DISSERTATION

HOW IS IT GOING TO BE THE FUTURE OF IN-STORE CHECK-OUT IN SUPERMARKETS? A CASE STUDY

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ABSTRACT

Supermarkets are increasingly challenged to innovate their in-store checkout processes to meet evolving customer expectations and operational demands. This project addresses the research question: "How it is going to be the future of in-store checkout in supermarkets?". To answer it, the research takes in example a case study on Lidl Italy and Italian customers, with a mixed-methods approach applied, hence combining a structured survey with Italian supermarket customers and a semi-structured interview with a Lidl Italy manager. The results show that while customers are open to automation and faster checkout systems, they still value the presence of human assistance. Traditional cashier and self-checkout options remain dominant, whereas newer models like cashierless stores and smart carts are not yet widely adopted due to many reasons. The interview findings confirm that in this context Lidl Italy is pursuing a pragmatic strategy, investing selectively in technologies that balance cost efficiency with customer needs. The study concludes that the future of checkout will likely be hybrid, blending automation with human interaction. Supermarkets must maintain trust and provide flexible options despite the unavoidable nature of technological change. This study offers useful advice on how retailers can innovate properly in a market that is extremely competitive and driven by consumers.

Keywords: In-store checkout, Retail technology, Self-checkout, Supermarkets, Lidl Italy, Customer experience

RESUMO

Os supermercados estão cada vez mais desafiados a inovar seus processos de checkout na loja para atender às expectativas dos clientes e às demandas operacionais. Este projeto aborda a questão de pesquisa: "Como será o futuro do checkout in-store nos supermercados?". Para responder, a pesquisa toma como exemplo um estudo de caso sobre a Lidl Itália e os clientes italianos, com uma abordagem mista aplicada, combinando assim uma pesquisa estruturada com clientes de supermercados italianos e uma entrevista semi-estruturada com um gerente da Lidl Itália. Os resultados mostram que, embora os clientes estejam abertos à automação e sistemas de checkout mais rápidos, eles ainda valorizam a presença da assistência humana. As opções tradicionais de caixa e de autoatendimento permanecem dominantes, enquanto os modelos mais recentes, como lojas sem caixas e carrinhos inteligentes ainda não são amplamente adotados devido a muitas razões. Os resultados da entrevista confirmam que, neste contexto, a Lidl Itália está perseguindo uma estratégia pragmática, investindo seletivamente em tecnologias que equilibram a eficiência de custos com as necessidades dos clientes. O estudo conclui que o futuro do checkout provavelmente será híbrido, combinando automação com interação humana. Os supermercados devem manter a confiança e oferecer opções flexíveis, apesar da inevitável mudança tecnológica. Este estudo oferece conselhos úteis sobre como os retalhistas podem inovar adequadamente num mercado extremamente competitivo e orientado pelos consumidores.

Palavras-chave: Checkout em loja, Tecnologia no retalho, Self-checkout, Supermercados, Lidl Itália, Experiência do cliente.

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Abbreviations

AR – Augmented Reality

CAGR – Compound Annual Growth Rate

SCO – Self Checkout

SSTs – Self-Service Technologies

R&D – Research & Development

RFID – Radio Frequency Identification

ROI – Return On Investment

1. INTRODUCTION

According to Harrison et al. (2024) the checkout counter is known to be the retail store's service window. There are many variables such as availability, quality and cost of various product that influence the most the performance of the grocery store and impact customer satisfaction, but waiting time during checkout is definitely a fundamental indicator (Mykoniatis et al., 2020). Indeed, Melachrinoudis & Olafsson (1995) analyzed which factors help customers determine the choice of the supermarket for shopping and also from this study emerged that waiting time was one of the most important rating factors. That is because usually customers favor more stores with short queues and instead they complain about long waiting times.

As technology has advanced, traditional checkout"[1]started to being partially replaced by more modern solutions which became convenient both for retailers and customers, such as self-checkout tills, scan&go[2], smart carts and frictionless checkout[3]. For instance, taking in example the self-service technologies (SSTs)[4], as Collier & Kimes (2013) noticed, they can be viewed as better solutions for supermarkets since they allow them to lower staff costs while still giving customers more options to use for checkout. In fact, these systems enhance the entire shopping experience by diminishing waiting times and reducing the workload for

[1] "Traditional Checkout" in supermarkets generally refers to the classic payment process that occurs when the customer brings products to the checkout, a cashier scans the items and the customer pays with cash, credit/debit card or other methods, and receives a paper or electronic receipt.
[2] "Scan & Go" is a self-checkout system where shoppers use a handheld scanner or their smartphone to scan items as they shop. Instead of waiting in line, customers simply scan, pack as they go, and pay at a dedicated terminal or directly in an app.
[3] "Frictionless checkout" refers to a seamless, fast, and often invisible payment experience — no lines, no scanning, no cashiers, sometimes not even a wallet. Customers just grab what they want and leave.
[4] "Self-service technologies" (SSTs) are systems customers can use to perform services independently, without direct assistance from employees, self-checkout kiosks for instance.

the personnel (Tan et al., 2024). Furthermore, the growing worldwide adoption of this technology illustrates its viability and demonstrates how self-checkouts and other innovations are convenient and cost-saving options for retailers (Adebakin, 2023). Finally, it is known that supermarkets will find it affordable to implement new technologies on a big scale eventually, and that the customer will have an even more automated, seamless and faster grocery experience. Nevertheless, there are many challenges, considerations and concerns that must be addressed, and there is still debate whether or not these technologies will be effectively employed by retailers and most importantly accepted by customers.

Many studies discussed each single in-store checkout solution with its pros and cons, as Adebakin (2023) for self-checkout, Ritchie et al. (2021) for smart carts, Lee et al. (2023) for facial payments, and Wolniak et al. (2024) for scan & go and frictionless checkout. Others addressed the future on in-store checkout as Oksala (2024) for instance, but there are no studies that examined and considered together the current and emerging in-store checkout solutions on the market. And yet a project focused only on the checkout subject has never been published, especially with the purpose of trying to understand which will become the most predominant in the next years and what are the challenges to face. Thus, the goal of this research is to develop and understand, both from the retailer and customer's perspectives, how it is going to be the future landscape of in-store checkout in supermarkets.

The influence of supermarkets in the grocery retail industry and their cultural innovation impact is among the many reasons why this matter was selected. Indeed, this business is an interesting case study for analyzing technological change because of two characteristics. First, the organizational structure of the industry has grocery retailers at the heart of the value network. Indeed, they can be considered to be in a position of gatekeepers, as they are

the intermediaries who facilitate the revenue flow between consumers, suppliers and tech vendors (Geyskens, 2018). Secondly, according to Pantano & Viassone (2014), grocery retailers typically adopt technology developed by other research and development (R&D) firms rather than producing their own. This simplifies and standardizes the choice taken by grocery stores to merely make-or-buy[5] decision for obtaining technological innovations (Oksala, 2024). In addition, another reason for pursuing this topic is the potential impact of the supermarket's technology on social lives, as supermarkets are gathering places for individuals from all walks of life and where investigations are conducted regularly in relation to customer behavior (Clement, 2007; Terblanche, 2017).

In order to address the research question, in the literature review it was first gathered knowledge related to the technologies currently used in supermarkets and then identified the emerging in-store checkout models that are expected to be widely adopted in the next few years. Subsequently, the matter was empirically approached with a case study on Lidl Italy and Italian customers. The German retailer is, indeed, an international player that has presence in different countries, but since each one usually require tailored different strategies, the initial goal was to take just one market as example. The company's Italian branch, among many interesting reasons why is a relevant and compelling case that will be faced later, it was for the investigator, the perfect choice in terms of collaboration, alignment, accessibility and communication.

[5] A "make-or-buy" decision refers to a company's choice between producing a product or service internally (make) or purchase it from a supplier (buy), considering factors such as cost, quality, capacity, and strategic goals.

2. LITERATURE REVIEW

In this section, this project covers the literature that has been published regarding the in-store checkout models available in supermarkets. By presenting an overview on each model, the aim is to prepare the field for in-depth research in the following chapters. More precisely the focus will be on:

- Self-checkout
- Scan&Go
- Smart shopping carts
- Frictionless checkout
- Face Pay[6]

2.1 Emerging in-store checkout models in supermarkets

During recent decades, the industry of retail has witnessed significant change from a technological point of view with a large employment of digital devices that supported the automation of the manufacturing processes and produced value in the sector (Arshad & Ahlan, 2013; Evans, et al., 1996). Indeed, starting from simple traditional interactions, digital solutions switched to self-service checkouts, handheld scanners, mobile apps, and AI-based solutions, including augmented reality (AR) and facial recognition, revolutionizing how customers engage with grocery stores (Wolniak et al., 2024). Generally, there are four main identified technologies in the checkout category that are present nowadays on the market

[6] Face Pay is a biometric payment method where your face acts as your wallet. Instead of swiping a card, scanning a phone, or tapping a watch, you just look at a camera, and the system authenticates you and completes the transaction.

and are: self-check-out tills, scan and pay, smart shopping carts and frictionless checkout, but lately, a new seamless technology, known as “Facepay” is attempting to be a step forward in the checkout experience of today and the next years (Oksala, 2024).

2.1.1 Self-service checkout

The Self-Checkout (SCO) tills are nowadays considered as the most widely diffused technology in the checkout field of the four mentioned, but depending from the stage of development they can be considered both as a standard or a key emerging technology as their market only in 2022 it was valued around US$ 3.7 Billion, and it is projected to grow and touch approximately US$ 9.3 Billion by 2030, with a Compound Annual Growth Rate (CAGR) projection of 12.3% (Adebakin, 2023; Research and Markets, 2023).

According to Har et al. (2022) from COVID-19 pandemic the adoption of self-checkout has been accelerated in order to align with norm that required as less contact as possible with other people, thus, its acceleration was not surprising at all. Indeed, a Bloomberg (2020) report supported this argument presenting that COVID-19 has challenged not only organizations but also individuals to adjust to new standards and procedures and, always is accordance with this report, 87% of consumers preferred to go shopping in stores with self-checkout. Thanks to its ability to enable quick transactions and reduce contact interactions, self-checkout technology emerged as the most reasonable option.

To get more in detail, one key advantage that self-checkout offers is the ability to streamline the checkout process. Retailers indeed can optimize operational efficiency by reducing labor costs and increasing customer flow at the same time, and the personnel employed can focus on other store areas (Jones, 2012). Additionally, in his research

Adebakin (2023) has shown that self-checkouts can process transactions up to 50% quicker than traditional checkout lanes, thus resulting in shorter queues and lower waiting time for the customers. This consequently enhances the shopping experience and as already mentioned before it enables to raise the company's operational efficiency by optimizing staff allocation and reducing labor costs (Claire & Douglas, 2022).

According to Galdolage (2021), there are at least eleven features that make the customers favor self-service checkout over the traditional one. The first 8, related to the performance are: usefulness, speed, efficiency, consistency, cost-effectiveness, user-friendliness, reliability and finally trialability. While the other remaining features are about convenience: locational convenience, time convenience and physical effort. Lastly, following these characteristics, it must also be emphasized that self-checkout is especially useful during peak hours or in case a small number of items is being purchased, because it is usually much quicker compared to traditional checkout lanes, in particular for customers familiar and proficient with the process.

Nevertheless, due to numerous limitations, issues and client reluctance, self-service checkout cannot be perceived without any flaws. Indeed, for instance, despite what mentioned before regarding the Covid-19 effect, the potential risk of customers touching and scanning items others may have contaminated brought concerns (Venkatesh, et al., 2003). Additionally, the necessary learning curve required with self-checkouts may push away some customers, especially those who are less tech-savvy or who would rather engage with a person, having human interaction while shopping. To confirm this behavior, as also Dean (2008) concludes on his investigation, senior consumers typically do not experience SSTs, since they reported seeing the technology tricky to use, resulting to dissatisfaction, while, on

the other hand, the people who actually prefer the adoption of self-checkout technology are millennials (Adebakin, 2023).

Finally, Pentzold and Bischof (2023) make a reflection in their paper about the fact that self-checkout systems, although are intended for solitary usage, they frequently demand cooperation to function successfully because of to their vulnerability to technological issues and human mistake.

2.1.2 Scan&Go

Scan & Go (or Scan & Pay) technology is an additional advancement in self-service shopping. When utilizing Scan & Go customers take handheld scanners provided by the stores or in other cases their own smartphones, and after scanning the items they intend to buy, they immediately place them in their bags. Like that customers can make their own shopping list, always with the possibility that they can take off products if they decide they do not want to purchase them anymore. Specifically, regarding smartphones, shoppers can also use them by downloading a specific application of a given store or supermarket and they can have a seamless and personalized shopping experience, while being enabled as already mentioned, to track the cost of the grocery in real-time but also utilize digital coupons and promotions available at the specific supermarket.

Overall, there are numerous other advantages associated with this technology. Without being ordered by importance here is a list:

- Customers put the items directly into their bags rather than place them on a conveyor belt first.

- Because less personnel is needed at checkout counters, resources can be directed to other areas of the store.
- Accurate pricing and inventory management are guaranteed by automated methods.
- Contactless options via the app or special terminals can make the payments even faster
- Additional features, as for instance digital receipts can be offered with mobile apps

However, despite all these numerous advantages pointed out, with Scan & Go there can be some issues and threats involved. For instance, malfunctions, glitches or connectivity of scanners or apps can make it difficult for the customers, causing frustration and in general interrupting their customer experience. Another major issue are theft and misuse, such as under-scanning items or unintentional scanning errors made by the customers, which would affect companies with missed products, increased operating costs and inventory loss. However, as a precaution, shops rely on surveillance systems and regular inspections, but even these measures might not be enough to prevent every theft and legitimate customers may feel uncomfortable with that, as they can feel distrusted and also potentially linked for false accusations or disputes if they are wrongfully accused of stealing. To sum up, although the shopping experience is more convenient and efficient with Scan & Go technology, it also raises concerns that need to be carefully managed to preserve store assets and ensure to not impact negatively their shopping experience (Wolniak et al., 2024).

2.1.3 Smart shopping Carts

According to Price (2021), another checkout model that has become a very unconventional solution for the 21st century is the smart shopping cart, also designed like

the other cited solutions, with a technology focused on improving the conventional shopping experience of customers (Ritchie et al., 2021). The cart is designed with a system that includes RFID, sensors, smart cameras and scanners. Between all of these, radio-frequency identification is vital for both identifying the items that have been added to the cart and delivering information about the user interface (Chiang et al. 2016). Then, while the weight sensor at the bottom of the cart is directly connected to the store's control center, the barcode gathers details of the items picked so that they can be shown on the screen. Then, customers can quickly delete an item from the cart if they choose to return it to the shelves (Ritchie et al., 2021).

Furthermore, among the many benefits of this solution, the smart cart also has face recognition which can be set up to identify specific customers and retrieve their past purchases to make selections easier while they shop. Additionally, with the smart cart, customers can locate specific products in the store, something crucial for time savings. Then, according to a study of Wang and Yang (2016), for retailers to identify customer behaviors and react in real time to their feedback for enhancing sales promotion, it is crucial that the smart cart is portable and easy to assemble (Gangwal et al., 2013). Due to their technological suitability, smart shopping carts have become a feasible checkout solution recently and indeed the adoption and demand for this technology is on the rise. The first outstanding example has been the "Dash Cart"[7] developed by Amazon, one of the major retailers who recognized the need to modify autonomous retail systems (Bandoim, 2020).

[7] The Dash Cart is a smart shopping cart able to identifying items as you place them in the cart, tracks your total, and lets you skip the checkout line entirely.

All things considered, smart shopping carts bring many benefits to the table, especially for checkout processes: they can shorten customer waiting time, they improve customer satisfaction, minimize the need for cashiers and boost revenue by lowering expenses, but still, they are currently expensive to purchase and maintain (Borse et al. 2018).

2.1.4 Frictionless checkout

Amazon is also involved in a new in-store checkout technology called "frictionless checkout", as the opening of Amazon Go[8] in the past years brought space for the popular debut of a new in-store checkout solution that is a tremendous step in revolutionizing retail (Bandoim, 2020). Leaving aside the mentioned company, the "frictionless checkout" checkout model – or "cashierless" – is a system that employ sensors, RFID and image recognition to determine items when customers place them inside their carts or bags, taking off the necessity for hand scanning and lowering the queues (Wolniak et al., 2024). Like the models previously discussed in the project, this one also removes the inconvenience of traditional checkout lines. Indeed, with a system that instantly track the shopping activity in real-time, customers can leave the store without having to walk through a traditional checkout line (Hanooja et al., 2020; Fu, 2021; Sandosh 2023; Perumal et al., 2023)

To go into more detail, typically customers while navigating the aisles are monitored by a mix of cameras, sensors, and AI algorithms. In the moment they automatically add products to their virtual shopping carts and finish their shopping, they easily go out of the store. Through their registered accounts, the system immediately conducts the payment, and

[8] Amazon Go is a chain of cashierless convenience stores operated by Amazon. These stores use advanced technology to let customers shop without needing to wait in line or check out.

the entire expense calculated is determined solely by the items listed in the virtual basket, offering a rapid and reliable solution of completing transactions. By integrating this model, customers not only take advantage of more efficient shopping experience but also help supermarkets in streamlining their operations, as also frictionless checkout requires less staff, thus allows grocery stores to reduce personnel at checkout and reallocate resources to improve customer service in other areas. Furthermore, the knowledge obtained from the data collected by these systems can provide insightful information on consumer preferences and purchasing patterns, enabling supermarkets to successfully tailor their offerings and marketing strategies (Bednarek, 2021).

However, to optimize the potential benefits of AI technology integration into in-store grocery shopping, businesses must overcome several challenges. Namely, as shown in the table below (see Figure 1):

- Data Privacy Concerns
- Integration with Existing Systems
- High Implementation Costs
- Staff Resistance to Change
- Complexity of AI Algorithms
- Bias in AI Systems
- Reliability of Technology
- Regulatory Compliance

Table 1. Challenges of using AI technology-in-store grocery shopping (Wolniak et al., 2024).

Challenge	Description	Methods of Overcoming

Data Privacy Concerns	The implementation of AI technology often requires the collection of customer data, raising concerns about privacy and data security. Customers may be hesitant to share personal information.	Grocery stores can establish clear data privacy policies, ensuring transparency about data usage. Additionally, they can implement strong data security measures to protect customer information.
Integration with Existing Systems	Integrating AI technology with legacy systems and processes can be complex and costly. Compatibility issues may arise, leading to operational disruptions.	Grocery stores can conduct thorough assessments of their existing systems before implementing AI. Collaborating with technology partners can help ensure smooth integration and minimize disruptions.
High Implementation Costs	The initial costs associated with adopting AI technology can be significant, including	Grocery stores can consider phased implementation, starting with pilot programs to

	expenses for software, hardware, and training staff.	demonstrate ROI. Additionally, seeking government grants or partnerships with tech firms can help offset costs.
Staff Resistance to Change	Employees may resist the introduction of AI technology due to fears of job loss or the need to adapt to new systems and processes.	Providing training and support for staff is essential. Grocery stores should communicate the benefits of AI in enhancing their roles rather than replacing them, fostering a culture of collaboration.
Complexity of AI Algorithms	The algorithms used in AI can be complex and require specialized knowledge to develop and maintain. This complexity can lead to challenges in understanding and interpreting AI outputs.	Grocery stores can invest in training staff or hiring data scientists and AI specialists to ensure a thorough understanding of AI technology. Utilizing user-friendly AI solutions can also simplify usage.

Bias in AI Systems	AI algorithms can unintentionally reflect biases present in training data, leading to unfair treatment of certain customer groups or inaccurate recommendations.	Regular audits of AI systems should be conducted to identify and mitigate bias. Diverse datasets should be used for training algorithms, and ongoing monitoring can help ensure fairness and accuracy.
Reliability of Technology	AI systems may experience downtime or inaccuracies, leading to disruptions in service and customer dissatisfaction.	Implementing robust testing and maintenance schedules can enhance system reliability. Having backup systems and manual processes in place can help mitigate the impact of technology failures.
Regulatory Compliance	Compliance with data protection regulations (such as GDPR) and other legal frameworks can pose	Grocery stores should consult legal experts to ensure compliance with all relevant regulations. Developing a compliance

	challenges for grocery stores using AI technology.	framework that incorporates data management and privacy policies is crucial.

Among several, Data privacy is one of the most pressing issues. Indeed, customers can be hesitant to share their personal information because AI systems frequently require a lot of data collecting to operate efficiently and people could be worried about data breaches and the potential misuse of them. To ease these worries, grocery stores must therefore create comprehensive and transparent data privacy policies to mitigate these concerns and make sure that every consumer is aware of how the information is used but more importantly protected. (Kakimov, 2024).

2.1.5 FacePay

A new and effective option customers can use to finalize their purchases is provided by the growing integration of facial recognition technology in supermarkets (Gajdzik, 2023). With this technology, commonly referred to as FacePay", customers can now use their facial biometrics at the checkout, instead of other mentioned checkout solutions. As a result, traditional payment methods like cash, credit cards and mobile devices can be replaced. Additionally, because it would represent another big leap in terms of convenience, speed, and security, this technology can potentially change grocery shopping globally, as (Zhang et al., 2024; Li et al., 2020). To work correctly, the only way for face recognition payment systems is to put customers' facial features linked to their payment information. Once

registered and stored, the system scans their faces using high-resolution cameras and facial recognition software. Following accurate identification, and once the system receives the associated payment details, the transaction gets finished (Kim et al., 2024; Dowdall, 2023).

From this innovative checkout solution both customers and the retailer can benefit. Compared to other payment options it promotes security as payments are made only through biometric verification, reducing the possibility of fraud. Furthermore, this solution supports the growing trend of contactless transactions that has gained significance for safety and health reasons.

Thus, to sum up, for the customers, the advantages of facial recognition payments for consumers when grocery shopping are clear: they are a contactless payment option, they are convenient and reduce waiting times. While, for the retailer, the use of facial recognition technology can greatly improve the security of grocery stores. Additionally, grocery stores can benefit from facial recognition technology by fostering a sense of community, possibly enhancing the entire shopping experience. For example, if a customer enters the store and gets recognized and addressed by name, it does create a pleasant environment. This small gesture can be helpful to foster engagement and loyalty, as the more the shoppers can feel acknowledged and appreciated, the more likely they are going to return to the shop, especially in local grocery business. (Lee et al., 2023).

That being mentioned, there are numerous obstacles for implementing this technology. Like all the other previously mentioned solutions, consumers may feel discomfort related to data privacy, which would eventually impact on their loyalty and involvement with the supermarkets. Finally, the accuracy of face recognition systems is a concern because the technology is not flawless and problems like incorrect identification and

incapacity to recognize persons, might lead to wrong conclusions, generating frustration and mistrust among customers (Gao et al., 2023; Hu et al., 2023; Zhong & Moon, 2022).

The adoption of FacePay checkout in grocery shopping is expected to rise despite these and other obstacles. If consumers get more familiar to digital and biometric payment methods, and retailers address properly privacy concerns, they have a good chance to become an established feature in grocery stores all over the globe.

3. METHOD

In this chapter it is explained the methodology used to address the research question of this project, namely: "How it is going to be the future of in-store checkout in supermarkets?". The technical research approach applied is inductive, as the research question raised is exploratory, and the goal is to "understand what's next", rather than proving an existing theory. Indeed, this project does not have a predefined hypothesis but conduct empirical research using a case study to derive insights with a findings-led approach. Its purpose is not to test a hypothesis, but to formulate one for future inquiry. Furthermore, it is a Case study that it centers on Lidl Italy as a unique strategic case, and Italian customers. It has an embedded design that involves multiple units of analysis: an internal viewpoint from a Lidl manager, and a customer perspective from general survey data. The methodology – based Yin's framework[9](Hollweck, 2015) – follows a mixed-methos approach, combining qualitative and quantitative techniques, as the document involves semi-structured 1:1 interview with a Lidl Italy manager – Sales Organization & Store Systems Team Leader at Lidl Italy – and a quantitative structured questionnaire distributed to Italian customers. Aligned with the research question, specifically the two methods have two distinguished purposes: the interview aims to explore the retailer's strategic thinking, internal vision and direction; and the questionnaire is to gather measurable customer attitudes and preferences regarding their in-store checkout experience and the emerging checkout models (see Table 1. for the Data

[9] Robert K. Yin is a prominent scholar in the field of case study methodology. His book "Case Study Research and Applications: Design and Methods" is a go-to reference for researchers conducting in-depth studies of real-world phenomena.

Collection Methods). Additionally, the qualitative approach will be used with the aim to validate the quantitative approach.

Table 2. Data Collection Methods

DATA COLLECTION METHODS		
Method type	**Source**	**Purpose**
Qualitative data	Semi-structured interview with Lidl Italy manager	To gain strategic insight into Lidl's vision for checkout transformation
Quantitative data	Structured questionnaire to customers in Italy	To understand customer preferences and openness to emerging checkout models

3.1 Quantitative approach

The questionnaire was designed from the literature review and the qualitative interview and was then validated with the Lidl manager. Indeed, it reflects the same themes explored in the qualitative interview and in the literature review. The target audience of the survey were supermarket customers in Italy, across all age groups. The aim was to quantitatively assess their consumer behavior, preferences, and attitudes toward in-store checkout experiences in supermarkets.

The specific questionnaire approach involves a self-administered survey submitted through Google Forms and distributed through digital channels in Italian language. The estimated completion time of it is around 4-5 minutes. The format includes mix of:

- Multiple choice questions (single and multiple answers)
- Likert-scale items (e.g., satisfaction, importance)
- Rating scales (1 to 5 for experience or attitudes)
- Open-ended questions (for qualitative enrichment and exploratory insights)

The survey is structured in five thematic sections, aligning with one or more topics addressed in the qualitative interview and the literature review:

1. Respondent Profile – to enable segmentation.
2. Current Checkout Behavior – to capture usage patterns and satisfaction.
3. Attitudes Toward Checkout Innovation – to evaluate perceptions of automation, digital payment, etc.
4. Future Expectations – to support insight generation and foresight.

Table 3. Survey characteristics

SURVEY	
Aspect	**Description**
Purpose	To understand customer preferences and openness to emerging checkout models
Design Approach	Structured, self-administered, online survey (Google Form).
Question Type	Multiple choice, Likert scale, Rating scale, Checkboxes, Open-ended.
Sections	1. Respondent Profile 2. Checkout Behavior

	3. Attitudes Toward Innovation 4. Future Expectations
Estimated Time	4-5 minutes
Distribution Method	Online
Target Population	Supermarket shoppers in Italy (all age groups)
Language	Italian

Here below the 18 following questions of the survey built on Google Form with the Italian original questions and the translated version in English.

Table 4. Survey questions

Domande del sondaggio (Italian)	**Survey Questions (English)**
1. Qual è la tua fascia d'età?	1. What is your age group?
2. Qual è il tuo genere?	2. What is your gender?
3. Con quale frequenza fai la spesa al supermercato?	3. How often do you shop at supermarkets?
4. Quanto ti senti a tuo agio con l'uso della tecnologia (es. casse self-service, app, pagamenti digitali)?	4. How comfortable are you with using technology (e.g., self-checkout, apps, digital payments)?
5. Quali metodi di checkout hai utilizzato negli ultimi 6 mesi?	5. Which checkout methods have you used in the last 6 months?

6. Quanto sei soddisfatto/a dell'esperienza di checkout nei supermercati oggi?	6. How satisfied are you with the checkout experience in supermarkets today?
7. Ti è mai capitato di evitare un supermercato per via di una brutta esperienza alla cassa?	7. Have you ever avoided a supermarket because of a bad checkout experience?
8. Quali aspetti contano di più per te durante il checkout?	8. Which aspects matter most to you during checkout?
9. Quanto sono importanti i seguenti aspetti in una moderna esperienza di checkout?	9. How important are the following aspects in a modern checkout experience?
10. Quanto sei aperto/a all'uso di sistemi di checkout self-service in futuro?	10. How open are you to using self-checkout systems in the future?
11. Ti fideresti di un sistema completamente automatizzato per gestire correttamente i tuoi acquisti?	11. Would you trust a fully automated system to correctly process your purchases?
12. Quale delle seguenti opzioni descrive meglio la tua esperienza di checkout ideale?	12. Which of the following best describes your ideal checkout experience?
13. Secondo te, soluzioni di checkout moderne sono associate a supermercati di maggiore qualità?	13. Do you associate modern checkout solutions with higher-quality supermarkets?

14. Un'esperienza di checkout veloce ed efficiente ti rende più propenso/a a tornare nello stesso supermercato?	14. Does an efficient and fast checkout experience make you more likely to return to the same supermarket?
15. Quanto influenzano le opzioni di checkout la tua impressione generale di un supermercato?	15. How much do checkout options influence your overall impression of a supermarket?
16. Qual è una funzionalità o tecnologia che ti piacerebbe vedere nel futuro delle casse al supermercato?	16. What is one feature or technology you would like to see in future supermarket checkouts?
17. Secondo te, come sarà il checkout nei supermercati tra 5–10 anni?	17. In your opinion, what will checkout look like in supermarkets in 5–10 years?
18. Hai ulteriori commenti o suggerimenti sull'esperienza di checkout nei supermercati?	18. Do you have any additional comments or suggestions regarding the supermarket checkout experience?

3.2 Qualitative approach

Before conducting the interview, with the aim of introducing the subjected questions at the interviewee, it has been investigated the context of the company for which the manager works for. Indeed, by facing many aspects that influence the environment in which Lidl operates, it has been highlighted a summary of the company profile, its checkout solutions and finally Lidl Italy and the landscape in which it does its business. Subsequentially, in accordance also with the topics faced in the literature review, a semi-structured interview

was designed for being the primary method of data collection for its versatility and flexibility, which allowed in-depth exploration of the expert perception in a complex topic. Additionally, the interview took place over a period through online videocalls, not in single moment, and it was conducted in Italian. Further, all of these meetings were recorded to ensure the accuracy of the data and following transcription. They were later rearranged with 15 distinct questions and associated highlight of the responses to present the subjects in a linear and logical manner in this document. More specifically, the questions reflect an exploratory logic that touches on key areas of Lidl Italy, as the strategy, technology, human resources, costs, customer behavior and the future of in-store checkout.

Table 5. Interview characteristics

Interview	**Aspect Description**
Purpose	To gain strategic insight into Lidl's vision for checkout transformation
Design Approach	Semi-structured interview conducted over multiple online video calls.
Language	Interview conducted in Italian, later translated and transcribed with highlights into English.
Recording and Transcription	Meetings were recorded for accuracy and transcribed for analysis.

Question Structure	Based on an interview guide aligned with the research questions. Allowed flexibility for improvised follow-up questions.
Topics Covered	Company context, strategy, technology, human resources, cost, customer behavior, and future trends in checkout.
Interview Format	Exploratory logic with 15 open-ended questions and associated responses.
Interaction Style	Reciprocal and adaptive discussion based on the interviewee's responses (per Kallio et al., 2016).

3.2.1 Lidl

Lidl Stiftung & Co. KG – commonly known as Lidl – is a German-based discount supermarket chain that operates internationally. The company was founded in 1930 by Josef Schwarz and at the time it was a grocery wholesaler but then was transformed into a discount supermarket. Lidl is currently a member of the Schwarz Group, one of the largest retail groups in the world, with over 12,350 stores and employing 375.000 people in more than 30 countries across Europe and the US. Since its business model is centered on offering low-price private-label products that focus on essentials like groceries, home goods apparel, while cutting costs for supply chain, warehouse, and store layout, Lidl gets recognized for efficient operations, a pragmatic approach to retailing and inexpensive prices. About the stores, they are smaller than standard supermarkets – which is another crucial leverage for

saving costs as it immediately lowers rent and store management costs – and they have a straightforward layout, designed to be efficient and a limited product range. Despite that though, the company has expanded its variety of products over the last years, including more fresh and organic products. Additionally, Lidl has worked to enhance its sustainability practices with the goal of decreasing the environmental impact, shortening the carbon footprint, minimizing food waste and more.

About competition, Lidl has many international competitors, and since it is present in many countries, it has also national rivals who differ in each territory. To mention names, Aldi, Tesco, Carrefour, Walmart, Woolworths, Morrisons, Asda, Sainsbury's are just some of them (Admin, 2024; Euronews, 2024).

3.2.2 Lidl in-store checkout solutions

Regarding the in-store checkout models mentioned above in the document (see section 2.1), Lidl does not employ all the technology available on the market but just a few. Indeed, the German company, aside the traditional checkout, it uses only the Self-checkout and the Scan & Go technologies, and they still have not relied on smart shopping carts, frictionless checkout or face pay technologies as feasible solutions (Wilkes & Evans, 2024).

Indeed, they started introducing self-service checkout back in 2017 and currently many European countries are using this approach widely. 2024 is the year of the major roll-out in the company's home country and a period until February 2025 in which they delivered around 7,200 self-checkouts in more than 12 European countries (Wilkes & Evans, 2024).

Schwarz Group tried in the past to find its way forward Scan & Go technology and the implementation of this system was happening just in stores with SCO, as the customers

could have used just these tills to pay at the end of the shopping experience. Though, afterwards, due to the increased likelihood of theft, Lidl began to abandon the idea of Scan & Go customers just leaving the stores and making their payments automatically online. Currently, there are again in pilot some project regarding the Scan & Go technology, but just for registered users on the Lild Plus app, who in this different case need first to register with a specific store, share their location through the app and scan a QR code at the store's entry (Weber & Weber, 2024).

3.2.3 Lidl Italy

The first Lidl Italy store opened its doors in Italy in 1992 nearby Vicenza[10] – precisely Arzignano –, starting a journey that has continued for 33 years later, with a presence of over 750 stores and 22.000 employees on the Italian peninsula (Lidl Italia, 2025.)

Discounts weren't really that prevalent in Italy until the early 1990s, but when Lidl arrived, the grocery landscape changed significantly, as it brough an increased competition between the other retailers. Lidl Italy's approach obtained good results from the start, with a strategy based on low prices, good value for money, a reduced number of staff and a profitable range of private label products. Initially, the first stores had a small dimension, minimal furnishing, simple packaging and reduced scanners at checkout, then after a few years, the discount made several adjustments, including the stores' size, which was upgraded also with interiors design and new introduced products. Furthermore, Lidl Italy located its first stores just in the northern part of Italy, for then focusing with time in other regions across

[10] Located in the Veneto region between Venice and Verona.

all over the country (Macchion, 2020. Particularly, in the last 10 years Lidl Italy has undergone a significant shift compared the previous 20 years, with 300 million investments in restructurings and new openings to improve the point of sales, trying to get closer to becoming a supermarket rather than only a discount store (Pacifico, 2013)

In terms of competitiveness, from 2019 to 2022, Lidl had a market share growth – from 4,30% to 5,80% - and made large profit (793 million from 2017 to 2021), as during the pandemic, with the economic situation influenced by inflation, many customers decided to reduce their spent regarding their money and thus switched to more affordable grocers. However, in Italy Lidl is far from being market leader due to the landscape split into several grocers. Precisely, – in 2022 – Conad[11] had 15% market share, Selex Group[12] 14,30%, Coop Italia[13] 12,90%, Esselunga[14] 7,9%, Gruppo VèGè[15] 7,9%, Eurospin[16] 6,80% and Carrefour[17] 5% (Statista, 2025).

Though, nowadays, Lidl Italy is in an expanding situation, as at the end of 2024 it reached 7,16 billion of revenues, with 194 million profits but regarding the future, as previously mentioned, it has now around 750 stores that will become 1,000 by 2030. Additionally,

[11] It's a cooperative supermarket chain founded in 1962 and now one of the largest retail groups in Italy.
[12] The Selex Gruppo Commerciale is one of Italy's biggest retail groups, made up of independent regional chains that collaborate under a single umbrella
[13] Coop is a cooperative retail system, made up of many consumer co-ops that unite under the Coop Italia brand. It's one of the most recognized supermarket chains in Italy and a leader in ethical, sustainable, and member-driven retail.
[14] Esselunga is one of Italy's most iconic and high-end supermarket chains, known for its premium products, sleek stores, and intense customer loyalty.
[15] Gruppo VéGé is one of Italy's largest retail consortia, made up of independent regional retailers that collaborate under a shared brand and logistics network.
[16] Eurospin is a discount supermarket chain based in Italy, offering low prices, essential products, and a solid range of private label brands.
[17] Carrefour is a French multinational retail group, one of the largest retailers in the world. In Italy, it's known for its wide variety of store formats, international brand presence, and strong emphasis on fresh food and private labels.

specifically about in-store checkout, in accordance with the company strategy adopted by the German group in other countries for checkout solutions, the supermarket will invest 30 million in the next 3 years only for adopting in every store self-checkout machines (Di Angelo et al., 2025).

3.2.4 Semi-structured 1:1 interview

Table 6. Interview questions

Strategic vision & trends
Q1: What factors influence Lidl's decision to invest or not in new checkout technologies?
Q2: Does Lidl Italy's in-store checkout strategy differ from other countries?
Q3: How do you look at your competitors regarding checkout technological improvements?
Q4: Have you noticed a shift in consumer behaviour around checkout before and after the pandemic?
Technology and Implementation
Q5: What are the cost implications of implementing new checkout technologies?
Q6: How important is the integration of digital payment systems when selecting a checkout solution?
Q7: How does Lidl choose suppliers for checkout machines and systems? What criteria are most important in that decision-making process?

Operational impact
Q8: What are the key metrics Lidl uses to evaluate the performance and efficiency of its checkout systems?
Q9: How do you assess the overall impact of these technologies on customer experience and operational efficiency?
Q10: What steps does Lidl take to reduce the environmental impact of the checkout process (e.g., energy use, paper waste)?
Human Workforce & Organizational Changes
Q11: What is your point of view about human workforce replacement in Lidl? Is Lidl employing the same or less personnel compared to the past? Are store staff roles evolving alongside increased use of new checkout models?
Customer-Centric Design & Feedback
Q12: What steps are taken to ensure inclusivity and accessibility of checkout systems – for elderly customers or those less comfortable with technology?
Q13: How does Lidl approach data privacy and customer information security in the context of checkout systems?
Future Outlook
Q14: In your view, what will in-store checkout look like in 5-10 years? Do you think we will see a hybrid model or a fully automated, cashier-less future in supermarkets?

Q15: What lessons has Lidl learned from past checkout technology implementations – successes or failures?

4. FINDINGS

This section presents the results of the survey and the 1:1 interview. As already mentioned, the results are in Italian, as they were conducted in this language, but they are reported in English. First, they are presented the highlights of the survey and then the reported answers of the interview – to see all the original full results go to link at Appendix 1.

4.1 Survey results

As already indicated, the results are organized by four sections: Respondent Profile, Checkout Behavior, Attitudes Toward Innovation and Future Expectations.

4.1.1. Profile of Respondent

The online survey was completed by 106 individuals over a two-week period and the age groups of under 25 (22.6%) and 25–34 (21.7%) accounted for the majority of responders, followed by 35–44 (19.8%) and 45–54 (18.9%). Gender distribution was about equal, with 48.1% being female and 51.9% being male.

Most of respondents said they went to the grocery store either once a week (59.4%) or almost every day (29.2%), just 8.5% of respondents said they shopped twice a month and 2.8% said once a month or fewer.

4.1.2 Checkout Behavior

82.1% of respondents said they have used the traditional cashier checkout technique in the previous six months, making it the most popular option. 20.8% used Scan & Go, whilst 77.4% used self-checkout systems. None of the participants used cashier less stores or smart

carts. When asked which checkout option they preferred, 48.1% said traditional cashier, 38.7% said self-checkout, and 11.3% said Scan & Go.

When asked about satisfaction with the checkout experience nowadays: 48.1% felt satisfied, 17% very satisfied, 29.2% neutral and only 5.6% extremely or generally unsatisfied.

63% of respondents said they have never avoided a supermarket because of a bad checkout experience, but, however, 22.6% said they did.

Respondents ranked checkout speed as the most significant factor (73.6%), followed by simplicity (52.8%) and few lines (63.2%). The availability of human support (24.5%) and staff friendliness (43.4%) were other factors. Less often noted were cleanliness (23.6%) and frictionless experience (17%). When asked about other variables, respondents gave importance on the following ones overall: digital payments compatibility, inclusivity and easy-to-use interfaces. While sustainability and self-service tills resulted as less relevant.

68% of respondents said their ideal checkout experience is either mainly automated or balanced with human support, 26.4% prefer a human-based experience with technology support and only 3.8% and 1.9% are the extremes, preferring correspondingly an only human experience and a full-automated frictionless one. Additionally, 52.8% perceived modern checkout technologies as being associated with higher-quality supermarkets, nearly a third (29.2%) disagreed and the remaining 17.9% were uncertain.

4.1.3 Attitudes Toward Innovation

In terms of technological familiarity, 39.6% of respondents said they felt quite comfortable using checkout-related technologies (such as apps and digital payments), while

52.8% said they felt extremely comfortable using them. Just 0.9% said they were uncomfortable using these tools.

84% of participants said they were open to using self-checkout in the future – with 30.2% affirming they were somewhat open and 53.8% that they were extremely open. Only 9.4% is neutral and 6.8% is not open to that – 5.7% a little and 0.9% not at all.

A fully automated checkout system would be trusted by 53.8% of participants to handle their purchases, while 19.8% said they wouldn't trust it, and 25.5% weren't sure.

51.9% of respondents stated that checkout alternatives had a significant impact on how they view a supermarket overall and a quick and easy checkout process would increase the likelihood that customers will return to the same store, according to 69.8% of respondents.

4.1.4 Future Expectations

Participants were asked to describe one feature or technology they would like to see in future supermarket checkouts. Among the variety of recommended features (see link at Appendix 1. for all of them), common suggestions included: automated product recognition, scan-free carts, faster systems, digital receipts, automatic bagging, and simplified user interfaces. Others brought up features like Amazon-style checkout-free systems, real-time discount visibility, and facial recognition.

Then, in the last separate question, participants were asked to imagine supermarket checkout in 5-to-10 years and most of them talked about increased automation, including

fully automated or cashierless systems, mobile integration, and AI-driven experiences. Furthermore, they reported the still needed presence of human interaction, especially for specific consumer groups and circumstances.

4.2 Interview results

The following findings are presented as a summary of the highlights of the Lidl manager's responses. "Q" stands for the questions raised by the interviewer and "A" for the interviewee answers. The questions raised were 15 in total.

4.2.1 Strategic vision & trends

Q1: *"What factors influence Lidl's decision to invest or not in new checkout technologies?"*

A1: The manager answered by explaining there are many factors that influence an investment or not regarding a new checkout solution. Although, according to his words, it is mainly a matter of cost and benefits: indeed, it has been explained how behind this decision there is strong consideration of the eventual revenues and profit, "*around that revolves much of the decision-making, of course is not the only reason, but a company careful to the costs as Lidl reckon a lot on this*." The manager also explained how if the arrival of new technology is not convenient from an economic point of view, then it doesn't make sense for supermarkets. "Then of course companies like Amazon[18] that are not just supermarkets can afford to make such investments, even without necessarily making a profit from them, but retailers don't think in this way". Then, the manager revealed that despite there are viability analysis

[18] The interviewee was referring to Amazon Fresh and Amazon Go supermarkets.

and many other documents taken into consideration before implementing these technologies, a professional decision such as this also has its foundations on a more straightforward basis "*putting SCO tills in a store for example can cost up to 80.000 euros, it is an expensive decision*".

Furthermore, the interviewee underlined how important it is that the choices made today need to considered correct also for tomorrow: "*an investment like this is a commitment because in most cases it means accepting that from the time of purchase to the next 5-10 years, the checkout solution purchased will be the one in the stores and that it probably won't be changed until the end of its amortization and life cycle*". Taking in consideration the customers, the manager discussed the difficulty of measuring the qualitative impact of new checkout technologies "*Customer Satisfaction[19] and Customer Retention[20] of these investments for instance, they are not easy to measure*". More: *and even from a quantitative point of view, it's much more subjective than you think, as numbers change due to so many factors. Think also about the different times of the year, in which there are times when consumption is higher than others".* Lastly, it has been clarified that some decisions are not taken by Lidl Italy, but top-down from the German headquarter "*obviously there we have no power*."

Q2: "*How does Lidl Italy's in-store checkout strategy differ from other countries?"*

A2: "*Obviously every strategy differs from the ones of other countries*" pointed out the interviewee. Then, "*In every country Lidl is present, it has its own headquarter, which*

[19] It is a measure of whether a company met, exceeded, or fell short of a customer's expectations.
[20] It is a measure of how well a business can keep customers over time instead of losing them to competitors.

manages the stores in every country, thus part of the decisions and the strategy changes country by country".

Furthermore, it has been explained why Lidl, having different competitors and different customers in each country, has to adapt to the market needs and characteristics. "*For instance, in Poland or Finland there is a high percentage of customers that pay with digital payments, while in Italy we are still attached with cash payments. A factor like this needs to be taken in consideration when choosing which technological solutions to implement".* Additionally, others example the respondent made are the fact that in other countries there is the Scan & Go as in-store checkout solution, while in Italy it is not present. Just the SCO or the traditional checkout. And also that in a country like Italy is it is a big commitment deciding to change the checkout technology, while in in other smaller countries it has lower costs "*In Italy we have more than 760 stores, while for instance in Portugal around 300, it changes a lot in terms of time and costs implementing self-checkout in 300 stores or the double."*

Q3: "*How does Lidl Italy look at the competitors regarding checkout technological improvements?"*

A3: The manager explains how important it is to have a close analysis of competitors under any aspects, from the price tracking, to set-up, technological solutions and everything they do to figure out which numbers are delivering. "*We are not in school anymore, where you cannot copy from others as it is considered cheating. If a competitor has done something for the first time, correct or wrong, it is an example to take in any case. Then of course there*

are some ideas. strategies, innovations that have patents and cannot be copied, but for instance, putting the fruit and vegetables upon entering stores or the SCO is something legal and normal". Additionally, the interviewee also mentions as Lidl, being present in over 30 countries, has internal examples for enhancing the decision-making "*For instance, before doing something in Italy, we can look at Lidl Austria or Lidl France if they already implemented some checkout technology."*

Q4: "*Have you noticed a shift in consumer behaviour around checkout before and after the pandemic?"*

A4: The interviewee explained that the interaction between cashier and client changed during the pandemic and at the time it was a problem for the customer, but especially for the cashier, "*that's why we used measures such as plexiglass, masks, gloves*". Additionally, "*another thing generally recognized is that today certainly many more consumers are very comfortable using these new checkout systems than the traditional one, the pandemic certainly brought about a technological revolution, and it also touched our sector".*

4.2.2 Technology and Implementation

Q5: "*What are the cost implications of implementing new checkout technologies?"*

A5: The expert answered this question by taking in example the SCO implementation they did in Italy in 2020 "*for instance the SCO tills have a list of dozens of cost components, that ranges from the furniture costs, the tills, the hardware, the electronical arrangements, the maintenance and also others. Like for instance the little gates for the exit, as in fact, an implementation of a new technology also entails other costs related to the components of the checkout elements*". The manager also pointed out that despite what people think, there is

still need of personnel for self-checkout, "*we still need to pay people supervising the check-out at the tills for 80/90 hours per week*[21]*."*

Q6: *"How important is the integration of digital payment systems when selecting a checkout solution?"*

A6: For Lidl it is convenient the growing integration of digital payments as the interviewee explained "*in a company like ours, cash management involves a lot of costs and a lot of time: security doors, safes for cash, assurances, transporting values, insolvencies, opening and closing the cash drawers, recount the money*". It has been mentioned also how Lidl, being a big retailer, it has a broader bargaining power regarding the fees on digital payments compare to small supermarkets "*despite all the fees coming from digital payments, for us it is more convenient that our customers pay with the cards than with the cash*."

Q7: "*How does Lidl choose suppliers for checkout machines and systems? What criteria are most important in that decision-making process?"*

A7: The manager outlined how "*there is always a choice when buying a outsourced checkout solution: taking a standardized technology from a vendor and having it personalized or commissioning specialized companies to develop a tailored solution from scratch that is perfect for what the company wants, its needs and characteristics*". Then the interviewee mentioned the time-to-market[22] is another relevant factor, as for a company like Lidl it is faster to personalize a standardized solution than outsourcing a tailored project while

[21] The interviewee was referring to the average hours a supermarket is open every week.
[22] Refers to the amount of time it takes to develop a product and bring it to market — from the initial idea or concept to when it's available for customers to buy.

"*other competitors that work just in Italy usually go for the commissioned checkout solution, but as we are present in multiple countries, we need a more practical solution*[23]".

4.2.3 Operational impact

Q8: *"What are the key metrics Lidl uses to evaluate the performance and efficiency of its checkout systems?"*

A8: The respondent talked first about the importance of measuring the overall Return On Investment (ROI)[24] when evaluating a checkout system, and then in detail about cost savings and different use of labor staff hours for other activities. In addition, the manager mentioned the significance of measuring the number of people using SCO and (or) traditional checkout, the time of waiting and the overall process. Finally, the interviewee mentioned that other more thorough measures are being taken. For example how many times a staff member take action to solve a problem and how much time they need ("*the less they step in, the more it means the process is fluid")* or how many people prefer the SCO over a specific number of purchased items "*we do not have a limit for SCO tills, but for sure a customer with a large grocery prefer the traditional checkout*".

Q9: "*How do you assess the overall impact of these technologies on customer experience and operational efficiency*?"

A9: The expert mentioned how they do a pre and post comparison between stores that have undergone changes in using new checkout technology and stores that have not *"if*

[23] Indeed, Lidl bought technological solutions from Diebold Nixdorf, one of the world's SCO till suppliers.
[24] ROI it's a performance metric used to evaluate the efficiency or profitability of an investment. It shows how much return (or profit) it gets relative to the cost of the investment.

sales grew by 5 % in the store that changed technology and the other stores grew by 2 %, you understand that the difference was also made by such a decision". Additionally, the manager mentioned that despite they do measure the customer satisfaction it is difficult to come across reliable indicators "*on the Lidl website you can leave your opinion on checkout technologies in the customer service page, but it is not that easy to find reliable metrics, even internationally it's hard to find any for example on SCO".*

Q10: "*What steps does Lidl take to reduce the environmental impact of the checkout process (e.g., energy use, paper waste)?"*

A10: The manager responded by mentioning two topics: the amount of paper waste used with receipts and the energy employed by the SCO. On the latter the expert said that *"at the end of the day, whether we are talking about SCO or traditional checkouts, they are both 2 similar checkouts from an energetic point of view as the software is the same, the components are similar, the energy expense is more or less the identical".* While, about the receipt the interviewee stated "*Lidl offers the possibility of using the digital receipt on the Lidl Plus app but if you want to make a return you will always need the paper receipt. In order for the digital receipt to be considered as a normal tax receipt, it must have a set of criteria connected with the Italian Tax Authority*". Despite this problem, the expert mentioned that "*we are aware that it is something that many competitors already have, and it is definitely one of the next things we're going to do on the Lidl Plus app, it is on our to do list".* Furthermore, the interviewee mentioned that Lidl tried to optimize and reduce the amount of paper wasted in receipt: "*we had done an operation to try to maximize space on receipts by removing as many lines of information as possible, but right now, the receipt*

issue is still dictated by regulatory issues that cannot be touched". It has been added: "*Think for example that for us to remove one line of information from a receipt, just in Italy it would save in paper between 10 and 20 thousand euros a year and certainly plenty of paper. Regarding what we said before about digital receipt, let's do a calculation: if there are 50 lines on a receipt and each one costs 20 thousand euros a year, in one year we could save 1 million euros if all receipts were digital".*

4.2.4 Human Workforce & Organizational Changes

Q11: *"What is your point of view about human workforce replacement in Lidl? Is Lidl employing the same or less personnel compared to the past? Are store staff roles evolving alongside increased use of new checkout models?*

A11: The interviewee answered saying that *"this is one of the main criticisms we receive when we introduce SCO, the first connection customers do when they see this change is that the arrival of self-checkout is equal to people being fired, but the reality is much more different and complicated than this"*. According to what the expert stated, Lidl does not increase or decrease the personnel when introducing a new in-store checkout method, but they *"reduce the necessary investment of employee hours on certain activities that add little value, to reinvest them on something else that yields even more turnover and more profit".* Then the respondent added that *"compared to a hypermarket where people specialize in one area, in our stores people know how to do a little bit of everything"*.

4.2.5 Customer-Centric Design & Feedback

Q12: *What steps are taken to ensure inclusivity and accessibility of checkout systems—for elderly customers, or those less comfortable with technology?*

A12: The manager discussed about the effort Lidl put to keep also the traditional checkout tills as a sign of inclusivity, especially for these categories mentioned above in the question: *"at the present time, it is not feasible to have a store with only automated checkout machines, as it is a risk in excluding customers who are not predisposed and many people see it as forcing"*.

Q13: "How does Lidl approach data privacy and customer information security in the context of checkout systems?"

A13: The respondent affirmed how much Lidl is "*hyper vigilant about data privacy"*, though the manager explained how for instance the data gathered through the Lidl Plus app are used with the purpose of using them later by the purchasing department to customize offers and promotions to the customer, thus profiling the target audience: *"what the consumer has previously purchased, frequency, location, demographic data, and all the registration data are used for customizing".* Then, the interviewee added that "*other data that can be extracted and then possibly used are all those that come from the receipt, so the time, what was bought, prices, turnover ecc..."*. Lastly, when asked about the digital payments data, it has been stated that Lidl does not detect card information or data about the individual who paid, since it is encrypted data.

4.2.6 Future Outlook

Q14: In your view, what will in-store checkout look like in 5-10 years? Do you think we will see a hybrid model or a fully automated, cashier-less future in supermarkets?

A14: The interviewee answered saying "*changes will come but they will be gradual"* and that there are many factors that need to be taken into account. *"What will need to be increasingly considered as a key factor in the next years is time"*, referring to the fact that today it is already common to do grocery online without the need to go physically in the stores, and that *"grocery shopping does not take an hour a year, but often an hour a week minimum"*. Then, doing shopping does not only satisfy a need, but it is a proper experience itself: *"For elderly people is an excuse to get out of houses, move around, go to a public place, have a word with cashiers"*. Furthermore, the respondent added that speed is going to be another essential component, as it will be done everything possible to make checkout even faster. Another driver mentioned by the expert are the costs even here, as *"consider that a 30/35% of the hours of employees employed in stores are related to checkout activities, in the view of cost containment and fewer and fewer people available to do this work, if technologies such as RFID will have even lower costs it will have great possibilities to spread on a large scale"*. Finally, related to this question the manager opened for a more deeper reflection about the role of the stores in the next future: *" I have a hard time imagining the same role that the physical store plays today, as I said before I imagine there will be many more people who will want to do their shopping online or at most go to pick it up. With that in mind, what will the store be? More of a warehouse? Or maybe the store will be an experience, or a one-stop store only for very fresh produce, like fruits, vegetables, meat and fish?"*.

Q15: "What lessons has Lidl learned from past checkout technology implementations—successes or failures?"

A15: The manager responded by talking about the implementation of the SCO, defining it as *"complex than expected".* The interviewee specified as *"it's not so easy to reach the break-even point when making such an investment"* but also that they learned that the Lidl target customers who look more at saving money, and not always but often coincide with people who have a lower level of education, and are usually not used to interacting with automated checkouts, reading a message or understanding what they are being told to do by a screen. And this obviously leads them to leave the store dissatisfied, complaining about the issues. Additionally, the expert added that *"customer's exigency on SCO is much higher and leads to more customer complaints".* Finally, it has been mentioned again the problem that *"in Italy resists a large use of cash by customers".* Nevertheless, among the successes, the manager mentioned the adoption rate of the SCO, as in Italy it touched around 50/60%.

5. DISCUSSION

The objective of this research was to understand, both from the retailer and customer's perspectives, how it is going to be the future landscape of in-store checkout in supermarkets. The research findings are discussed in this chapter by integrating the survey findings, which are supported by the results of the qualitative interview and connecting them with the literature presented in the second chapter.

Survey outcomes revealed that the most prevalent checkout methods utilized were traditional cashier (82.1%) and self-checkout (77%), while technologies such as cashierless stores and smart carts were essentially non-existent among survey respondents. Only about 20% had tried Scan&Go and self-checkout is proposed as the most mature emerging model, accelerated during the pandemic and still is expected to grow until 2030 (Research and Markets, 2023; Har et al., 2022). The limited use of Scan&Go also reflects concerns noted in the literature, such as theft risks and operational challenges (Wolniak et al., 2024), which were confirmed during the interview with the Lidl manager, who mentioned that Scan & Go is approached cautiously and selectively within the company.

Customer satisfaction with the current checkout experience was moderately positive: about half of the customers reported satisfaction and only a very small minority reported dissatisfaction. Moreover, 63% indicated that a negative checkout experience would not cause them to avoid a supermarket. These findings suggest that while checkout is important, it is not the sole driver of customer loyalty, resonating with existing research that has ranked checkout as a critical but not exclusive component of customer experience (Melachrinoudis & Olafsson, 1995; Mykoniatis et al., 2020).

Checkout speed, simplicity, and minimizing waiting lines emerged as the most valued factors during the checkout process. The manager's interview responses aligned with this, emphasizing that Lidl's decision-making regarding new checkout technologies is focused on maximizing speed and efficiency as the primary objective, with cost management as the balancing dimension. Literature supports these findings by highlighting that self-service technologies today are cheaper, more efficient, and mostly help to reduce waiting times, enhancing the overall customer experience (Adebakin, 2023; Collier & Kimes, 2013; Tan et al., 2024).

When considering the ideal checkout model, most of the respondents favored a hybrid solution: they liked automation but with human support available. More than half indicated that they would trust a completely automated checkout, but complete replacement of human contact was unpopular. This tendency matches the arguments in the literature review where hybrid experiences, blending digital convenience with human reassurance, are seen as the most plausible supermarket future (Wolniak et al., 2024) It also resonates with the manager's reflections, who stressed that while Lidl Italy is investing in automation, it remains attentive to customers who seek personal interaction when shopping.

Respondents' future expectations for checkout technology included faster systems, digital receipts, automatic bagging, simplified user interfaces, mobile integration, and broader deployment of frictionless checkout models. Interestingly, in addition to their openness to technological innovation, respondents still expressed a clear preference for human presence in certain cases. This expectation mirrors the overall discussion in the literature around technologies such as smart carts, frictionless checkout, and FacePay, which are seen

as promising innovations but not as complete substitutes for traditional checkout (Bandoim, 2020; Gajdzik et al., 2023; Wolniak et al., 2024).

From a retailer's perspective, the qualitative interview validated that technological adoption is driven not just by customer demand but also by strategic and economic factors. The manager underscored that Lidl evaluates each technology based on possible ROI, labor cost savings, and operational viability, reaffirming previous academic research highlighting the importance of cost-benefit analysis in technology adoption decisions (Oksala, 2024). In Addition, the defensive approach towards Scan & Go, the emphasis on self-checkout rollout, and the measured investment of €30 million by Lidl Italy over the next three years reflect the balance supermarkets need to have between innovation and risk management.

Overall, the evidence suggests that the future of supermarket checkout will be a hybrid model: more digitalized, faster, and more automated, but still with human elements where required. Lidl Italy's strategy reflects partially this reality, in the sense that the firm tries to optimize operating efficiency while maintaining high the customer loyalty and satisfaction.

6. CONCLUSION

The study answered the question: "How is in-store checkout going to evolve in the future for supermarkets?", employing a mixed-methods approach coming from a case study combining a structured questionnaire of Italian consumers and findings derived from a semi-structured interview of a manager in Lidl Italy.

The findings confirm a retail setting where technological innovation is expected but cautiously embraced. Shoppers demonstrated a clear preference for faster and more streamlined checkout processes, valuing speed, simplicity, and reduction of waiting times. Although automation is well-liked and accepted and by more than half of the respondents, most still prefer human assistance options to be available, supporting the idea that hybrid checkout models – like combining SSTs with traditional service elements – are destined to dominate in the near future. These findings both validate the ongoing importance of customer-centric technology adoption highlighted in the literature and the growing significance of human interaction in physical stores.

From the retailer's point of view, Lidl Italy's innovation strategy at checkout is a realistic balance between the implementation of technological advancements and maintaining operational and financial sustainability. Investments in SSTs are grounded in transparent cost-benefit calculations, consistent with previous studies on technological adoption in retailing. Moreover, the interview's results illustrate how Lidl Italy's strategy aligns with common trends in the industry, aiming not only business effectiveness but also a satisfaction of the consumers for the in-store customer experience.

This project contributes to the marketing field by presenting an integrated view of how both consumers and retailers perceive today's transformation of in-store checkout. It

emphasizes the intricate relationship between customer demands, technological possibilities, and corporate strategy within a competitive and dynamic market environment.

Practically, the findings offer effective suggestions for grocers and marketers. Investing in technologies that improve speed and convenience while preserving elements of human support that customers continue to value will be crucial in the next years. All the innovations noted in the literature review should be pursued, but with a clear understanding of the customer segments that may require additional assistance or reassurance.

In conclusion, the future of supermarket checkout will likely be characterized by a fine balance between automation and personalization. Technology will probably continue to drive efficiency and convenience further, but the touch of human connection will remain central to delivering an enriching and inclusive shopping experience. Supermarkets that can successfully integrate both dimensions effectively will be best positioned to have a competitive advantage and hence meet the evolving needs of their customers, in order to thrive in a more digitalized retail environment.

6.1 Limitations and future research

As with any research study, this research has several limitations that should be acknowledged to provide a balanced interpretation of its findings.

First, the research did not investigated the role of supermarkets as gatekeepers in the value network of retail. Those managerial and operational choices that position supermarkets at the center of broader industry relationships – such as their influence on suppliers, logistics, and technological adoption beyond their own stores – were one of the reason chosen for this

investigation but they were left outside the interview and the survey, therefore remain unaddressed in the findings.

Second, the case study only involved Lidl Italy and Italian supermarket consumers. Indeed, although the research question was asked in general terms ("the future of in-store checkout in supermarkets"), the analysis was limited to the Italian context. Thus, as a consequence, the findings should be interpreted as reflective of Italy specifically – but not only – rather than being generalized as global sample in retail developments.

Third, while technologies such as Scan & Go, smart shopping carts, frictionless checkout, and FacePay were discussed in the literature review and applied in open-ended survey questions, they were not deeply investigated in the others sections. Lidl Italy currently does not adopt these technologies due to their expensive costs and operational complexity, and the primary focus still remained on traditional checkout and SCO. Thus, the explanation of these more advanced technologies is limited, and the analysis of their practical feasibility stays theoretical.

Fourth, research was limited by a lack of ability to receive internal or proprietary data from Lidl Italy. Some operations measures, strategic plans, or particular financial impacts related to innovation at checkout were not available due to confidentiality limits, which limited depth of exploration on implementation outcomes and business performance.

Fifth, while the study tried to predict the future of in-store checkout, it looked only at a limited time horizon of five to ten years. While this is consistent with typical corporate planning horizons, it will not necessarily capture the long-term technological revolutions or societal shifts that will influence the industry in twenty or thirty years.

Further research could explore comparative study between different national markets to explore how cultural, technological, and regulatory differences shape checkout innovation. Further research could explore the supermarkets' position as orchestrators of the retail value network, analyzing how their strategic decisions concerning checkout solutions affect the supply chain and the technology providers. Another potential area of opportunity would be a detailed examination of customer acceptance of new checkout technologies like frictionless checkout or FacePay once their adoption becomes more prevalent.

Finally, future studies that extend beyond a five-to-ten-year horizon could provide richer insights into how the convergence of physical and digital retail channels might reshape the overall supermarket experience.

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8. APPENDIX

Appendix 1.

The following link below brings to the 1:1 interview full highlights and the Survey questions, answers and general results.

https://drive.google.com/drive/folders/1GRd31mQ8ufAe_trvddXXvfwIY8UY7IDS?usp=drive_link