rather important" or "very important". In summary, high customer expectations were

discovered across the entire value chain[16], which elevates the performance pressure on e-grocery BMs.

4.1.2 Commercial barriers to e-grocery shopping

At this point, the commercial barriers to e-grocery BMs were identified in the expert interviews. For this purpose, 11 experts[17] from the retail industry were consulted and their insights were obtained using keyword analysis.

Generally, low margins, the price sensitivity of customers, high competition, the necessity for a wide assortment range and the latest influences of the Covid-19 pandemic are regarded as difficulties for both online and offline grocery retail. Regarding online-only grocery business, a lack of online capabilities, very difficult execution, new costs surrounding new business models, the need for very high productivity and the ongoing consolidation of information are challenging aspects for (e-)grocers.

In *Pre-Sales*, experts emphasized the challenging field of performance marketing (1),[18] which is also scalable only to a certain extent (1) and thus needs to be accompanied by other means of advertising (1) and proper brand and loyalty building (1).

In *Purchasing*, planning and forecasting (11) are by far the most challenging components, given the unclear and volatile future demand. The difficulty is increased by the extremely broad range of stock-keeping units (SKUs) (8) that need to be procured. Furthermore, there is a trade-off between the sufficient inventory for product availability (6) and the incentive to hold as little inventory as possible to avoid tying up capital (3). Along with price (2), quality (2), freshness (2), consistent operations (2), and differentiation of products (2), e-commerce requires a new commercial model (2) for purchasing, as slotting fees from stores are now placement fees for online interfaces that have to be negotiated with suppliers.

In *Ordering*, the emphasis is clearly on navigation and ease of use (18) to lead customers through their digital shopping journey. Coherent, smart suggestions (12) and proper visualization (9) for customers are regarded as inevitable to cope with the threatening lack of impulse purchases (8) known from offline stores, the need for time efficiency (3), and sufficiently large shopping cart value (5). Furthermore, the overall experience (6) of the

[16] Appendix 43: Summary of findings on customer expectations

[17] Appendix 44: List of interviewed experts

[18] Appendix 45: Summary of findings on commercial barriers; Numbers represent the frequencies insights were mentioned

ordering interface is deemed very relevant. Also, dynamic pricing (10) is a mechanism that must be implemented not only to capture consumer surplus, but also to ensure availability (4) through demand smoothing (Expert H; Expert K). In summary, this makes it imperative to deeply analyze interface requirements, which is a huge challenge, not least given the enormous range of SKUs (2).

In *Fulfillment*, the most challenging part is the proper use of IT and systems (13). In warehouses, many different systems are used and Expert K explained that a Rewe customer fulfillment center (CFC) uses up to seven IT systems in one location. While product quality (and freshness) (11) and (picking) efficiency (11) must be elevated as much as possible, execution cost (8) must be minimized at the same time. Coping with logistic waves (4) in the volatile grocery market becomes even more challenging when products from different temperature regimes (6) must be fulfilled. Also, the trade-off between availability (3) and inventory level (3) plays a role in the fulfillment phase. Another challenge after picking is the right packing (3) for customer satisfaction.

In *Delivery*, optimal packing or load optimization (11) is a central point of interest. Furthermore, experts have stressed the importance of the right staff (11) at the door, the last touchpoint in people's customer journey. To make the journey pleasant, not only the visibility and transparency (6) of the delivery process are important, but, also at this step, quality and freshness (6) must be maintained. With regard to the mentioned factors and extremely challenging economics (7), companies need to determine the most viable logistics model (5), depending on key factors such as customer density (5). Also, punctuality (5) and receiving (4) goods in the right way are important and must be fostered through route optimization (4), among other things.

In *After-Sales*, customer satisfaction (1) and loyalty programs (1) are the two challenging aspects. Recurring revenues are inevitable to make the business model profitable and Expert G built upon this by stating that "profitable customers must be identified and treated differently."

4.1.3 Reasons for the failure of e-grocery

Driven by high customer expectations, as discovered in section 4.1.1, and severe commercial barriers, as depicted in section 4.1.2, the first entrants in pure-play e-grocery were unsuccessful. Tim Steiner, CEO of UK-based Ocado, recalls that his founder team was horrified when looking at Webvan, which "had spent huge amounts of capital before seeing any sales to speak of" (Alvarez et al., 2016, p.1) Studies in Finland (LTT, 1995, 1997) found that households visit shops on average 4.6 times a week, spending a total of 200 hours or five work weeks per year

doing their grocery shopping. (Tanskanen et al., 2002, p. 170) thus postulated that "supermarket profits are based on the exploitation of working hours and transportation carried out by the customer." As illustrated in Figure 4, e-grocers are thus aiming at replacing stores with other means of storage and transportation.

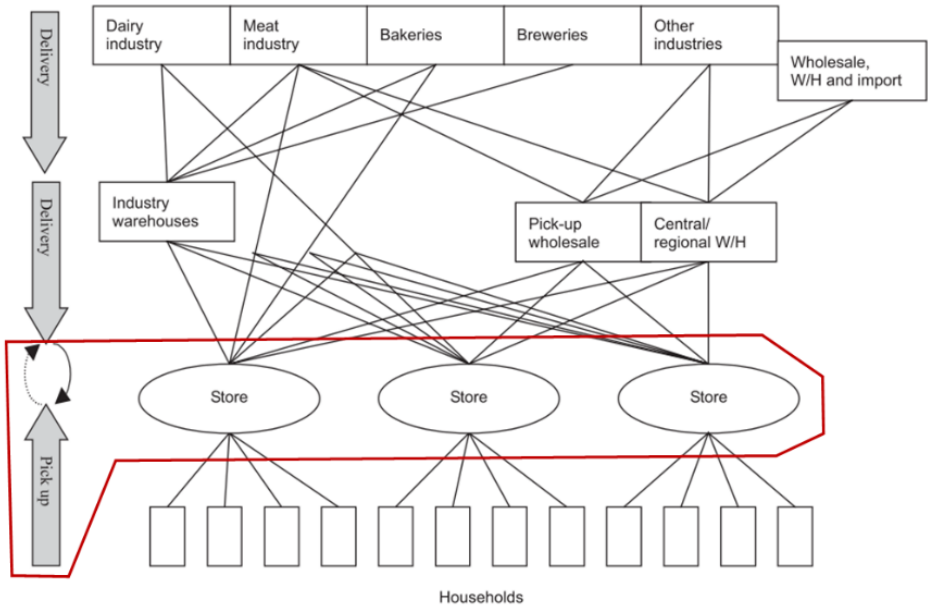

Figure 4 - Structure of the traditional grocery supply network & influence area of e-grocers
(Source: Tanskanen et al., 2002; own illustration)

Another problem in e-grocery is that new routines have to be established and even moderate charges for the service may remarkably slow down customers' willingness to shift to e-shopping. From the customer perspective, early e-grocers' approaches were still self-service, while their BMs did not sufficiently leverage technology advantages (Tanskanen et al., 2002).

For instance, shopping online was time-consuming and had to be repeated each time. Furthermore, customers needed to wait at home during short delivery windows to get their goods delivered. Streamline's reception box and "don't run out" services were measures taken against these difficulties. Yet, all such attempts were overshadowed by a lack of value-added services along e-grocers' value chains. Webvan, for instance, invested heavily in highly automated distribution centers, but lacked customer density which would have made these investments worthwhile. This lack of customers also made transportation very expensive. In retrospect, these problems spawned six actions necessary for setting up a successful e-grocery operation (Tanskanen et al., 2002).

First, it is important to have (1)[19] local customer density and later bring the working system to other densely populated areas. Otherwise, operational costs will be unbearable. Furthermore, (2) e-grocery is a loyalty business. With an estimated customer acquisition cost (CAC) of $50 to $200 (Sherman, 2000) and Webvan's $133 exemplary CAC, it is clear that occasional customers can never be profitable vis-à-vis typical gross margins of around $10 per purchase (Sherman, 2000). Thus, e-grocers were not able to systematically build and maintain trust by putting insufficient emphasis on a fast and high-quality customer response. This ultimately shrank customer retention rates. Also, (3) buying power is extremely important. Whereas large, established grocers can buy at very low cost, "starting from scratch will require a lot of capital, because the higher purchase prices at start-up volumes have to be subsidized" (Tanskanen et al., 2002, p.174). Entering the market without partnering or acquiring with a traditional retailer can be another common source of error. To commence, (4) the operational efficiency and service level are very important. Yet, efficiency does not solely depend on the density of drops, but also on the way deliveries are received and how costly the picking is. Also, (5) ordering interfaces and product information must facilitate product display and selection. If this is not the case, a great deal of value will be lost. Finally, (6) enlarging the range of products is also highly relevant. Companies that have integrated consumers to their systems by bringing daily groceries to their homes are in a great position for upselling or cross-selling (Tanskanen et al., 2002). In fact, these aspects also apply to physical retail to a great extent. Yet, in e-grocery, efficiency and service level (4) must also be achieved in new dimensions such as delivery and picking. Ordering interfaces and product information (5) must be entirely redesigned for a digital format.

In response to RQ1, it can thus be stated that high customer expectations (4.1.1) and commercial difficulties (4.1.2) across e-grocer value chains must be taken into consideration. Thus, earlier entrants' models were not sufficiently solving for the discovered requirements in the market.

4.2 Current approaches to e-grocery

4.2.1 Comparison of grocers in analyzed market(s)

During extensive research on case examples in the e-grocery sector, Ocado appeared to be the most promising company to create valuable findings. Table 1 illustrates how Ocado quantitatively outperforms the UK's three largest grocers in certain dimensions, recently

[19] Numbers in brackets illustrate the original source's logic of aspects

overtaking Tesco and becoming the most valuable grocer in the UK with a £21 billion market capitalizaion (Wood, 2020).

Table 1 - Extract of UK grocers' performance

	Tesco	Sainsbury's	ASDA	Ocado
Δ Market share FY17-20	-0.61%	-0.07%	-1.23%	0.5%
Δ Revenue FY17-20	21%	11%	4%	66%
Ø Online basket size	£76.3	£72.29	n/a	103.83
Stock Δ 01/17 – 01/20	29%	-24%	76%	406%
Stock Δ 01/20 – 01/21	-3%	13%	21%	128%

As the world's largest pure-play online grocer, Ocado is mentioned in numerous prestigious journals, (e.g., Alvarez et al., 2016; Iansiti & Lakhani, 2020), stressing its pioneering role in fulfillment automation and overarching AI adoption. Furthermore, its venture portfolio is comprised of players in vertical farming (JFC and Infinite Acres), 3D printing (Inkbit), automated meal preparation (Karakuri), and robotics (Haddington Dynamics, Inc. and Kindred Systems, Inc.) (Ocado, 2021e). Also, Ocado has developed into a solutions business, selling its approach to leading grocers across all continents, which proposes a certain level of maturity of its e-grocery solution. Finally, Tsikriktsis & Keller-Birrer (2010) have stressed its outstanding consumer ratings. In summary, these findings made a deeper investigation of the company appear most reasonable for the present study.

4.2.2 The Ocado model

Ocado was founded by three ex-Goldman Sachs bond traders in 2000 and launched in 2002 (Ocado, 2021f). The founders knew that the market was highly competitive and extremely hard to get into. Yet, by increasingly meeting and driving novel demand patterns, in 2014, Ocado was the largest pure-play online grocery retailer in the world, with £948.9 million in sales, an EBITDA of £71.9 million, and 8,500 employees. In addition, it was recognized as a world leader in the automation of online order fulfillment. In 2014, it served 453,000 active customers with more than 8.5 million deliveries, achieving 99.3% item accuracy and 95.3% on-time delivery. By 2020, its customer base had increased to a total of 680,000 active customers (Ocado, 2021e). After a spike in demand that was mainly driven by the Covid-19 pandemic, it has a list of 1 million additional users waiting to sign up (Butler, 2020).

In the previous section, expectations and difficulties were both mapped to six essential landmarks of the e-grocery value chain: Pre-Sales, Purchasing, Ordering, Fulfillment, Delivery, and After-Sales. The same logic is used for the assessment of Ocado.

In *Pre-Sales*, Ocado not only applies performance marketing through channels such as Instagram (Ocado, 2021f), but also seeks to closely connect with consumers through other ways of communication. Its brand name, drawing from "avocado," is unique, unused (Gibson, 2021) and conveys a sense of freshness throughout its marketing channels. It further ensures that it takes a position as the customer's responsible counterpart by providing recipes, vegan content, food waste prevention tips, and even launching a zero-food-waste challenge on social media (Ocado, 2021d). It also fosters direct exchange with consumers via cooking sessions and sponsored television brunches (Ocado, 2021c). Most importantly, though, it uses insights as to why consumers buy groceries online and, based on this, hands out deal vouchers or grants discounts for friend referrals (Alvarez et al., 2016). In this way, it leverages synergies of push and pull marketing.

In *Purchasing*, Ocado relied on a partnership with Waitrose to gain access to its mature supply chain. In turn, in the field of online retail, suppliers needed to operate more experimentally and secure listings on one of the "digital shopping aisles." Also, suppliers were challenged to reduce redundant packaging for in-store display, which often left them happy because they also benefited from cost savings. Furthermore, quality and the location of barcodes needed to be improved and Ocado had strict criteria for pallet dimensions to minimize the number of exceptions to be considered in automation efforts (Ocado, 2021i). Now, Ocado primarily leverages its end-to-end system. It allows the company not only to assign SKUs to every item type, but also brings unique identifiers to individual units, one level below SKU level. In this way, Ocado gains full transparency over its inventory levels. It can reduce its stock, and thus bound cash reserves, by running a perfect first-in, first-out (FIFO) system based on data (Jensen, 2018). This also ensures the freshness and quality of goods, as individual units can be matched with best-before dates. Ocado claims to have reduced its waste level to below 0.4% (Ocado, 2021l), compared to the 2–3% industry benchmark (Jensen, 2018). This not only saves costs and space, but also improves the company's overall sustainability. In addition, the highly automated warehouses require low levels of inventory to be worthwhile, but do not have the drawback of physical limits such as customer-facing shelf space, and thus offer unlimited scaling potential (Jensen, 2018).

The *Ordering* process at Ocado happens through its website or hand-held application. The company facilitates the process for new customers by giving them the option to import existing shopping lists from other retailers' websites (Alvarez et al., 2016). The ordering interface is highly optimized. In addition to intelligent searching, exclusive discounts for subscribers and a constant basket display optimizing the journey, Ocado offers comprehensive favorites-first

sorting and is able to display guaranteed product life (Alvarez et al., 2016; Jensen, 2018). The collection of customer data further enables Ocado to automatically create the regular shopping basket for customers, allowing users to check out within 60 seconds. A mobile ordering rate north of 48% (Alvarez et al., 2016), and voice ordering (Lomas, 2017) illustrate how Ocado leverages and optimizes new sales channels. Orders can be kept open until submission deadline if the list needs further editing. Before checkout, the web shop (website or app) "audits" a shopping list for a range of improvements: (1) Items normally bought but not included and which are on special deal, (2) items normally bought that Ocado estimates must be running low, (3) incomplete offers in the basket, for example, "two-for-one" offers where only one item has been ordered, (4) alternatives that are cheaper, (5) new products that might be of interest, and (6) offers of free products, perhaps paid for by manufacturers. In addition to "audits," Ocado employs personalized recommendations and individualized messaging based on user behavior, stage of purchase, and real-time intent signals. This historically led to an 8x increase in conversion rate, a 20% increase in baskets of more than £75 and a 54% boost in click-through rate (CTR) (Dynamic Yield, 2021).

Ocado.com offers the widest range of items, as >54,000 separate products are available. While the minimum order size is £40, the average customer spends £137 per order (Ocado, 2021e). Moreover, Ocado offers a scheme at ~£100 per year where a customer would never have to pay a delivery fee. In this way, barriers to ordering online are lowered significantly. Ocado manifests all this by providing a lowest price guarantee, stating that every comparable basket will be cheaper than buying from Tesco, its biggest UK rival (Ocado, 2021h).

While taking sales from traditional, large-scale retailers (Jensen, 2018), Ocado also manages to take market share from small-format grocery stores. It believes "top-up" stores exist mostly because people are poor planners, miss certain products in supermarkets and desire freshness. Ocado is increasingly able to eliminate planning hassle and assortment shortage by leveraging its AI and broad product portfolio. For those who are not willing or able to plan, it launched Ocado Zoom (Ocado, 2021h), a one-hour delivery service with a £15 minimum order value (MOV) and downsized 10,000+ SKU, which still surpasses corner stores' assortment size.

For the *Fulfillment* of placed orders, its unique CFC design is configured to accommodate much greater storage capacity than large, store-based alternatives. This is an enabler for increased turnover from "long-tail," margin-accretive products. Infrastructure within CFCs is modular and tailored to grow with the product range. Ocado's in-house built warehouse management system orchestrates the movements of up to 3,500 robots across the top of a grid structure that

provides roughly 720,000 storage locations. The robots, moving at 4 m/s with a 5 mm tolerance, communicate ten times per second with the center (Jensen, 2018; Ocado, 2021a) In this way, they create an ever-increasing amount of data that is fed into machine learning algorithms. The grid is thus 4D optimized to reduce customer lead times and place products in the optimum locations for future order profiles (Ocado, 2021a). This enables Ocado to pick, pack and dispatch a 50-item order within 15 min, picking at 600 units/h. At the same time, it ensures order accuracy of >99% (Ocado, 2021a). With in-store picking, the same process takes ~74 min and produces notably lower order accuracy (Jensen, 2018).

For their *Delivery*, customers can select one-hour delivery windows. In London, a 5.00 pm delivery window can be selected until as late as 11.00 am, while in lower-density areas 5.00 pm deliveries can be placed until midnight. With most delivery windows being free, the most popular windows carry a fee of £6.99 (Alvarez et al., 2016) – a clear upselling point for Ocado. As delivery times for Ocado.com can vary given the density of regions and the distance to CFCs, Ocado Zoom provides one-hour delivery for certain regions (Ocado, 2021h). To master the fabulous "last mile," AI-driven route optimization helps to identify optimal delivery journeys by making millions of calculations per second. The "hub-and-spoke" delivery model, also used by Picnic in Germany and the Netherlands, enables efficient management of fleets and significantly extends the radius of its serviceable area (Ocado, 2021b). Ocado operates 1,700 delivery vans specially adapted to fit Ocado totes, as well as some smaller, all-electric vehicles for city centers (Ocado, 2021k). Another central aspect of its insourced fleet is the option to let its own staff bring groceries to doors and thus tighten bonds with customers.

In *After-Sales,* it is key to retain customers through constantly high service and quality levels, in other words, fast delivery of fresh, undamaged goods at the right point in time, at the right price. This is achieved through formerly described components from purchasing, ordering, fulfillment, and delivery which are undertaken with great efficiency (e.g., robotic fulfillment) and consumer focus (e.g., shopping list audits). Ocado additionally manages retention rates through its Smart Pass subscription, a lever for mid-term lock-in of customers, who in turn receive deals, free delivery and other benefits (Ocado, 2021j). Also, it provides state-of-the-art customer service that is optimized through machine learning (Voica, 2016) and grants full refunds for expired or damaged goods.

In response to RQ2, it can thus be stated that Ocado delivers a value proposition to consumers which is richer and far more tech-driven than earlier iterations. This is the case across its entire

value chain, which ultimately enables it to function at efficiency and consistency levels required by the market.

4.3 Virtual value chain analysis

4.3.1 Businesses' use of the virtual value chain

Having explored customer expectations and commercial difficulties using the described methodology, this section investigates how the use of virtual components influences the value delivered by the Ocado business model. The VVC concept suggests that by *Gathering*, *Organizing*, *Selecting*, *Synthesizing*, and *Distributing* information, companies can establish a value matrix (Sviokla & Rayport, 1995). It allows firms to mirror activities from the marketplace (PVC) in the marketspace (VVC). Managing information in the VVC allows for new value creation by serving a broader range of customer needs. While physical activities continue to be carried out, the VVC creates additional value through content, infrastructure and context. For instance, content, that is, what is offered, refers to creativity, speed, and trust. Infrastructure, that is, what enables the transaction to occur, refers to information systems and networks aimed at maximizing reliability and minimizing cost. Finally, context calls attention to customer needs and behaviors and differentiation from competitors to deliver a compelling product or service. The three components are similar to product, delivery, and marketing in the PVC, yet the concepts are broader and richer (Liu & Wu, 2010).

With regard to the VVC, Liu & Wu (2010) have suggested the stages of (1) information visibility, (2) mirroring the value chain, and (3) founding new customer relationships. As further illustrated in Figure 5, the first is about knowing physical operations more effectively through information.

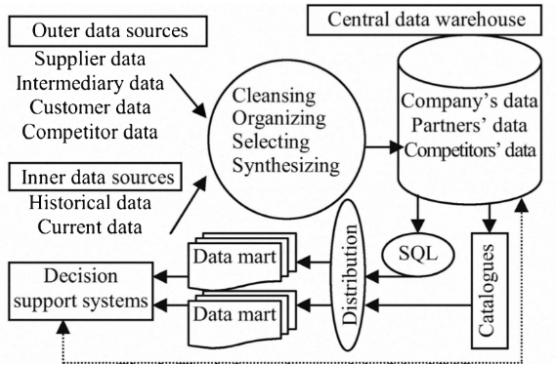

Figure 5 - The information model of the VVC
Source: Liu & Wu, 2010

Raw information, after being organized, selected and synthesized through integrated information systems, is delivered to the data warehouse. It is then delivered to the data marts

by SQL, before being distributed according to the information catalogues provided by the central data warehouse (Bhatt & Emdad, 2001). In this way, decision support systems are fed with insights from outer and inner data sources to manage processes quicker, more effectively, and at lower cost. In Clarke's (2020) terms, this is how a synthetic business environment is set up, which eventually leads to a multitude of advantages. After mastering the first two stages, the information advantage can be used to extract value through new customer relationships.

4.3.2 Ocado's use of the virtual value chain

In *Pre-Sales*, Ocado uses "up to 1,000 marketing channels, including trials of new technology with the likes of Google, Facebook and Sky" (Steiner, 2014, p.1) Data also come into play in *After-Sales,* where Ocado retargets its customers, based on previous purchases or demographic profiles (Vizard, 2014) and uses data for tailored customer service (Marr, 2020; Voica, 2016). Such in-depth exploitation of the VVC, that is, the notion of technology-based, one-to-one marketing, has been common for a number of years in *Pre-Sales* and *After-Sales* (Coviello et al., 2003). It is nonetheless worth investigating the VVC in the four core stages of e-grocery.

In *Purchasing*, tracking every single unit that goes in and out allows Ocado to operate a perfect FIFO and reduces waste levels to a notable extent (Jensen, 2018). Matthews (2019) claims that Ocado uses advanced forecasting engines that accurately predict demand for each of its 54,000+ SKUs, so it does not order surplus stock from suppliers. On the one hand, this allows it to cope with customer expectations of a wide assortment. On the other hand, it helps to mitigate the difficulties around planning and forecasting, the variance of SKUs, inventory levels, price, quality, and freshness.

In *Ordering*, the company similarly uses data and AI. In its web shop, advanced AI helps to understand customers' shopping habits (Matthews, 2019) and thus to fulfill expectations and mitigate difficulties. Not only does this allow for easier, more time-efficient navigation (Alvarez et al., 2016), but it also encourages customers to buy increased baskets through suggestions, dynamic pricing, and special discounts (Alvarez et al., 2016; McKinsey, 2012).

In *Fulfillment*, Ocado uses data and machine learning algorithms to make its picking infrastructure of swarm robots ever more time- and cost-efficient (Marr, 2020). The high degree of automation allows for above-average consistency levels with regard to order quality and completeness (Ocado, 2021g). Automation thus addresses central difficulties such as the IT and systems condition, efficiency and execution cost by leveraging the VVC. It further helps maintain the above in-store quality standards demanded by customers.

In *Delivery*, Ocado also augments its physical action with data and AI. Sharing routing information (data) with customers allows for transparency, while algorithms enable Ocado to deliver as fast and reliable as possible using route and load optimization (Ocado, 2021b). Thus, it also leverages the VVC in this stage, addressing expectations and difficulties at the same time.

In line with Liu & Wu (2010), it can be observed that Ocado draws cost-leading and differentiation advantages from the VVC. To start, it decreases the cost of production (i.e., procurement and fulfillment) through improved efficiency and decreased man-made losses (Jensen, 2018). Further, decreased management costs are beneficial, considering that, with the rising complexity of companies' internal management, the scarcity of management resources becomes ever more serious (Mackey et al., 2014). In addition, decreased external transaction costs mean an advantage which stems from the ability to synchronize external parties such as customers and suppliers. For instance, Ocado's customer service algorithms are able to prioritize requests from all supported channels (Voica, 2016) and thus dramatically improve the service experience. Furthermore, the principle-agent cost is decreased through improvements in information management such as supervision and feedback channels (Liu & Wu, 2010). As warehouses know the exact position of every single unit, stealing has become virtually impossible (Expert K).

The provision of additional information on products can be one source of further differentiation. A practical example is the display of best-before dates (Jensen, 2018) and live stock levels (Ocado, 2021g) in Ocado's ordering interface. Both are made possible through data from warehousing infrastructure, a VVC component. The structure of new channels for sales is essentially a differentiation advantage through reconstruction of the value chain. Here, Ocado's voice ordering (Lomas, 2017) provides further differentiation through the VVC.

In response to RQ3, it can be stated that a range of differentiation and cost-decreasing advantages make it worthwhile for Ocado to leverage the VVC, since it helps to solve difficulties and meet expectations across the firm's operations.[20]

[20] Appendix 46: Advantages from leverage of the VVC

5 Discussion

This chapter discusses the role of the VVC in e-grocery based on the prior analysis and a general outlook for grocery retailers is provided based on the scenario analysis. Finally, the findings are contextualized through a critical appraisal of the given limitations and future research potential.

5.1 The role of virtual value creation in e-grocery

Considering customer expectations that are met and commercial difficulties that are circumvented, it can be stated that the VVC enhances Ocado's value proposition in many respects. By reviewing the survey and interview outcomes, this can be further specified. First, all expectations that were identified, from *Purchasing* to *Delivery*, are met with the partial help of the VVC. Even the wide assortment, which is enabled through scalable warehouse design (Haywood, 2020), is more management intensive and must thus be handled with integrated information systems (Marr, 2020). These VVC components in turn help meet the expectations. With regard to the commercial difficulties of *Purchasing*, *Ordering*, and *Fulfillment*, it was revealed that the VVC helps address the top three problems and more, while it also helps cope with the top difficulty and more of *Delivery*.

This illustrates that, even if Ocado has found several ways of enrichening its value proposition through business model design (Alvarez et al., 2016; Jensen, 2018), its key value components are significantly enriched by virtual value creation. Some components of the Ocado model are apparently traceable to other grocers, as they increase efficiency, reduce costs and also promote differentiation, which in theory lead to a competitive advantage (Porter, 1985). Nevertheless, significant parts of the Ocado model are market specific and might not work in other countries. This is especially true for warehouse fulfillment and delivery. A large-scale, highly automated warehouse only becomes worthwhile given very high customer density, as in Greater London. The same applies to delivery in a short time, as it also requires enough households and the right infrastructure. The UK is the world's most advanced market for online groceries, driven by high rankings in terms of logistics performance, ease of doing business, and e-government development (Ogonowski, 2019).

To map future scenarios, the focus should therefore be limited to components in which VVC adds value across all markets. Ocado does not serve as a perfect showcase, but as a pioneer which can illustrate certain trends.

5.2 Scenario analysis of future developments in (e-)grocery retail

In e-grocery retail, the severe difficulties, high expectations, and industry specificities discovered render the VVC much more important than in other areas of e-commerce. Thus, it is possible to answer RQ4: *"What level of virtual value creation can be anticipated among grocery firms and what is the resulting impact for the industry's structure?"*

To answer this question, a scenario analysis following Schoemaker (1995) was conducted. Three scenarios outline to what extent different levels of virtual value creation in grocery retail firms would impact the industry's stakeholders. The extent to which virtual value creation is adopted is quantified by the share of total revenues invested in areas that benefit leveraging the VVC. The posed scenarios are: (1) conservative (0–2%), (2) business-as-usual (2–5%), and (3) accelerated (>5%) VVC adoption.

During the *expert interviews*, participants were asked: "In your perspective, which type of company will win the online era in grocery retail?" The top keywords experts regard as relevant for winners of the online era are "customer centricity" (7), "technology & consumer data" (7), "modern and agile company culture" (7), "scale" (6), "cost efficiency" (3), "flexibility" (3), and (proper execution of) "omni-channel business" (2). These concepts clearly indicate the elevated importance of the VVC in future successful businesses. It is noteworthy that today customer centricity is deeply interwoven with (consumer) data analytics, looking at Amazon which aims to become the "most customer-centric company in the world" (Amazon, 2021), while being known for its massive data-mining efforts.

The *expert notes* revealed intuitions of future scenarios in the same direction. In a recent HBS case study, Iansiti & Lakhani (2020) proposed that AI, which benefits from leveraging the VVC, has the ability to remove limits to scale, scope, and learning. Also, as illustrated in Figure 6, they particularly stated how scale can deliver virtually unlimited value in digital operating models, ultimately enabling them to outperform traditional operating models.

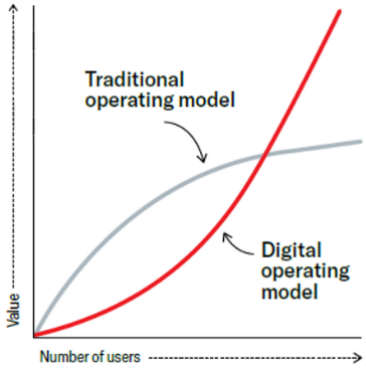

Figure 6 - Value creation in scaled, digital operating models
Source: Iansithi & Lakhani, 2020

This opinion is shared by a number of prestigious management consultancies. Oliver Wyman (2014) has noted that a 10% efficiency improvement of US online retailers would enable an online-only grocer with less than 7% market share to profitably serve 70% of the population. It added that "some – perhaps many – individual stores will actually become unprofitable" (Oliver Wyman, 2014), given that small declines in store sales have much larger declines in operating income as a consequence. Bain & Company (2019) have postulated that "absolute scale, rapid innovation and data-analytics expertise are now as important as local leadership." KPMG (2020) added that "those with no existing online or delivery channel will struggle to survive this challenging time." It stressed that (retail) companies must now not only be good at buying and selling goods, but also at things such as process automation, AI, machine learning, data analytics, online fulfillment, and home delivery.

Page (2020) predicts the return of physical store business by 2021, yet stresses the rising importance of personalized offers through recommendation engines. By 2025, she predicts "traditional retailers and online retailers will transition towards a convergence point," noting that "the conventional retail model […] will be on the way out." By 2030, "entire value chains will be aligned to accurate predictive models of consumer needs […] This kind of AI-to-AI integration will result in automated supplier-customer sales negotiations […] and upstream integration with suppliers of raw materials and financing solutions." (Bhyat, 2020, p.1)

Looking at *past actions*, the most noteworthy retail disruption was the shift to self-service. Bringing about significant customer success, it led to enormous growth in a short period of time. Obviously, where benefits are clear and upfront investments are feasible, the uptake is accelerated. With *current actions* the situation is different. The retail sector has experienced significant consolidation to mostly publicly traded, large-scale firms, whose main purpose is to secure cashflows for shareholders. Therefore, traditional retailers have little incentive to actively drive the shift to e-business, knowing that it would cannibalize its current sources of value creation. Therefore, the online era in grocery retail was not only kept back by high customer expectations and commercial barriers, but also by existing industry players' decision-makers.

Whereas *players' visions* seem to be somewhat aligned (e.g., Edeka, 2021; Tesco PLC, 2021), *strategies* to get there differ a great deal. In Germany, the three largest grocery groups all employ different approaches to adopt the e-grocery paradigm. Whereas Rewe delivers via an own fleet from central warehouses (Expert K), Schwarz-Gruppe's Kaufland partners with third-party logistics businesses such as Glovoo (Schader, 2020). Germany's largest player, the Edeka

Gruppe, employs its own delivery service, Bringmeister, and has additionally (re-)invested in Picnic, a Dutch delivery startup growing at high speed (Schader, 2020). In the UK, the situation is similarly diverse. While Tesco focuses on click-and-collect and deliveries with its own fleet (Tesco PLC, 2020), Ocado operates as a pure-player and additionally sells its white-labeled software and warehouse solutions (Ocado, 2021i) to partners worldwide. Once again, it is evident that, in addition to the level of virtual value creation, country-specific factors have a significant influence on the adoption of e-grocery and the resulting industry structure.

When consolidated, the findings suggest that delivery business models will only really take off when the big players are ready to use their scale and invest massively. While the question of the right delivery model and the last mile will differ even inside countries, investments in IT, infrastructure, and customer data will pay off in any scenario. However, the "innovator's dilemma" is a problem, especially for large, shareholder-driven companies. A lack of incentive for investments in areas that benefit from leveraging the VVC could be a symptom. The attached risk would be an increasing dependence of such players on Ocado-like white-label solutions. The analysis provides an example of how value creation in grocery retail is shifting from variables such as brand and physical experience to value provided by IT. If the "IT investment debt" becomes too large for retailers, this step will cause them to fall into costly dependency.

Findings further suggest that by 2030, physical store numbers will decline, seeing as non-experience shopping in particular (also driven by the Covid-19 pandemic) increasingly appears to be a burden to customers. Until then, several data-driven delivery schemes will have captured market share. Lower-end supermarkets in particular will have to be careful not to lose their USP to efficient, low-cost online players that are more digitally enabled. Thus, the future will not simply be determined by (delivery) business model design and its value proposition, but by companies' general IT capabilities.

In response to RQ4, the business-as-usual scenario[21] is most likely. On the one hand, the experts, both from the interviews and the literature, are of the opinion that the online and IT trend is indispensable, which corresponds to research findings and current events. On the other hand, both existing companies and enormous difficulties with market penetration continue to form barriers that will only be overcome in the mid-to-long term.

[21] Appendix 47: Scenario Analysis

6 Conclusion

To investigate the topic at hand, the research was split into four research questions to arrive at the desired findings. Insights were obtained from a literature review, customer surveys, expert interviews, and a virtual value chain analysis of the object of the study. The findings were subsequently discussed in terms of a scenario analysis, building potential future scenarios of VVC adoption and the resulting implications for the industry.

RQ1: It was found that firms in the sector are mainly facing two challenges: high customer expectations regarding their performance and a broad range of commercial difficulties. On the one hand, customers are not prepared to accept a compromise in quality or higher prices. On the other hand, costs and complexity are higher in e-grocery compared to traditional grocery stores. These circumstances have made it difficult for early entrants to serve the market sustainably.

RQ2: This study investigated the business model of Ocado and distilled its key success factors. From an outside-in perspective, it became evident that Ocado's technology-centric approach allows it to significantly enrich the value proposition for customers. In particular, Ocado managed to achieve high process efficiency (e.g., significantly higher picking rates) and consistency (e.g., lowest waste levels). These factors, among others, differentiate the company from earlier entrants.

RQ3: The study further found that leveraging the VVC offers Ocado a range of differentiation advantages and allows to decrease costs. It was revealed that the VVC is a significant contributor to addressing customer expectations and commercial difficulties in the e-grocery sector. Within e-grocery, especially for Ocado, the added value of the VVC goes beyond a supporting role to the PVC.

RQ4: Several sources of information were consulted to estimate the likelihood of potential scenarios of VVC adoption in e-grocery. Adoption of the VVC was quantified by the share of total revenues committed to areas that benefit leveraging the VVC (i.e., IT spend in percent of total revenues). Three scenarios were proposed: (1) conservative (<2% CAGR; 0–2% basis), (2) business-as-usual (<5% CAGR; 2–5% basis), and (3) accelerated (>5% CAGR; >5% basis) of VVC adoption. The evaluation of expert interview results, expert notes, past and current actions, players' visions and strategies, and their synthesis with findings of this study make the business-as-usual scenario appear as the most likely alternative. Despite current barriers, VVC is a value-adding concept that will be increasingly adopted among grocers in the mid-to-long term.

7 Limitations and potential for future research

It should be noted that this research study was subject to a number of limitations. In general, the study was conducted over five months, a very limited timeframe for the scientific analysis of a complex, multifaceted topic.

Furthermore, the methodology was limited by a number of factors. Due to the ongoing pandemic, personal contact with experts was not possible, which made the interviewing process more difficult. Even though insights could be obtained to a great extent, personal contact with experts would have facilitated capture of interviewees' latent sentiments and opinions. The number of respondents was sufficient for the present analysis, but insufficient for accurate regression analyses. In addition, a major limitation of the final scenario-building is the fact that current levels of grocers' VVC usage could not be obtained. Therefore, the comparison and outlook are somewhat limited regarding anticipated growth compared to accumulated levels. Furthermore, the comparison between Ocado and competing grocers was constrained by the limited access to information.

Accordingly, the study provides indicators for potential future research. A larger sample would allow for multiple regression models with significantly higher accuracy. The limitation of unknown current levels of VVC usage among grocers is another starting point for future research. An investigation of major grocers' current VVC usage would enrich the context of the present study and bring more transparency regarding the industry's digital maturity. Also, such a study could make the topic multidimensional by scientifically defining other indicators of the VVC adoption level in addition to the share of revenues invested.

Further, it remains unclear how sustainably Covid-19 will influence trends and impact consumption practices at the current pace. Thus, this thesis represents a snapshot that needs to be refreshed periodically. In addition to the unusual business situation, the analyzed industry is one of constant, high-paced change and should therefore be reinvestigated in regular cycles.

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9 Appendices

9.1 Appendix 1: Ocado Group Consolidated Income Statement 2020

£ millions	FY 2020 Pre-Exceptional	FY 2020 Exceptional Items	FY 2020 Total Statutory Reported	FY 2019 Pre-Exceptional	FY 2019 Exceptional Items	FY 2019 Total Statutory Reported	Pre-Exceptional Growth
Revenue[1]	**2,331.8**	**–**	**2,331.8**	1,756.6	-	1,756.6	32.7%
Gross profit	**813.9**	**–**	**813.9**	597.3	(5.5)	591.8	36.3%
Other income	**87.6**	**103.9**	**191.5**	83.9	23.8	107.7	4.4%
Distribution and administrative costs	**(827.5)**	**0.7**	**(826.8)**	(638.6)	(12.3)	(650.9)	29.6%
Share of results from joint ventures and associates[2]	**(0.9)**	**–**	**(0.9)**	0.7	–	0.7	–
EBITDA[A]	**73.1**	**104.6**	**177.7**	43.3	6.0	49.3	68.8%
Depreciation, amortisation and impairment	**(168.9)**	**–**	**(168.9)**	(136.1)	(99.0)	(235.1)	24.1%
Loss on disposal of subsidiary	**–**	**–**	**–**	–	(1.1)	(1.1)	–
Net Finance costs	**(52.8)**	**–**	**(52.8)**	(27.6)	–	(27.6)	91.3%
(Loss) before tax	**(148.6)**	**104.6**	**(44.0)**	(120.4)	(94.1)	(214.5)	23.4%

Source: Ocado, 2021

9.2 Appendix 2: Disaggregation of 2020 Ocado Group Revenues

Disaggregation of revenue

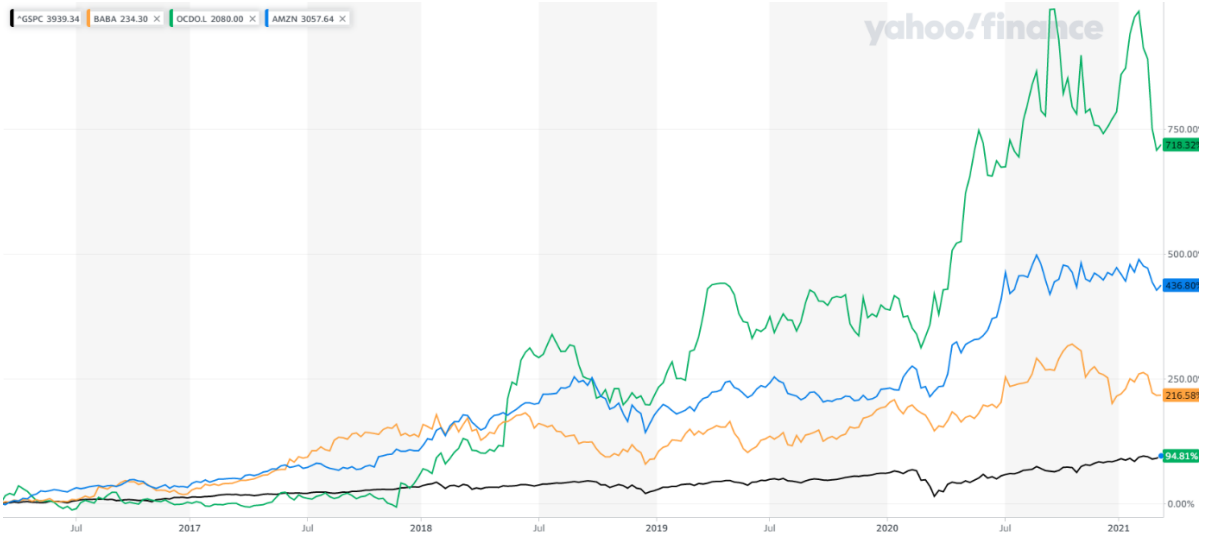
Set out below is a disaggregation of the Group's revenue:

	52 weeks ended 29 November 2020 £m	52 weeks ended 1 December 2019[1] £m
Retail	**2,188.6**	1,618.1
UK Solutions & Logistics	**654.3**	576.0
International Solutions	**16.6**	0.5
Other	**–**	9.8
Group eliminations	**(527.7)**	(447.8)
	2,331.8	1,756.6
Timing of revenue recognition		
At a point in time	**2,188.5**	1,626.4
Over time	**143.3**	130.2
	2,331.8	1,756.6

(1) The figures for the 52 weeks ended 1 December 2019 have been re-presented to reflect changes to the basis of allocating revenue to segments. The total revenue is the same, but the figure attributed to each segment has changed.

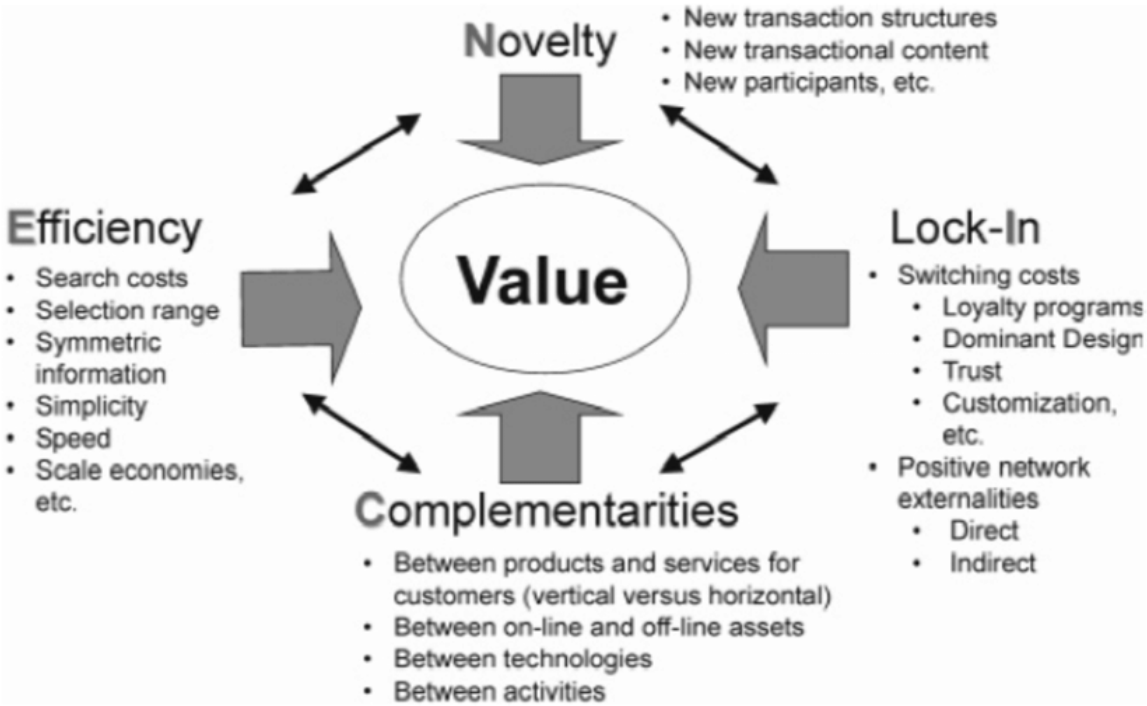
Source: Ocado, 2021

9.3 Appendix 3: 5Y Stock Performance of Amazon, Alibaba, Ocado, S&P 500



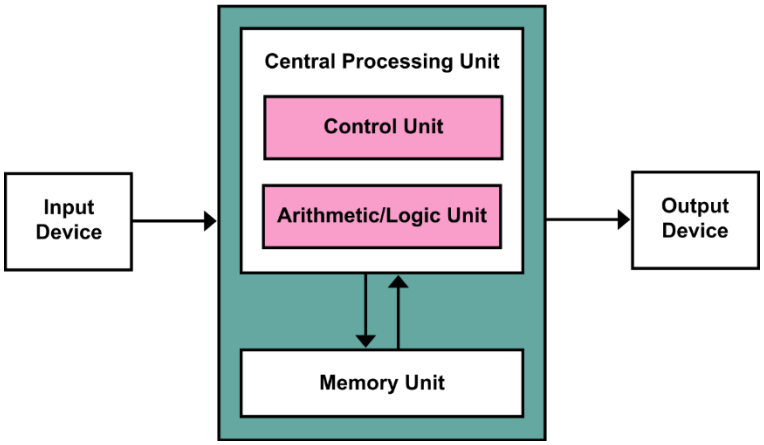
Source: Yahoo! Finance, 2021

9.4 Appendix 4: Sources of value creation in e-business



Source: Amit & Zott, 2011

9.5 Appendix 5: von Neumann Architecture



Source: von Neumann, 1945

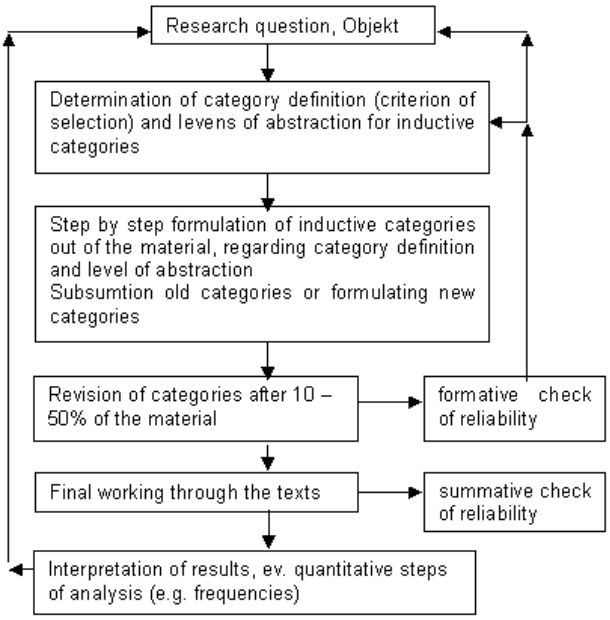
9.6 Appendix 6: Use cases of robotic arms

TABLE III
WORKPLACE TASKS

Place	Detail
office	cleanup and tidying
	transporting, searching, picking up, retrieving, and returning objects (e.g. book, document, ...)
	massage when tired
sport	opponent for tennis, baseball, table tennis, ...
	trainer for body posture training/adjustment (e.g. golf, yoga)
art/music	enhance person's skills
	helping disable/injured artist paint, sculpt, play music instrument, ...
service	counter for money exchange, teller, ...
	automatic point of sale, kiosk, food stand
	logistic robot for loading/unloading, sorting, searching, ...
	parking lot robot for helping drivers park their cars
	mass ingredient preparation in hotels or restaurants, cooking assistant, serving food
	distributing handbills, pamphlet, brochures in public areas, tourist spots
production	manufacturing processes such as welding, drilling, cutting and milling
	heavy material manipulation such as iron ore, metal sheets, copper rods
	assembly line for cars, airplanes, buildings, trains, ...
	installing utility such as pipes, cables, networks, ...
	inventory management robot for small inventory that cannot be accessed by forklifts or other vehicles
miscellaneous	working in extreme environments such as space, deep ocean, rescue, disaster zone, ...
	teleoperation when human override is needed

Source: Wongphati et al., 2012

9.7 Appendix 7: Inductive category development for semi-structured interviews



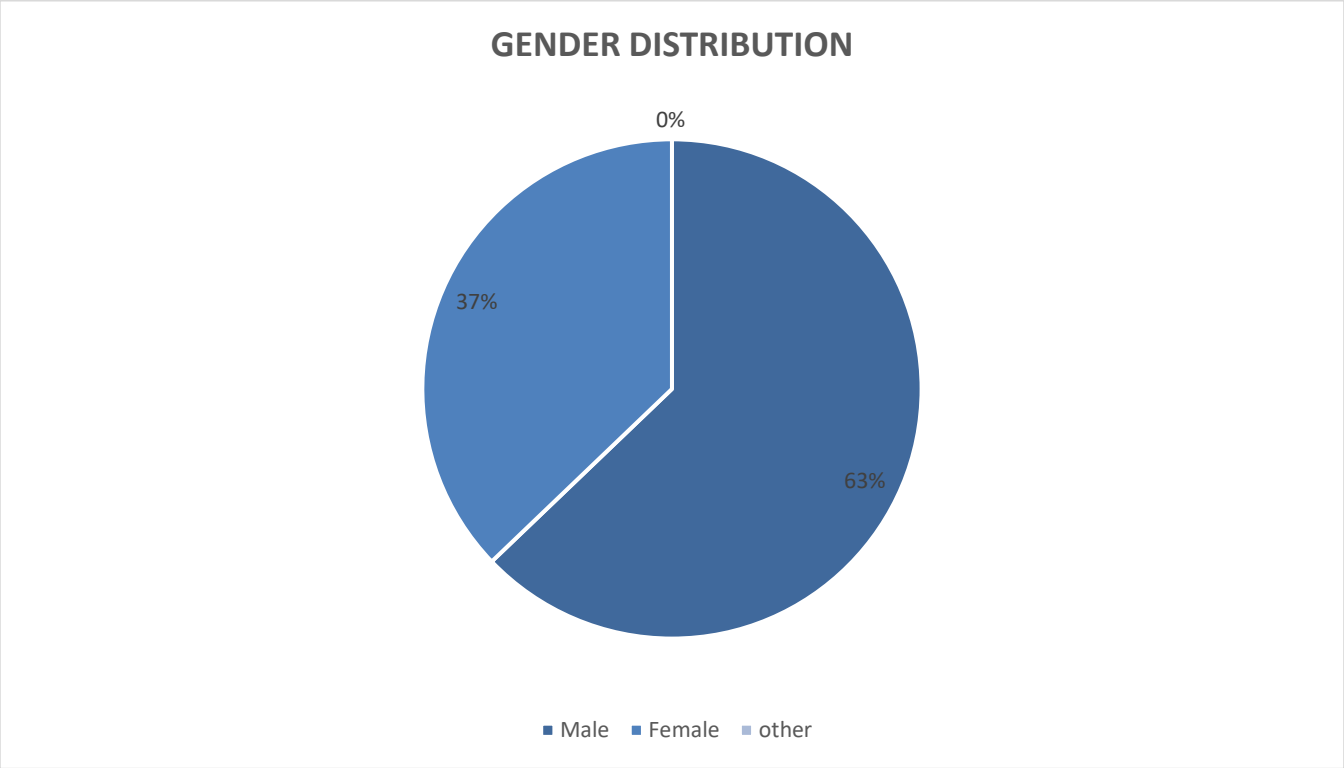
Source: Mayring, 2000

9.8 Appendix 8: Coding agenda for semi-structured interviews

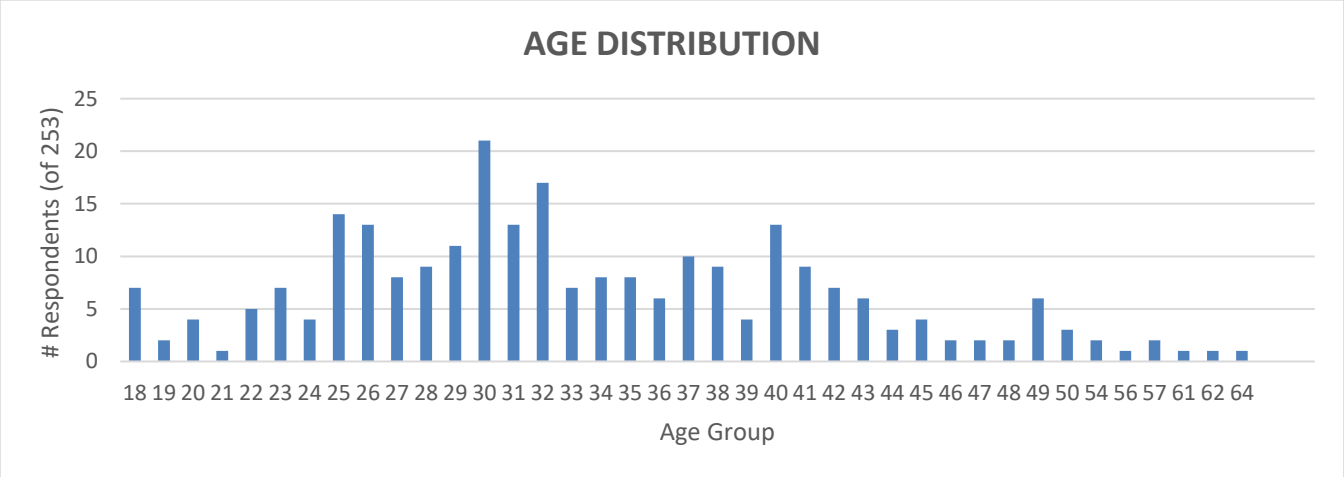
Category	Definition	Examples	Coding Rules
C1: Extreme importance	Signifying that the mentioned aspect is of utmost importance and/or highly influential to the discussed section.	(1) I think globally, food retail has been an industry with **very low margins**, cash positions are relatively better. But the margins are always **very, very sharp**. (2) And the consumer doesn't want to pay more than if you would go to the shop. *laughs* Yeah, it's very difficult. **It's very, very difficult.** (3) And the complexity of	The statement points to *very high significance* in its wording or reaffirms it in a second, attached statement. In its full context, it is described with "very,very", "extremely", "enormous", etc.

Category	Definition	Examples	Coding Rules
		managing that, right? Yeah, this is of course, **highly, highly complex.**	
C2: Elevated importance	Signifying that the mentioned aspect is of elevated importance and should be mentioned in the context of the given section.	(1) "So, purchasing also has a **very important role** to play to find the right partners […] value is perceived by the consumers." (2) . I could reduce my inventory holding and yet fulfill your order now. It's not so easy. I think this is an operationally **very challenging par**t of it.	The statement points to *elevated importance/significance* of the aspect with supportive words such as "very", "pretty", or "highly".
C3: General importance	Signifying that the mentioned aspect plays a certain role or is somewhat important for the mentioned section.	(1) Yeah, and then - Suggestions. I think **it's important.** (2) And of course, the right connection with the customer. I think **that's the important part** - we were talking more about the technical part.	The statement points to a *somewhat important* role of the aspect by simply stating it as a fact or, without any connective words, stating it is "important" or "significant" in the context.

9.9 Appendix 9: The "Gender" variable



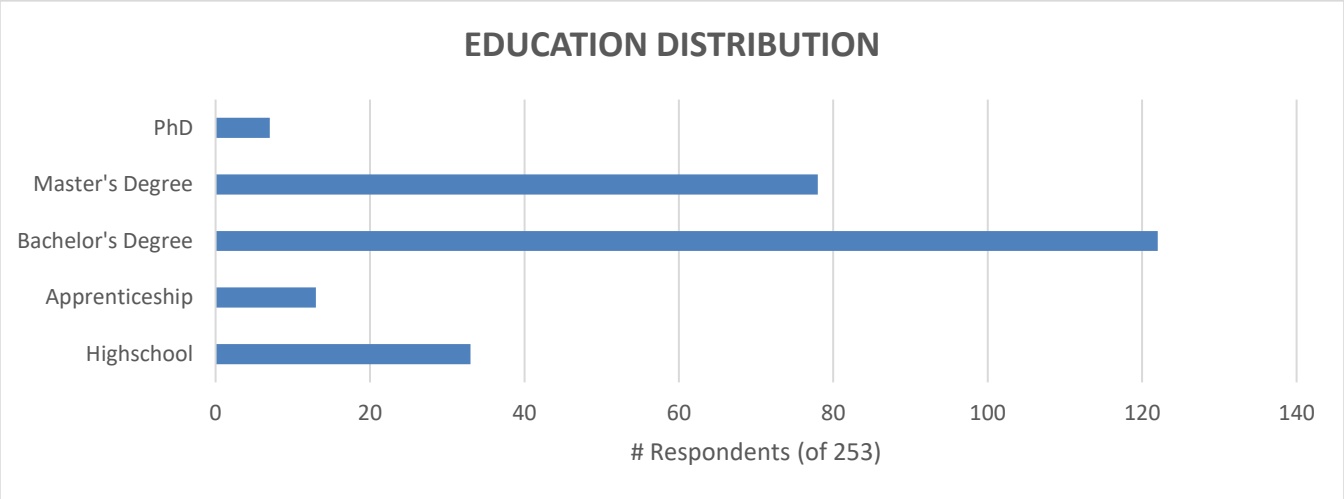
9.10 Appendix 10: The "Age" variable



Summary statistics:

Min	Max	Mean	Median	SD	Variance	CV
18.00	64.00	33.58	32	8.79342	79.81	0.2619

9.11 Appendix 11: The "Education" variable

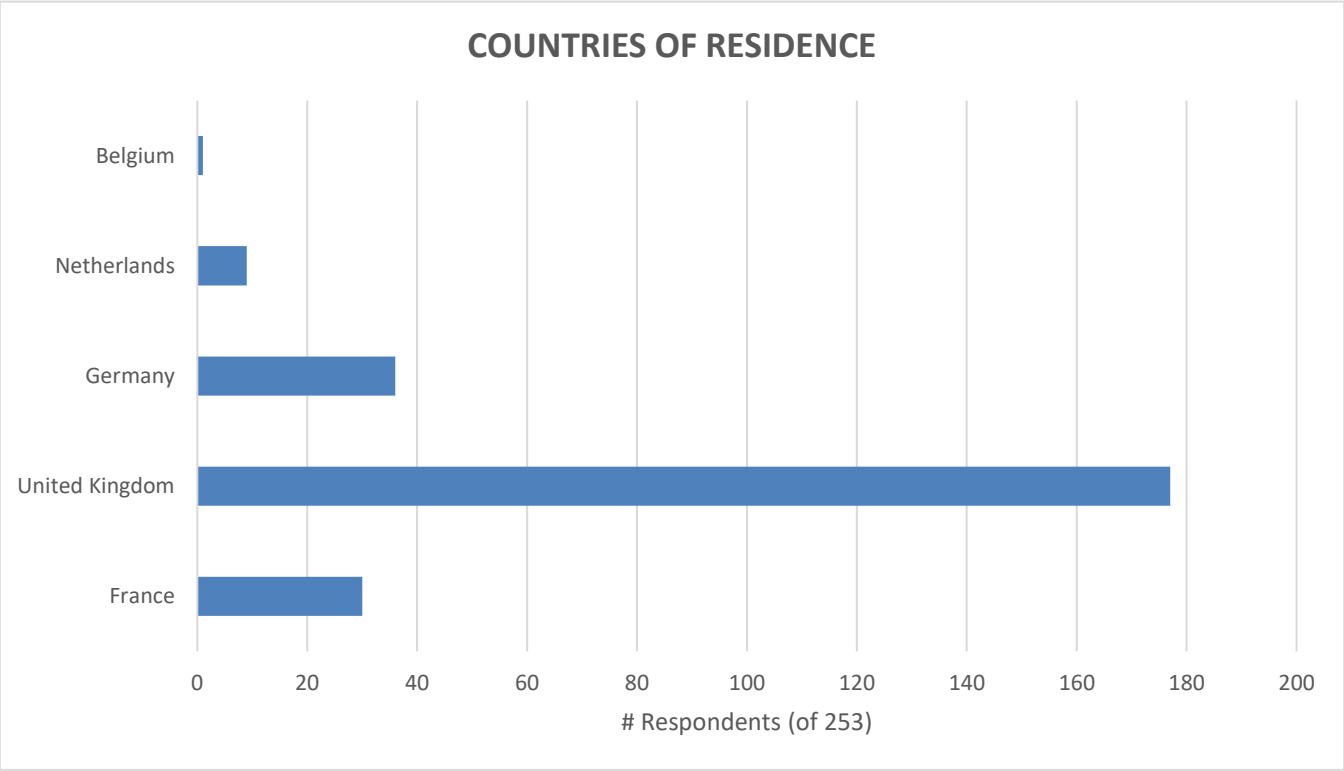


The variable was also translated to the numeric variable Education2, which ranges from Highschool (1) to PhD (5).

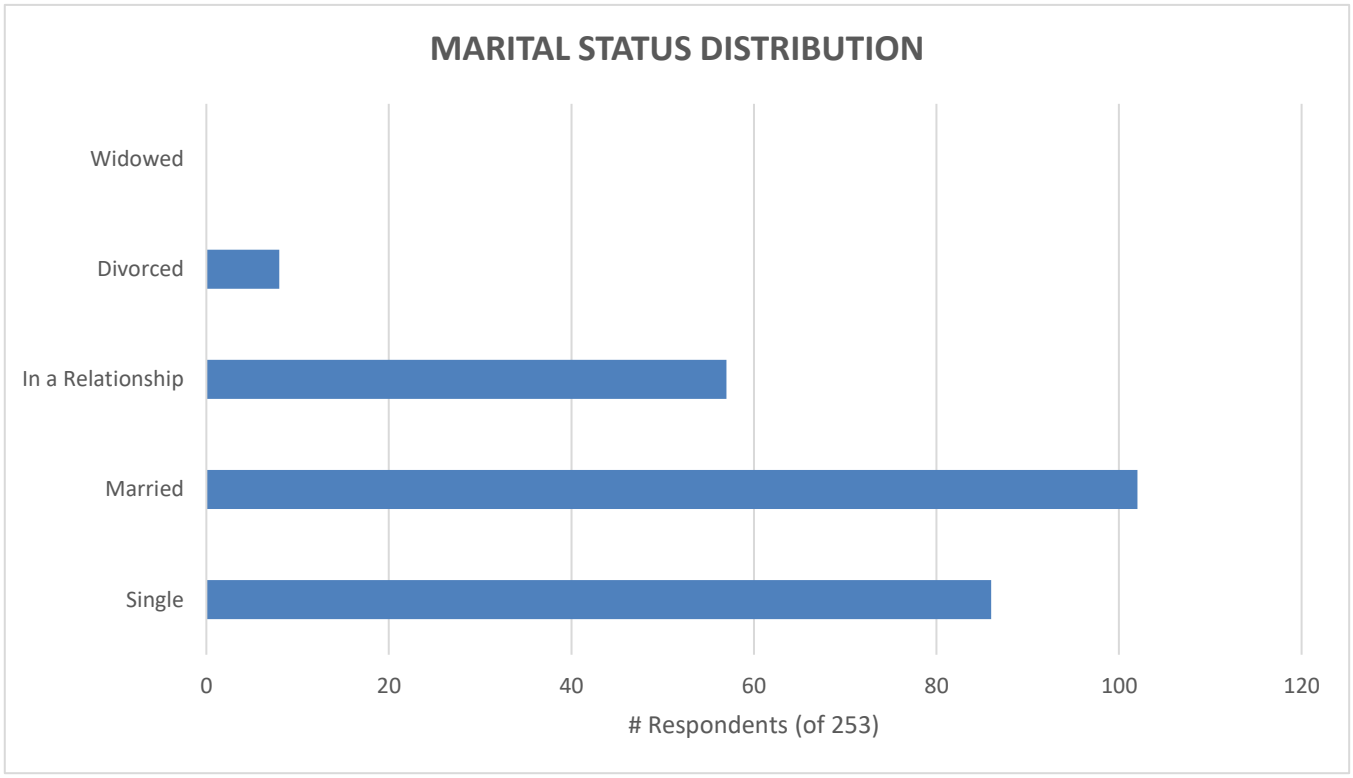
Summary statistics:

Min	Max	Mean	Median	SD	Variance	CV
1.00	5.00	3.051	3.000	0.9966	0.99321	0.3266

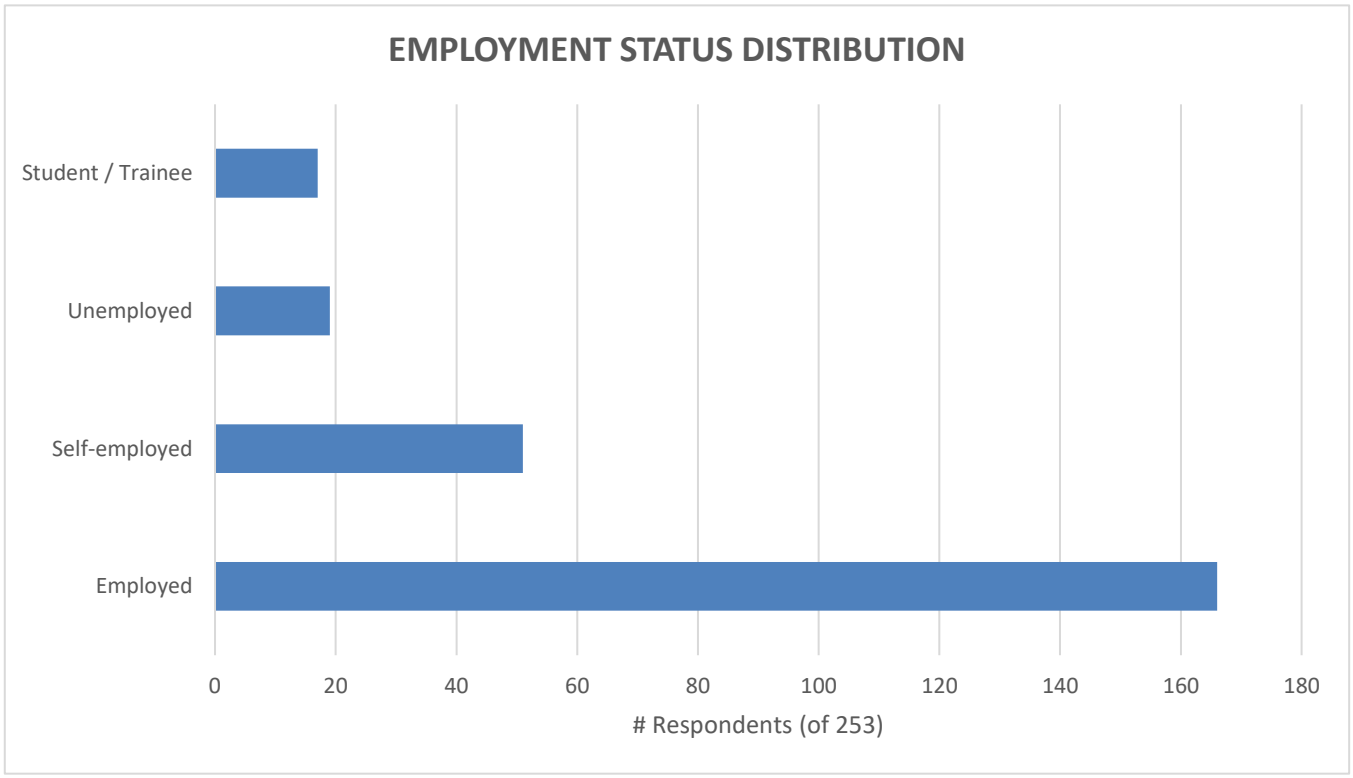
9.12 Appendix 12: The "Country of Residence" variable



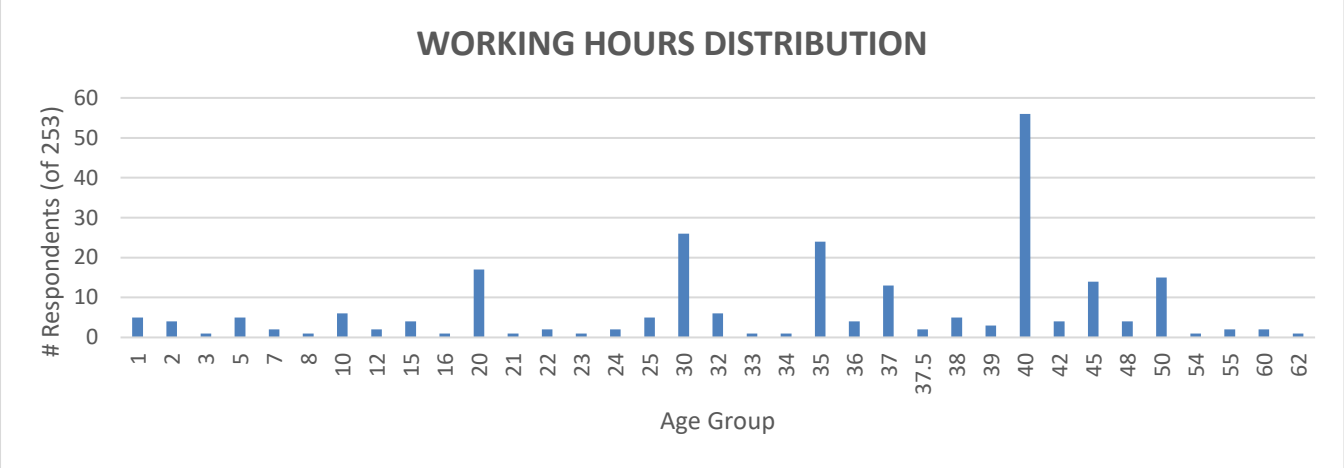
9.13 Appendix 13: The "Marital Status" variable



9.14 Appendix 14: The "Employment" variable



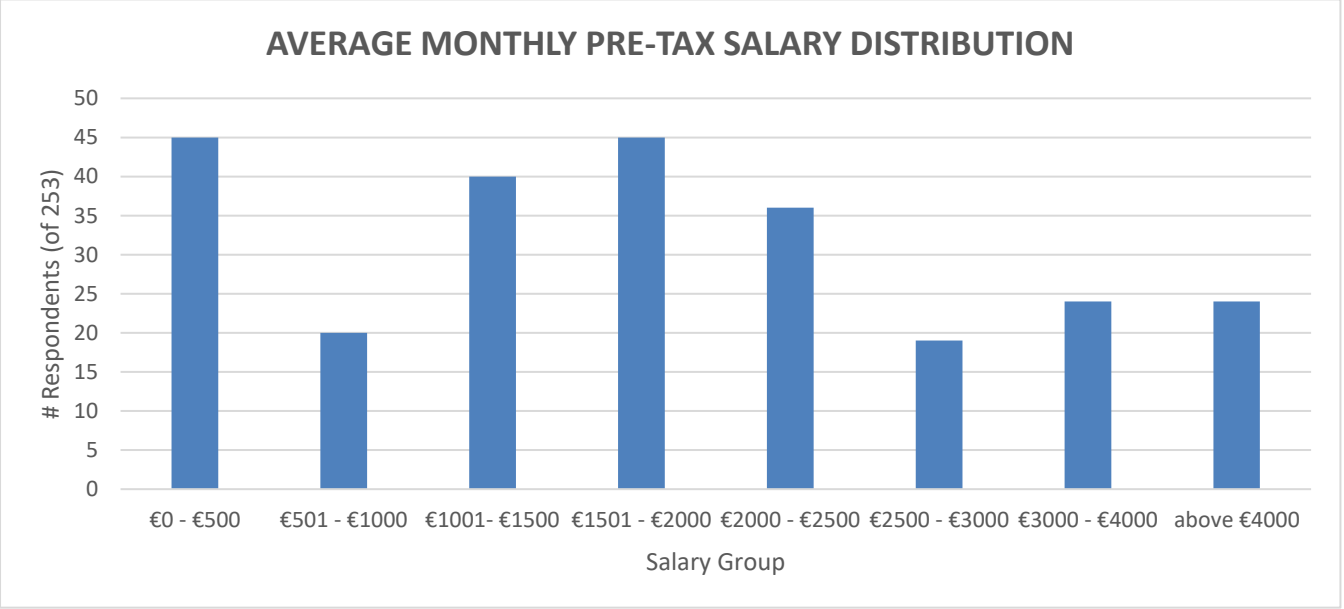
9.15 Appendix 15: The "Work hours" variable



Summary statistics:

Min	Max	Mean	Median	SD	Variance	CV
1	62.00	33.07	37	12.87629	165.79884	0.389

9.16 Appendix 16: The "Salary" variable

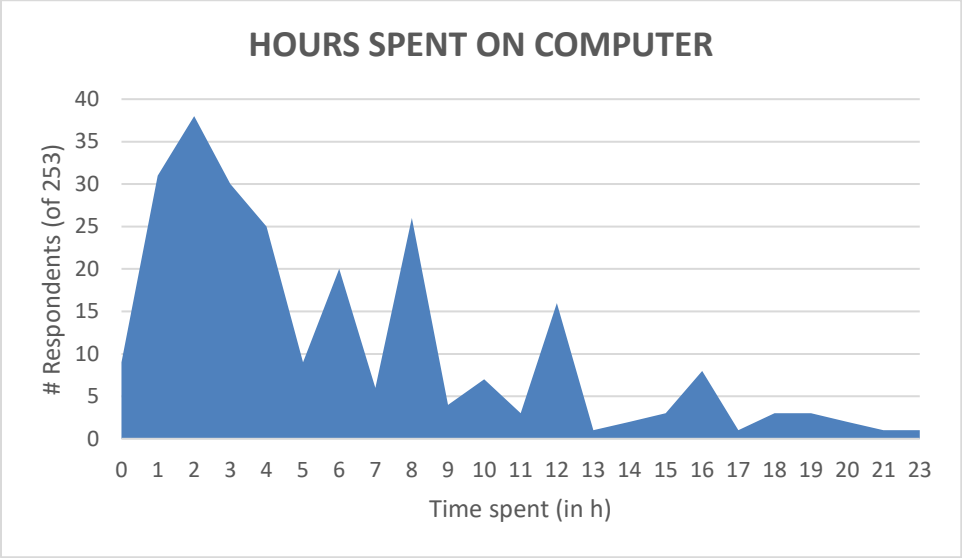


The variable was also translated to the numeric variable Salary_Group, which ranges from "€0 - €500" (1) to "above €4000" (8).

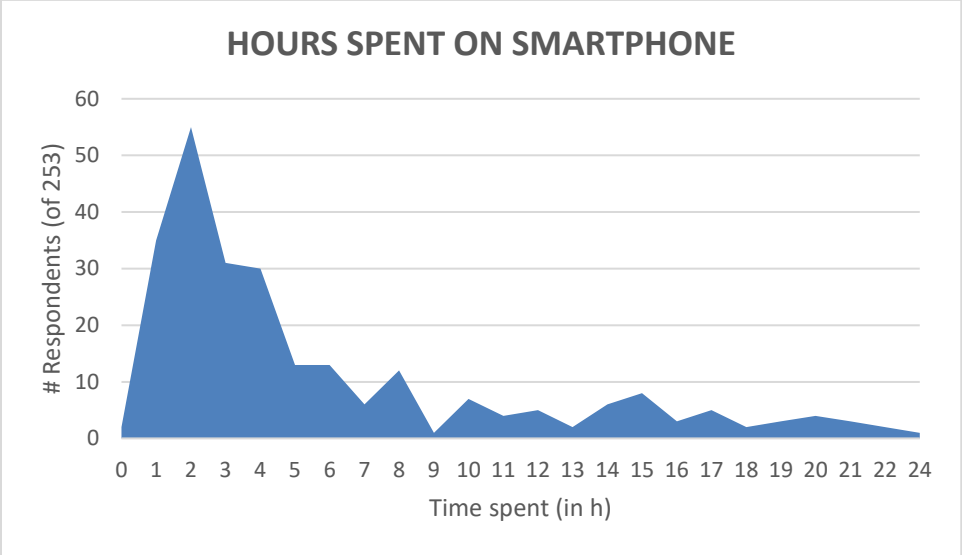
Summary statistics:

Min	Max	Mean	Median	SD	Variance	CV
1.00	8.00	4.107	4.000	2.212983	4.8972	0.5388

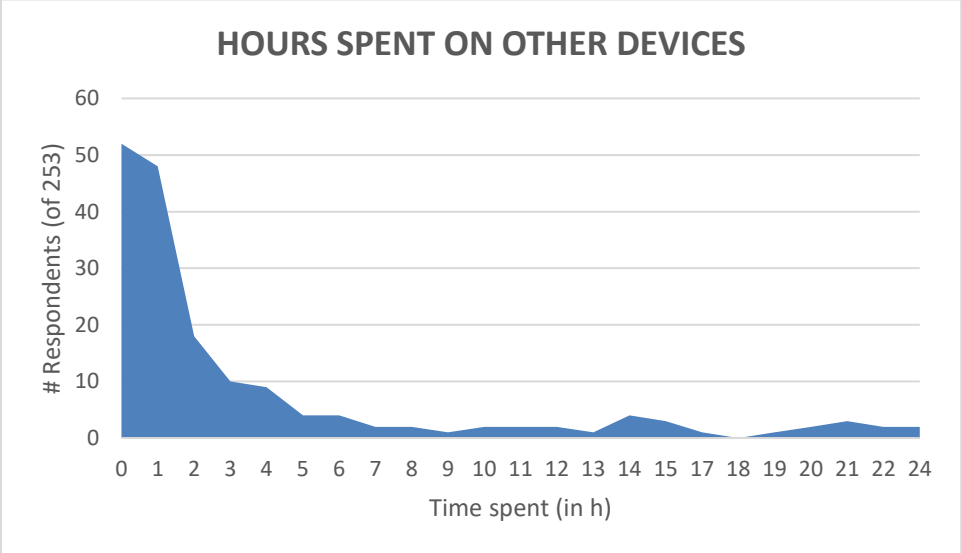
9.17 Appendix 17: The "Devices" variable



Min	0
Max	23
Mean	5.90
Median	4

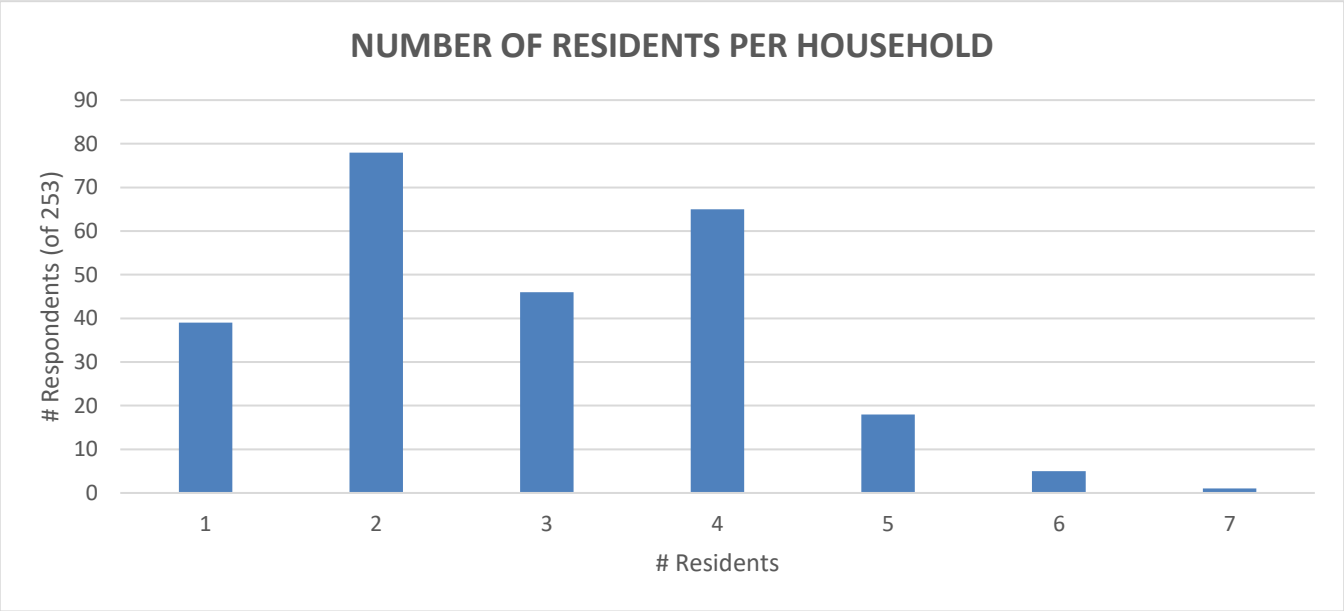


Min	0
Max	24
Mean	5.89
Median	4



Min	0
Max	24
Mean	3.68
Median	1

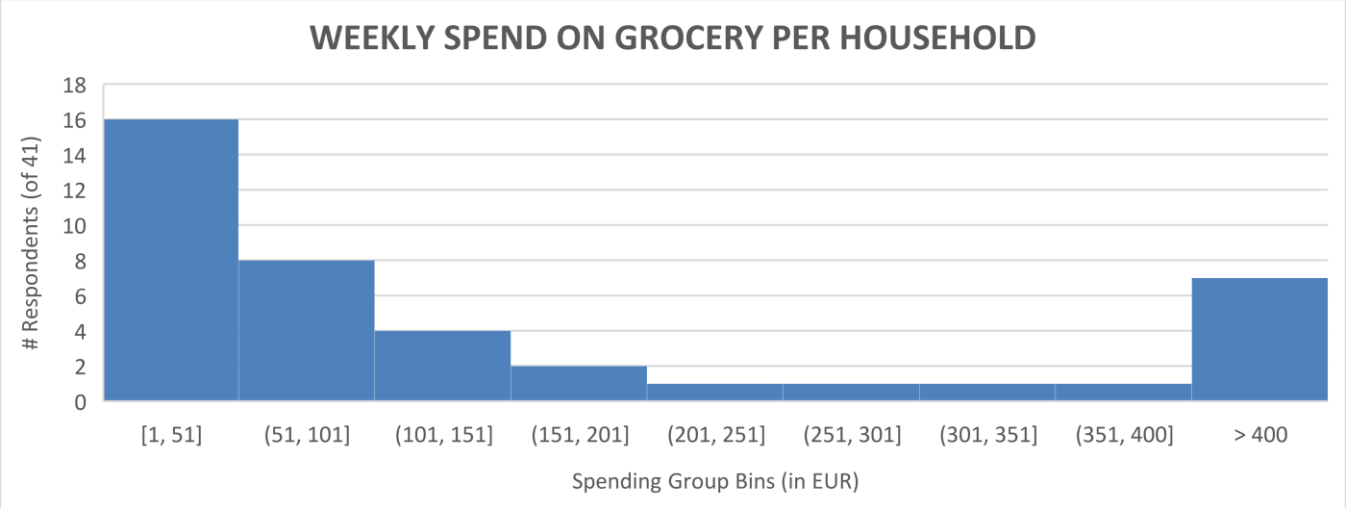
9.18 Appendix 18: The "Household Size" variable



Summary statistics:

Min	Max	Mean	Median	SD	Variance	CV
1.00	7.00	2.857	3.000	1.304081	1.70062	0.4564

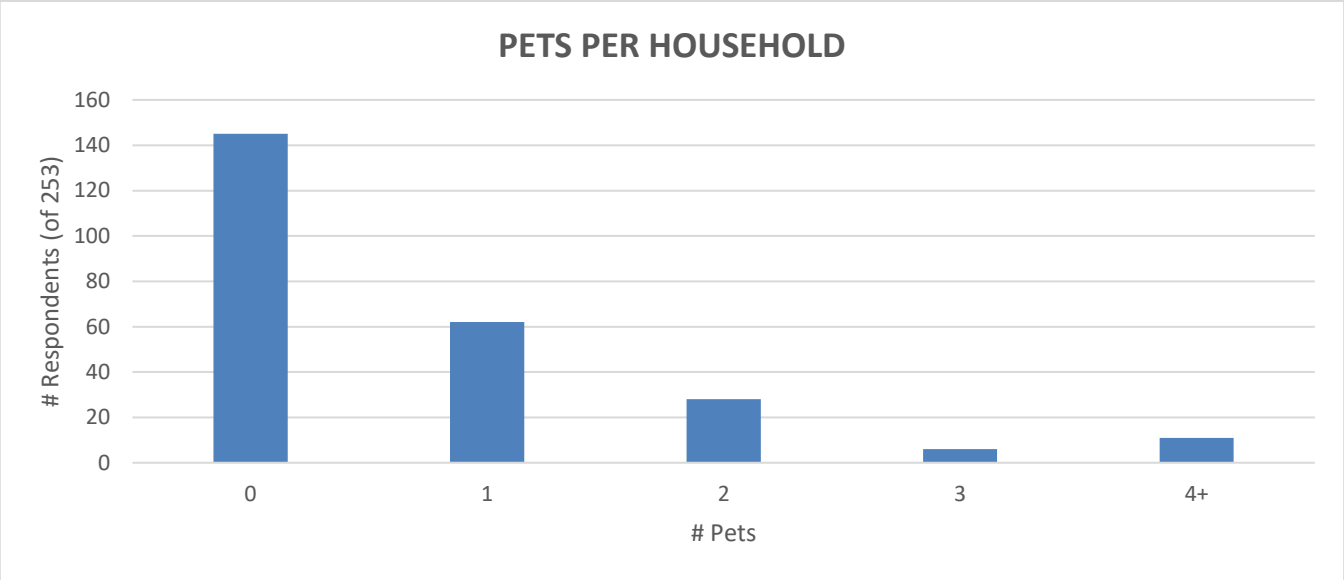
9.19 Appendix 19: Weekly Grocery Spend



Summary statistics:

Min	Max	Mean	Median	SD	Variance	CV
1.00	4000.00	136.9	80.00	348.5929	121,517.009	2.546332

9.20 Appendix 20: The "Number of Pets" variable

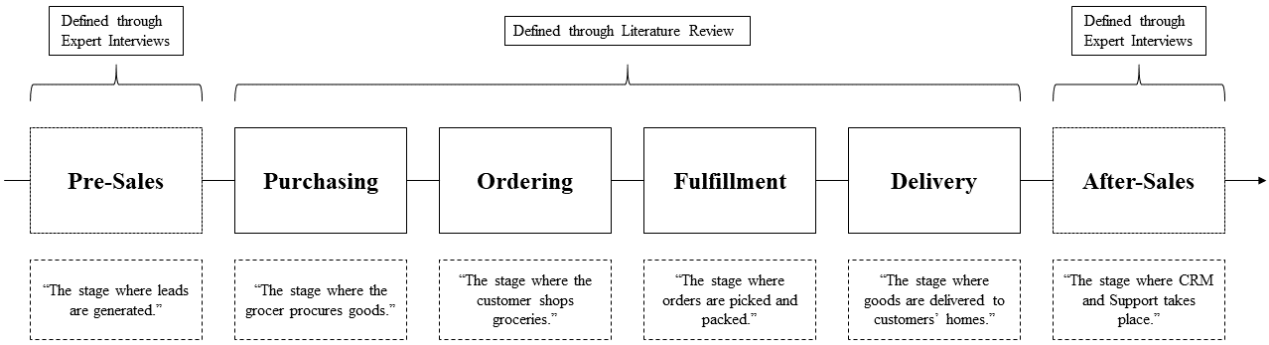


The variable was also translated to the numeric variable NumberPets2, which ranges from "0" (1) to "4+" (5).

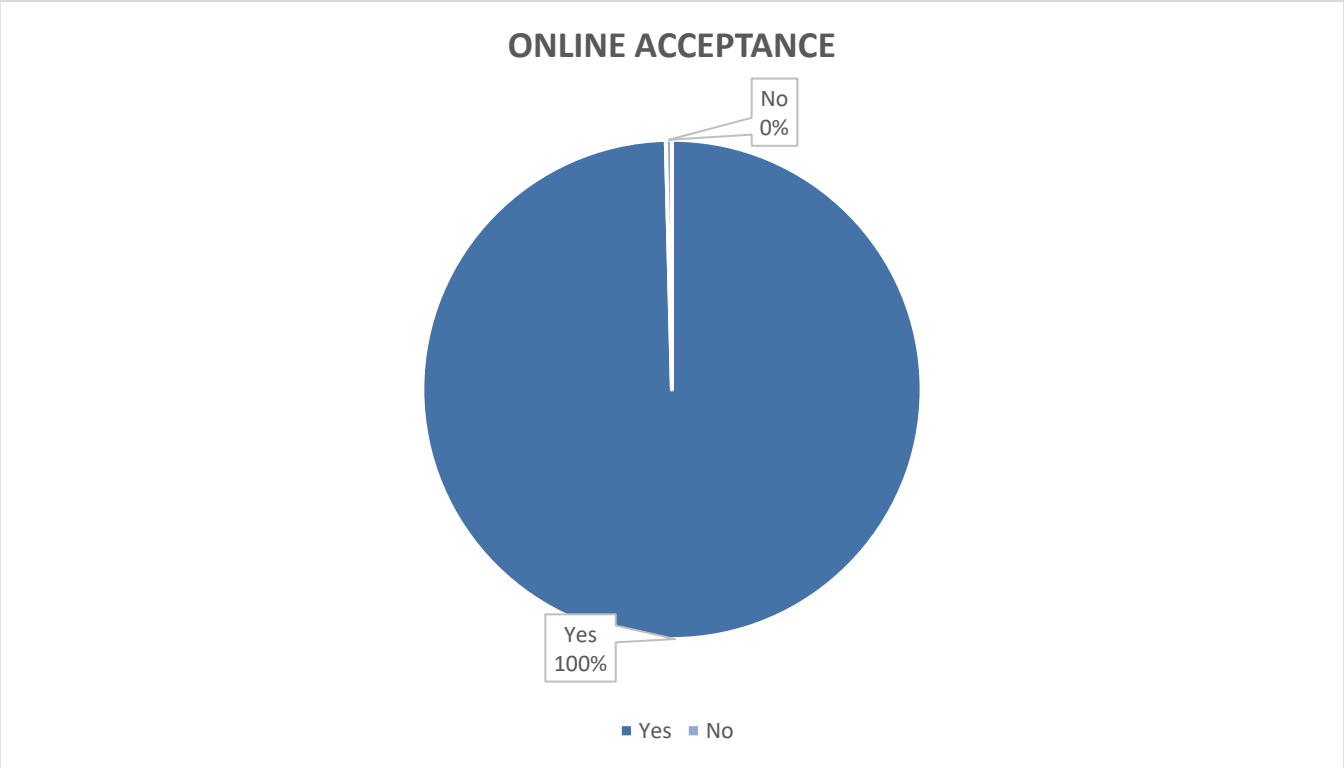
Summary statistics:

Min	Max	Mean	Median	SD	Variance	CV
1.00	5.00	1.714	1.00	1.047533	1.09732	0.61116

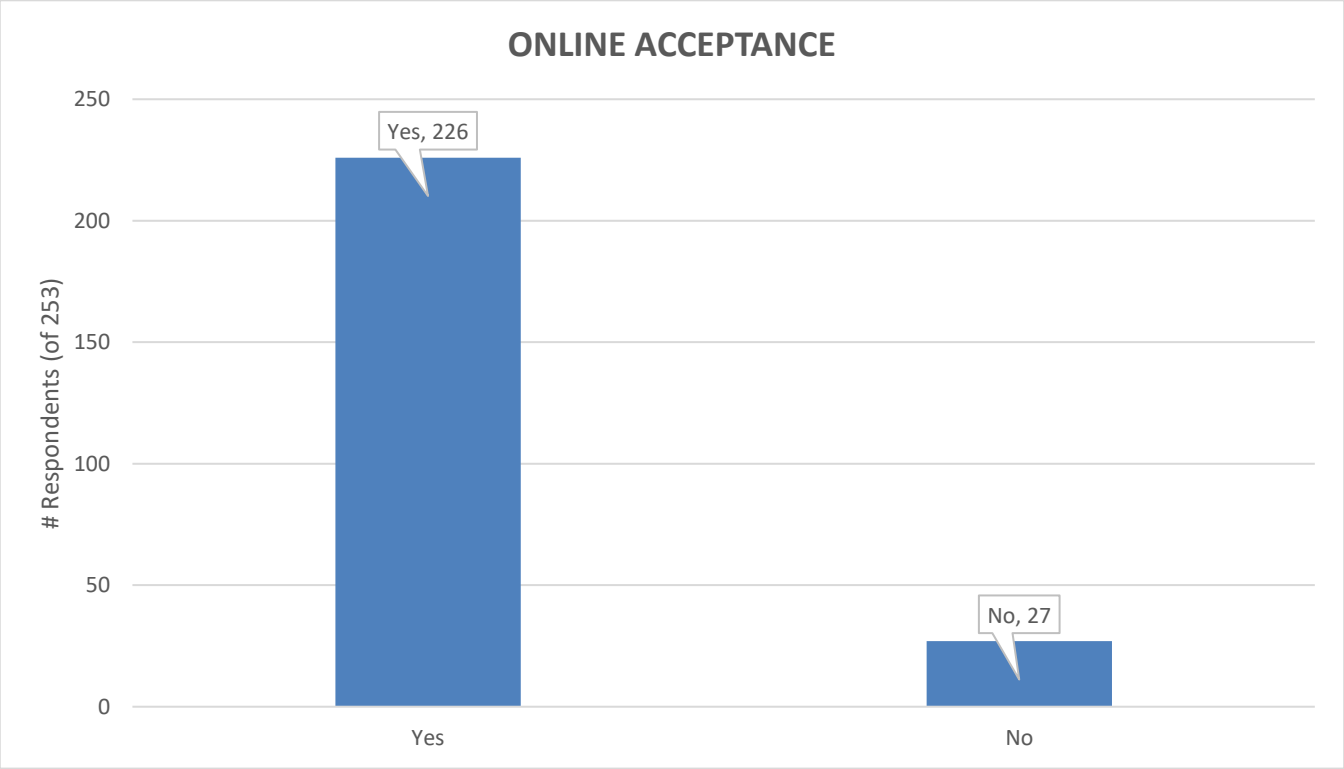
9.21 Appendix 21: The e-Grocery Value Chain



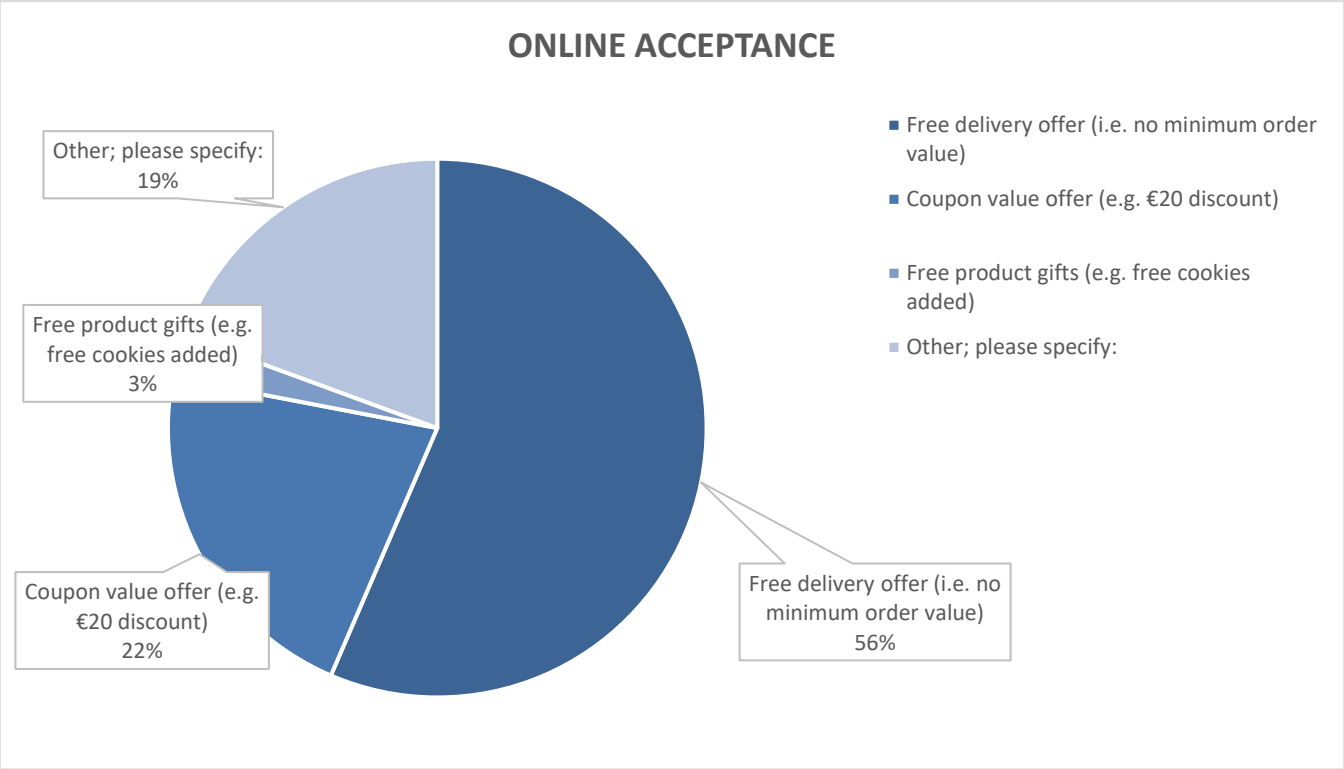
9.22 Appendix 22: "Have you ever ordered any product online?"

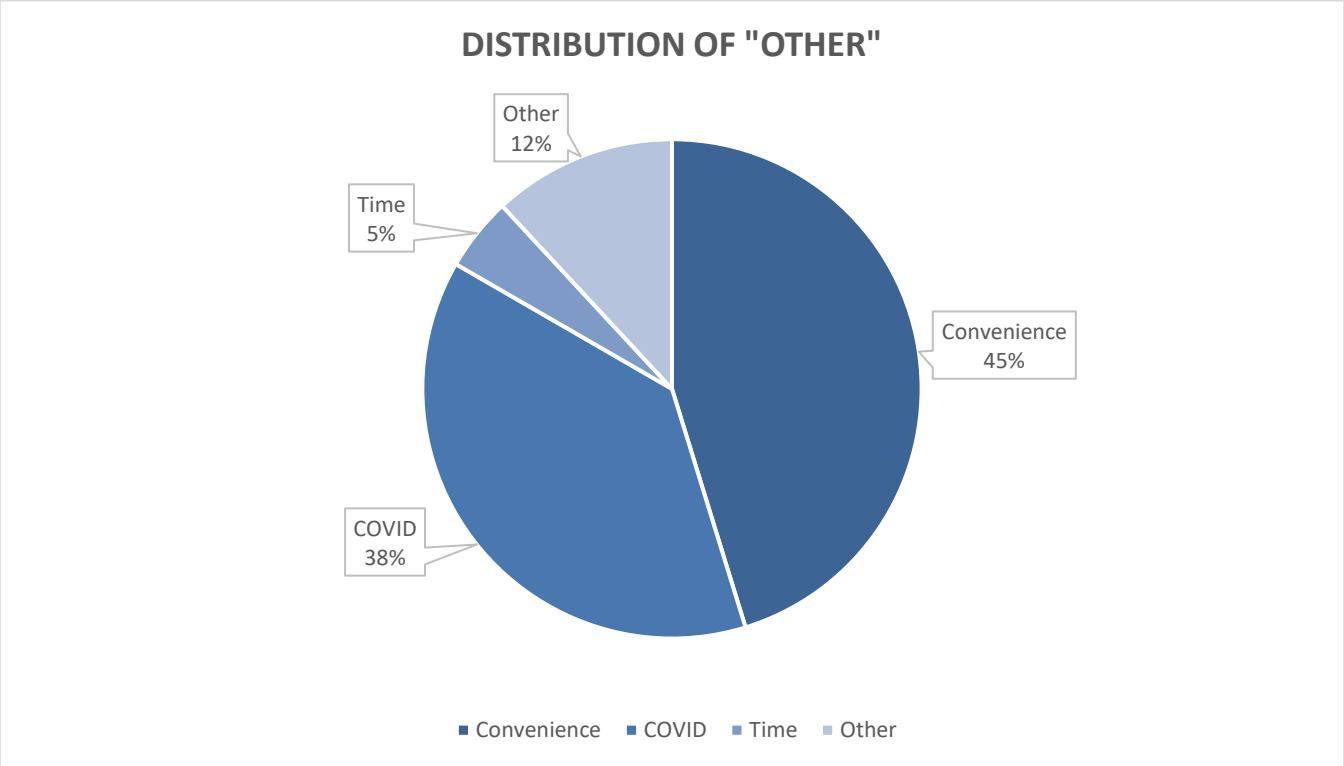


9.23 Appendix 23: "Have you ever used grocery home delivery?"

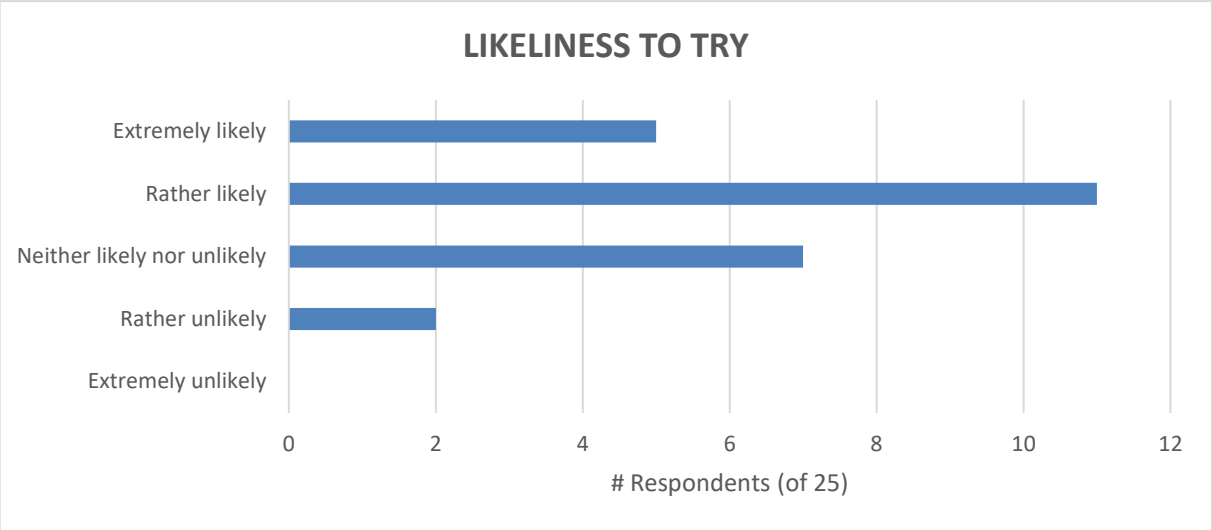


9.24 Appendix 24: If you have used grocery home deliveries before, what made you use it for the first time?





9.25 Appendix 25: If you have not used home deliveries before, how likely would you be willing to give it a try?

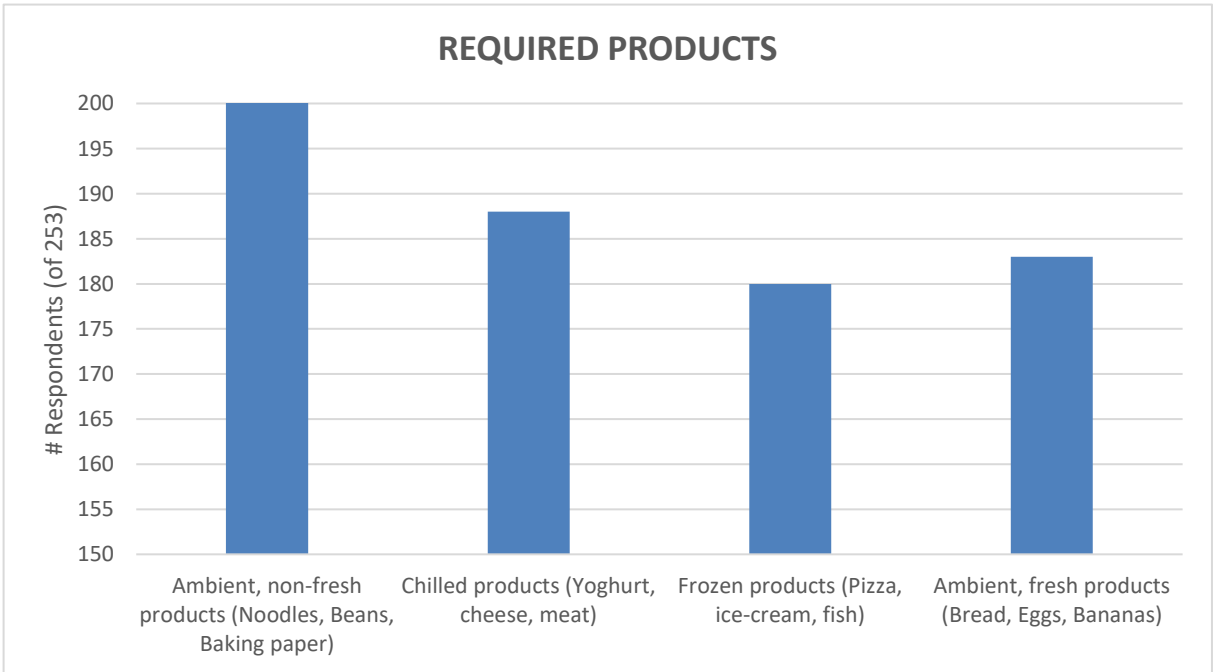


The variable was also translated to the numeric variable "Likeliness_Try2" which displays the answers from "Extremely unlikely" (1) to "Extremely likely" (5).

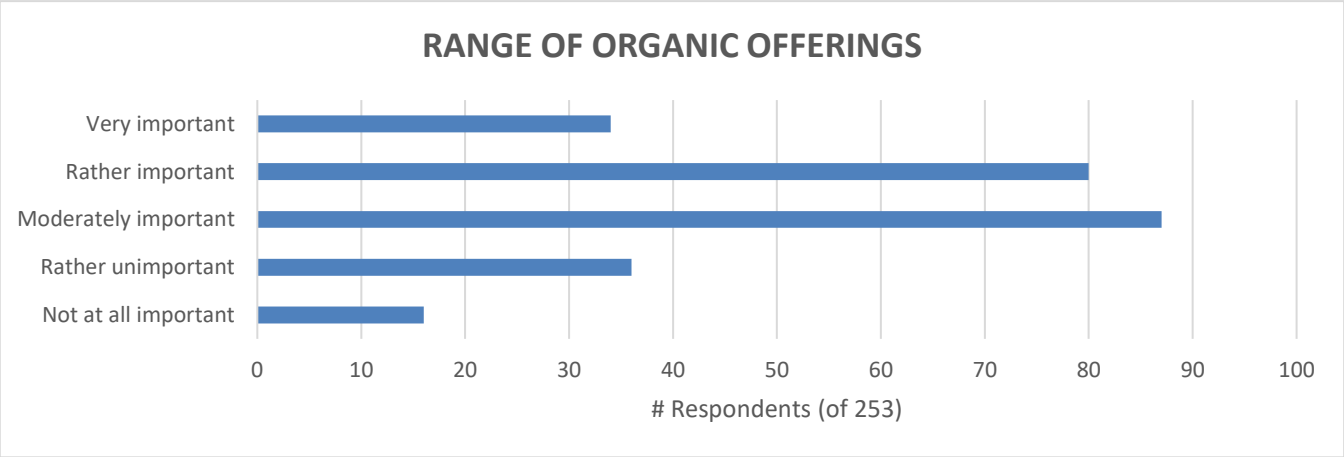
Summary statistics:

Min	Max	Mean	Median	SD	Variance	CV
2.00	5.00	3.76	4.00	0.8793937	0.7733	0.2338

9.26 Appendix 26: Which products would you like to buy? (Multiple answers possible!)



9.27 Appendix 27: How important are the following when buying from a specific online grocer? – Range of Organic Offerings

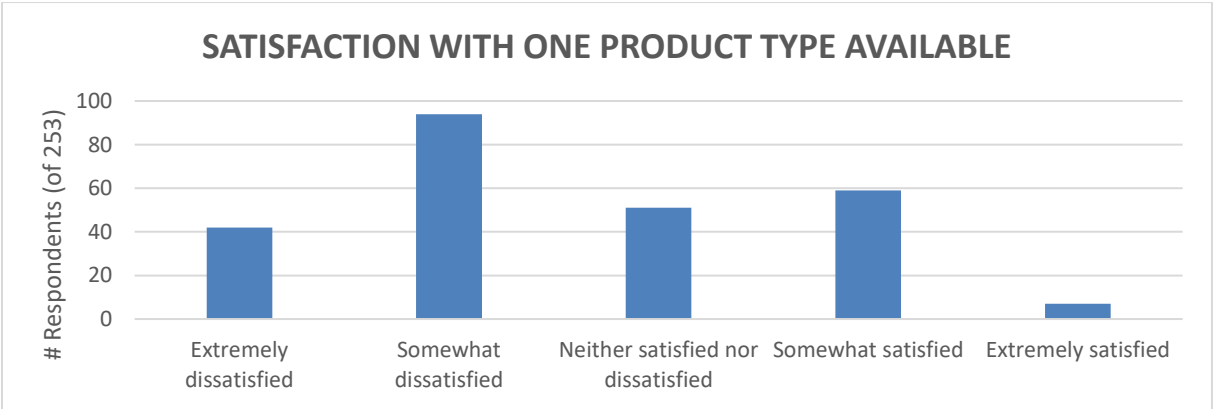


The variable was also translated to a numeric variable ranging from "Not at all important" (1) to "Very important" (5).

Summary statistics:

Min	Max	Mean	Median	SD	Variance	CV
1.00	5.00	3.316	3.00	1.074	1.15347	0.2299

9.28 Appendix 28: Imagine you were shopping for potatoes. If there was only one option, how satisfied would you be with the offering?

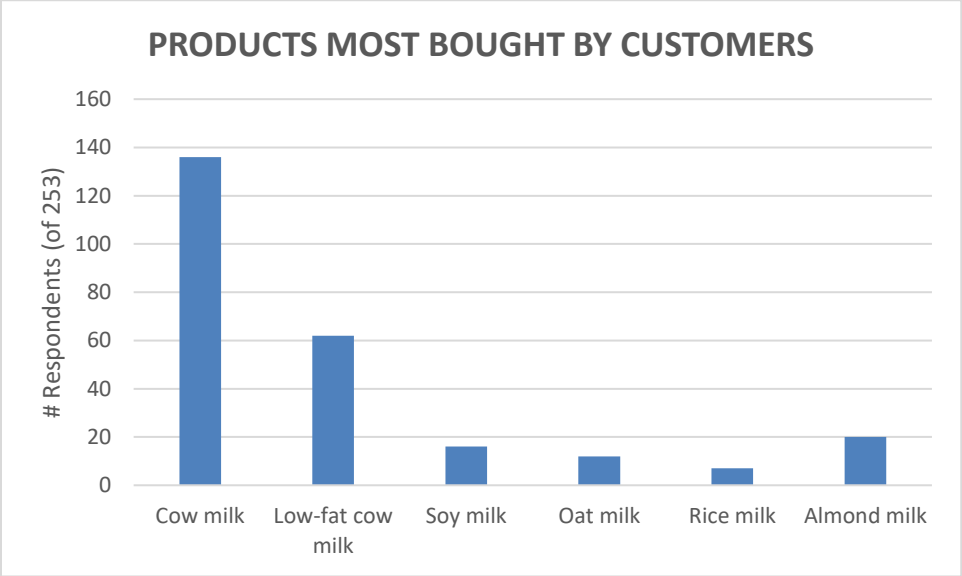


This variable was also translated to the numeric variable "Potatoes2" which ranges from "Extremely dissatisfied" (1) to "Extremely satisfied" (5).

Summary statistics:

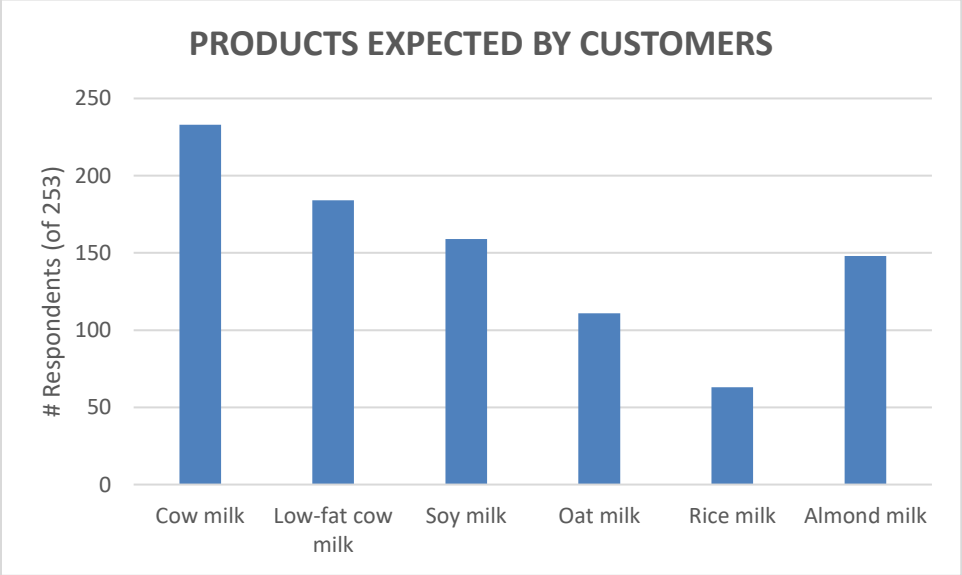
Min	Max	Mean	Median	SD	Variance	CV
1.00	5.00	2.585	2.00	1.100907	1.2119	0.4258

9.29 Appendix 29: Imagine you were shopping for milk. Which type do you buy the most?



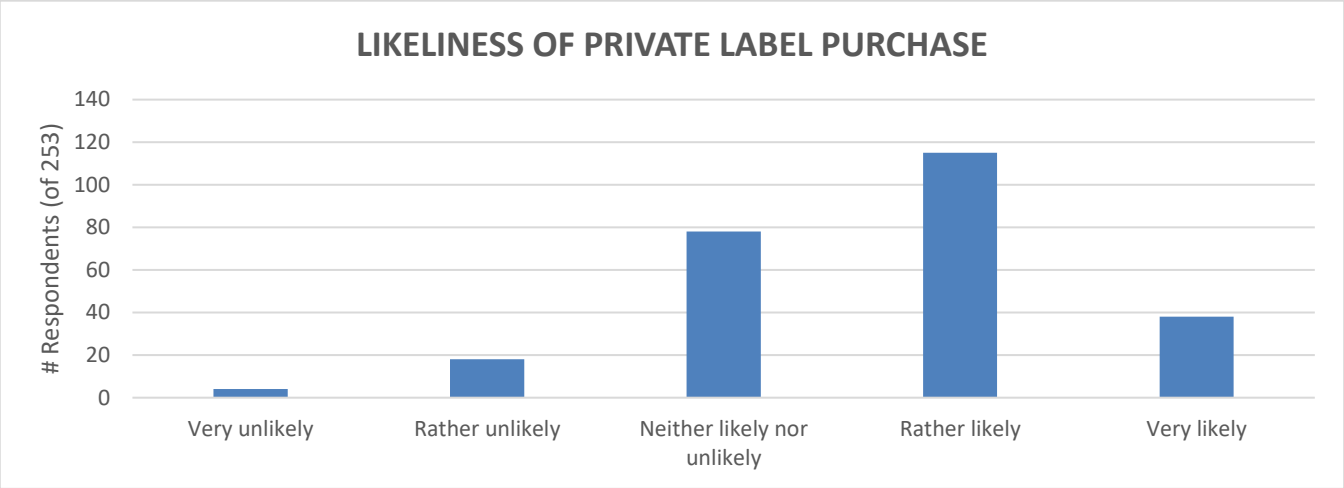
Total
253

9.30 Appendix 30: What types of milks do you expect to find? (Multiple answers possible!)



Total	**Multiple**
898	**3.55**

9.31 Appendix 31: How likely are you to choose a retailer's private label product over the branded, more expensive product for a commonly purchased item? (e.g. soap, milk)

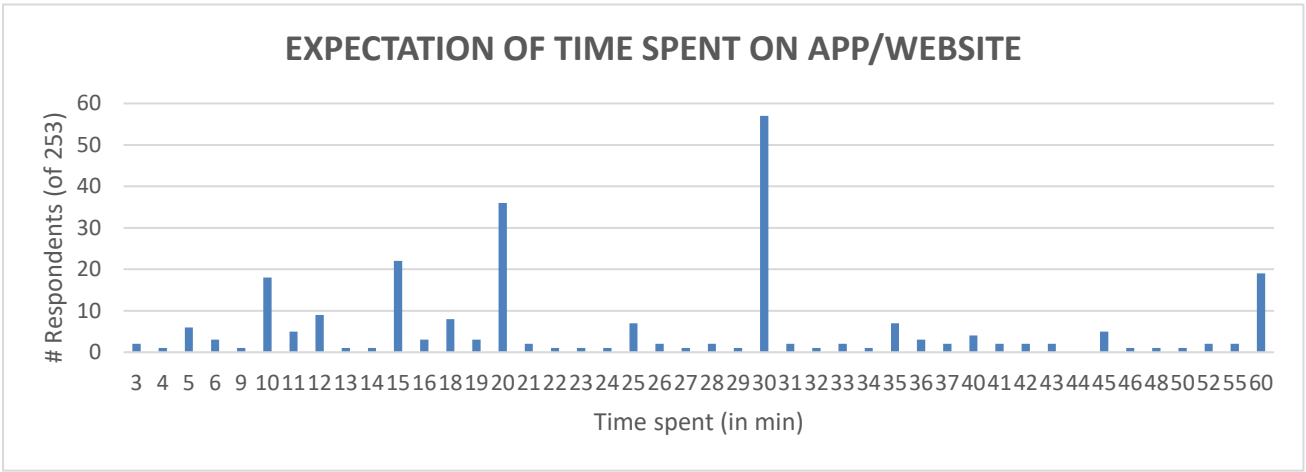


This variable was also translated to the numeric variable "PrivateLabel_Likeliness2" which ranges from "Very unlikely" (1) to "Very likely" (5).

Summary statistics:

Min	Max	Mean	Median	SD	Variance	CV
1.00	5.00	3.652	4.00	0.8760	0.7673	0.2398

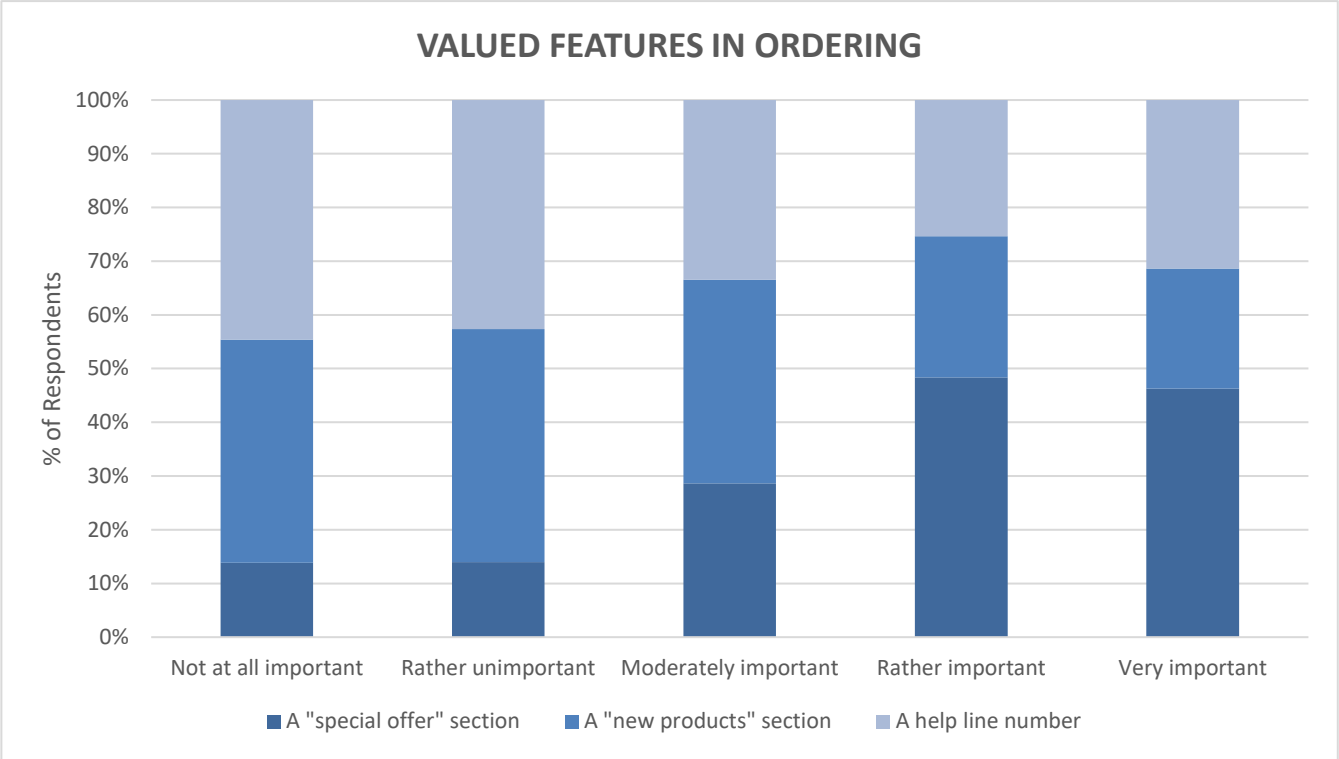
9.32 Appendix 32: What length of time on the app/website do you expect to spend when ordering groceries online?



Summary statistics:

Min	Max	Mean	Median	SD	Variance	CV
3.00	60.00	26.29	25.00	14.27	203.6329	0.542

9.33 Appendix 33: Which features do you value when buying groceries online?

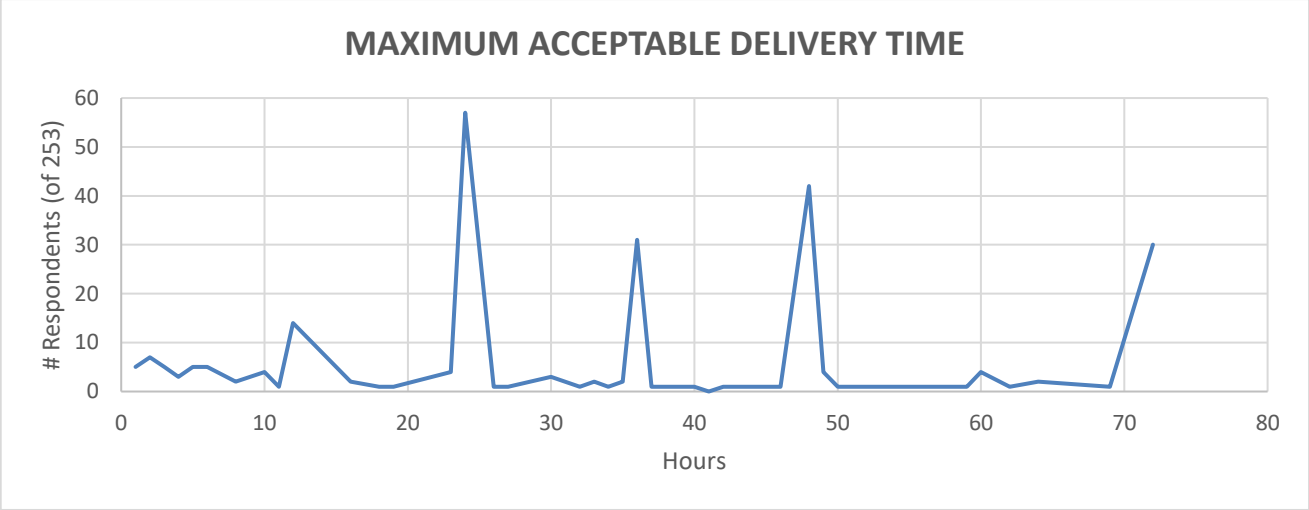


The variables were also translated to numeric variables ranging from "Not at all important" (1) to "Very important" (5).

Summary statistics:

Feature	Min	Max	Mean	Median	SD	Variance	CV
"Special offer" section	1.00	5.00	3.715	4.00	1.0009	1.0018	0.269
"New products" section	1.00	5.00	3.004	3.00	1.1426	1.3055	0.380
Help line number	1.00	5.00	3.071	3.00	1.2227	1.4949	0.398

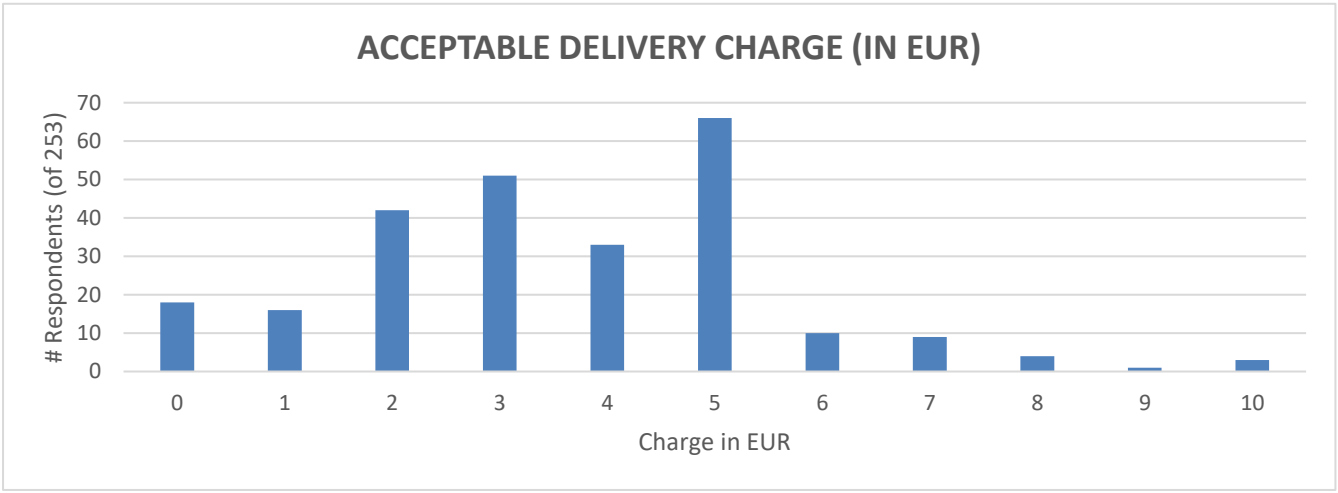
9.34 Appendix 34: What delivery time is the maximum you can accept?



Summary statistics:

Min	Max	Mean	Median	SD	Variance	CV
1.00	72.00	34.54	35	20.78	431.808	0.6016

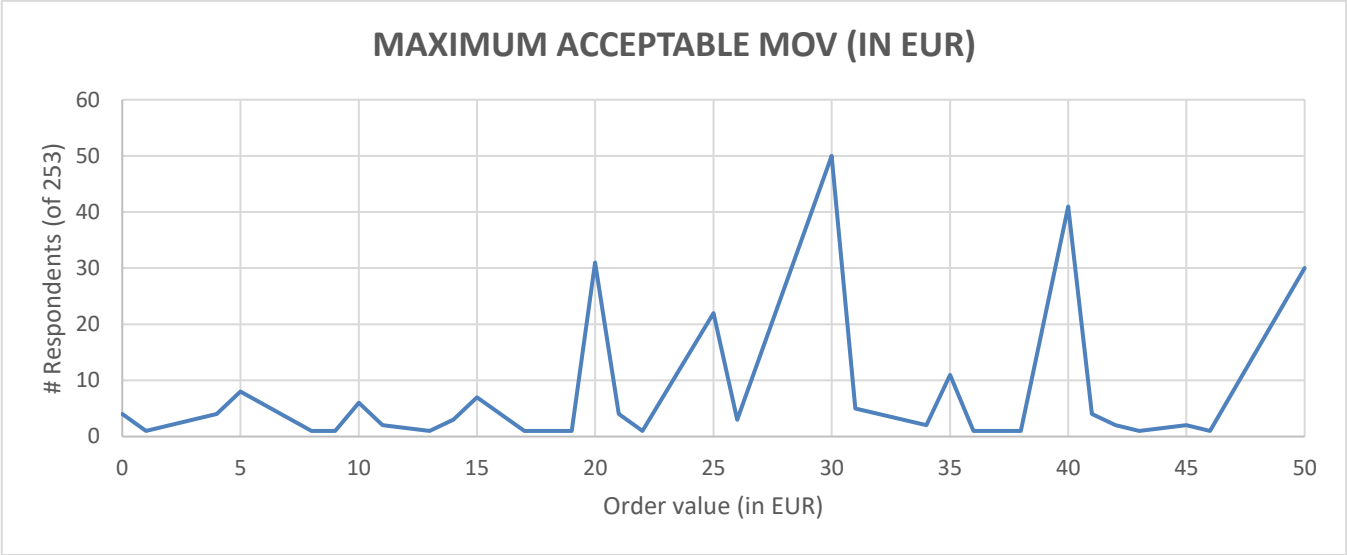
9.35 Appendix 35: What delivery charge are you willing to pay?



Summary statistics:

Min	Max	Mean	Median	SD	Variance	CV
0.00	10.00	3.59	3.0	1.985	3.9402	0.5529

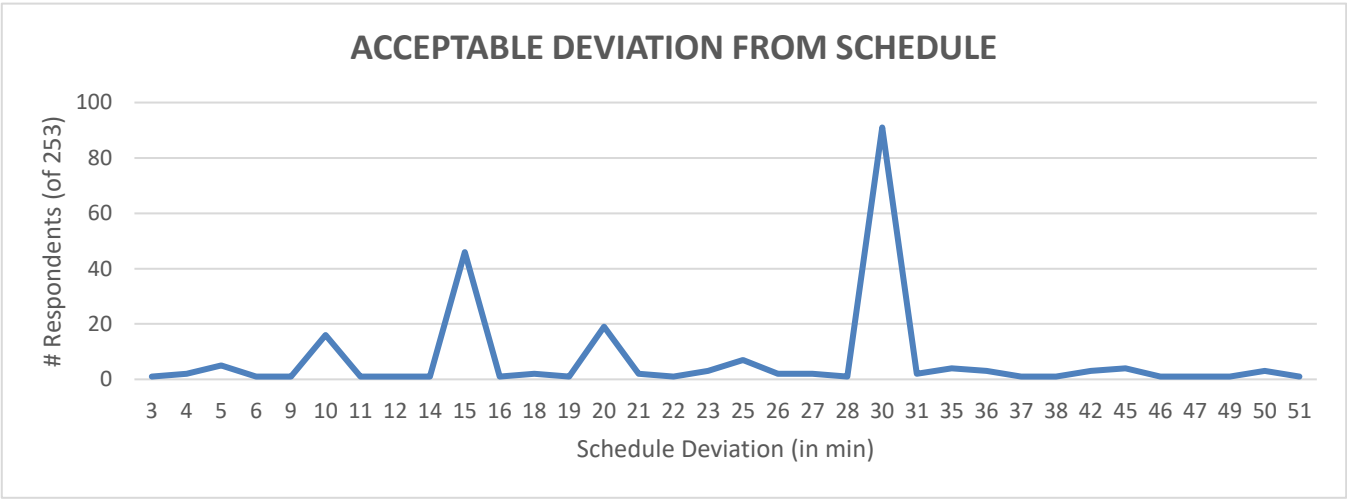
9.36 Appendix 36: In your opinion, from what threshold should deliveries be free of charge?



Summary statistics:

Min	Max	Mean	Median	SD	Variance	CV
0.00	50.00	29.58	30.00	12.8297	164.601	0.433

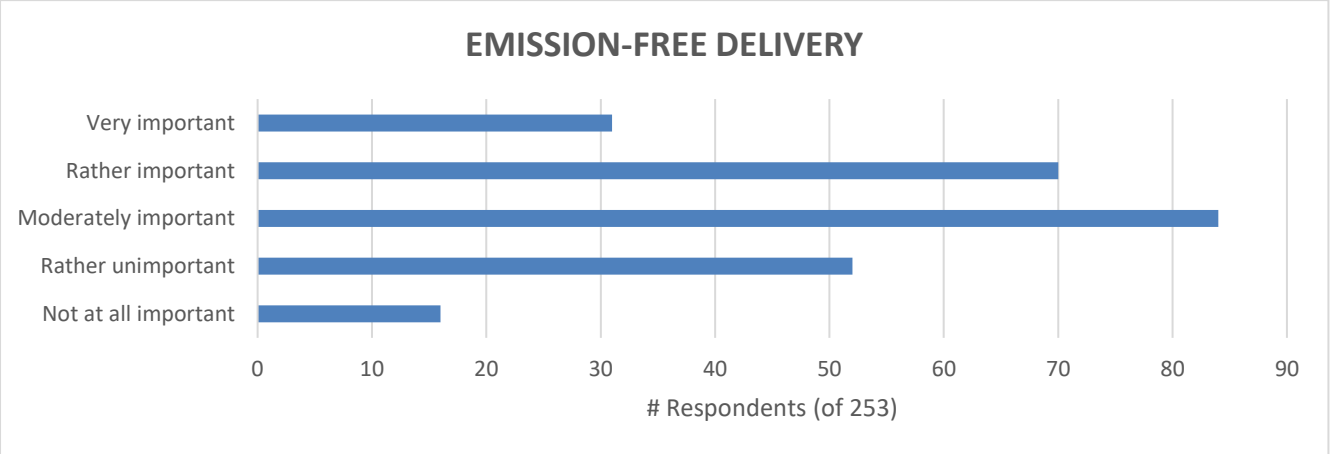
9.37 Appendix 37: You have scheduled your grocery delivery at 2PM. How many minutes of deviation (+/-) are you willing to accept when receiving your goods?



Summary statistics:

Min	Max	Mean	Median	SD	Variance	CV
3.00	60.00	27.09	30.00	13.79955	190.427	0.5093

9.38 Appendix 38: How important are the following when buying from a specific online grocer? – Emission-free delivery



The variable was also translated to a numeric variable ranging from "Not at all important" (1) to "Very important" (5).

Summary statistics:

Min	Max	Mean	Median	SD	Variance	CV
1.00	5.00	3.19	3.00	1.092713	1.194	0.3425

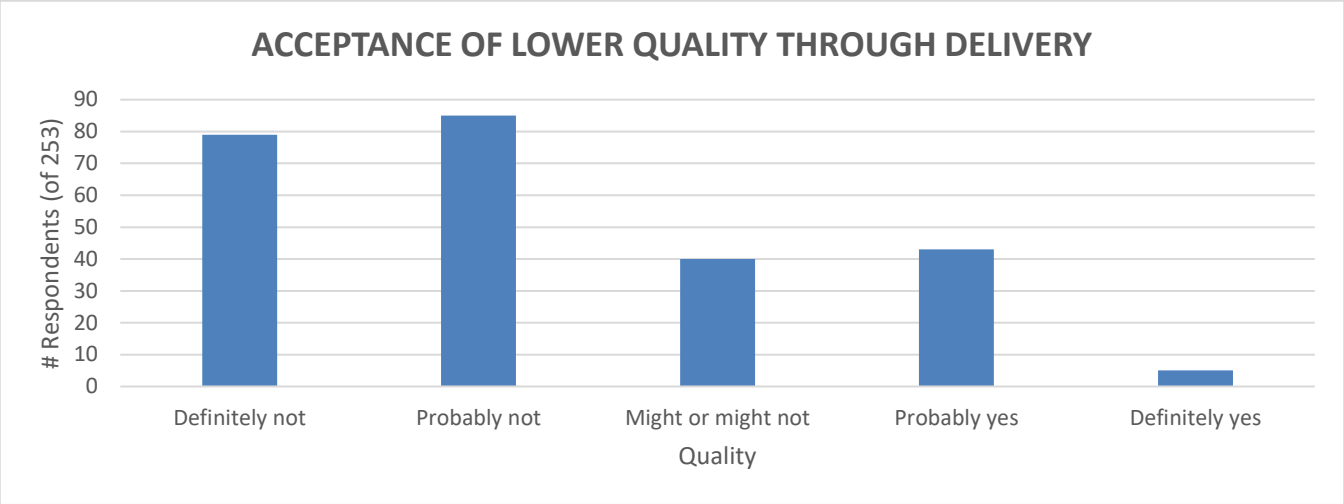
9.39 Appendix 39: Compared to product quality (freshness, condition, ...) you receive in offline supermarkets, what quality do you expect to receive from deliveries?

The variable was also translated to the numeric variable Acceptance_Quality2, which ranges from "Much lower" (1) to "Much higher" (5).

Summary statistics:

Min	Max	Mean	Median	SD	Variance	CV
1.00	5.00	3.209	3.00	0.7556	0.5710	0.235

9.40 Appendix 40: Are you willing to accept lower quality (freshness, condition, ...) caused by the delivery process?

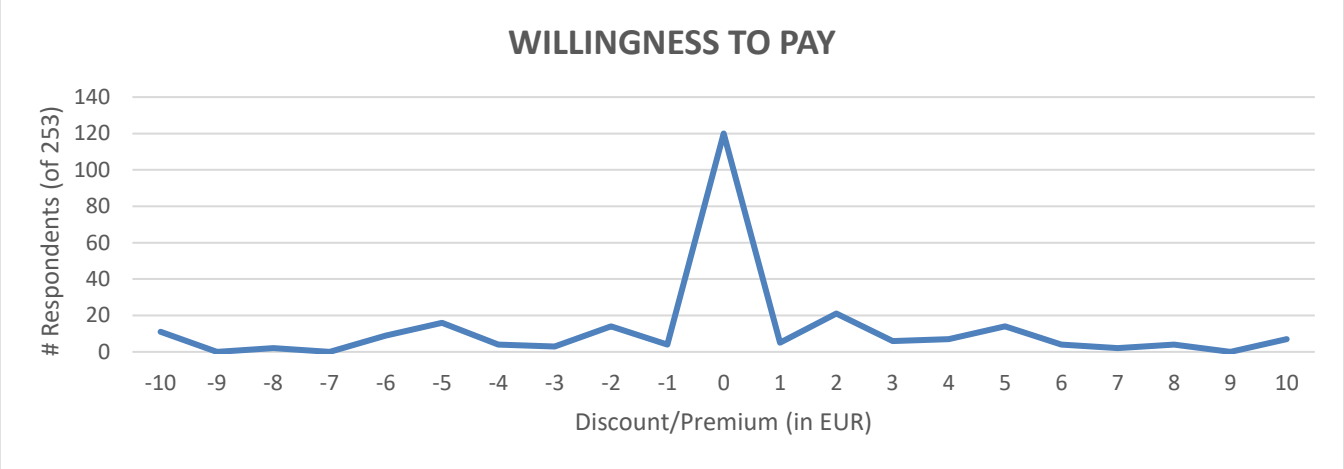


The variable was also translated to the numeric variable Acceptance_Quality2, which ranges from "Definitely not" (1) to "Definitely yes" (5).

Summary statistics:

Min	Max	Mean	Median	SD	Variance	CV
1.00	5.00	2.246	3.00	1.13043	1.2778	0.5033

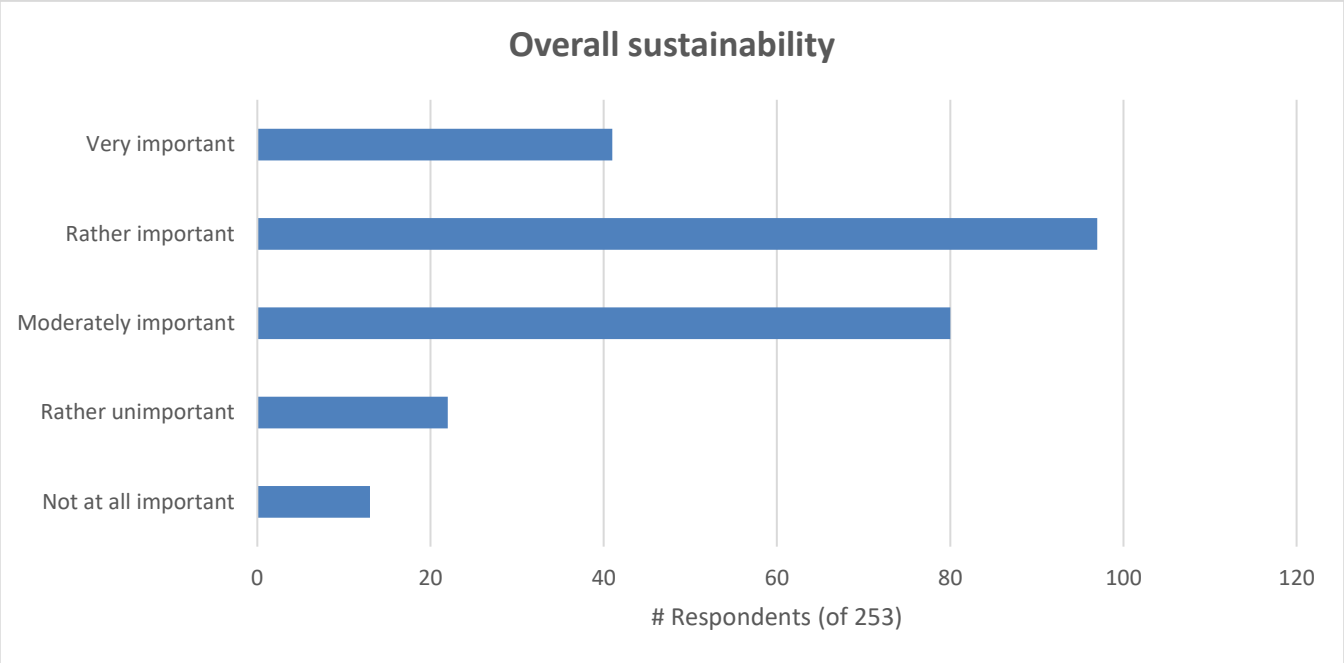
9.41 Appendix 41: If you paid €50 in a supermarket, how much are you willing to pay for the same purchase online?



Summary statistics:

Min	Max	Mean	Median	SD	Variance	CV
-10.00	10.00	-0.05534	0.00	3.936613	15.496	-3.8813

9.42 Appendix 42: How important are the following when buying from a specific online grocer? – Overall sustainability



The variable was also translated to the numeric variable Imp_Overall_sustainability2, which ranges from "Not at all important" (1) to "Very important" (5).

Summary statistics:

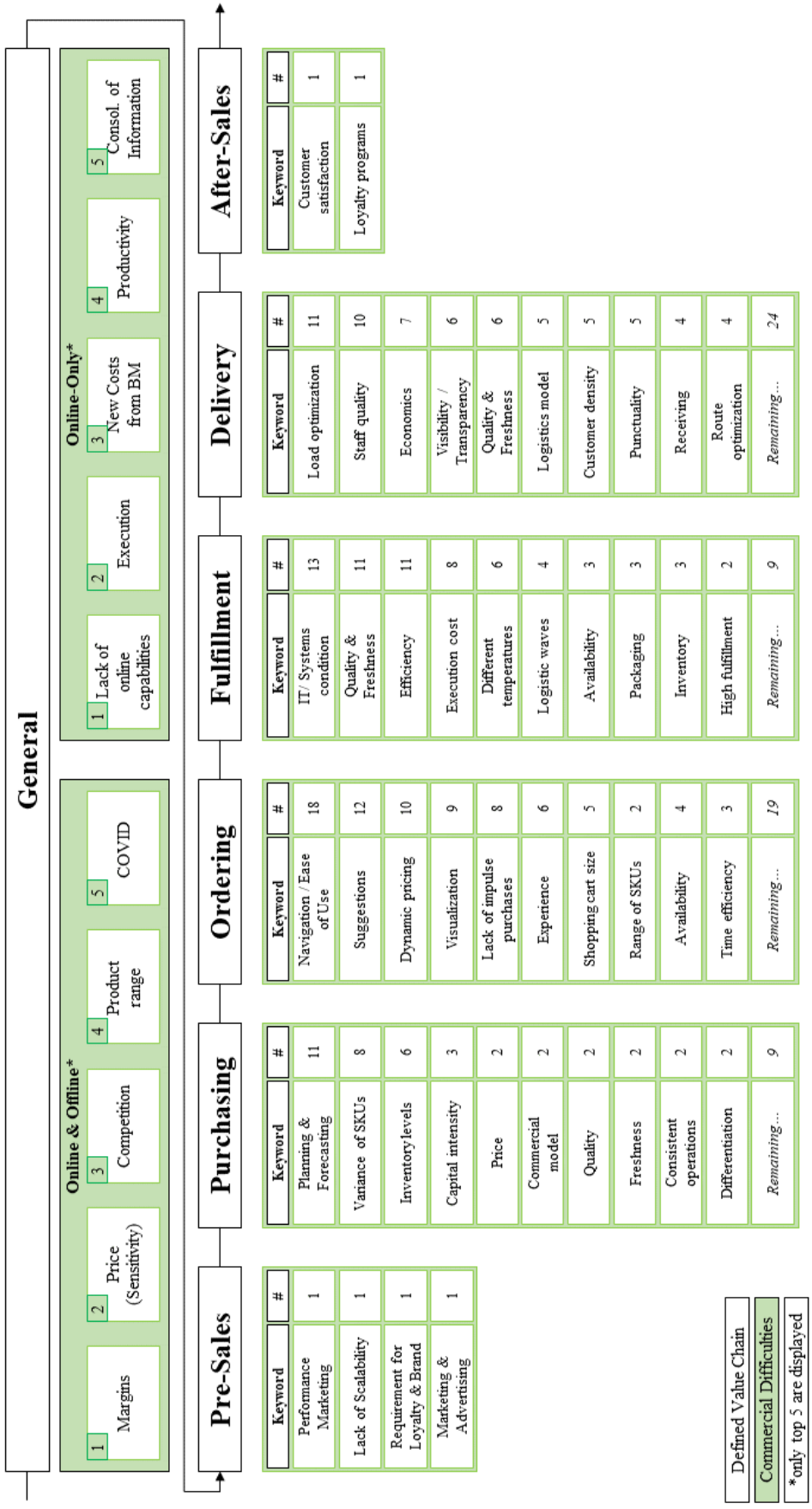
Min	Max	Mean	Median	SD	Variance	CV
1.00	5.00	3.518	4.00	1.0297	1.060	4.277

9.43 Appendix 43: Customer expectations towards e-grocery

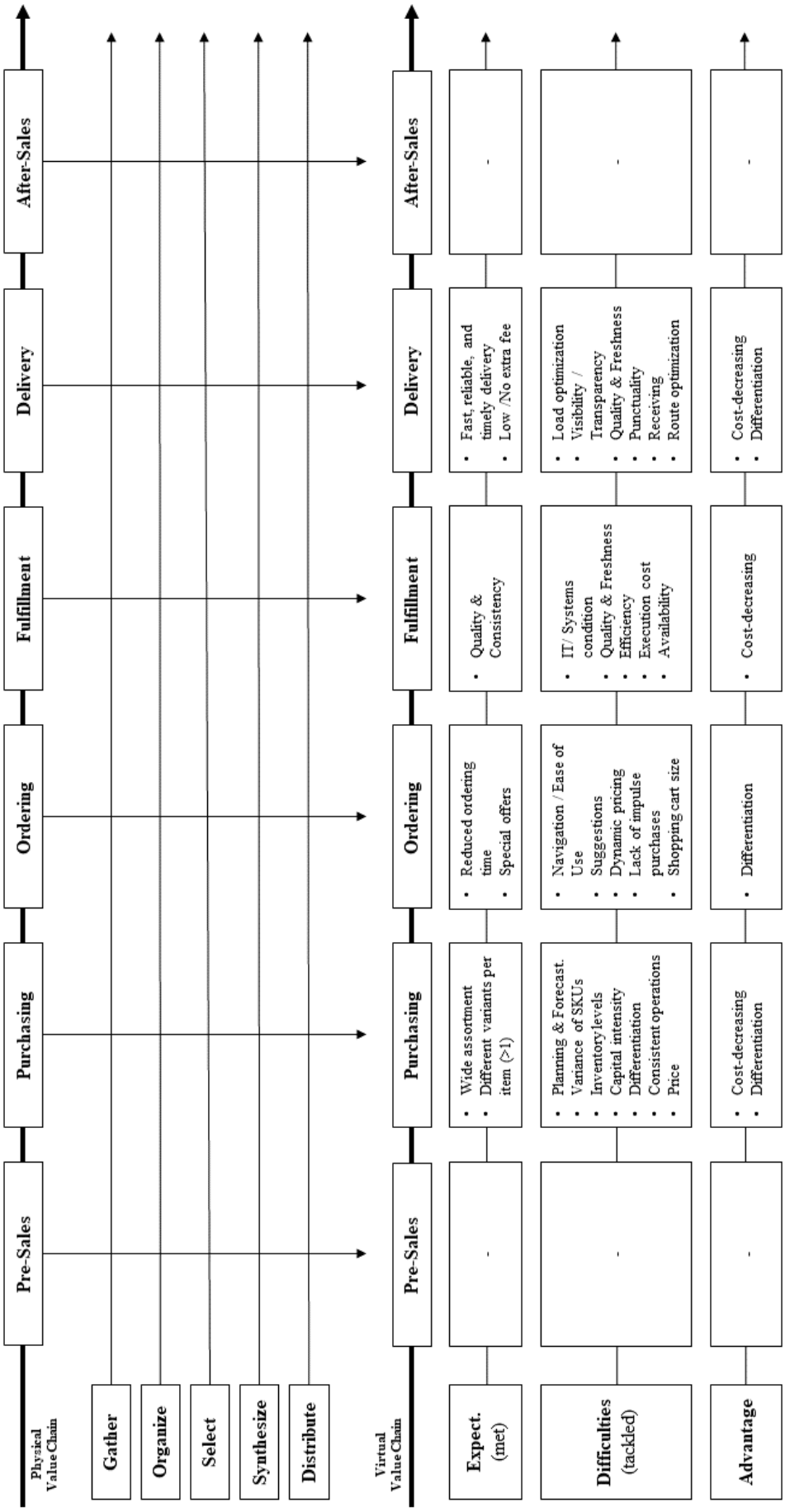
9.44 Appendix 44: List of Interviewed Experts

Expert Name	ID	Interview Type	Expert Area	Company	Company Type	Position
Arjun Anand	A	Zoom Call	(Fast-Moving) Consumer Goods	Verlinvest	Private Equity	Executive Director
Elena Helbig	B	Written Answers	E-Grocery Retail	knuspr.de	E-Grocery Start-Up	Expansion Project Manager
Filip Kegels	C	Zoom Call	(Fast-Moving) Consumer Goods	DANONE ONE PLANET. ONE HEALTH	FMCG Brand	Ex-General Manager, Dairy Products
Hugo D'Horta Da Conceicao	D	Zoom Call	Retail, Supply Chain, Sales	DIA	Traditional Retailer	National Director, Sales Development and New Business
Joao Pedro Goncalves	E	Written Answers	Retail, eCommerce	BBOX SPORTS	Retail Brand	Retail Business Manager
Kasra Baron-Hamidi	F	Zoom Call	Retail, Logistics, eCommerce	LIDL digital	Traditional Retailer	Director; Logistics Operations eCommerce
Katharina Kempf	G	Written Answers	Strategy Consulting (Retail)	Kurt Salmon Part of Accenture Strategy	Strategy Consultancy	Strategy Consultant; Retail and Consumer Goods
Dr. Marcus Kroth	H	Written Answers	Strategy Consulting (Retail)	BCG	Strategy Consultancy	Principal; Retail and Consumer
Niklas Tauch	I	Zoom Call	Retail, Supply Chain	liefergrün	Delivery Start-Up	Co-Founder & CEO
Prashant Chhaya	J	Zoom Call	(Fast-Moving) Consumer Goods	DRUMS Food International Pvt. Ltd.	FMCG Brand	Non-Executive Board Member
Thomas Haas	K	Zoom Call	Retail, AI & ML Implementation	BlueYonder	Retail Solutions	Sales Executive EMEA

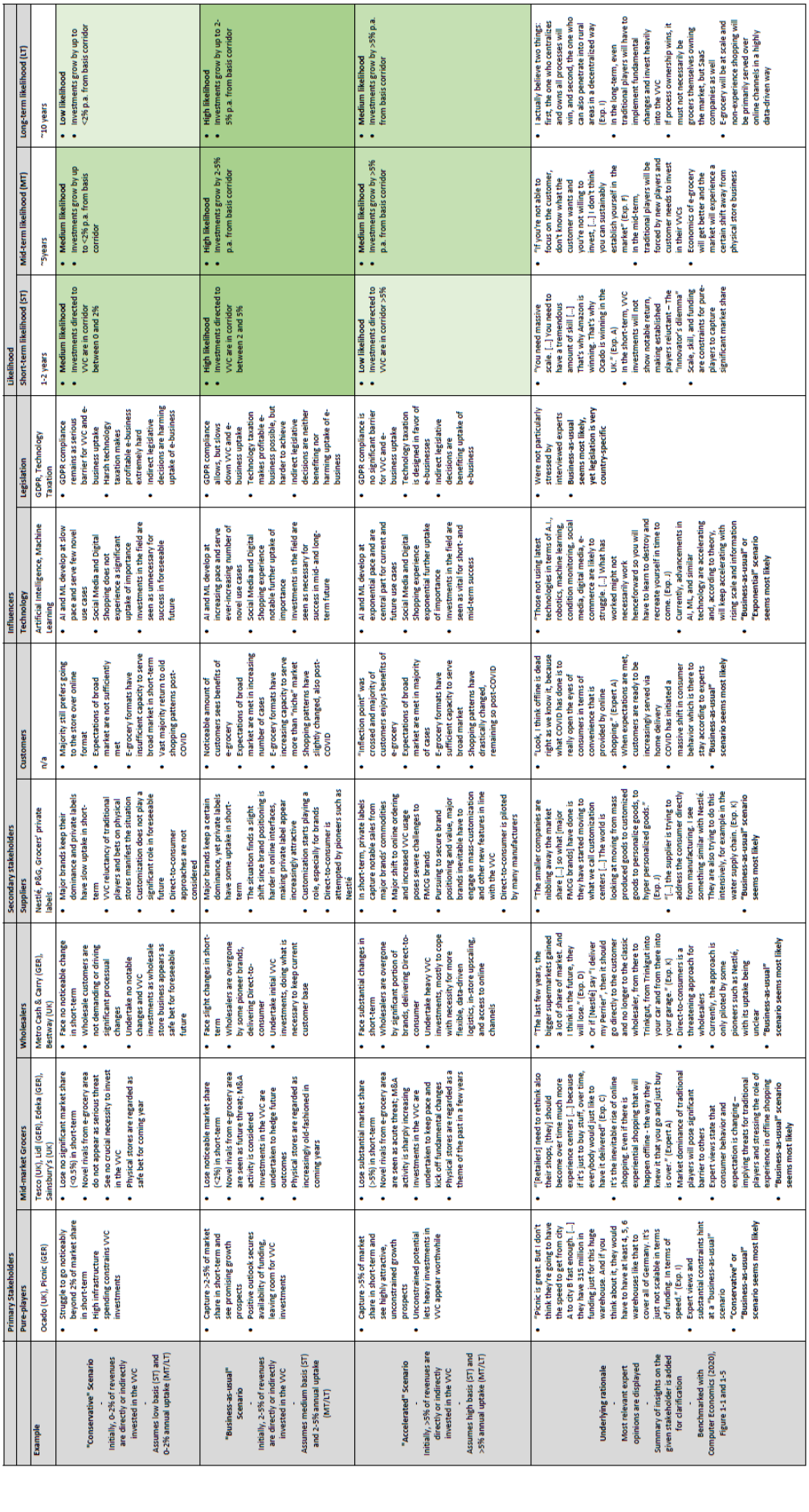
9.45 Appendix 45: Commercial difficulties of (e-)grocery business models



9.46 Appendix 46: Advantages from leverage of the VVC

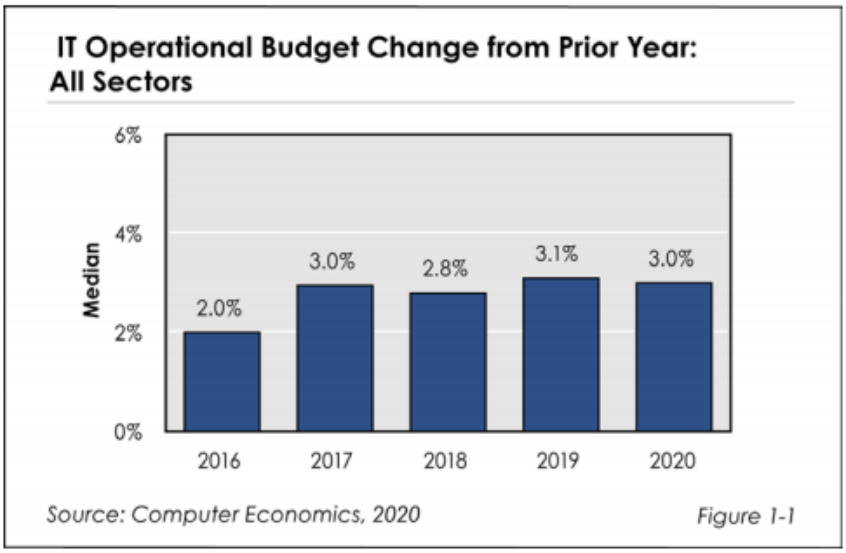


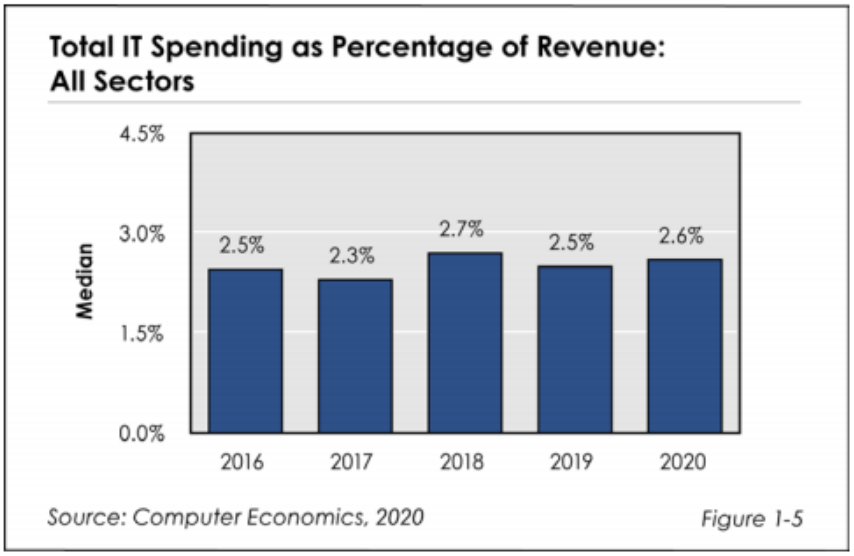
9.47 Appendix 47: Scenario Analysis

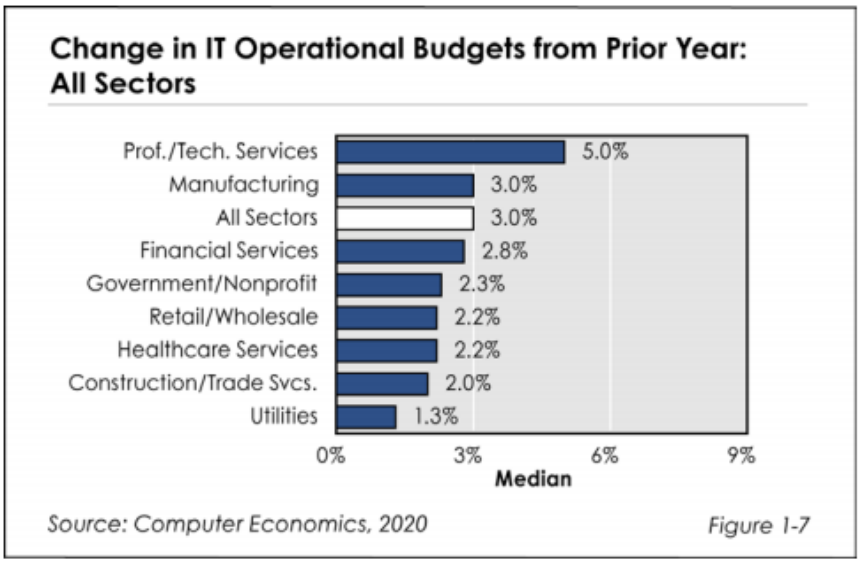


	Primary Stakeholders		Secondary stakeholders		Influencers		Likelihood			
	Pure-players	Mid-market Grocers	Wholesalers	Suppliers	Customers	Technology	Legislation	Short-term likelihood (ST)	Mid-term likelihood (MT)	Long-term likelihood (LT)
Example	Ocado (UK), Picnic (GER)	Tesco (UK), Lidl (GER), Edeka (GER), Sainsbury's (UK)	Metro Cash & Carry (GER), Bestway (UK)	Nestlé, P&G, Grocers' private labels	n/a	Artificial Intelligence, Machine Learning	GDPR, Technology Taxation	1-2 years	~5years	~10 years
"Conservative" Scenario - Initially, 0-2% of revenues are directly or indirectly invested in the VVC - Assumes low basis (ST) and 0-2% annual uptake (MT/LT)	• Struggle to go noticeably beyond 2% of market share in short-term • High infrastructure spending constrains VVC investments	• Lose no significant market share (<0.5%) in short-term • Novel rivals from e-grocery area do not appear as serious threat • See no crucial necessity to invest in the VVC • Physical stores are regarded as safe bet for coming year	• Face no noticeable change in short-term • Wholesale customers are not demanding or driving significant processual changes • Undertake no notable changes and VVC investments as wholesale customers appear as safe bet for foreseeable future	• Major brands keep their dominance and private labels have slow uptake in short-term • VVC reluctancy of traditional players and lacs on physical stores manifest the situation • Customization does not play a significant role in foreseeable future • Direct-to-consumer are not considered	• Majority still prefers going to the store over online format • Expectations of broad market are not sufficiently met • E-grocery formats have insufficient capacity to serve broad market in short-term • Vast majority return to old shopping patterns post-COVID	• AI and ML develop at slow pace and serve few novel use cases • Social Media and Digital Shopping does not experience a significant uptake of importance • Investments in the field are seen as unnecessary for success in foreseeable future	• GDPR compliance remains as serious barrier for VVC and e-business uptake • Harsh technology taxation makes profitable e-business extremely hard • Indirect legislative decisions are harming uptake of e-business	• Medium likelihood • Investments directed to VVC are in corridor between 0 and 2%	• Medium likelihood • Investments grow by up to <2% p.a. from basis corridor	• Low likelihood • Investments grow by up to <2% p.a. from basis corridor
"Business-as-usual" Scenario - Initially, 2-5% of revenues are directly or indirectly invested in the VVC - Assumes medium basis (ST) and 2-5% annual uptake (MT/LT)	• Capture >2-5% of market share in short-term and see promising growth prospects • Positive outlook secures availability of funding, leaving room for VVC investments	• Lose noticeable market share (<2%) in short-term • Novel rivals from e-grocery area are seen as acute threat; M&A activity is considered • Investments in the VVC are undertaken to hedge future outcomes • Physical stores are regarded as increasingly old-fashioned in coming years	• Face slight changes in short-term • Wholesalers are overgone by some pace-setter brands; delivering Direct-to-consume • Undertake initial VVC investments, doing what is necessary to keep current customer base	• Major brands keep a certain dominance, yet private labels have some uptake in short-term • The situation finds a slight shift since brand positioning is harder in online interfaces, making private label appear increasingly attractive • Customization starts playing a role, especially for brands attempted by pioneers such as Nestlé	• Noticeable amount of customers sees benefits of e-grocery • Expectations of broad market are met in increasing number of cases • E-grocery formats have increasing capacity to serve more than "niche" market • Shopping patterns have slightly changed, also post-COVID	• AI and ML develop at exponential pace and serve ever-increasing number of novel use cases • Social Media and Digital Shopping experience notable further uptake of importance • Investments in the field are seen as necessary for success in mid- and long-term future	• GDPR compliance allows to break down VVC and e-business uptake • Technology taxation makes profitable e-business possible, but harder to achieve • Indirect legislative decisions are neither benefiting nor harming uptake of e-business	• High likelihood • Investments directed to VVC are in corridor between 2 and 5%	• High likelihood • Investments grow by 2-5% p.a. from basis corridor	• High likelihood • Investments grow by up to 2-5% p.a. from basis corridor
"Accelerated" Scenario - Initially, >5% of revenues are directly or indirectly invested in the VVC - Assumes high basis (ST) and >5% annual uptake (MT/LT)	• Capture >5% of market share in short-term and see highly attractive, unconstrained growth prospects • Unconstrained potential lets heavy investments in VVC appear worthwhile	• Lose substantial market share (>5%) in short-term • Novel rivals from e-grocery area are seen as acute threat; M&A activity is sharply increasing • Investments in the VVC are undertaken to keep pace and kick off fundamental changes • Physical stores are regarded as a theme of the past in a few years	• Face substantial changes in short-term • Wholesalers are overgone by significant portion of brands, delivering Direct-to-consumer • Undertake heavy VVC investments, mostly to cope with necessity for more flexible, data-driven logistics, in-store upscaling, and access to online channels	• In short-term, private labels capture notable sales from major brands' commodities • Major shift to online ordering and increased VVC usage poses severe challenges to FMCG brands • Pursuing to secure brand positioning and value, major brands inevitable have to engage in mass-customization and other new features in line with the VVC • Direct-to-consumer is piloted by many manufacturers	• "inflection point" was crossed and majority of customers enjoys benefits of e-grocery • Expectations of broad market are met in majority of cases • E-grocery formats have sufficient capacity to serve broad market • Shopping patterns have drastically changed, remaining so post-COVID	• AI and ML develop at exponential pace and are central part for current and future use cases • Social Media and Digital Shopping experience exponential further uptake of importance • Investments in the field are seen as vital for short- and mid-term success	• GDPR compliance is no significant barrier for VVC and e-business uptake • Technology taxation is designed in favor of e-businesses • Indirect legislative decisions are benefiting uptake of e-business	• Low likelihood • Investments directed to VVC are in corridor >5%	• Medium likelihood • Investments grow by >5% p.a. from basis corridor	• Medium likelihood • Investments grow by >5% p.a. from basis corridor
Underlying rationale - Most relevant expert opinions are displayed - Summary of insights on the given stakeholder is added for clarification - Benchmarked with Computer Economics' (2020), Figure 1-1 and 1-5	• "Picnic is great. But I don't think they're going to have the speed to get from city A to city B fast enough. [...] they have 315 million in funding just for this huge warehouse. And if you think about it, they would have to have at least 4, 5, 6 warehouses like that to cover all of Germany. It's just not scalable in terms of speed." (Exp. I) • Existent cost and substantial constraints hint at a "business-as-usual" scenario • "Conservative" or "Business-as-usual" scenario seems most likely	• "[Retailers] need to rethink also their shops, [they] should become over time much more experience centers [...] because if it's just to buy stuff, over time, everybody would just like to have it delivered" (Exp. C) • It's the inevitable rise of online shopping. Even if there is experiential shopping that will happen offline - the way they knew it that you go and just buy is over." (Expert A) • Market dominance of traditional players will pose significant barrier to others • Experiment behavior and expectation is changing – implying threats for traditional players and stressing the role of experience in offline shopping • "Business-as-usual" scenario seems most likely	• "The last few years, the bigger supermarkets gained a lot of share of market. And I think in the future, they will lose." (Exp. D) • Or if [Nestlé] say "I deliver my Perrier", then it should go directly to the customer and no longer to the classic wholesaler, from there to Thinkgut, from thinkgut into your car and from there into your garage." (Exp. K) • Direct-to-consumers is a threatening approach for wholesalers • Although the approach is only piloted by some pioneers such as Nestlé, with its uptake being unclear. • "Business-as-usual" scenario seems most likely	• "The smaller companies are nibbling away the market share [...] so what [major FMCG brands] have done is they have started moving to what we call customization centers [...] The world is looking at moving from mass produced goods to customized goods to personalize goods, to hyper personalized goods." (Exp. J) • "[...] the supplier is trying to address the consumer directly because they want to have something similar with Nestlé. They are also trying to do this intensively, for example in the water supply chain. (Exp. K) • "Business-as-usual" scenario seems most likely	• "Look, I think offline is dead right as we know it, because what COVID has done is to really open the eyes of consumers in terms of convenience that is provided by online shopping." (Expert A) • When expectations are met, customers are ready to be increasingly served via home delivery • COVID has initiated a massive shift in consumer behavior which is there to stay according to experts • "Business-as-usual" scenario seems most likely	• "Those not using latest technologies in terms of A.I., robotics, machine learning, condition monitoring, social media, digital media, e-commerce are likely to struggle. [...] What has worked might not necessarily work henceforward so you will have to learn to destroy and recreate yourself in time to come. (Exp. J) • Currently, advancements in AI, ML and accelerating technologies are accelerating and, according to theory, will keep accelerating with rising scale and information • "Business-as-usual" or "Exponential" scenario seems most likely	• Were not particularly stressed by interviewed experts • Business-as-usual seems most likely, yet legislation is very country-specific	• "You need massive scale. [...] you need to have a tremendous amount of skill [...] That's why Amazon is winning. That's why Ocado is winning in the UK." (Exp. A) • In the short-term, VVC investments will not show notable return, making established players reluctant – The "innovator's dilemma" • Scale, skill, and funding are constraints for pure-players to capture a significant market share	• "If you're not able to focus on the customer, don't know what the customer wants and you're not willing to invest, [...] I don't think you can sustainably establish yourself in the market (Exp. F) • In the mid-term, traditional players will be forced by new players and customer needs to invest in their VVCs • Economics of e-grocery will get better and the market will evolve from a certain shift away from physical store business	• I actually believe two things: first, the one who centralizes and owns all processes will win, and second, the one who can also penetrate into rural areas in a decentralized way (Exp. I) • In the long-term, even traditional players will have to implement fundamental changes and invest heavily into the VVC • If process ownership wins, it must not necessarily be grocers themselves owning the market, but SaaS companies will scale and e-grocery shopping will be primarily served over online channels in a highly data-driven way

9.48 Appendix 48: IT Operating Budgets in Retail







Source: Computer Economics, 2020