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ARTIFICIAL INTELLIGENCE & SUSTAINABILITY: IMPLICATIONS IN THE CUSTOMER JOURNEY

GIOVANA SALOMÃO PONTES

Work project carried out under the supervision of:

João Nuno Lopes de Castro

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Abstract

Artificial Intelligence and Sustainability topics have both been gaining momentum on their own for their potential to improve the current global scenario in multiple aspects. The combination of both, though, is still being explored by retailers interested in taking part on the achievement of the Sustainable Development Goals by transitioning to a circular economy. Moreover, these changes have a direct impact on the customer journey, which is a key aspect for customer attraction and retention. Although it can be hard to convince some clients, Generation Z customers are growing up with the necessary mindset to demand and take part in this transition. Therefore, Gen Z customers were surveyed and interviewed, and showed their willingness to engage in sustainability initiatives, especially when facilitated by the use of AI-powered technology.

Keywords

Sustainability, Circular Economy, Customer Journey, Artificial Intelligence, Generation Z, Sustainable Development Goals

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1 Motivation and Purpose

The main goal of this joint research project is to unlock the pure prospects of AI across the retail world and how humankind's most dominant weapon is driving unparalleled value to seamless customer journeys. This paper adheres to the following structure: in chapter two, the authors decipher the fundamentals of the digital world and how emerging technologies empowered AI capabilities, and how the Covid-19 pandemic accelerated it. Furthermore, the authors explore the impact of the Big Data revolution as the primary catalyst of AI. Chapter three analyses significant milestones in the history of AI, AI's core, the rise of some cutting-edge fields such as machine learning and deep learning. Consequently, it examines the goals of AI, its main fields of application, risks and biases, and some of its most well-known controversies. The fourth chapter, and the last of the joint research, scrutinizes and sets the stage for a new world shaped by AI and its technologies. Hence, the following chapters pursue deep-dive research into the new AI world through individual research from each work project's members.

2 The Fundamentals of the Digital World and New Technologies

2.1 What is a Digital Interface?

This section addresses the context of the emerging interfaces and technologies oriented for the digital world, and it is crucial first to describe a digital interface. A digital interface, defined as a bridge, and an enabler between humans, machines, and data (Cook, Allan V.; Dajee, Jiten; Berman, Jonathan 2019), is sustained on technology that grants interconnectivity to multiple types of equipment (John Watkinson 2004). In other words, hardware devices can communicate, embracing audio and video sources on top of each other, translating on how digital services can bring value (Cookson 2020). Human-centered design techniques and cutting-edge technologies emerge – leading big old computer mouses to wide and clean mousepads (Cook, Allan V.; Dajee, Jiten; Berman, Jonathan 2019).

Intelligence and effectiveness are two key factors that give way to new frictionless and faster interaction methods. Scanners, microphones, touchscreens, voice commands are some of the many examples of interfaces that can be improved or taken to another level of utility through complex AI-based features (Cook, Allan V.; Dajee, Jiten; Berman, Jonathan 2019). Simply put, a suitable example of a proper digital interface is a convenient combination of rich feature sets and a simple practice, with a natural design sense that perfectly goes with the product (Williamson 2021). Human behavior can now be digitally interpreted and converted in a screen or variables like never before – by sensing movements and gestures, AI-based systems can instantaneously answer to nonverbal user commands through human-centered design methods and top-notch technologies – such as AR and VR tools, robotic processes, 3D printing and computer vision (Cook, Allan V.; Dajee, Jiten; Berman, Jonathan 2019).

People today still need to stop whatever they are doing to read a message, decide what to read, then specify to any mobile device they are using what they would like to do – be it a message reply, a voice command, or a simple swipe. In this way and considering all the continuous research and development made around interfaces, humankind will be able to interact with smartphones and tablets in ways that do not require their full attention while perceiving and dealing with stimuli while having dinner with beloved friends, which could be a new normal in a very near future (Maes, 2019).

2.2 Technology Landscape

The key to delivering the best possible experience is to put user competence, interface technology, interface design, and good use cases in a perfect flow (Cookson 2020). This disruptive and technology-driven world is changing at an unprecedented pace, forcing companies to predict and acknowledge which technologies will better guide them to a significant digital disruption (Gourévitch, Antoine; Russo, Massimo 2020). However, business owners are

still reticent towards digital transformation due to misinformation and a shared sense of fear and uncertainty. It is relevant to mention that expectations from both sides (platforms and users) on the adoption of new digital interfaces thrived by their experiences with the giant's Amazon, Alphabet, Apple, or Tesla than by whatever other companies are doing (Reeves, Martin. Whitaker, Kevin 2019). This *quasi-monopoly* phenomenon happens under the tremendous amount of data these big tech-giants not only possess but also act on – which in turn establishes and follows certain "data-policies" (Stucke 2018). Besides, they are all connected by the abuse allegation on their gatekeeper status in distinct internet industries to ensure their market power in various sectors (Ghaffary 2020). Data delivery optimization and digital interfaces evolution are directly and positively correlated (Maes, 2019). Hence, for companies to extract as much value as possible from data, they need to seek emerging technologies and develop their own IT architecture to its optimal point. Despite an IT architecture constituting a key component in every digital strategy, to date, most companies have been averse to addressing resources to it without any clear return on investment (Podlesny , Jannik; Soller, Henning; Wenzel, Marvin 2020).

2.3 Emerging Technologies - Impacts

Almost any organization is reshaping its whole technology framework regarding the following: data sources, level of complexity of its operation, industry, and maturity of the company (Podlesny , Jannik; Soller, Henning; Wenzel, Marvin 2020). For instance, financial services, insurance, and healthcare primarily depend on in-memory and top-notch computing, advanced analytics, and data-driven decision-making. At the same time, the public sector, media and communication, and manufacturing are developed upon transparency and distribution of entire workflows, significantly leveraged by blockchain technology. This immutable distributed ledger provides a transparent trade of encrypted data in a shared way to multiple parties (IBM 2021).

The retail industry complies with sensor data and stream data processing (Podlesny , Jannik; Soller, Henning; Wenzel, Marvin 2020). Intelligent interfaces provide real-time automated feedback loops, employing several applications across industries – from lifestyle and health care to energy, computer science, and more–and gathering information from different sources, such as physical, psychological, and sensorial biological data (Cook, Allan V.; Dajee, Jiten; Berman, Jonathan 2019).

The global market for **advanced robotics** (further analyzed in **chapter 3.5**) expects to grow up to $87 billion by the end of 2025, and it is one of the critical drivers of empowering AI, and consequently, the retail industry (Gourévitch, Antoine; Russo, Massimo 2020). Moreover, its entire landscape is a natural fit for using sensors and cameras empowered by AI sub-technologies such as **Machine Learning** (ML) and **Deep Learning** (DL) algorithms.

Further, it is essential to mention **5G**, the next-gen mobile connectivity technology massively deployed among most industries, including the retail industry. This next-gen mobile connectivity allows more intelligent devices to connect simultaneously on the same network – promising faster data rate, higher device intensity, reduced latency, and lower energy – bringing the Internet of Things (IoT) to life. With 5G, latency will significantly drop (nearly by a factor of 10), meaning that a self-driving car could co-operate and communicate with cloud-based data in real-time (Blum 2018). The 5G use-cases may well boost global GDP by $1.2 trillion to $2 trillion by 2030 in these four commercial domains alone, which means that the exposed value will impact the global economy (Grijpink, et al. 2020).

As for all the excitement built up around the **IoT**, the technology enables the possibility to connect any device (with an on/off switch) to other interconnected devices using the internet – from smartphones, wearable devices, headphones, washing machines, etc and more. It is a comprehensive web of connected things and people – in which occurs a constant collection and share of data related to the surrounding environment and its usage (Clark 2016). Hence, the

inherent value of IoT can be easily pertinent across multiple industries. The economic value of this network of interconnected equipment could easily reach a volume of trillions of dollars per year, distributing significant impacts from one industry to another (Chui, et al. 2019). B2B companies notably struggle to develop and maintain data ecosystems, given the vertical-specific solutions, as hundreds of IoT systems are eager for ascendancy.

Additionally, B2B faces more barriers in extracting value from data, making companies seek a domain. There are IoT platforms of every shape and size, and according to DBS Bank, in fast-changing times, the number of IoT-connected devices will progressively increase from today's 11 billion to 125 billion by 2030. As for monetization, the Internet of Things expands its outcomes across three primary means: augmented product sales by IoT enablement, leveraging from premium pricing for connected devices and "servitization" of products; direct monetization of IoT data from developed IoT solutions, including platform and software licenses, and fees for managed-services SLAs; and monetization of the whole IoT ecosystem, from software licenses, analytical services fees, and ISV marketplace revenue sharing (Gourévitch, Antoine; Russo, Massimo 2020).

Last but not least, **cloud and edge computing** refer to the capability to make AI-driven interfaces get real-time insights and dynamically manage data processes (Cook, Allan V.; Dajee, Jiten; Berman, Jonathan 2019). This keen for computational capacity from the cloud is emerging a new sector, namely edge computing (Chabas, et al. 2018). Edge computing relies on anything that implicates retaining service provisioning, data, and intelligence closer to users and devices. Mobile apps can benefit and better assess use throughout artificial intelligence procedures and complex machine learning algorithms with the edge network if they do not have to depend entirely on their processors (D. Carr 2020). Edge computing delivers real-time analysis on local data to devices – from household appliances and oil refinery equipment to smartwatches (Chabas, et al. 2018). Other typical applications might involve edge computing for augmented

reality. From the AR goggles to smart cities service systems – being the inherent decentralization of edge computing the best way to dodge system collapses with the massive amount of data inputs, while simultaneously promoting smart cities efficiency –, continuous distribution of navigation software overnight to vehicles and networked traffic systems, machinery automation, predictive maintenance, and monitoring (D. Carr 2020). Emerging technologies are not only here to provide, but rather to thrive.

2.3.1 **Covid-19 Impacts on Emerging Technologies**

User experience experts have been facing a complex web of new effects on user behavior during the pandemic. It is safe to say this COVID-19 outbreak is a once-in-a-lifetime tragedy of global implications; however, it is also unlocking some doors for some UX teams to upgrade their users' experiences in ways never imagined before (Moran 2020) . The COVID-19 pandemic has pressed a rapid adoption of **digital channels** across industries all over the globe, but digital's growth has stayed at a steady level (Hajro, et al. 2021). Companies could attract and engage with new digital consumers by digital remodeling experiences, investing in "phygital" – as for retail, physical and digital are cooperating in a smooth flow, where there is neither a picture-perfect physical solution nor an ideal digital solution in retail, but rather an entirely combined one. The post-pandemic landscape is driving massive demand for touchless interfaces, particularly sensory interfaces (Zero UI) – every touchpoint during the user experience is most likely to be restyled in a hands-free, screenless intelligent interface. Building and developing solid touchless environments will require a human-centric approach, establishing security, reliability, privacy, and freedom (Srinivasan 2020). Moreover, and as previously mentioned, major global lockdowns have might be accelerating the shift for edge computing (Goel, et al. 2020) . Hence, this happens because whole industries heavily invest in edge computing to address latent needs in **network infrastructures**.

The technology sector impact of COVID-19 is evident on three key dimensions – reaction, recovery, and growth. From implications on supply chains, electronics value chains, and inflationary impacts on products and services, the sequels of the pandemic are deeply felt around the globe. Security software will take in third-order interests due to a growing remote workforce, while at the same time, IT budgets on security software will expand as companies race to secure endpoints, especially VPNs and cloud-based solutions (Sallomi 2020) .

In the end, due to its rising popularity, since the beginning of the COVID-19 pandemic, most of the **blockchain** discussion has still centered mainly on its technical side, disregarding other purposes it puts. Once the blockchain is well strengthened, the question is whether it should be resourceful in other complex and distinct contexts, such as the management of the pandemic – as it allows to deliver trackable and cost-effective solutions, driving to right-fit predictions and properly addressed contingency plans with in-time reaction (Capece e Passiatore 2021). Blockchain's trust value will progressively become more pertinent in this post-pandemic new normality. Entire supply chains have been restructured as businesses struggle to fill the gaps in demand, especially transparency along the whole chain, considering that customers are getting more tech-oriented and increasing regular critical thinking in this matter. Constant global lockdowns and a shaky demand have compromised just-in-time delivery, one of the pillars of current manufacturing (Bendrik 2020). Companies can only narrow their priorities to the transparency of the supply chains – right where blockchain offers the right-fit solution. Blockchain's efficiency, tracking, and monitoring capabilities make it a powerful asset in the battle against the virus (Capece e Passiatore 2021).

2.4 Big Data

This section aims to address one of AI's main catalysts: Big Data. Simply put, big data refers to both unstructured and structured hard-to-manage volumes of data.

Due to its neurons and learning system, AI is pursuing a revolutionary and innovative road due to its ability to evolve autonomously like a human. This paper will discuss the comparison of AI with the human brain and apply different memory types. Through a combination of periodic memory and semantic memory – that can be extended to the long term – the urge for an advanced technology that can actively operate in distinct industries and perform a plurality of tasks is clearly evident. Hence, one of the major emerging challenges that come with high-tech development is to achieve such a comprehensive technology Here is where the principle of "Big Data" comes into play. This term refers to "information resources whose characteristics in terms of volume, velocity, and variety require the use of particular technologies and analytical methods to generate value." (Gewirtz 2021). Nowadays entire industries, companies and business models resort to data-driven operations, in order to leverage on as much information and resourceful insights as it can be gathered. More data means more applicable knowledge. And in a technology-driven context where businesses fight for competitive leverage, not only the amount of data is relevant, but what do with the data is also crucial. Here is where big data take a part. So forth, raw information should be gathered, stored and accessed into useful data-driven insights, leveraging on the effective analytic systems of Big Data. At this point, a virtuous cycle take form to analyze growing volumes of heterogeneous raw-data at unprecedent speed. As data sources become more and more complex – which are being driven AI, top-notch connectivity, smart devices, IoT, and a variety of social networks –, big data is able to deliver cutting-edge decision-making and smooth planning flows that give confidence for making strategic business moves. Big Data comprises a plurality of functions depending on the context it is used. The global Big Data market has doubled in less than four years and has increased from $30 billion in 2018 up to $66 billion in 2021 (Joumana Boustany, 2017). This rapid growth is mainly evident on the extensive cycles of data flows vastly used on data analytics services and software providers, such as Microsoft, SAP, Oracle, or IBM. Also, big data aims to provide in-time

accessibility a variety of data touchpoints, enabling industry players to exploit analytical and data-rich methodologies at its optimal conditions (IBM, 2021).

Big data is commonly described by three major components – the three-V's theory. The first “V” refers to “volume”, in which individuals or corporate entities are able to gather data from distinct sources – including video and audio formats, IoT transactions, smart devices, tech-wearables industrial equipment – and accurately store the same amount of data in an almost-costless way. By this way, excessive amounts of data can be stored in data lakes, which might be on of the main next-gen data management solutions – complementing entire data warehouses and intelligence solutions – providing a continuous framework that allows ML algorithms and real-time analytics to be inter- and intra-connected in a concerted environment. The second “V” corresponds to “velocity”, which can easily measure in and out data flows through firewalls or internal data lakes. With the emergence of IoT, in-time answers and data streams should be timely handled and move at an unprecedented pace using radio-frequency identification (RFID) tags, sensors. At last, the third “V” refers to “variety”, in which data can be properly handled throughout all types and formats – form structured data like numeric databases to unstructured raw formats like text documents, images, videos and even financial instruments (SaaS, 2021). Briefly, the “variety" stands for the heterogeneously management of data (Gewirtz 2021).

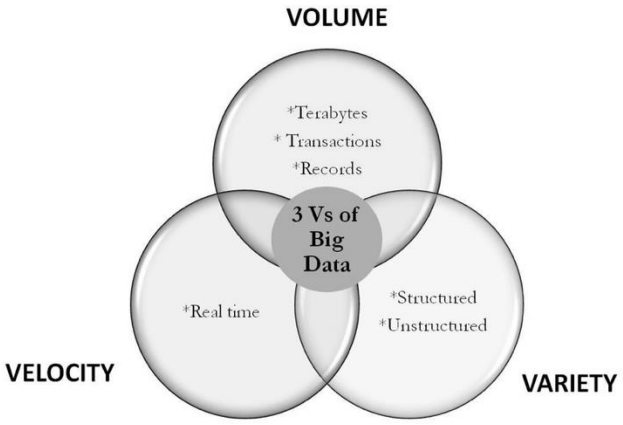

Figure 1. Big Data “3V” (Gewirtz 2021).

Additionally, it is relevant to mention that big data can also serve as a solid basis for typical software as a service (SaaS) business models. Whence, two additional vectors are integrated in a five-V's theory. The first added "V" leads to "variability" – occurring by the increasing speed and unexpected fluxes throughout data flows – that challenges organizations to control and address occasional-triggered data peak events. Lastly, the "V" corresponding to "veracity" was urged due to shared sense of uncertainty around the negative externalities of digital transformations and broad AI implementation. This last "V" is responsible to quality assessment, in a context where linkages and connections are frequent hurdles whenever businesses need to clean, transform and establish data relationships across multiple systems and networks.

To conclude, the usage of big data cannot limited only by the amount of handled data, but also to the inherent value organizations are able to extract from its streams. Therefore, industries can now leverage on quick and accurate failure detection, efficient data translation into desired outcomes (e.g., converting medical images into useful insights, assess investment portfolios risks in record time, or even detect fraudulent schemes within organizations) through complex DL and classification models (SaaS, 2021). Big Data and Artificial Intelligence have deeply connected themselves due to the massive data collection. The data stored must represent a substantial volume to be efficient for the machine learning processes (Arthur I. Miller, 2019). AI is nothing less than the means to give meaning to big data. So forth, AI is today a significant asset for companies in terms of competitiveness and intelligent outcomes prediction, fueled by data-driven decision-making.

3 A Powerful Technology of Mankind: AI

3.1 AI – Fundamental Marks in History

In this section, the authors propose to address the prominent marks in the history of AI. Even though it is a trendy topic to talk about nowadays, many people do not seem to know that its first

marks in its history began a long time ago. The first work came from the invention of the programmable digital computer in the 1940s, the machine based on the abstract essence of mathematical reasoning. (Groumpos, 2019) This device and the ideas behind it inspired a handful of scientists to start seriously discussing the idea of building an electronic brain. Also, in 1950, Alan Turing proposed the Turing test, and in the same year, Isaac Asimov proposed the 3 Laws of Robotics. Thus, in 1951, the first AI-based program was written. ("Artificial Intelligence 2020 A Simple Guide to Understanding AI", 2018) In 1955, the first self-learning game-playing program was created, followed by creating the MIT AI lab in 1959. Concrete direct consequence: GM set up the first robot into its assembly line in 1961. (Mijwel 2015)

Thanks to the article "AI Research" (Newell and Simon, 2021), the authors can easily understand where the concept of artificial intelligence comes from, who its precursors are, and its overall functioning. Indeed, AI is highly influenced by how the human brain works, addressed further by the author, who takes up the theories of AI precursors: Newel and Simon.

A complex given environment with different variables, algorithms, or other expert programs intended to solve a problem implies an organization acquiring enough data, evaluating them, acting, and finally learning from it. In the 70s, the emergence of this concept gave rise to various and varied interpretations. Therefore, the authors understand how artificial intelligence has become a problem-solving tool through the article 'Artificial Intelligence and the Management Science Practitioner: Rational Choice and Artificial Intelligence' (Jacob 1988).

At the beginning of the 1990s, AI would experience the most significant turning point in its history. Indeed, the technological advances of this time are correlated with Moore's law to allow researchers to develop previously unexploited skills. Nevertheless, the world must wait until May 1997 to witness the consecration of AI with the victory of Deep Blue created by IBM, which beat Garry Kasparov, then worlds chess champion - it represents a milestone in the history of AI. Right after, MIT AI labs demonstrated the first emotional AI, and many innovations will

follow. (Mijwel 2015). Still in this development phase: after being a tool, a problem solver, AI has come closer to a human brain thanks to networks of connections. Today it is a question of evolving autonomously through neural networks and learning systems. For example, Google has been working on a self-driving car since 2009. The time frame below shows that AI has a concise history, but its growth is transcendent (Undercoffler 2021).

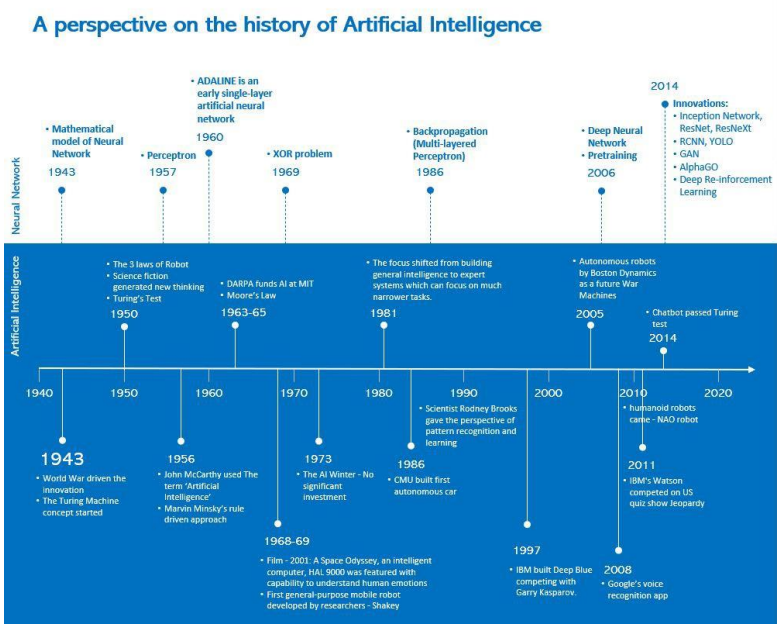

Figure 2. High-level timeline of AI (Roy, 2021).

Furthermore, AI has different degrees of execution, as explained in the article 'A case study in AI methodology '(Ritchie and Hanna 1984). AI can manifest itself at different levels. Assisted intelligence improves what people do within an organization through automation. An "augmented intelligence" optimizes tasks thanks to sophisticated algorithms that consider a large amount of data. Alternatively, an autonomous intelligence learns and works autonomously without special human instruction. To make even more complex decisions with programs that apply improvingly better to any environment. Deep learning, further discussed in the following topics, is defined: "The general principle that guides this approach is to let the computer discover for itself the optimal strategy to solve a problem" (Breton 2021). However, other methods exist, as they are extremely well detailed and explained in the book "Usages intelligence artificial"

(Ezratty 2019). The diagram below from the book shows the different tools that emanate from the concept of AI. These non-exhaustive concepts (as it dates back to 2018) are crucial to understanding artificial intelligence applications.

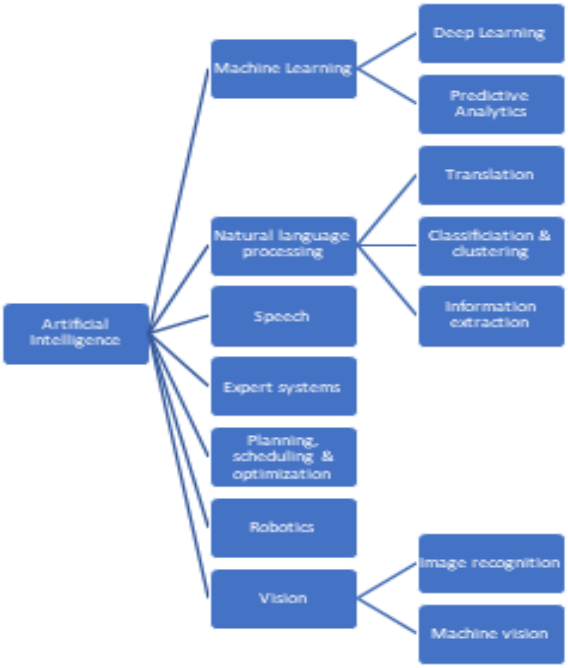

Figure 3. ‘Les usages de l’Intelligence Artificielle’ (Olivier Ezratty, 2019)

3.2 The Core of AI – What Is and How to Exploit It?

What is artificial intelligence? It seems to be a simple question, but it is pretty complex. To further understand the true meaning of AI, it is a prerequisite to know what "human intelligence" means. To further understand the true meaning of AI, it is a prerequisite to know what "human intelligence" means. An old explanation defines it as a mental capacity that comprehends the ability to learn independently from experience, adapt to new situations, and understand and handle abstract concepts (Sternberg 2021). Although, a more contemporary approach tries to dilute the human intelligence to multiple intelligences comprehending capacities such as linguistic, musical, logical-mathematical, spatial, creative physical, intra/interpersonal, naturalistic, or existential intelligence (Gardner 2011).

The concept of what defines AI has changed over time, but at the core, there has always been the idea of building machines capable of thinking like humans (Marr, What is AI 2021) by pursuing the arduous task of reproducing the human brain (Sirrenberg 2020). The idea of building computers do things at which, at the moment, humans perform better (Rich 1983), makes this definition always match the actual context, until computing capabilities (Meyer 2011) come to a day, if it may come, on which AI-enabled technologies surpass human-like cognitive capabilities (Huang 2018). It includes speech recognition, visual perception, learning, reasoning, planning, and decision making (McKinsey 2020). AI does not refer to a specific technology or field of study. However, it acts as a general-purpose technology (McKinsey 2020) over an umbrella of many different disciplines- neural networks, machine learning, and deep learning (Arslanian 2019). Hence, to try to develop an **AI definition**, this paper required research on several reports, articles, and books, such as B.J.Copeland (2021), Sirrenberg (2020), B.Marr (2019), Haenlein and Kaplan (2019), Eling and Lehmann (2018). The author's proposition to define AI consists:

A digital computer or computer-controlled robot can examine big data, learn from it by applying some algorithms to such data, and then make decisions autonomously and predict outcomes independently to achieve human-like specific goals or tasks such as identifying a face in a photo or translating a language.

To the best of the author's knowledge, AI thrives for three main reasons. Firstly, the expanding "ocean" of data characterizing today's big data world (Hasan 2020) and the continuous generation of data than ever before is fuelling AI unprecedently (Arslanian 2019). The topic of Big data revolution has already been explored in **section 2.4**. Secondly, the computing power enhanced over the last years can store and process vast amounts of data (Marr, Artificial Intelligence in Practice 2019). Lastly, the change in consumers' expectations contributed to its usage increase across many different industries (Jones 2019), from healthcare to self-driving

cars or to predict the outcome of legal cases (Marr, What is AI 2021). When applied to generated and collected data sets, AI algorithms' usage comprehends pattern recognition, optimization, and prediction**.** The classification or analysis of such data can occur in different formats like text, speech, image, or video. An important concept comes across regarding data classification: structured and unstructured data (Shroff 2019)**.** **Structured data** is appropriately formatted, making it is easier to explore and search in databases. In contrast to the previous type, **unstructured data** has no pre-defined format, which becomes more challenging to collect, process, and analyze (Pickell 2018).

A critical element of AI is the so-called **neural networks (NL)**. The term heritage from neuroscience consists of recreating neuronal networks characteristically from the human brain (Sirrenberg 2020). NL is a computer system with millions of artificial neurons designed to recognize patterns in data such as images through identification, classification, and analysis of diverse data (Shroff 2019). Each of these artificial neurons falls into one of three layers. As previously mentioned, the input layer receives raw data, structured or not. Then, the output layer provides the results of the AI system, such as predictions or decisions. In between**,** hidden layers receive the previous layer's output and aim to connect the input and output units (Arslanian 2019), as shown in **appendix 7**. The amount of layers between the input and the output characterizes the depth of NL (Sirrenberg 2020).

3.3 The Rise of Machine Learning and Deep Learning

The terms AI and machine learning (ML) are often reciprocally misunderstood. Samuel (1959), credited as the first author to conceptualize ML, is an application or sub-discipline of AI. Some authors, such as B. Marr, even proclaimed the current state-of-the-art of AI. ML allows computers to perform a task, using data to feed and train the algorithm, while testing its performance along the way (Arslanian 2019), letting the "machine" learning for itself and by

distancing itself from the original "knowledge" (Schölkopf 2018) - without human intervention. Renowned authors in the field of AI, such as Sirrenberg (2020), Marr, B. (2020), Arslanian (2019), Gentsch, P. (2018) comprised ML into three types of learning: supervised, unsupervised, and reinforcement learning.

Supervised learning is a subset of ML that uses a predefined (structured) data set to train algorithms with an expected output. Let us take the auto vehicle industry to apply this concept. If the objective is to identify a car model, the AI system could be presented with multiple inputs (brand, horsepower, type of engine, etc.) and identify the intended variable (car model) based on the training images. Besides image recognition, this learning applies to speech recognition, such as Alexa from Amazon or Siri from Apple. According to McKinsey, the most common models/algorithms include (Deep) neural networks or generalized linear models (GLM) (McKinsey 2020). **Unsupervised learning** does not have a predefined target (output), and it focuses on recognizing similarities and patterns by drawing inferences from large sets of unstructured data. Taking social media as an example, this type of learning can be applied to perform customer segmentation with great precision through clustering algorithms. Besides, it is commonly applied to identify commonalities between input data and grouping – Fraud detection (McKinsey 2020). Lastly, **Reinforcement learning**, the most sophisticated subset of ML, occurs when there is no or only a few available training data, and the optimum solution is unknown. Thus, the AI system tries out solutions through a trial-and-error process driven by "rewards" (for good solution ideas) and "punishments" (for inadequate approaches) (Sirrenberg 2020). Q neural network, deep determinist, and policy gradient represent a few examples of these learning application models/algorithms (McKinsey 2020).

Deep learning (DL) is a particular design of neural networks and a subset of machine learning. DL focuses even more narrowly than other ML techniques, as it shows **appendix 8**, on which the "deep" refers to the large number of layers of the neural network – Deep Neural Networks

(DNN); enhancing more substantial capabilities of learning through experience and even to learn from its own mistakes similarly to humans (Marr, Artificial Intelligence in Practice 2019). It can also discriminate between important and irrelevant information from the input (Panch 2018). Processing a more comprehensive range of data resources usually achieves better results than other ML subsidies (Sirrenberg 2020). Finally, the combination of reinforcement learning with DL unlocks the ultimate human capability of "learning by doing," enabling some of the most well-known AI innovations such as self-driving cars or when used during the competition between the world's champion of a complex game called "Go" and Google's computer "Alpha-Go" (Marr, Artificial Intelligence in Practice 2019).

3.4 The goals of AI

For some authors, look to AI as a leading threat to humankind, and for others could be seen as an anchor to "save" us towards tackling some of the biggest challenges this world is facing (Marr, Artificial Intelligence in Practice 2019) and providing uncountable possibilities to improve people's lives in multiple areas, from healthcare to transportation (Stone 2016). This thesis focuses on the perspective that takes AI as the main driver to disrupt humankind lives to the same extent as previous game-changing innovations such as electricity or the internet (McKinsey 2020). So disruptive that **AI is at the top of executive agendas** across many business leaders, industries, and even countries (Arslanian 2019). Amazon CEO Jeff Bezos believes that the world has entered the "golden age" of AI (Bezos 2017), and Google co-founder Sergey Brin stated that "The new spring in AI is the most significant development in computing in my lifetime" (Brin 2018). In 2020, more than half of top executives from many different industries admitted to implementing some AI into their businesses (Balakrishnan 2020), and this trend will continue to rise, as shown in **appendix 9**. Furthermore, extensive reports on how to implement AI were set

by major economic/political countries such as the United States (US), China, Russia, and European Union (EU).

AI objectives can be divided into Strong vs Weak AI (Sirrenberg 2020). Arslanian (2019) classified between Broad vs. Narrow AI, and (Marr, What is AI 2021) distinguish AI goals into two branches: Generalised vs. Applied AI. Although different authors have different classifications, they mean the same thing. **Strong AI** seeks to reproduce human intelligence by performing various tasks in many areas of human's everyday lives (Arslanian 2019). The development of strong AI enhances complex concepts such **as superintelligence, technological singularity, and transhumanism** (Bostrom 2014); (Chalmers 2010); (Kurzweil 2005) and (Russell 2020). Although, the author has focused merely on narrow artificial intelligence ("weak" AI) and its applications throughout this thesis. **Weak AI** Seeks to perform effectively one specific human task with a predetermined and predefined range, such as playing chess (McKinsey 2020).

3.5 The Key Fields of Application

This section aims to present and explain the critical fields of AI application and what it comprehends. This thesis follows the approach of Sirrenberg (2020), on which they exclude the areas of ML, and subsequently, DL, as they do not represent independent fields of application but rather fundamental subsidiary technologies for the basis of AI usage. Therefore, the fields include Natural Language Processing (NLP), Computer Vision, Expert Systems, and Robotics.

NLP or **Speech Recognition** enables computers to extract data to understand natural language, the ones spoken by humans, both written and spoken words (Nilsson 2010), and generate meaning in a readable, grammatically correct form (Deloitte 2020), using similar language (Hall 2017). There are four main types of application, on which all rely on ML algorithms to perform: Speech-to-Text (STT) – e.g., Siri (Apple); Speech-to-Speech (STS) – e.g., Digital personal

assistants such as Alexa (Amazon); Text-to-Speech (TTS) – e.g., Spoken version of Google Translate and finally Text-to-Text (TTT) – e.g., DeepL (Sirrenberg 2020). Hence, it is a unique challenge for AI systems due to the ambiguity (two possible meanings for the same sentence) and robustness (saying fewer words than the original meaning) of human language (Yeung 2020). **Computer Vision**, also known as **Natural Image Processing**, allows computers to replace some human vision functions (Sirrenberg 2020). Therefore, it enables machines to recognize objects and track movement, through visual elements, by analyzing images or video content (Nilsson 2010). Some of the leading-edge computer vision applications are in the medical field through intelligent diagnosis or in the military context, where drones replace human observation and measure the trajectory for missiles (Yeung 2020). **Expert Systems** are computer programs that represent knowledge as a set of rules, like a human expert, that enhances decision-making on what to do in different complex situations (Deloitte 2020) and (Sirrenberg 2020). Thus, these rules aim to create knowledge discovery with auxiliary data-mining processes and an intelligent database (Jackson 1998). Some of the most well-known business applications are in financial services in high-risk credit decisions or marketing to improve advertising decision-making.

Robotics programmable machines combined with AI become artificial robot agents (Marr, AI vs Robotics 2021). Hence, AI acts as the brain, and robotics itself acts as the body to enable human tasks "naturally," such as walking, observing, speaking or smelling, and interacting with the environment (Russell 2020). The different classifications of Robots are according to the fields of application (e.g., industrial, medical, military, navigation, etc.), to their degree of mobility (e.g., stationary or mobile), to their degree of interaction with humans (e.g., independent or supervised by humans) and also to their "human appearance" (e.g., machine-like or humanoid robots like the ones it is usually seen in scientific movies) (Sirrenberg 2020). ML algorithms help robots strategize about future movements based on their prior motion, enhancing robots to

"learn by doing" since they start with no knowledge about physical motion (Marr, AI vs Robotics 2021). Thus, it even enables them to gain social skills for smoother and more positive human-robot interactions (Zewe 2021), quite helpful in the medical field for example. Robotics will reshape the global economy from faster customer service to more efficient operations across organizations. Furthermore, these applications are not exclusive and require interdependence for a well-known AI case of self-driving cars.

3.6 Risks & Biases of AI

AI, as a technology, comes with challenges of integration and the risks associated. Although many inventions developed in research laboratories and academic institutions, it is thanks to commercial interests that accelerate the changes and shape today's world.

Thanks to a Deloitte study, the authors can state that fewer than four in 10 adopters report that their organization is "fully prepared" for the range of AI risks that concern them. (Hupfer 2020) They are undoubtedly technical risks to the use of AI in business. Some specialists for McKinsey (Cheatham, Javanmardian, and Samandari 2019) have reported those risks. They deal with the issues related to the receipt and use of private data (which is driven by the law as GDPR in the EU, for example), the technological problems, especially the concordance between software and internal transmission of information. There is also fraud and other security-related issues (cyber security) and the interactions between machines and humans. Olivier Ezratty (2019) also confirms the risks related to the security of an AI system that can be compromised at different levels, including networks and the cloud, sensors, and power supply.

There is AI bias when there is an anomaly in the output of machine learning algorithms. These could be due to the prejudiced assumptions made during the algorithm development process or prejudices in the training data. Biases are impacting the outcomes of the algorithms. As below,

biases can come from different angles and impact the outcomes of fundamental subjects as health, statistics, justice. (Dilmegani 2020)

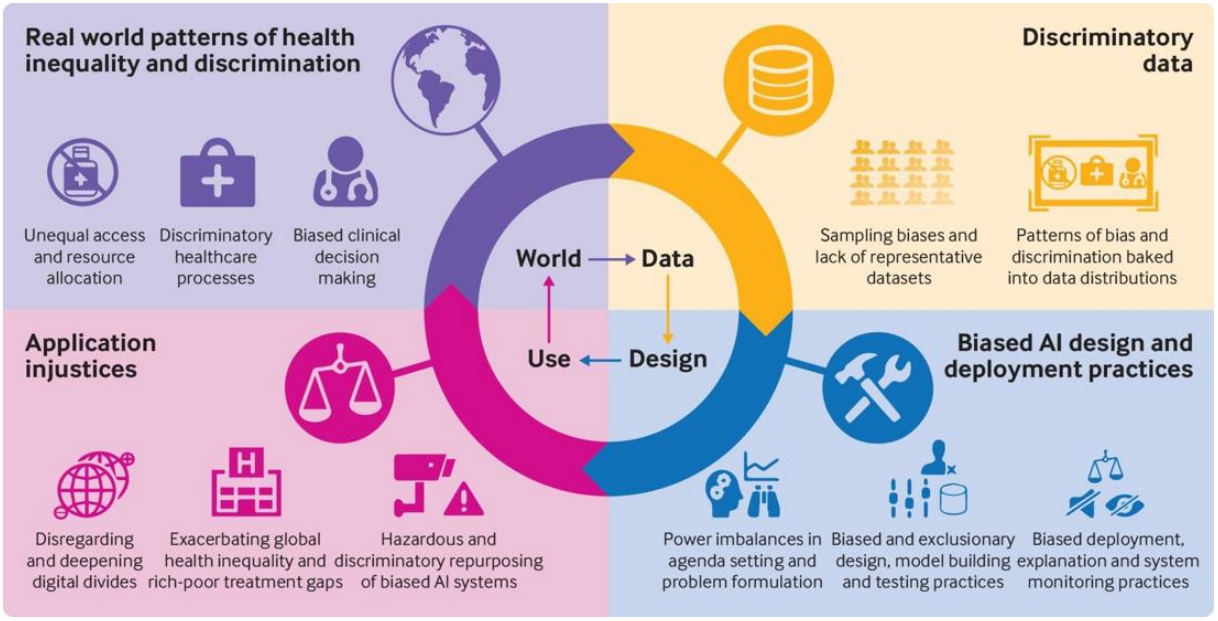

Figure 4. ‘Bias In AI: What It Is, Types & Examples Of Bias & Tools To Fix It’ (Dilmegani and Cim 2020).

Another challenge would be the human challenges, and it is not easy to move current operating models to proactive, personalized, autonomous, and predictive ones in a multinational or an SME. Moreover, it is more than legitimate as cognitive technologies such as robots, AI, machine learning, and automation will replace 16% of US jobs by 2025. (Dilmegani 2020)

Thanks to the book 'The Highways and Byways to Radical Innovation' by Kolding, the authors learned that there are different types of resistance to changes when introducing new technology, and there are tracks for good integration. According to Kolding, it is important to involve stakeholders when identifying the need to manage resistance to an innovation project through AI because non-involvement can lead to mistrust that hinders future development phases. Therefore, the "co-construction of the project with the stakeholders characterizes the corporate

strategy." It anticipates conflictual relations between various actors and partners. According to Kolding, the co-construction of an innovation project by AI is a "contract of trust established on a form of the human-machine pact." (Kolding 2017)

Peter Buell Hirsch also assures us that companies can reap the rewards of their business decisions without becoming prey to the "monsters of moral failure that they have caused" with the proper protections in place. (Hirsch 2018)

The challenge of this integration starts by breaking the myths around AI, set out by Robin Bordoli (2016). He considers the following seven myths: 1) 'AI is magical and deep learning can solve all problems; 2)'AI is reserved for a technological elite and GAFA.'; 3) AI is dedicated to solving big problems worth billions of Euros', 4) 'Algorithms are more important than data,' 5) 'Machines are better than humans, 6) 'Machines will replace Men' and 7) 'AI is machine learning or deep learning'. Those ideas are essential demystified across in any company.

Best practices to integrate AI begin by performing a Benchmark. Indeed, if the supply of technology is external to the company in terms of AI, it will be necessary to be particularly vigilant because technology providers often exaggerate the results, the reality, and the results of the projects. This first selection is crucial. Then, the next phase will be related to choosing the technology appropriate to the company; the goal is to have the maximum amount of data to make the best decision. The last element more than essential to a good integration is to call on specialists who know the diversity of the many techniques and methods in using AI. (Ezratty 2019)

In parallel, the author’s notified that some projects might require external funding. There are ways to benefit from aid and loans to finance AI projects. To increase the competitiveness of companies and, in particular, SMEs and mid-caps, the French State has made available financing solutions, tax credits often supplemented by an effort by local authorities.

3.7 Controversies towards Technology & Legal Framework

The present section highlights some of the most evident controversies and legal compliances of AI because it may represent a "dream" for some or a "nightmare" for others. Movies have shown us that machines are always initially created to be helpful to humans, but as time goes by, the more intelligent they become and then begin to act by their own will, with deadly consequences. These sci-fiction ideas have become the AI's biggest cliche. Elon Musk, one of the most recognizable "voices" preaching the dangers of AI, has spoken about AI arms races and compared artificial intelligence to "summoning [a] demon." (Valentine, 2017) Moreover, he founded OpenAI, an association to banish AI from the Earth because of his concerns. By the same token, as AI progresses in human's daily lives, digital assistants like Apple's Siri and Google Assistant collect everyone's data by enriching their relevance. (Valentine, 2017)

Big Data and AI are linked as AI require substantial data volumes to perform machine learning effectively. AI makes sense of Big Data by using and analyzing all this data at a speed that is hard to match. With this processing speed, AI is a considerable means for companies in terms of efficiency and learning. Nevertheless, this raised how AI can deal with Big Data while complying with all the legislation regarding data. Jayshree Pandya, in his article for Forbes (Pandya 2019), shows that AI is an area where almost no rules of engagement are yet applied and that each country will have difficulty creating security from algorithms and defining any international law. Although some agreements have emerged to fight cybercrime, the interpretation of the war on AI remains outside of any binding legal obligation. In the absence of consensus on AI standards, every business model and company is threatened. (Pandya 2019)

Switzerland has the most important number of AI companies in Europe, so the country needed to tackle the question and challenge the applications of AI (ASGARD 2021). Furthermore, to handle this question, a list of subjects has been discussed to delimit the usages of AI (Gordon 2021), as presented below.

Copyrighting: It should clarify how copyright law deals with the fact that many forms of AI require enormous amounts of data for the training process, which are at least partially protected by copyright. (Gordon 2021)

Patents: AI cannot be named by the inventor, but it also does not act as a mere tool for its operator to be named inventor without question. Today, recognition of AI systems is excluded due to their lack of legal capacity, but the legal community can recognize that AI-created results can be assigned to a natural person and are patentable. (Gordon 2021)

Data Ownership/data protection: Transparency of data and sources is required and can be the object of verification and control. (Gordon 2021)

Algorithms & big data: The classic juridic schema limits Cartel and unfair competition. Moreover, because algorithmic computer programs can now store, collect and process a large amount of data, antitrust concerns relating to big data also have to be considered. (Gordon 2021)

Specific regulations: in November 2020, the Federal Council published guidelines that set out specific principles: 'Putting people at the center of things,' 'Setting framework conditions for the development and use of AI,' 'Transparency, traceability and explainability,' 'Responsibility,' 'Security,' 'Active participation in the governance of AI' and 'Inclusion of all relevant national and international actors. (Gordon 2021)

Implementing AI/machine learning/big data into businesses: Companies' legal difficulties when implementing AI are data protection and financial trading rules, and regulation liability. They need to implement rules and dedicate a budget to structure and control the usage of AI. (Gordon, 2021)

Legal frameworks are essentials for companies to structure the usages of AI. Switzerland is a leading country in the EU for AI, and they are well advanced in creating a legal framework.

As of today, the EU is still in the process of creating laws. In April 2021, proposals covered different objects: ethics framework for AI, liability for AI causing damage, and intellectual

property rights. ("Regulatory Framework On AI" 2021). The current stage is that the regulation could enter into force in the second half of 2022 in a transitional period. In this period, standards development and governance structures would be operational. The second half of 2024 is when the regulation could become applicable to operators with the standards ready and the first conformity assessments. ("Regulatory Framework On AI" 2021)

4 A New World Shaped by AI capabilities and Technology

4.1 Impact of AI on the Global Economy

The AI industry could be worth more than $15trillion by 2030 thanks to its democratization: indeed, 80% of emerging technologies will have AI foundations by 2021, which will significantly impact the global economy. (Ocampo, 2021)

37% of organizations in 2019 use AI in the workplace. Moreover, AI adoption across businesses grew by 270% between 2015 and 2019. (Dilmegani, Cem. 2021) The pattern of adoption and complete absorption might be relatively rapid. Consequently, the rise of digital platforms, especially global ones like Alibaba, eBay, or Amazon, is one of the main drivers for AI adoption. The rise of machine usage started to transform the workplace, and many factories today are fully automated. The development of artificial intelligence is developing in many different areas. As AI aims to increase productivity and business opportunities, its macroeconomic influence is one of AI's impacts on economic growth. For example, when AI increases productivity growth, hence, increases economic growth as well. ("The Impact Of AI On Global Expansion" 2020)

AI adoption and its implementation are one of the company's main priorities. Executives say the primary goals of AI implementation are 51% enhancing their products' features, function, and performance, 36% optimizing internal operations, and 36% freeing up workers. (141 Myth-Busting Statistics on AI, 2021) AI helps in an extensive range of industries: by financial services

companies to serve customers better and detect fraud; by healthcare providers to diagnose illness and identify more effective treatments; by manufacturers to keep machines up and running on the plant floor and to streamline supply chains; and by city authorities to track and mitigate urban challenges such as traffic, pollution, and crime more accurately. (Hoffmann 2021)

AI echoes in very different ways, impacting the global economy. For example, AI-based translation services help to improve trade negotiations and exchanges. On top of that, as AI becomes increasingly embedded in society, it will change the businesses that adopt it and have significant economic, social, and civic effects on citizens and consumers. (Hoffmann 2021)

The expectation is high when it comes to the impact of increasing productivity: The Labor Productivity Improvements should be around $6.6 trillion and the Increased Consumer Demand; $9.1 trillion. (Desjardins 2017) Numbers are not surprising as AI supports a lot when automating tasks and making intelligent predictions. (Angelou economics 2021)

New research from the McKinsey Global Institute tries to simulate the impact of AI on the global economy in seven categories. The first deals with AI adoption on a mix of production indicators that directly affect company productivity. The four next are externalities related to the adoption of AI connected to the broad economic environment and the transition to AI (Bughin 2018).

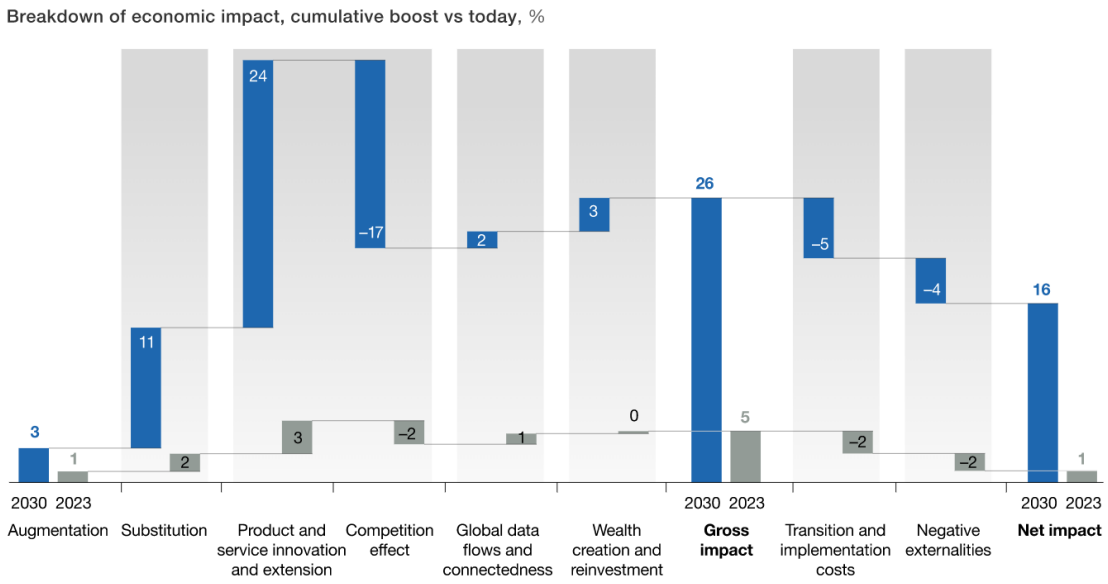

Figure 5. 'Notes from the AI Frontier: Modeling the Impact of AI on the World Economy'. McKinsey. (Bughin 2018)

4.2 AI in the Retail Industry

According to an expert market research website, 'the global retail market reached a value of about USD 23 trillion in 2020, and the market expects to witness a healthy growth in the forecast period of 2021-2026'. The retail industry is used daily, from supermarkets to fashion companies: everywhere. (EMR 2021)

Enhanced by Covid, the revolution of AI is becoming more and more present in the industry because they need to answer new customer expectations. "Retailers have been investing significantly in their digital transformations to respond to customer expectations and thrive in the new reality, and given the potential benefits, AI and analytics brought to life by improved technologies are indispensable parts of their business strategy." (KPMG 2021). That is why most tech giants Amazon, Apple, Facebook, Google, IBM, Microsoft, and technology companies like Alibaba, Baidu, and Tencent have already adopted AI-driven strategies in the products and applications they are managing.

In this dynamic, Microsoft wants to offer an AI that would allow retailers to tailor their offerings more precisely to customer demand, with services such as personalizing sales through the provision of personalized experiences, offers, pricing, and plans to modernize the shopping experience. Also, tools help with dynamic pricing and planning through predictive models that anticipate demand to be more efficient in decision-making. Microsoft relies on one of the leading examples of retail; ASOS. Indeed, the application has evolved on a micro-services platform running on Microsoft Azure. As part of its transformation, the company has launched a mobile app with a built-in recommendation engine to ensure that the proper subset of the 85,000 products suits the right consumers. As a result, Microsoft assures that in 2016, the new platform processed more than double the volume of orders recorded during Black Friday of the previous year (Microsoft 2021).

In addition to the development of algorithms, robots represent an essential tool in applying AI. The giant Walmart works with a San Diego-based company, Brain Corp. Thanks to it, Walmart uses robots to clean its stores and adapt to all kinds of environments. Walmart seeks to integrate intelligent and autonomous robots into its processes in this approach. The startup follows the needs of retail companies, and its Product, BrainOSBrainOS, could analyze the different products on the shelf, manage data, create reports, and interact with end customers and even other robots. Hence, it allows Walmart, for example, to have a much better view of the market, avoiding any biases. ("Brain Corp To Provide AI Services to Walmart - Brain Corporation", 2018)

E-commerce and the customer experience are inevitable challenges for large, medium, small businesses and startups. Moreover, many retail players, such as analyst (Vijay Michalik, 2017), argues that "Improving and refocusing the customer experience online and offline must be the guiding principle for all retail businesses." ("Artificial Intelligence Comes To The Rescue For The Retail Industry" 2017) For this, his article considers that the bare minimum for retail

companies would be to own a chatbot or another virtual assistant, intelligent data analysis to better segment the market, and a sales forecasting tool to optimize its supply chain.

Lowe's Home Improvement Warehouse, an American distribution chain specializing in construction and gardening equipment for individuals, is an old company based on a classic family retail business model that integrated AI at the center of its operation and in a physical way – not an e-retailer. Equipped with a robot directly about the customer, the author will see how these objects have revolutionized the background, the face of the brand, and especially the customer experience delivered because the physical point of sale has also undergone dramatic changes. If consumers can buy anywhere and enjoy near-instant gratification, the store becomes obsolete mainly as a transaction facilitator (Reinartz, Imschloss, and Wiegand 2017). Therefore, the main question is not how to impose digitization at a point of sale. Instead, it is about effectively integrating and anchoring the point of sale in the consumer. The new physical environment of retail focuses on showrooming and customer support to retain and complement other transaction channels. Sellers are freed up to improve customer service as Lowe does.

How not take the titan that is amazon today as an example? According to the article Artificial Intelligence trends shaping the Retail Industry, Amazon has been one of the forerunners of the transformation of retail methods. Amazon has taken up many of the challenges of e-commerce, the main ones being fast delivery and a personalized offer. The author raises new problems on e-commerce chains; on storage, choice of investments in technology, cost of operations to expand their offer and reach the most potential customers. In the same way as Vijay, Rakheja Jagrati also insists on the need for companies to move quickly towards the technologies offered by AI that he defines as the "backbone" of digital transformation. His article then proposes the possible current improvements in the face of the challenges of each stage of online sales and from companies' point of view. (Jagrati 2018)

4.2.1 **Impact on Logistics**

Retail and logistics are significantly linked as they **transport** a product from a point to its destination. Likewise, there are multiple ways to move cargo by land, air, or water depending on the goods' weight, volume, and destination. It is fair to say that the logistics industry is the backbone of the global economy.

As globalization begins, the demand for the transportation of manufactured products considerably increases from firms that stimulate trade and the economy. The industry's key players are Deutsche Post DHL, United Parcel Service, and FedEx. In parallel, the rise of e-commerce allows online retailers like Amazon and Japan's Rakuten to tap into the logistics market and further expand their supply chains as the **number of packages** shipped follows the growth. Today, the global logistics industry is around over nine trillion U.S. dollars. The largest third-party logistic market globally is the Asia/Pacific and the United States. (Statista, 2021)

Of course, the last episode of the pandemic has enhanced the swift from traditional stores to ordering from the coziness of their own homes. They became the 'must-have' for online suppliers and purchasers. The trend creates extensive opportunities for a logistics company. To become the best player in the market, it needs to 'deliver the right product at the right time and the right place.' Logistics is indispensable to solve the last two points. Some key elements have been considered in the Figure below to achieve it. These will include transport, warehousing, inventory, packaging, and information.

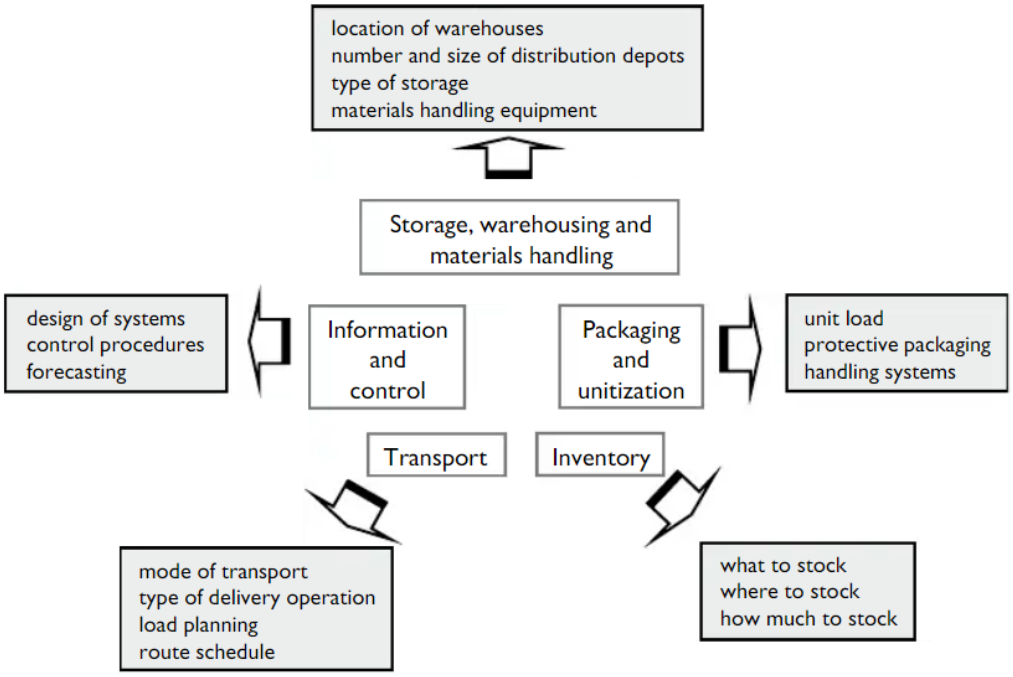

Figure 6. Process in the logistic industry (RUSHTON, CROUCHER and BAKER, 2021).

The table below shows the critical success factors in the different columns; the critical success factor, the challenge, and how to integrate AI into phases.

Table 1. AI Technologies Application.

Key success factor	Description	AI integration
Planning and Forecast	Efficient logistics is about planning.	AI empowers companies with Predictive capabilities (build on Big Data) as with demand prevision tools
Adopting Automation	Business process software like SAP or ERP can be integrated that provides timely updates	Robots for Inbound and Outbound / Robotics, Blockchain.

	regarding the movement of goods	
Value Relations	Humans are very important to manage	Specialists of AI need to be trained to understand the logistic challenges and integrate the teams to develop business
Warehouse Management System	The software application is designed to support and optimize warehouse functionality and distribution center management	IoT (the integration of communications, control, and information processing across various transportation systems), Predictive Maintenance.
Efficient Transportation System	Determine the best delivery route, cost-effective packaging that ensures low investment and safety of goods	High-tech autonomous vehicle, high-level cost-calculations: Route Optimization, Delivery Drones.

To conclude, AI can support back-office functions, the planning and forecast, the WSM, and the transportation phase. Thanks to the usage of Big Data, AI is becoming more and more useful for logistic companies. For example, according to the MHI Annual Report, only 12% of businesses use AI technology in their warehouses (2020 MHI Annual Industry Report, 2021). Moreover, at the same time, 38% of the retail industry counts on AI to improve their supply chain management. (McKinsey, 2018).

4.2.2 **The Impact of AI in the Banking Industry**

This section aims to reveal the impact of AI adoption throughout the banking industry. Recent studies portrait by PwC showed that the use, development, and adoption of AI systems may have prominent signs regarding the world's GDP, which may raise 14% until 2030, equaling an

additional value of $15.7 trillion (Riba 2017). Hence, McKinsey showed that organizations across all industries are using AI as a tool to **generate more value** (Balakrishnan 2020), and scoping to the global banking industry, AI capabilities/technologies can deliver up to $1 trillion of additional value creation each year (McKinsey 2020). The advancements of those capabilities will act as one of the main drivers to tackle the current landscape, which is characterized by almost three-quarters of banks globally earning returns on equity that do not cover their cost of equity (McKinsey 2020). AI technologies will empower banks to increase their revenue at a lower cost while enhancing superior customer experience (Biswas 2020). On the one hand, the potential **cost savings** through AI expects to be $447 billion by 2023 (Marr, The 7 Biggest Technology Trends 2020). On the other hand, recent estimates believe **revenues will increase** by 10% due to AI implementation (Wamba-Taguimdje 2020). How AI is responsible for these improvements will be addressed in the following **chapter 4.2.2.1**. Despite the benefits mentioned, only 40% of financial services companies allocated more than 10% of their R&D budget to AI (Ryll 2020). Even though financial services, including banking, are leading industries investing in AI (McKinsey 2020). According to Venture Scanner, venture capital (VC) investments in AI startups went from less than $500 million in 2007 (Meunier 2018) to more than $36 billion investment accumulated until 2018, with an average annual rate of 50% (McKinsey 2020). Furthermore, recent studies show that 52% of financial services executives are making substantial investments in AI, while 72% believe it will be a business advantage (Marr, The 7 Biggest Technology Trends 2020). To conclude, the EY global AI survey in the finance sector reveals that AI appears to positively impact organizations' **profitability**, with 51% of respondents indicating a slight increase and 18% a significant increase, as shown in **appendix 10**. The impacts between FinTechs and incumbents are distinctive. FinTechs focus on creating new revenue streams by developing new AI products and services, while incumbents focus on improving existing processes (Ryll 2020).

4.2.2.1 **The AI adoption in the Banking Industry**

In this section, the author will briefly address some of the most recognizable impacts of AI within the banking landscape. It is relevant to mention that AI is foundational in making other major technology trends such as big data analytics, blockchain, robotic process automation (RPA), cloud computing, cyber security, and voice interfaces work, which also impacts the world of banking (Marr, The 7 Biggest Technology Trends 2020). AI capabilities will enhance further value creation within the bank's value chain – from front-office revenue growth to back-office operational efficiencies (Deloitte 2021). AI exploited the bank's **front office** in the form of biometrics, virtual assistants and chatbots, and customer analytics through personalization insights and targeted offers, addressed in detail further in chapter X. The **middle office** is affected by AI empowerment in the money laundering battle, detection, and fraud prevention while conceiving more precise creditworthiness. Lastly, the **back office** comprehends AI mainly through automated tasks and risk management (Magana 2020).

McKinsey showed that in 2019, 62% of the financial services companies, which accounts for banking, reported having implemented at least one AI technology (Biswas 2020), because the cost and other barriers to adoption are falling from a technology perspective. It is becoming easier to implement and integrate those (Deloitte 2020). Despite some of the shreds of evidence pointed out in this paper, almost 65% of companies invested in AI in recent years have not yet recognized the actual benefits (Ransbotham 2019). The most used AI technological applications may vary across different areas within banks organizational structure: robotic process automation - RPA (36%), virtual agents – chatbots (32%), natural language text understanding (28%), machine learning (25%), and computer vision (24%) (Biswas 2020). **Appendix 11** shows some concrete examples even though AI applies to all core banking business areas (Königstorfer 2020).

Banks are committed to **reducing costs** through efficiencies generated by higher automation, reduced errors rates, and better resource utilization enabled by some AI capabilities (Biswas 2020), mentioned in the last paragraph. RPA is applied for structured operational tasks and can facilitate 25% to 50% cost savings (ATKearney 2016). AI will eventually replace human decision-making by accounting for more speed and accuracy within banking day-to-day activities such as account management, funds transfer; bill payment; risk assessment, or automating reports and financial documentation (Shanin 2021). Machine learning (ML) techniques are mainly applied to enhance security by exploiting biometrics for authentication to prevent dangers of stolen identity (Shanin 2021)and prevent/detect fraud (Marr, The 7 Biggest Technology Trends 2020). Besides, ML is used to support credit scoring with savings up to $31 billion by 2030 of their underwriting and collection system costs (Wiggers 2020). Furthermore, ML also helps banks improve lending decisions and risk management, perceived as one of the most promising AI implementation fields (Ryll 2020). Moreover, AI technologies can play a crucial role in **boosting revenues** through increased **at-scale personalization** (Biswas 2020), providing experiences tailored to each customer (Yurcan 2017). Automated chatbots, as discussed in the **chapter 4.3**, are used to tackle some of the attending customer's basic needs, including service inquiry (the first use of AI in the banking world), advising on financial services, and promoting other banking services offered (Shanin 2021). The following pages will focus on the customer engagement perspective instead of operational benefits.

4.2.3 **Implications of AI in the Customer Journey**

The retail industry works and grows if customers continue to buy the market's current products. Thus, it is in companies' interest to ensure customers feel attracted by their products and brands. The search for ways to ensure customer happiness along all touchpoints with the company is challenging, but organizations need to understand how customers feel from end to end of the

journey (Maechler, Neher, and Park 2016). The customer journey includes things that happen before, during, and after a purchase (Maechler, Neher, and Park 2016), and mapping all the touchpoints allows to make the most of the connection opportunities with the public (Cinus 2018).

Customer journeys can differ on time, number of touchpoints, placement, and many other factors. However, their design is key to shaping their perception of a brand (Maechler, Neher, and Park 2016). The experience stimulates customers' behavioral, cognitive, emotional, and sensorial responses (Schmitt 2011, 55-112), and later can be translated into loyalty and engagement with the brand (Amorim 2018).

Mapping the journey requires intense work and continuous effort to understand how customers think and make decisions (Court et al., 2009). The three main phases, pre-purchase, purchase, and post-purchase involve numerous touchpoint opportunities (Amorim 2018), which will be further detailed.

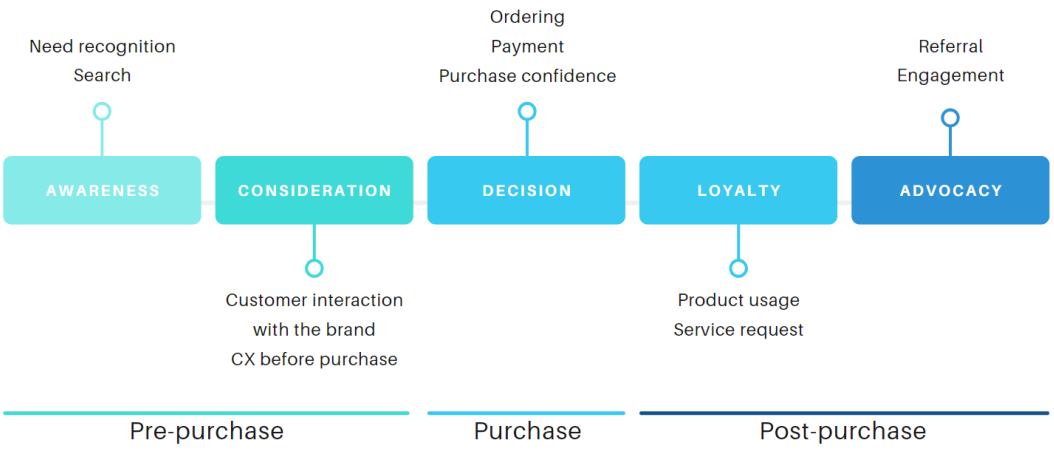

Figure 7. The main phases of a customer journey (Figure by authors).

With the ever-rising use of technology, AI has gained momentum with brands that wish to provide extraordinary customer experiences. This technology helps companies understand

customers through behavioral, social, and historical data analysis. Thus, the content can better target a specific audience, create more sales opportunities, and improve the customer journey (Clark 2020).

4.2.3.1 Customer journey: Implication in the Pre-Purchase

At the beginning of the customer journey, the pre-purchase includes all customer's interactions with a brand before purchasing a service or product. From identifying a need to researching the options available and choosing the product, customers can encounter multiple possibilities to satisfy their desires (Lemon and Vetvik 2016, 69-96). Therefore, it is part of the company's challenges to create awareness and stand out for customers. Each brand owns its strategy to boost its efficiency and effectiveness, attracting more buyers. For that, AI is an increasingly adopted ally (McKendrick 2021).

Awareness

The first step of customer interaction with a brand is the awareness stage, when the customer notices a company's product. It can come from all sorts of online and offline channels, such as word of mouth, social media, and brand advocates (Qualtrics 2021). Creating brand awareness helps potential customers get more comfortable with the company, making them more likely to become buyers later. (Walgrove 2019)

According to Siggelkow and Terwiesch (2019), most companies still wait for customers to seek them, but an essential aspect of a decision process is the amount of energy a buyer has to spend. Using AI allows companies to go after customers from the starting point, when they recognize the need, in a hyper-personalized way. The data collected can be used to facilitate this proactivity

through the identification of trends and profiles for a more accurate target audience, targeted campaigns, and advertisements based on buying behavior (Greenwood 2020).

Consideration

Customers who liked what they saw and heard go on to the consideration stage, where actual engagement and research over the products of interest begin (Qualtrics 2021). Whatever the company makes available (e.g., chatbots, demos, free trials, physical store) is an opportunity to impress customers since it will likely be an asset used when making the final decision. If powered by AI, companies can invest in personalized recommendations and shopping bots to better guide customers through the experience (Greenwood 2020).

By applying mathematical certainty to words, Persado (2020) has reinvented creative marketing, offering AI-powered solutions that cover the entire customer journey. JPMorgan Chase Bank signed a five-year contract in 2019 to improve its customer-reach potential through AI-powered creative marketing. In 2016, while on a pilot project, Chase Bank had click-through rates increasing 450% on campaigns by Persado (Bloomberg 2019).

4.2.3.2 Customer journey: Implication in the Purchase

The customer is ready to purchase at the decision stage: all relevant research regarding the product and the company, making it the best fit. However, there is a 70% chance that the customer will abandon the purchase in e-commerce shopping (Coppola 2020). Thus, companies need to ensure no challenges filling the shopping cart, applying discounts, choosing payment methods, and checking out (Qualtrics 2021). Besides giving what customers want, it is an opportunity to upsell and cross-sell (Dakner 2021).

With the help of AI, companies can provide undivided attention for customers on any challenges faced, reducing the chances of dropping out. Also, with customer data analysis, AI-powered technology can create personalized cross-sell and upsell offers, maximizing revenues

(Greenwood 2020). Although the use of AI on the purchase stage is more straightforward for online purchases, companies can also use omnichannel strategies to provide unique experiences in physical stores. The digital features can be used for data collection to personalize offers, complementing in-person product trials, for example, creating exclusive moments. (Briedis et al. 2021). Lidl, the discount supermarket chain from the German Schwarz Group, launched in 2018 a chatbot called "Margot" to act as a personal sommelier for their customers in the UK. Putting together the online and the physical shopping experiences in an omnichannel strategy, "Margot" was built to interact and engage in a fun way through Facebook, facilitating customers' in-person wine shopping experience (Weber and Schütte 2019).

4.2.3.3 *Customer journey: Implication in the Post-Purchase*

In the post-purchase step, customers assess their overall satisfaction with the product, the experience, and the company. If the relationship is smartly nurtured and managed, valuable outcomes can be generated. Happy customers are more likely to reply to post-purchase surveys, helping to gather more data that can be used to improve the relationship with the customers—for example, looking for feedback from the client after the transaction opens space better to understand the journey's positive and negative aspects and identify improvement opportunities. Later, these positive perceptions can be translated into loyalty and advocacy for the brand, resulting in more profits. (Bosco, 2021)

Loyalty

According to Zubak (2017), it is around five times cheaper to retain a customer than acquire a new one. Companies can invest in follow-up communications driven by AI with the data gathered from previous steps. Follow-up calls and surveys are ways to keep in touch with customers and ensure that any problems are easily solved so they remain satisfied (Penumarthy 2021).

Loyalty programs can encourage customers to return for new purchases and grow more robust relationships with them (InfoEmpire 2021). For a successful loyalty program, AI-powered technology can create customized outputs for each client, from messages to promotions. Algorithms can learn from data to identify patterns for consumption, behavior, and trends, adjusting in real-time (Penumarthy 2021).

Amelia has gained the market with AI-enabled customer service, which is available to deal with customers' inquiries and improve the post-purchase experience. Companies that hire the service can provide instant help to their clients through Conversational AI, which can solve many problems, making call center agents available to address more complex situations (Amelia, n.d.).

Additionally, digital brand ambassadors are an emerging AI technology developed to connect with clients and potential customers. These digital humans combine artificial and emotional intelligence to build authentic trust and loyalty due to their built-in personality and storytelling capabilities, unlike usual chatbots (UNEEQ 2020).

Advocacy

The advocacy stage, considered the hardest to achieve since it requires excellent work throughout all the previous stages, brings a set of advantages for the company that can achieve it (Zubak 2017). Brand advocates are enthusiastic customers that use word of mouth to spread positive marketing about a company, helping to attract new customers (Huhn 2019). AI can be used as a tool to nurture this relationship in the long term, feeding customers with relevant information, referral bonus, and personalized messages, keeping the brand in their minds as a current topic to address (Heasman 2019).

4.3 AI & Sustainability (by Giovana Pontes)

4.3.1 Introduction

In the current global scenario, with climate changes gaining even more importance, the use of technology as a powerful "weapon" to facilitate the adoption of sustainable initiatives is even more significant to be explored. Since 1972, at the United Nations Conference on the Human Environment in Stockholm, the notion of sustainable development is being discussed in global political forums (Sustainable Development Commission, n.d.). Recently, representatives of 197 nations got together at the 26th Conference of the Parties to tackle the climate change issue (Envirotech 2021) and pledged on deforestation, methane emissions, use of coal, and net-zero emissions (Duggal 2021). Also, in 2015 the 2030 Agenda for Sustainable Development was adopted by all United Nations Member States, agreeing on 17 Sustainable Development Goals (SDGs), defined in 169 targets, comprising global issues related to water, energy, climate, oceans, urbanization, transport, science, and technology (UN DESA, n.d.). These conferences and agreements held between countries to fight the global challenges show that the sustainability journey must embrace a collaborative approach. The cooperation needs to happen at every level with continuous knowledge sharing between companies, suppliers, and customers and promoting continuous innovation over sustainable practices to achieve the expected SDGs (Breul et al. 2018). These initiatives show how important sustainability topics are in the current social and economic context, creating opportunities for companies and individuals to develop creative solutions.

According to Vinuesa et al. (2020), out of the 169 targets from the SDGs, AI has the potential to help achieve 134, representing 79%. Also, the McKinsey Global Institute identified 135 worldwide use cases of AI in support of the SDGs (Chui et al. 2018). Hence, these numbers may not represent the actual potential applicability of the technology in each area because it might demonstrate the evolution and discovery of the possible applications. The following figure

represents each SDG target by a block. The original author found published evidence of potential AI applications to enable the respective target for those highlighted in green.

Figure 19. Impact of AI on the SDGs. (Figure by author, Adapted from Vinuesa et al. 2020)

Hence, to go further in the potential applications of AI, a few examples can be mentioned. As it is known, access to electricity is an essential condition to retail operations (UN DESA 2020), and companies have been addressing the topic over SDG 7 (Affordable and clean energy). AI is being used to increase the efficiency of renewable energies by predicting the required energy production based on the daily availability of the power plants (Acciona, n.d.). Regarding the industry, innovation and infrastructure (SDG 9), and responsible consumption and production (SDG 12), AI enables more efficiency in terms of storage, manufacturing, and distribution systems by doing more and better with fewer resources (De 2021). Additionally, this technology can power systems to identify faults that are not caught by humans, preventing quality and safety problems (Acciona, n.d.). Falkrony, for instance, is a company disrupting operational efficiency through the use of AI. They help businesses unlock their full potential in terms of uptime, quality, yield, and safety with a digital transformation (Falkrony, n.d.).

4.3.1.1 *The Circular Economy*

The Circular Economy (CE), a concept mainly developed by the Ellen MacArthur Foundation, has been gaining momentum in a global context, as a promise to address root causes and achieve multiple SDGs, as 6, 8, 11, 12, 13, 14, and 15 (United Nations 2018). The linear economic model, which is currently the most present in the world, comes from the early industrialization stage in 1800, bringing both unparalleled growth and unsustainable extraction and consumption levels, as referred in an article by the Ellen MacArthur Foundation and the McKinsey Center for Business and Environment (2015). With an increased awareness of the damages of this model to the environment, the concept of circular economy (CE) has been gaining momentum among companies, governments, and researchers.

According to the Ellen MacArthur Foundation (2019), promoting a systemic shift towards CE not only reduces the environmental damages of a linear model but creates the base for long-term growth, respecting the environment and its limitations of resources. This circular economic system is mainly affected by three key elements: elimination of waste and pollution, circulation of products and materials at their highest level, and regeneration of nature. The diagram in Appendix 16 illustrates the continuous flow of technical and biological materials that create the true circularity when combined. By conceptualizing the transition of the current economic model to one where products and materials' usage is maximized, waste and pollution are eradicated, and natural systems are regenerated (Ellen MacArthur Foundation, n.d.), CE caught the attention of specialists in the Expert Group Meeting during the 2018 High-Level Political Forum under the theme of "Transformation towards sustainable and resilient societies", addressing sustainable consumption and production, climate change, ocean action, and food waste (United Nations 2018). However, while many governments (e.g., European Parliament (2008)) and businesses (e.g., Apple (2021)) have been stating their support for the CE, there are cultural, regulatory, market and technological challenges (Kirchherr et al. 2018) that need to be addressed to ease the

transition in a global scale. As a practical guide, academics and practitioners have been using different varieties of the R frameworks, which shows a hierarchy of actions (Kirchherr et al. 2017). The 9R framework (Potting, Hekkert, and Hanemaaijer 2017), possibly the most detailed one, is depicted in Figure 20.

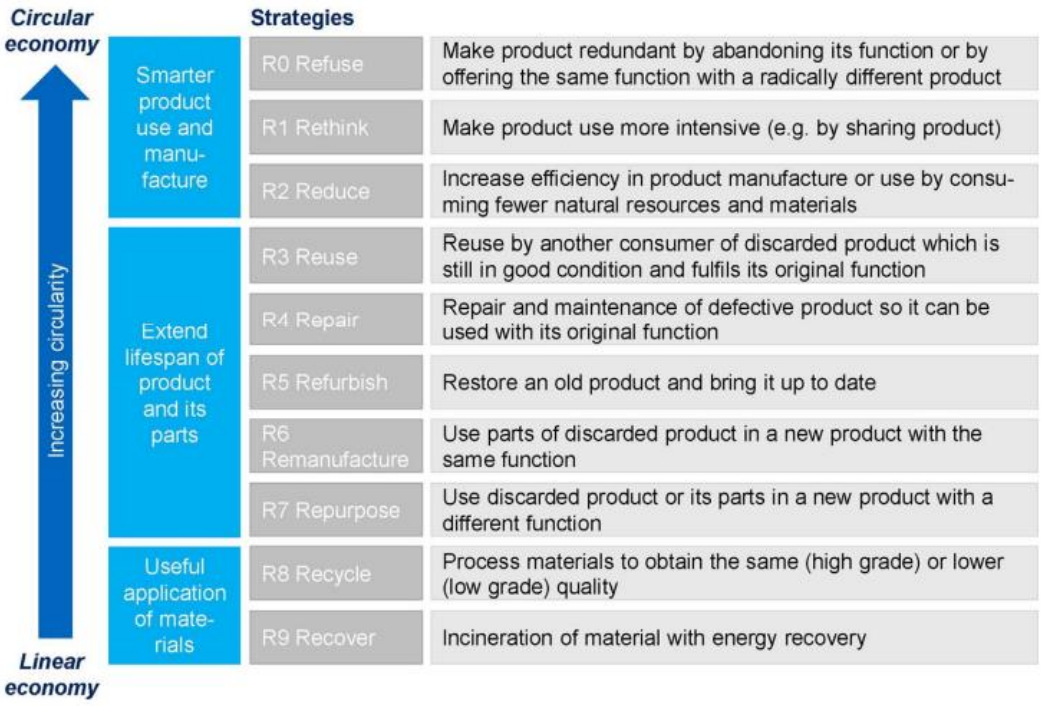

Figure 20. "The 9R Framework". From Kirchherr et al. 2017, Conceptualizing the Circular Economy: An Analysis of 114 Definitions, 224, 1.

The strategies highlighted above need to be addressed by both companies and individuals, and technology adoption facilitates the process. For instance, Stuffster, a social enterprise focused on boosting the reuse (R3) of apparel by enabling retailers and their customers to recirculate pre-owned items (Stuffster, n.d.), uses AI algorithms to operate their circular business model, allowing dynamic price setting and refined sales strategy (The Ellen Foundation 2019).

4.3.1.2 *The Generation Green*

Gen Z, born between January 1995 and December 2003 (Deloitte 2021), is being labeled as the "Generation Green" (Petro 2021). They grew up in a digital context, which influences their world

views, values, and behaviors (Deloitte 2021), and they had to deal with the worst global crisis since World War II, the COVID-19 pandemic (Guterres 2020). Although the pandemic created numerous problems for society, the reduction in social and economic activities reflected short-term benefits to the environment, resulting in less pressure from energy and agricultural-related emissions (Dellink 2021). Additionally, most Gen Zs were optimistic about reversing climate change and enforced more since the environment is one of their top-ranked concerns (Deloitte 2021).

Generation Green is an activist (Israel et al. 2020) and cares about buying from companies that take care of the environment (Deloitte 2021). According to an article by Calvin Furbee (2020), their buying habits are already negatively impacting the profits of retail companies that chose an unsustainable line of work, as global fast-fashion brands like Forever 21, H&M, and Zara. Also, the study from Israel et al. (2020) showed that the economic power of this generation is expected to grow on a fast rate and reach $33tn by 2030, representing 27% of the global income. Adding future inheritances, the $78tn owned by Baby Boomers and the Silent Generation will increase even more Gen Z's economic relevance.

As stated, multiple concepts and stakeholders play an essential part in achieving the SDGs, but in this paper, they will be narrowed down to the use of AI in the customer journey of retailers from a sustainability perspective. The discussion will be centered in the opportunities that were identified in the interviews and survey targeting Gen Z customers. Hence, to achieve that, three main questions will be answered:

1. What are the advantages of designing a customer journey that addresses sustainable matters?
2. What are the challenges that need to be overcome to make Gen Z customers engage in circular economy initiatives?

3. How can AI-powered technology be used to facilitate the achievement of the SDGs while increasing companies' profits?

4.3.2 Methodology

A survey is one of the most used tools for measuring attitudes and orientations of large populations, and in this research, the web-based electronic questionnaire was chosen as the method of the survey because it is convenient and economical. The survey was divided into four sections, as demonstrated in table 3. Appendix 17 shows the questions from each section.

Table 3. Sustainability survey structure (Table by Author).

Section	Objective
Section A	Identify respondent's profile.
Section B	Identify respondent's current sustainability practices inspired by the 3Rs (Reduce, Reuse, Recycle) framework.
Section C	Identify respondent's perception over retailers' sustainability practices.
Section D	Identify respondent's willingness to use AI-powered technology to facilitate theirs and companies' sustainable practices

Furthermore, stratified sampling was used to achieve statistical validation to balance the distribution of gender, birth year, country of residence, and level of education of sample's population. Out of 103 respondents, 63% were women and 29% men (Appendix 18); the overall age distribution can be seen in Appendix 19. Respondents from 4 continents participated in the research, namely Europe, Asia, America, and Africa. However, it was not possible to connect with participants from Oceania. The number of participants per country can be seen in Appendix 20. The final information gathered on respondents' profiles showed that 46% have a Master's and 40% have a Bachelor's degree (Appendix 21).

In-depth interviews were considered suitable for following up on quantitative data insights from the surveys (Bell, Bryman, and Harley 2019). Five in-depth- interviews with individuals from the Generation Green (1995-2003) (Petro 2021) were conducted, selected according to theoretical sampling (Eisenhardt, 1989) within the circle of friends and family. The five interviewees were between 19 and 25 years old, and 60% have a Master's level of education. Moreover, the contestants consisted of two male and three female respondents interviewed individually. Appendix 22 shows the Interviewees' detailed profiles.

The interviewer explained the topic and ensured privacy security by fully anonymizing respondents' identities at the beginning of the interview, creating a safe space for interviewees to share their thoughts (Ritchie and Lewis 2003). The interviews took 20-30 minutes, divided into the same sections as the online survey (Appendix 23) and following the semi-structured method, to allow comparison of the answers of the contestants (Ryan, Coughlan, and Cronin 2009), with flexibility for additional questions. Questions were posed as open-ended so interviewees could freely explain their opinions. With the consent of every participant, the interviews were recorded and transcribed verbatim.

4.3.3 Findings

The first questions asked to the respondents enhanced their practices in support of sustainability. 55% do not know the correct disposal method for most items they buy, and 58% never ask the seller to share information on the topic either (Figure 21). Hence, 37% throw items in the trash, which they think is the most adequate, and only 11% have the habit of selling their used items (Figure 22). However, 82% showed interest in getting more information on the end destination of their used products.

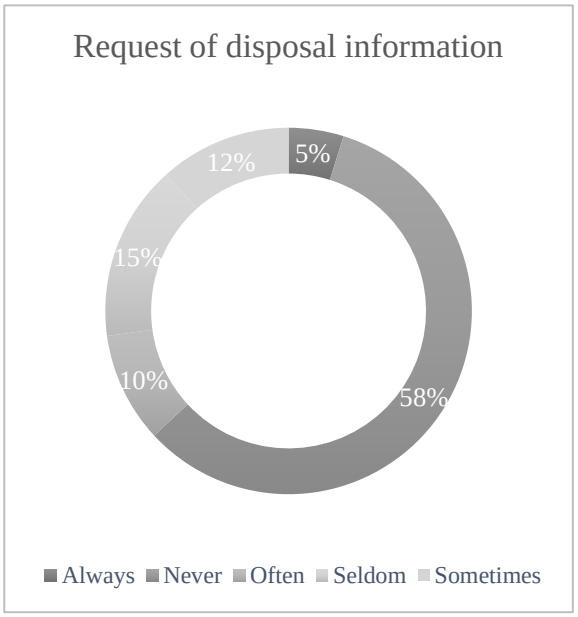

Figure 21. Request of disposal information (Graph by author)

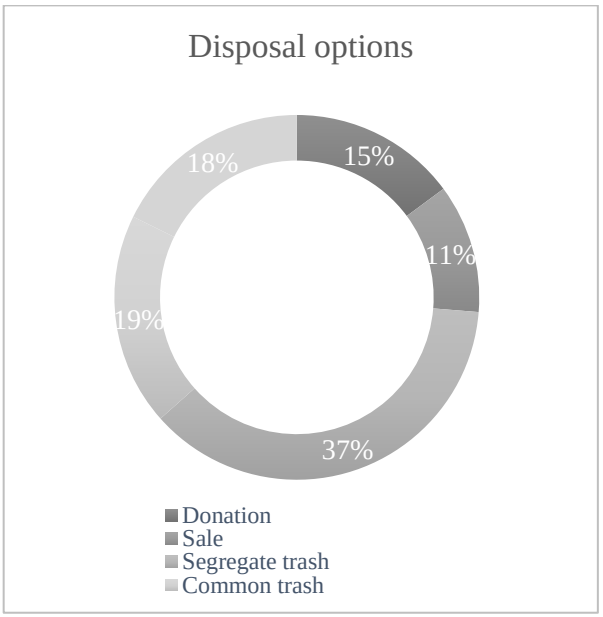

Figure 22. Disposal options (Graph by author)

Using the Net Promoter Score[SM] from Bain & Company (Markey and Reichheld 2011), the overall score of the reverse logistics service is at -25 on a scale of -100 to 100. 81% of the respondents never used a reverse logistics service, but those reported having a bad experience with it. Apple Inc's reverse logistics service was mentioned eight times, with mostly positive ratings, achieving a total NPS of 25. Additionally, during the interviews Respondents, 2 and 5 shared using Apple's reverse logistics service and commended it for being straightforward, fast, and providing an above average financial return. This service improved their customer experience and resulted in the purchase of new items while returning the used ones.

Later, survey participants shared their second-hand items' purchase habits. 23% said never to buy used items, and only 8% buy them weekly. The ones that never buy find it challenging to get used items that fill their needs.

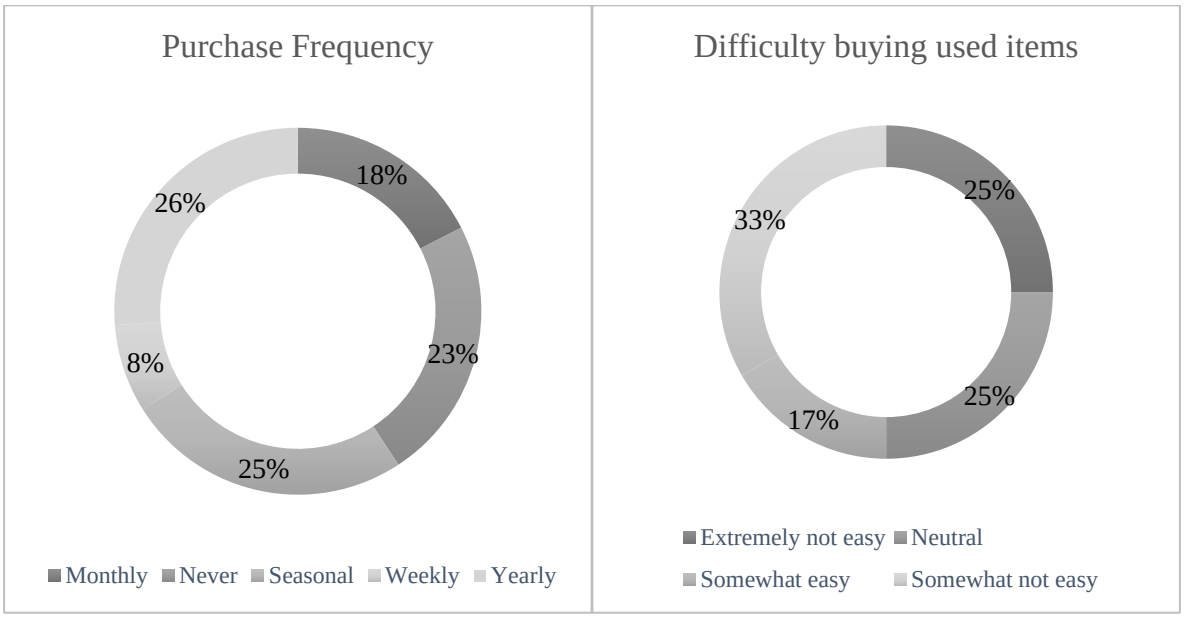

Figure 23. Purchase frequency of second-hand items (Graph by author).

Figure 24. Difficulty buying second-hand items (Graph by author).

To further understand the decision process of buying second-hand items, the author asked respondents to rate five drivers most capable of influencing their decision-making. Product quality and price were the most critical factors, and return policy the least. Five participants also added payment methods as a relevant aspect. 60% said to usually use digital methods (online stores and social media) to search for these items.

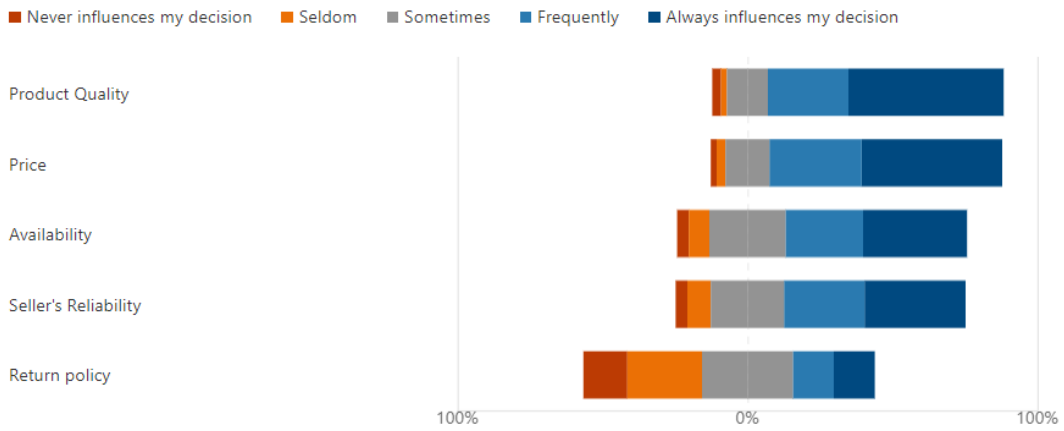

Figure 25. Topic influence over decision to purchase second-hand items (Graph by author).

Moreover, during the interviews, interviewees shared aspects that would make them more willing to buy second-hand items. All participants demonstrated deep concerns over not knowing the actual quality conditions of the products sold and agreed that they would increase their buying habits among used items if this issue was solved. Also, it was a recurring comment among all interviewees that they would likely be loyal to a company that made them feel safe about the quality of the used items sold. On top of that, the author asked survey respondents to rate their willingness to buy used items from different retail segments (Figure 26). Books, music & video, Apparel & Accessories, and Furniture & Home Furnishings were the highest-rated, while Food & Beverage and Health, personal care & beauty were the least.

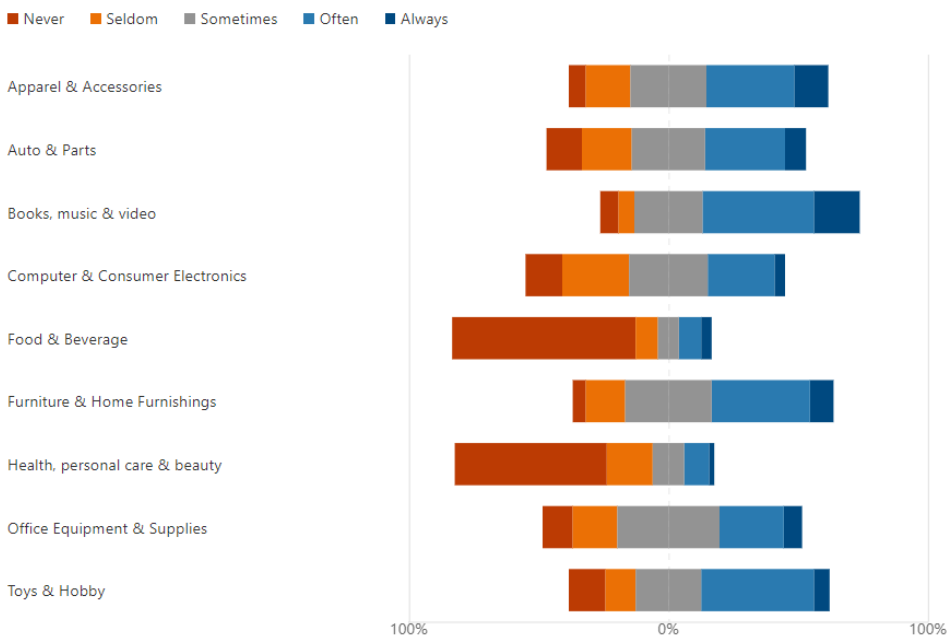

Figure 26. Willingness to purchase used items from different retail categories (Graph by author)

The author addressed respondents' perceptions of retail companies' sustainability practices in Section C of the questionnaire. 53% declared not to believe when companies state that they are sustainable, and 80% stated they did not know companies with a sustainable business model. Additionally, during the interviews, this result was complemented by interviewees claiming they

usually think companies only talk about their sustainable practices for marketing strategy, releasing biased information, and not taking tangible actions to reduce their impact in the world. 53% of questionnaire respondents also said to have never or hardly ever seen companies sharing information on the correct disposal method for items they sell; 63% believe companies should be obliged to do so. Moreover, 58% said they would pay more for sustainable products, and 92% wished companies would use recovered items as raw materials for their products.

The last section of the survey gathered perceptions on the potential of AI-powered technology to help customers and companies become more aware of sustainability. By, ultimately, aiming to embrace a sustainable mindset towards consumers' daily lives and companies to grasp strategically sustainable practices. 81% would trust an automated system to find a second-hand item that suits their needs, 86% would trust it to decide on the best disposing option, and 70% would be willing to share personal data to help companies train their algorithms, but 54% would require product discounts in return. For the participants, the most critical retail sections to be covered by the technology would be Computers & Consumer Electronics, Apparel & Accessories, and Furniture & Home Furnishing, mostly exploring alternatives on sale, donation, and waste segregation.

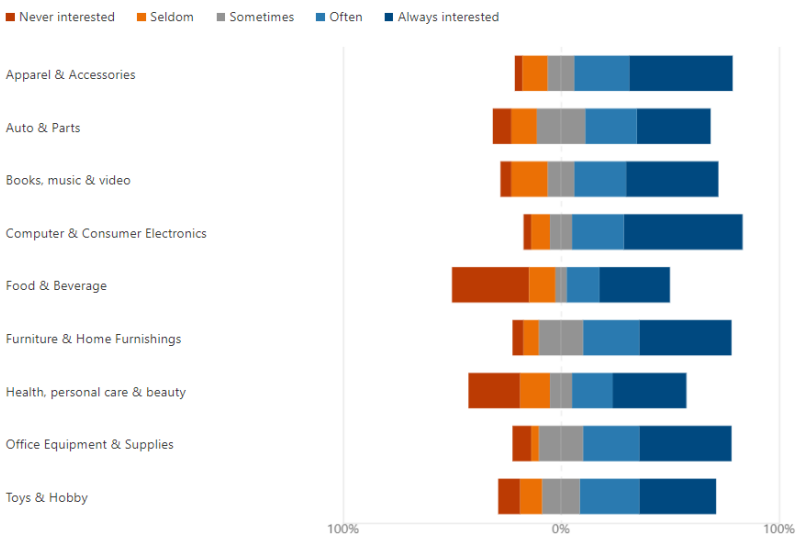

Figure 27. Desire of using technology to dispose used items from different retail categories (Graph by author).

For the survey participants, using this technology would be highly interesting to help them make the most sustainable choice, and 52% would be willing to pay to use it. Interviewees added that it would be essential to ensure reliable services and potentially an AI-powered scan of the product to assess the actual conditions. Additionally, 3 out of 5 participants shared that having an automated system that reduces the workload of selling used items (e.g., answering potential customers, arranging visits to show the item, organizing deliveries) would be highly interesting.

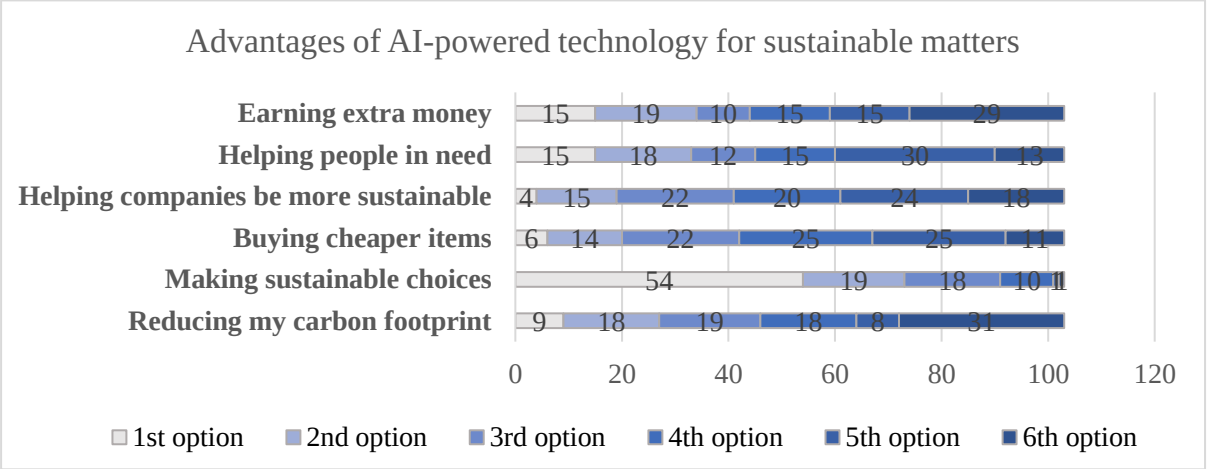

Figure 28. Advantages of using AI-powered technology for sustainable matters (Graph by author).

4.3.4 Conclusion

What are the advantages of designing a customer journey that addresses sustainable matters?

Gen Z customers are highly interested in seeing companies do more about sustainability and are willing to pay more for companies that effectively address it. Additionally, respondents shared that they would be willing to provide data to help companies train AI algorithms to facilitate the transition to a circular economy. Hence, going back to the different stages of the customer journey, data is a crucial aspect of creating a personalized experience for each client and improving the chances of finalizing the purchase transaction. If another touchpoint is added to

the customer journey for returning used items, companies open up to one more chance to delight customers, collect data and feedback, and stimulate repurchases. As interviewees shared, Apple does it well. In the end, customers have multiple options to choose from, and standing out is not an easy task for companies. Thus, getting a first-mover advantage on a topic gaining importance can be a smart strategy for a prosperous business.

What are the challenges that need to be overcome to make Gen Z customers engage in sustainability initiatives?

Gen Z is growing up in a digital context and have an application to help with most tasks they have or want to do. Sustainability is a topic that has never been so strong and openly discussed by the world's population, but it takes effort to change the way things have been conducted. For instance, companies using AI algorithms to assess these items' conditions could fully solve the concerns shared over the quality of second-hand items. The results show that these customers do not know the best disposal options, but they would be happy to contribute to an application that automatizes and facilitates the process and even be willing to pay for it. Organizations can take these items back and be responsible for their reintroduction in the market; After all, who knows the product's conditions better than their manufacturer?

How can AI-powered technology be used to facilitate the achievement of the SDGs while increasing companies' profits?

The world only has a finite quantity of natural resources to offer, so to allow the continuity of businesses and even humanity, everyone must participate in facilitating the recovery of products and materials. As discussed, there is evidence of AI being used to achieve multiple targets of the SDGs, but obviously, it can only be fully adopted if the overall benefits are positive. On top of that, it is essential to unveil the SDGs in small actions that individuals and companies can easily relate to daily, as the Rs framework. However, even these tiny actions can seem like too much

effort since it implies changing the *status quo*. Hence, this can be seen as an advantage, as the perfect context to use AI-powered technology to boost the process. The results confirmed that since Gen Z customers reported, they would trust AI algorithms to make choices for them on this matter. In the end, it only works if it is all a joint effort. For instance, retail companies need customers to buy their items to make the business prosperous, so it is necessary that clients are interested and engaged with sustainable matters to justify the costs and efforts of transitioning to a circular business model.

4.3.5 Limitations & Further research

One of this paper's main limitations was to connect to the size and composition of the sample used. The sample is small in number, and, as such, it may not be easy to generalize the conclusions drawn to the whole Gen Z customers. Therefore, future research needs to be done in this path to better characterize and profile Gen Z with its specificities and behaviors regarding sustainability practices and perceptions. Additionally, future works can thoroughly analyze the impact on each SDG target, demonstrating a context that is easily actionable for customers and companies. With this work, the author aimed to create a background on which to build more profound and conclusive research on Gen Z and retailers using AI as a tool to achieve SDG goals and improve companies' results.

5 Conclusion

The inherent interdisciplinarity of AI, extended throughout the extensive scope of its applications, could only bring excitement and willingness to acknowledge its relevance in this disruptive world. Besides, the possibility of approaching the subject on a joint research directive allowed each group member to benefit from opinion-sharing and dynamic interaction to address individual contributions and learned insights better.

This joint research exploited the impact of AI, namely in; retail industry, virtual assistants – such as the chatbots –, banking customer journey, supply chain benefits, and opportunities, food supply chain – narrowing the research to restaurant supply chains –, and the concept of the customer journey. It is safe to assume that AI will play a vital role in a progressively growing number of business models and industries. From here, companies will shift their mode of operation from "survive" to "thrive". The critical research question was partially addressed by the extensive successful use-cases and impacts on global productivity, easiness of customer journeys, costly customer acquisitions, and accessibility in transparent business models. The future customer journey will match customers' savvy expectations through "hipper" personalized, characterized by an omnichannel experience, where new products and services arise due to a fast pace of innovation capacity, real-time response to their needs, and decreasing number of frictions within downstream and upstream IT structures.

This paper pursued a sustainable perspective throughout the whole search process. Technology and sustainability have never been as relevant in a global context as nowadays. However, it is not always that these topics are addressed together, especially in businesses and individual actions. This research showed the potential comprised in aligning these topics with the right stakeholders

to impact the world with mostly positive outcomes for all parties involved. Companies have the resources and the reach to make significant changes; Gen Z customers are highly interested in sustainable matters; and AI-powered technology can facilitate the transition to a circular economy. With the right combination, companies can transform their customer journey to promote actual sustainable impact with lower effort and higher customer engagement.

The authors may have from now on is how to manage these technologies. It is needed to analyze the potential adverse effects of the application of Artificial Intelligence on the use of resources, to better understand and manage the risks associated with AI from a sustainability perspective (e.g., cloud resources consumption). Can their environmental footprint balance the positive impact of technologies?

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Appendices

Appendix 1. Structure of Interviews about Chatbot.

Interview's Structure: Role of Chatbots in the customer experience

1. Presentation of the project & the participants
   - Questions about recording / privacy request
   - Background of the participants / experience with Chatbots
   - Actual projects
   - Context of the interview

2. Experience in designing chatbots
   Can you give a simple definition of Chatbots?
   What is the complexity?
   How do you train them?
   Are you satisfied with the ones you build previous?
   What were the goals?
   Did they achieve it?

3. Biases of Chatbots
   What tools are you using to design the chatbots? Are they subjects to biases?
   How are you tackling biases or UX?
   What are the KPI's for Chatbots evaluation?

4. Best practices / recommandations
   What are the best practices in your point of view for the chatbots designing phase? What are the skills needed?
   How it can help companies to boost their sales? And to personalize the customer experience?

Appendix 2. Age relation on the factor ‘never experienced chatbots’.

Have you ever chatted with a chatbot?	No/I don’t what is it.
Group Age	
+65	1
25-45	1
Grand Total	**2**

Appendix 3. Questionnaire / Customer Study.

Chatbots Experience

*Mandatory

1. Which age group are you belonging to? *

- ◯ 18-25
- ◯ 25-45
- ◯ 45-65
- ◯ +65

2. Have you ever chatted with a chatbot? *

- ◯ Yes
- ◯ No
- ◯ I don't know what it is

3. Why did you choose to use chatbot?

I don't know what it isWhy did you choose to use chatbot?

- ☐ Efficiency
- ☐ Quick answer
- ☐ Availability

Others: ☐ _____

4. Is your experience with Chatbots always good?

	1	2	3	
Not at all	◯	◯	◯	Yes

5. Did you already face troubles with chatbots?

Yes

No

6. If yes, can please tell me a bit more about this experience? Why you have been unsatisfied? _____

7. Do you think chatbots become a 'must-have' for a company?

Yes No

8. If you have something specific to share, feel free!

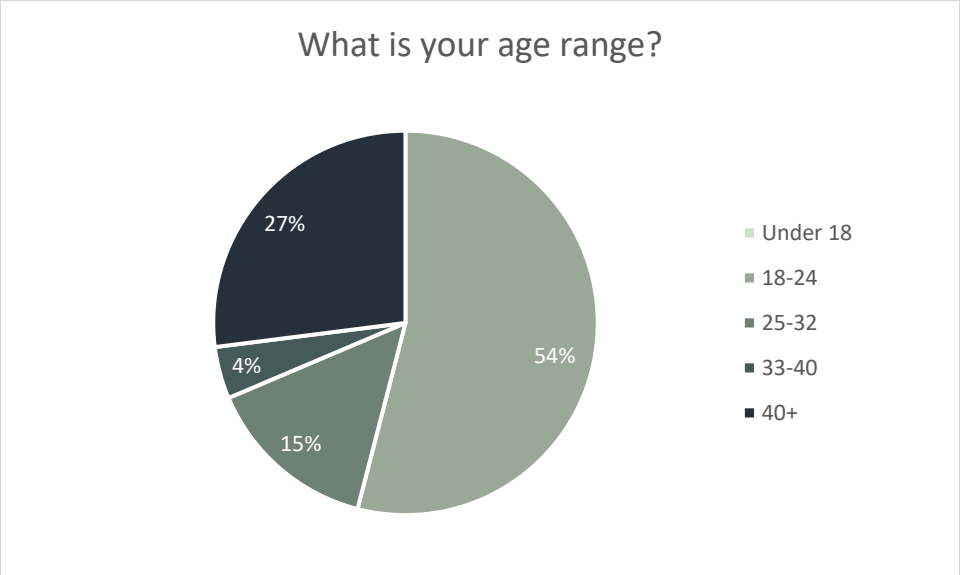
_____

_____

Appendix 4. Consumer's Survey.

Section 1 (S1): "About you"

1.1



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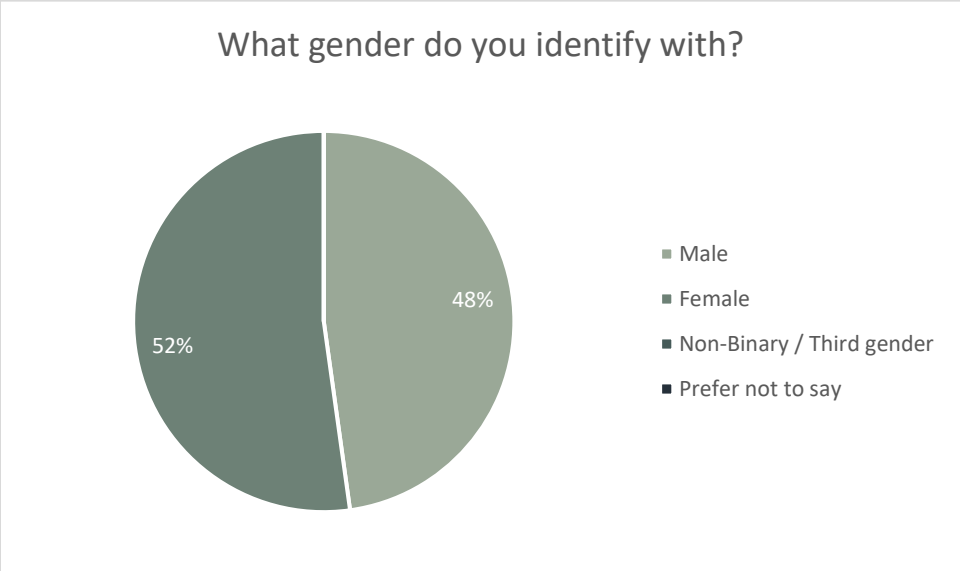

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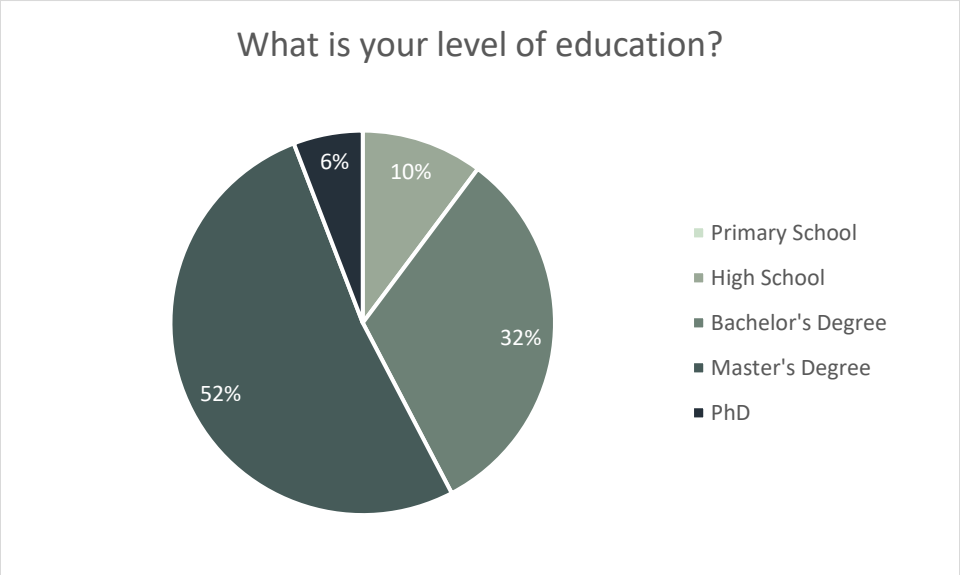
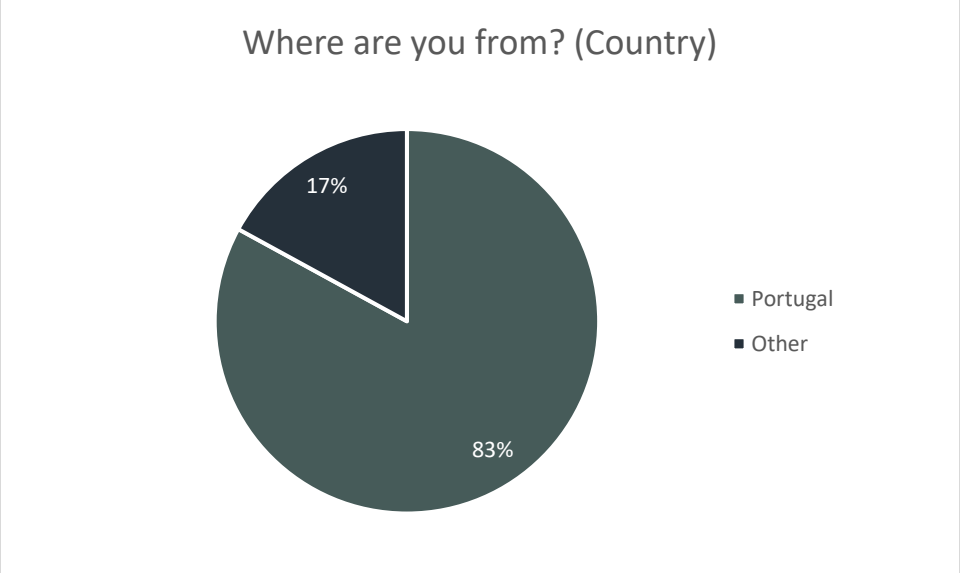
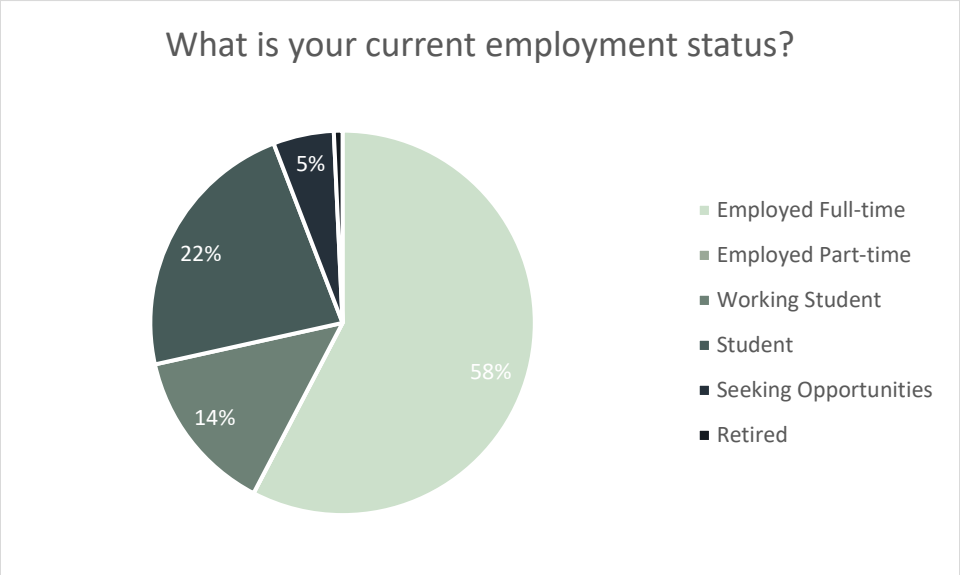

What is your level of education?
6%
10%
32%
52%
Primary School
High School
Bachelor's Degree
Master's Degree
PhD

1.4

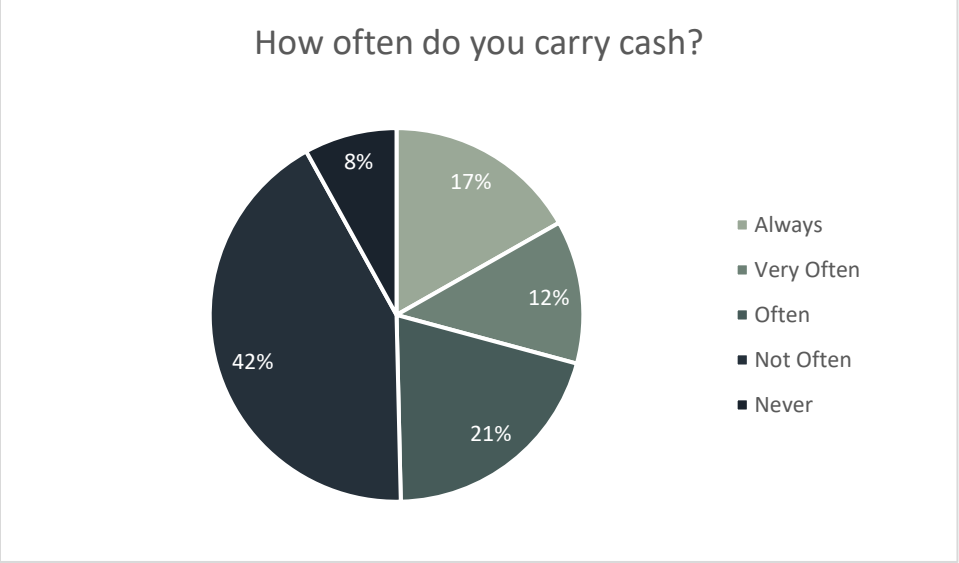

Where are you from? (Country)
17%
83%
Portugal
Other

1.5

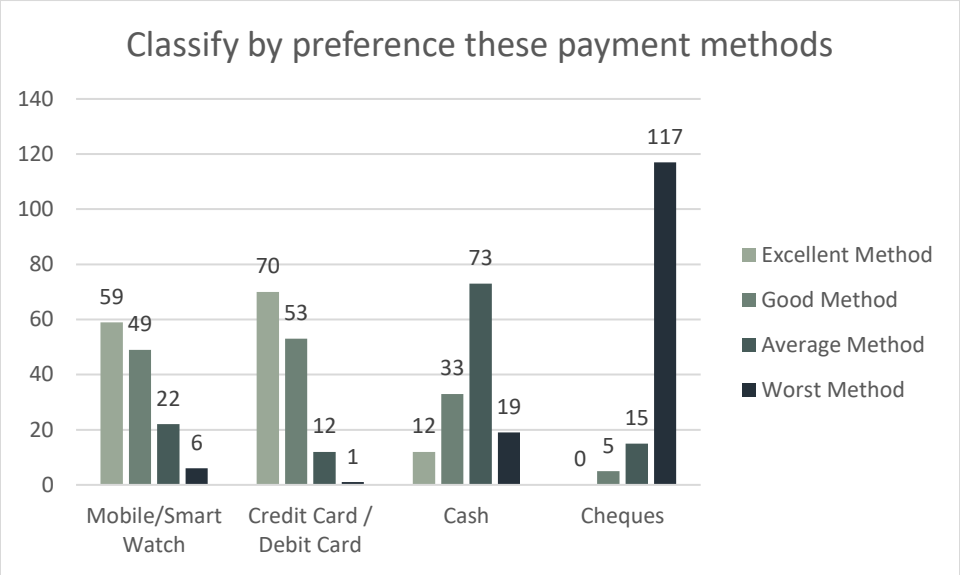


Section 2 (S2): "Your Banking Experience"

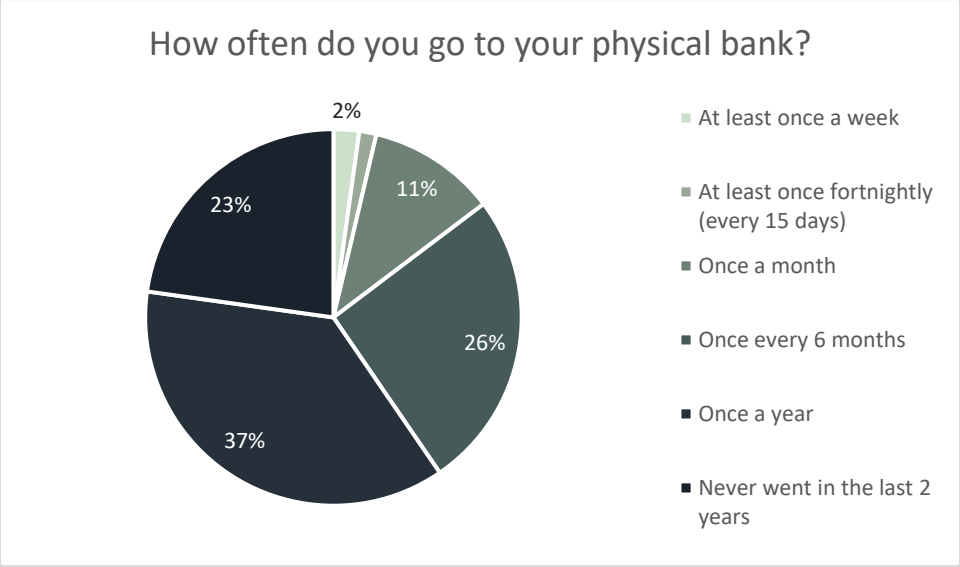
2.1



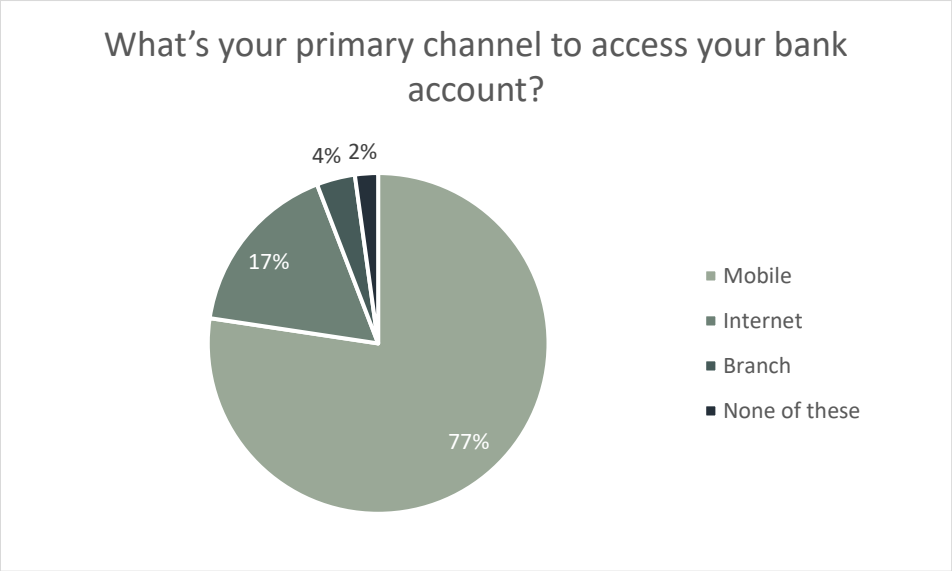
2.2


Classify by preference these payment methods
140
120
100
80
60
40
20
0
59
49
22
6
70
53
12
1
12
33
73
19
0
5
15
117
Mobile/Smart Watch
Credit Card / Debit Card
Cash
Cheques
Excellent Method
Good Method
Average Method
Worst Method

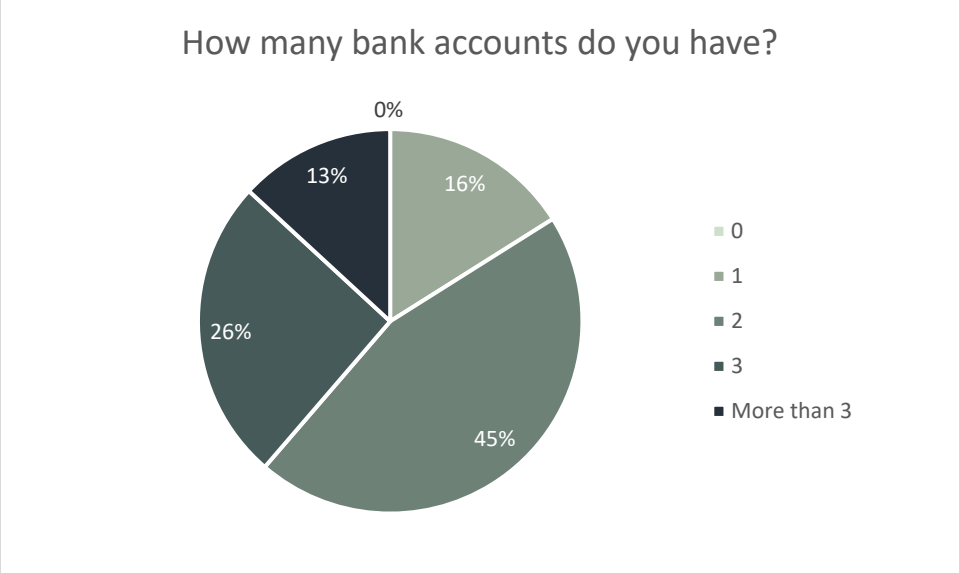
2.3


How often do you go to your physical bank?
2%
11%
26%
37%
23%
At least once a week
At least once fortnightly (every 15 days)
Once a month
Once every 6 months
Once a year
Never went in the last 2 years

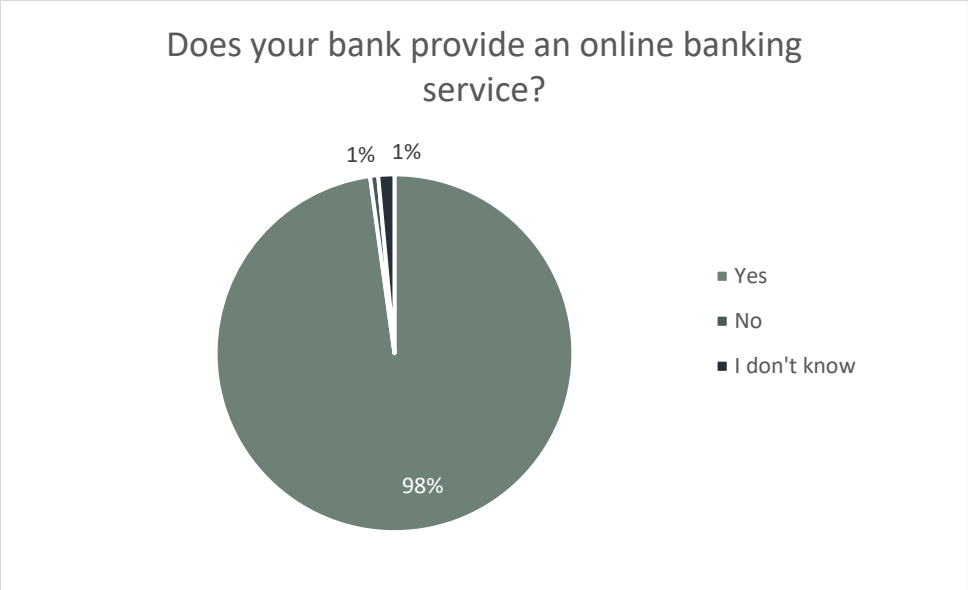
2.4


What's your primary channel to access your bank account?
4%
2%
17%
77%
Mobile
Internet
Branch
None of these

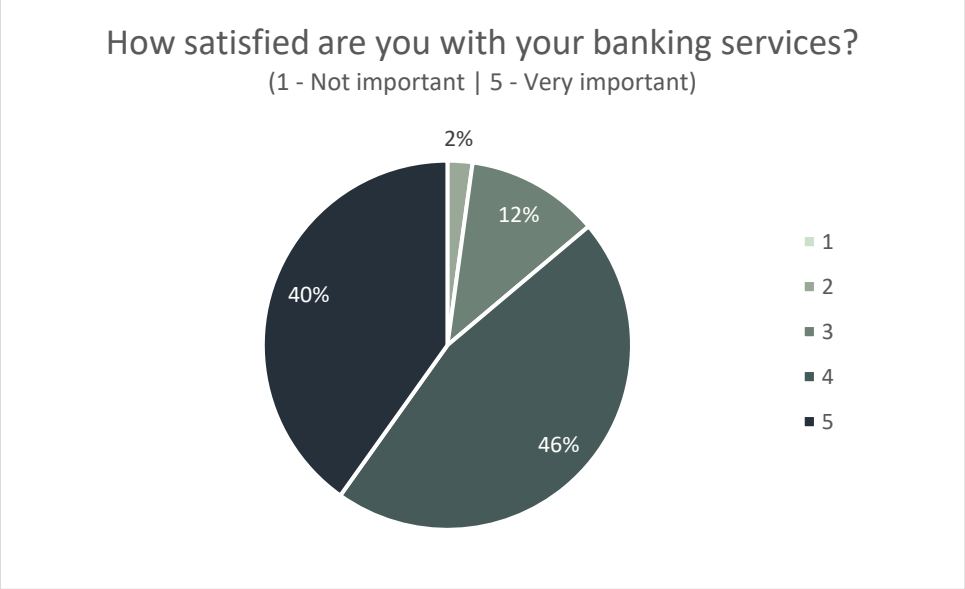
2.5


How many bank accounts do you have?
0%
13%
16%
26%
45%
0
1
2
3
More than 3

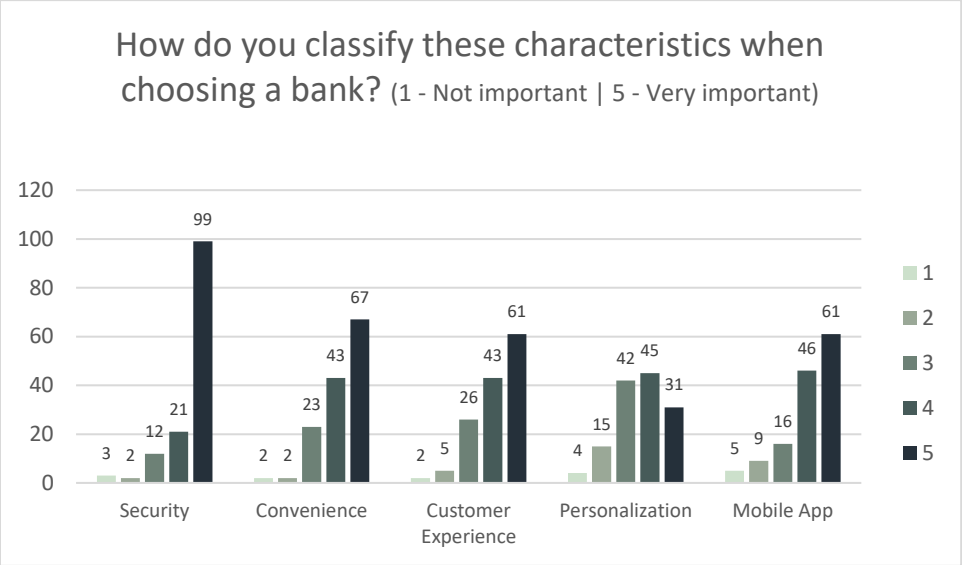
2.6


Does your bank provide an online banking service?
1%
1%
98%
Yes
No
I don't know

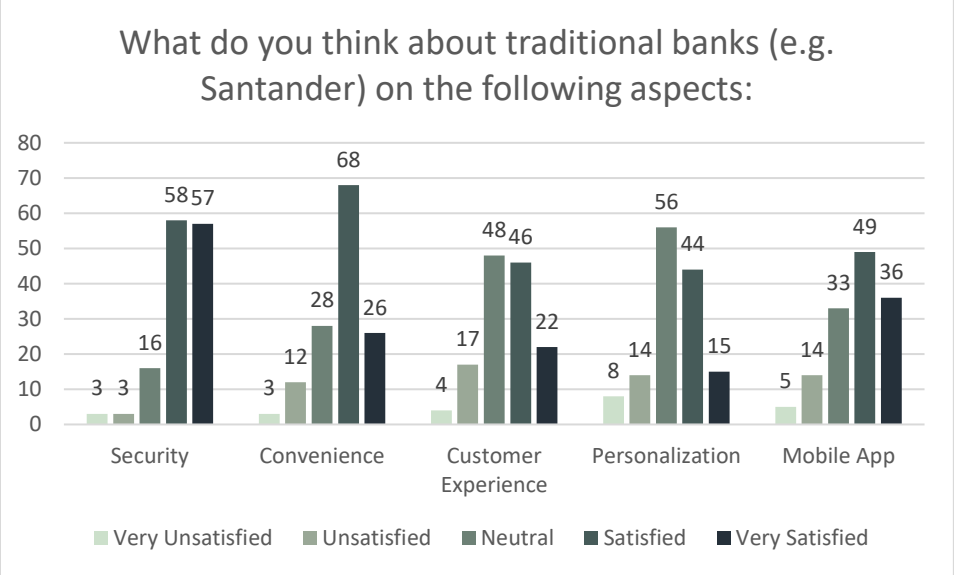
2.7


How satisfied are you with your banking services?
(1 - Not important | 5 - Very important)
2%
12%
40%
46%
1
2
3
4
5

2.8

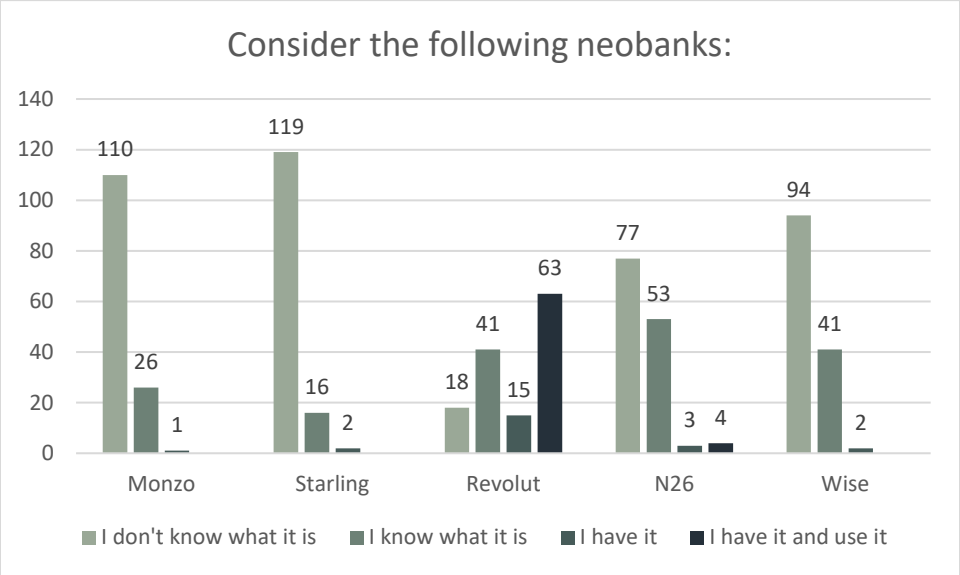

How do you classify these characteristics when choosing a bank? (1 - Not important | 5 - Very important)
120
100
80
60
40
20
0
99
67
61
61
43
43
46
45
42
31
26
23
21
16
15
12
9
5
3
2
2
2
5
4
Security
Convenience
Customer Experience
Personalization
Mobile App
1
2
3
4
5

2.9

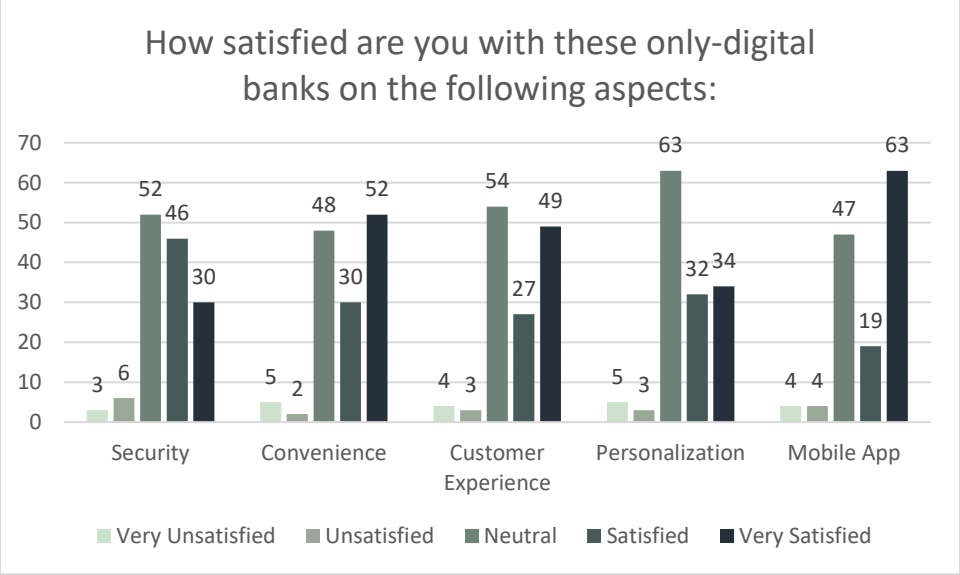

What do you think about traditional banks (e.g. Santander) on the following aspects:
80
70
60
50
40
30
20
10
0
68
58
57
56
49
48
46
44
36
33
28
26
22
17
16
14
12
3
3
4
8
5
Security
Convenience
Customer Experience
Personalization
Mobile App
Very Unsatisfied
Unsatisfied
Neutral
Satisfied
Very Satisfied

Section 3 (S3): "A New Banking Landscape Arising"

3.1



3.2



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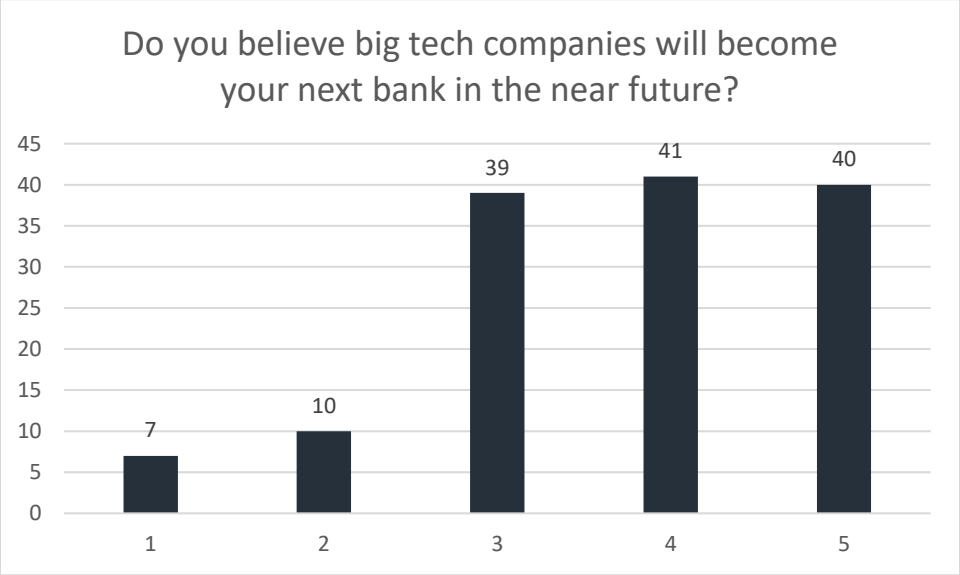
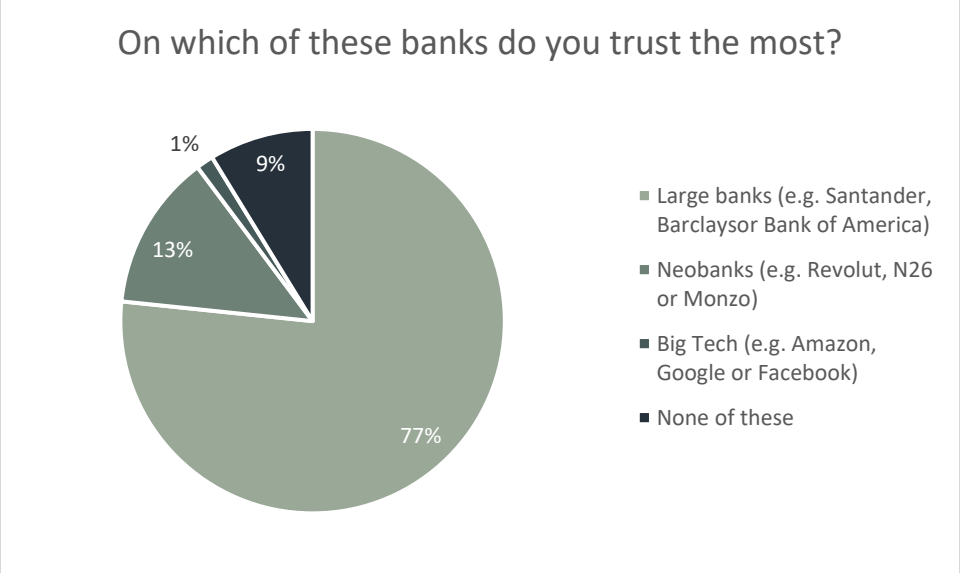
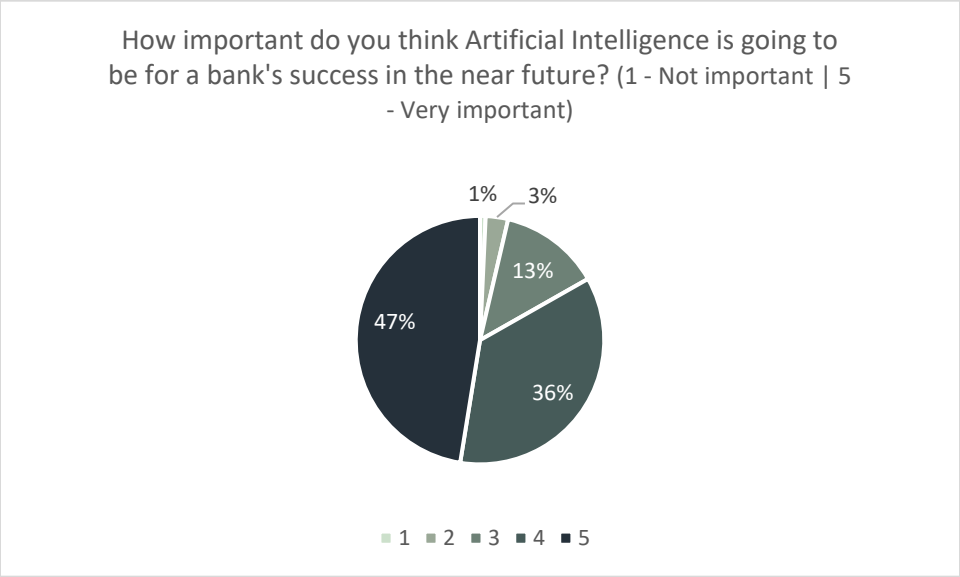

Do you believe big tech companies will become your next bank in the near future?
45
40
35
30
25
20
15
10
5
0
7
10
39
41
40
1
2
3
4
5

3.4


On which of these banks do you trust the most?
1%
9%
13%
77%
Large banks (e.g. Santander, Barclaysor Bank of America)
Neobanks (e.g. Revolut, N26 or Monzo)
Big Tech (e.g. Amazon, Google or Facebook)
None of these

Section 4 (S4): "A New Customer Experience Arising"

4.1



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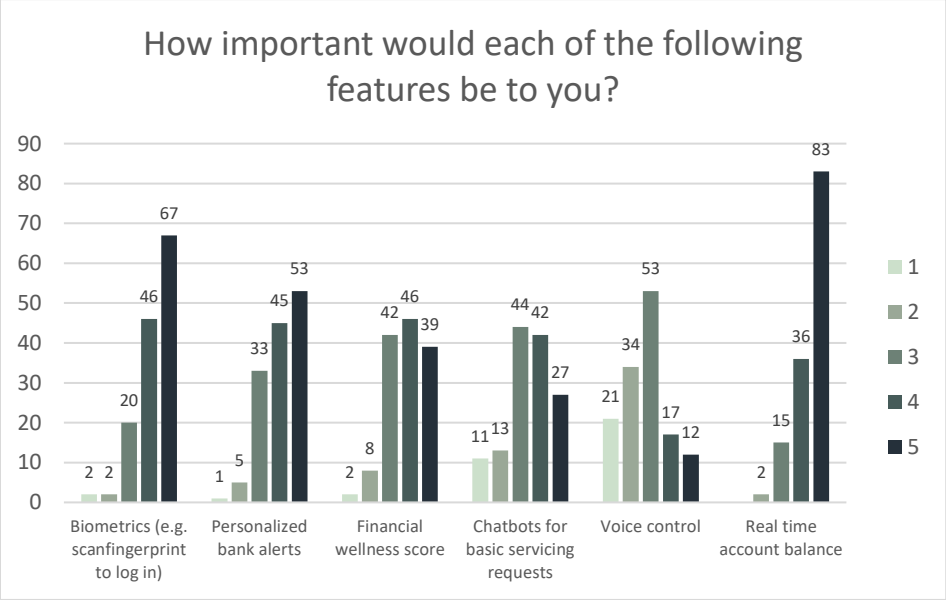
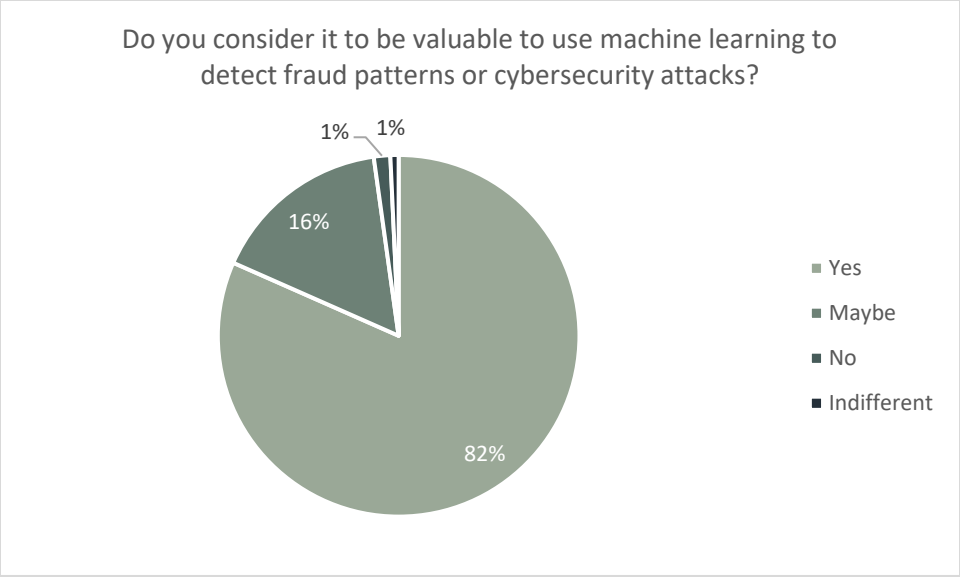
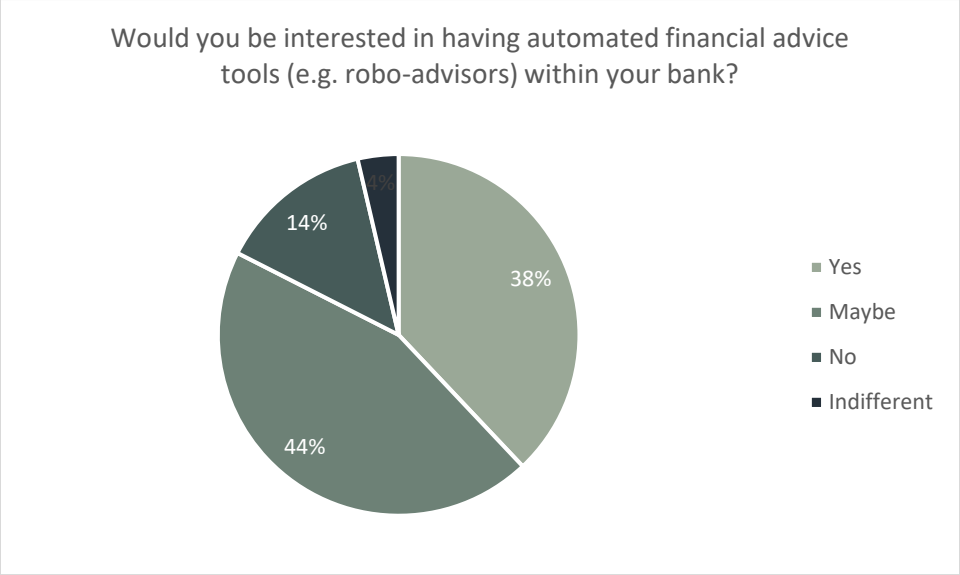


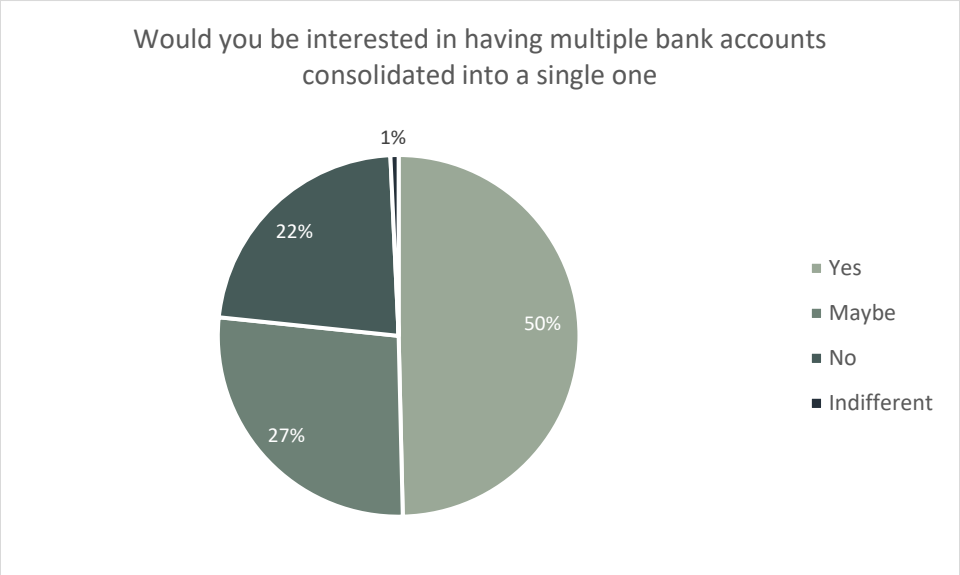
4.3


Do you consider it to be valuable to use machine learning to detect fraud patterns or cybersecurity attacks?
1%
1%
16%
82%
Yes
Maybe
No
Indifferent

4.4


Would you be interested in having automated financial advice tools (e.g. robo-advisors) within your bank?
4%
14%
38%
44%
Yes
Maybe
No
Indifferent

4.5



Appendix 5. Profile description of the industry experts (Interviews)

	Gonzalo Pradas	**Daniel Villatoro**	**Pedro Cantinho**	**Sandra Bamansa**
	Openbank	Openbank	Anixter International	CISCO
Who	Wealth Management Executive	Chief Data Scientist	Sales VP EMEA – Supply Chain Solutions	Partner Account Manager
Why	Built a pioneering digital wealth	Expert on Distributed Artificial	C-level position at Anixter International. A	C-level position at CISCO. A world-leading IT company

	business in digital bank born out of an incumbent (Santander), serving its clients through 4 different channels (web, mobile, contact center, and branch), and brings the best of traditional wealth management services by applying innovative, transparent and client-oriented mindset strategies	Intelligence and Behavioural Modelling while applying social network analysis, big data tools and geospatial mining	leading global distributor of Network & Security Solutions, Electrical & Electronic Solutions, and Utility Power Solutions. Provides intelligent full-line solutions to empower, resilient systems that sustain business infrastructures	that provides hardware, software, and service offerings are used to create Internet solutions that make networks possible

Appendix 6. Interviews transcript

Interview 1 & 2 – Pedro Cantinho / Sandra Bamansa | Semi-structured interview (Phone call)

Notes: Some parts of the interview were deleted because they didn't explicitly address some of this thesis's core points

1. How are you seeing the banking industry changing? What trends are you seeing emerging in banking and financial services?

1.1 Sandra: AI would be the game-changer on the financial services, banking on this case, and across every other industry. Besides, **Cybersecurity** it's the main priority for most banks, but once again, not only banks are affected by this issue. But for your thesis purpose, what I see the most fundamental changes in banking will occur in the customer experience spectrum. More precisely, the ability of banks to provide **omnichannel interaction** for customers. An example could be considered a customer that wants to open a new credit line for consumption. Imagine you, Gustavo, start to do it through your mobile phone, but then you want to continue in a branch for any reason. Each customer's interaction should be accountable on the bank's history record somehow, enabling you to continue your operation in the branch in the same step you stopped before, without interruption or either to start all over again. And the same applies if you want to do the same through the website instead of mobile. And once again, the interface should recognize your context instantly. This will enable a **smoother and frictionless single journey experience for customers**.

1.2 Pedro: Besides the omnichannel experience that Sandra mentioned, I would also add the need for banks to switch their approach towards customers. What I mean is that, before, banks would consider the product offerings before the customer. It should be precisely the opposite, with banks in their strategy privileging customer needs and expectations first and then adapting their products offerings. After knowing their customer, banks will make tailored offers to address the customer end need.

2. How fintech's are going to be a game-changer?

2.1 Pedro: Ohhh, definitely. I think that's another major trend. This is how the entering of fintech and big techs companies into the financial services world is reforming the entire customer experience. Look what Apple did in payments with apple wallet, for example? They transformed an existing action (payments) into one-click action!!! But not only through a direct effect on banking activities. Leading tech companies reshaped their entire business model towards providing compelling customer experiences! Look at Netflix, for example! Now on your dashboard, you have personalized offers based on your previous movies/series that you have watched! That's AI/ML working here towards your data as a user and making you valuable recommendations. Each user has its own different dashboard and recommendations! And this will also force banks to do the same – a **customer obsession approach**, but in this case through banking (or not) offers.

2.2 Sandra: I think an excellent point to mention, it's about regulation! Because banking it's a regulated industry- providing customers with money. You look it by Apple credit card - it's backed by Goldman Sachs. I am still not convinced they fell to banking as their core services, but instead continue taking advantage of some banking niches, such as payments. How many apple products can people be rejected for? Close to zero, but that changes as soon as you have a credit card! Because Apple doesn't control it anymore!

3. The hurdles of AI implementation – Can banks do it? Why not?

3.1 Pedro: I think by far the most considerable challenge concerns data! To have the capacity to build an entire data infrastructure, capable of capturing valid data (consumable), and then knowing how to use and exploit it, that's really difficult! The first step is to ensure **centralized data**, aggregating either internal or external data sources, on which banks can use it across different teams/departments. Besides, in the case of partnering with third parties, as we mentioned before, which I believe is the only way to go, a big challenge arises on **making technology infrastructure friendly** enough to share it through APIs.

3.2 Sandra: I also add the tremendous task of changing the entire **organizational culture**, a consequence of everything Pedro mentioned before! To partner with others in this particular industry will require this shift in mindset and corporate culture. Starting with the internal capabilities of their employees. One example I can give you from Cisco is that developed **Cisco Networking Academy**, an IT skills and career-building program precisely to prepare the future workforce for what it comes in the future! Check out this afterward!

4. What should banks do to embrace this new AI world of banking?

4.1 Pedro: Firstly, data data data! What I've mentioned before. Without having access and good data, everything else will fall apart. Then, partner to win the game – there might be some complications to implementing the speed of innovation, forces of heavy legacy / siloed data structures, traditional culture, or even compliance/regulatory processes. For that reason, banks should consider their approach towards the ecosystem. Should they partner or compete? In my opinion, banks would need to have a partnership strategy, especially towards some areas on which they clearly gain leverage in doing so, features beyond banking, onboarding processes, etc. It depends on each case! above everything should partner with fintech or big techs! Only then banks will be capable of knowing their client needs, expectations indeed and making strategic moves/actions towards this direction – tailored actions in real-time, through the proper channels (either a mobile, website, or either physically).

Interview 3 – Gonzalo Pradas | Semi-structured interview (Teams call)

1. How are you seeing the banking industry changing? What trends are you seeing emerging in banking and financial services?

1.1 The first is **digitalization**: digitalizing a bank/FS is a must because clients need it, and banks need it to address or serve clients with a scale. Digitalization destroys many of the barriers that traditional banking had, mainly regarding segmentation. Segmenting clients based on whatever the bank decides. Segmentation of one is what technology, data science, and AI enable you.

1.2 Eliminating intermediaries. They are many forces that believe that some banking sectors/ niches, banks are out of use. Instead of banks, they put a different type of intermediary between the client and the product that the client needs. For example – Cryptocurrency. It's not the banks are out of use, and it's sort of revolution that clients have a flawed perspective of banks.

2. How fintech's are going to be a game-changer?

2.1 They are today, but they are replacing banks, but what banks should do is work with them!! Wechat in Chat (check the video from the New York Times) – explains how it's so successful. Chinese customers can do every single action they will perform in one day through WeChat without logging out – getting an uber, buying food, ordering inside the restaurant – It's an **omnichannel experience** – through what? Summing to your platform, mini services, mini-apps but in one app.

2.2 In Openbank, what we do in Wealth management is get the best of many fintech of the wealth space. Then, we add to our app landscape to putting in front of the clients. Banks can either fight them or work with them. FinTech will never have the capillarity, the depth that banks have today. What fintech can do is jump into a bank and put their services to the clients of that bank specifically. Bitpanda – big fintech in Europe – started with crypto, and now it's doing brokerage. They will reach the critical mass that they can have in all the countries they are in Europe. They have done this through a B2B service. How can they approach more clients? B2B2C – Going to BBVA, Santander, etc. – and trying to incorporate those services into these banks.

3. Where do you see the open banking heading? Do you see the PSD2 directive as a game-changer for the banking revolution?

3.1 You have explained it really well! Because people, when talking about open banking they go directly to banking-as-a-service. But open banking is PSD2 first, then they share the APIs. What do you need to know is that clients typically give their data to people that they rely on and they trust. There are not many fintech's that they trust. Why? Because fintech's are not trustable? No, because many fintech's are specialized in a very niche product or service.

I will give you an example of Openbank – a digital bank from Santander. Our cards have the Openbank logo in front of the card and the flame of Santander in the back. As a client, when it comes to Wealth, you are giving the money to a third one to manage for you, which is sacred. Openbank is not the trustable point because here it's Santander as a group. Fintech obviously has a % of clients that trust them. Still, a significant % of the population in your market will be more willing to trust a large bank such as Santander.

3.2 Another interesting point regarding their limited offers is that most of these neobanks do not concede credits or mortgages. Do you think you, Gustavo, want to have Revolut or a "revolut" or to have 3/4 "revoluts" alike? One for each product or service that you need. My opinion is that you will want one bank of reference. Our experience is that clients need a vast catalog of products and services to that bank of reference. What you value from "revolut" is the easiness, the usability. That comes for every bank that wants to embrace digitalization. Revolut will be a prominent player if they get out of the niche of being the bank for the students leaving abroad and those who want a straightforward, inexpensive debit card. But whenever you want to buy a house and need a mortgage, Revolut will need to provide mortgage offers. They have an enormous challenge. Are u going to focus on delivering a comprehensive product catalog to make yourself the bank of reference? In the case of N26, they will focus on providing an optimizing investments platform. That is an excellent step toward becoming an actual large bank that can have millions of clients.

4. What can Banks gain by exploiting AI capabilities/technologies? And in which particular areas of their value chain?
4.1 The significant part of data science, machine learning, and AI is **growth – client acquisition** and second **client engagement**. **4.2** In regards to **client acquisition**. Conversion or acquisition in the digital world is the most transparent way of acquiring clients, and it is costly. And because you know what you pay. Being an expensive part of the journey, the conversion rate enhancement you can produce thanks to propensity models is 4 times the same as not using it. So you multiply by 4 the conversion rate thanks to propensity models. Propensity models have many perks but have one negative thing to start with. Until the companies have some experience in acquiring new clients forget about this kind of model. How to do it? You can also go with digital marketing and use the AI of others, Google, for example. What you can do is test every day with new clients, but that's relatively narrow, and it takes time. To bring new clients (new money), you are very dependable on third parties in a digital world. For example, in our bank, we had many advancements in the last 18 months working with Google to optimize keywords (in search). Also, the flow from that keyword to our onboarding but depends mainly on Google. Internally what we can do is to push clients from retail banking to wealth management, for example. When we talk about omnichannel, we are talking about the one-stop-shop concept, such as WeChat. There are so many benefits to an omnichannel platform. One action could be, top 100 by assets in the client book that does not hold investments. I've started to sit with every one of them (physical meeting) to inform them about new opportunities in wealth management offers. How do we define the top 100 clients? Based on data science filters and propensity models. It is not about having a large amount of money. But based on many different filters defined in-house. For example, for clients who use the app every day within a month but do not have Wealth, we move it towards a more exposure positioning in the landscape of the mobile app. In the end, it is all based on data, all based on what we can see and the AI that we can put today it has learned with the data itself – from thousands of clients. But also, how many channels, ways, vectors that I can execute everything on top. A clever app that allows me to go or not "on the go" while walking through the app. **4.3** But regarding the **engagement part**, AI is critical! In any sales campaign, we make some offers to our clients based on their cluster. A cluster of robot users, potential funds buyers, etc. How can we develop this client? And we can use the campaign of funds, for example. From a user experience perspective, u can also do the same. If there is a cluster of clients, the first thing they do when they enter the app is to go to "wealth"- and then they move to the highest movers of the markets during that day, and then go their portfolio. What I will do is to change the landscape/structure of the app. Or I will introduce tailored banners to address these specific clusters of customers. This does not deliver sales but makes clients feel that their experience is unique > which is the ultimate goal of a digital experience. So in that engagement part, you have two ways. The first delivers direct sales, and the other provides a better customer experience that delivers higher loyalty, trust, and activity within the bank's relationship.
5. The hurdles of AI implementation – Can banks do it? Why not?
5.1 It's going to sound too simplified, but I am convinced. The main challenge is to structure the data. Imagine IKEA or El Corte ingles. They have the data. Why do they not skillfully use the data to acquire new clients? El Corte Ingles they do pretty bad with data. Because they have 5/7/10

different applications. Each department/store was built without the context of building an all-data lake in which every piece of data is structured (centralized in a way that can be used). The main challenge of all the banks' data is not to have the best AI gurus and experts but instead to have deep, committed data science workers who can structure a clear data lake. Hence, from there, it is straightforward! And what happens to banks is to have a lot of different applications with different data, which becomes really difficult. Before everything, banks will need to have the data in a consumable way (usable).

6. What do u think will change the most in the future of banking activities?

6.1 Lending money or paying doesn't change the action itself. What is changing is the entire user experience. If I am in an online shop and try to order. When it comes to payment, I use apple pay. Although apple needs a card issuer on the other side, Apple is an actor in the payment industry. For any specific product/service in banking, the most significant advances will be on the user experience. You will have many third parties involved in your actions/operations. Still, for you, your experience only requires your mobile phone.
6.2 Coming back to data, whenever my bank asks me for data, I don't give it back, and it seems weirds. Still, because I assume, there is no added value to share your data with some providers. But whatever eases up my experience makes it faster and more straightforward, I believe most advances will be seen. If it's 3 taps, let's try to make it in 2 or 1 (apple pay, for example).
6.3 Regarding **the best client engagement**, it is the one that the client doesn't even acknowledge. I am not saying that you are tricking the client, but in the example of apple pay, it's so smooth that you don't even realize apple makes part of it. The way we are still engaging in banks is "dear Gustavo, can I bother for 5 minutes". We are not at the center of your hand as Apple. Even though we are present in daily actions from our clients, we still have so much road to drive to achieve that level of engagement some big techs can carry. And that's what I believe for the following years we will have to do. Align and work together with the googles, apples, etc., but we have to go that way.

Interview 4 – Daniel Villatoro | Semi-structured interview (Email)

Notes: The author has send the questions beforehand, and Daniel answer those through a written email

1. **What can Banks gain by exploiting AI capabilities/technologies? And in which particular areas of their value chain?**

1.1 : In Openbank we are **customer-centric obsessed**. Our developments are focused in improving customer experience and quality of interactions with the bank in the most efficient way. It is obvious that all banks have taken advantage of Machine Learning for **Fraud Management**. Past experience combined with ML models allows us to find behavioural patterns that allows us to avoid fraudulent behaviour, and warn our customers when anomalous operations are detected. In this initiative, it becomes very important to reduce the number of false positives in order not to alert customers in excess, as they can easily loose trust in our alert system. For future developments we are trying to obtain a threshold of warning configured per customer, as we assume that certain customers might prefer more false positives than others.

1.2 Other areas where Machine Learning is applied is in **Credit Scoring**, as classical approaches to this task implies using generic scorecards that determine customer likelihood to return money given very few variables; ML approaches allows us to find patterns using thousands of variables that goes deeper into behavioural monetary patterns than sociodemographic variables, and measure both intentionality and capability to repay.

1.3 Finally, as a big initiative, customer experience is also adapted using AI models, optimizing **customer propensity to products** and handling **churn management** efficiently in order to determine what would be the next best action to offer customers.

2. What should banks do to embrace AI capabilities? What is Openbank doing it so far?

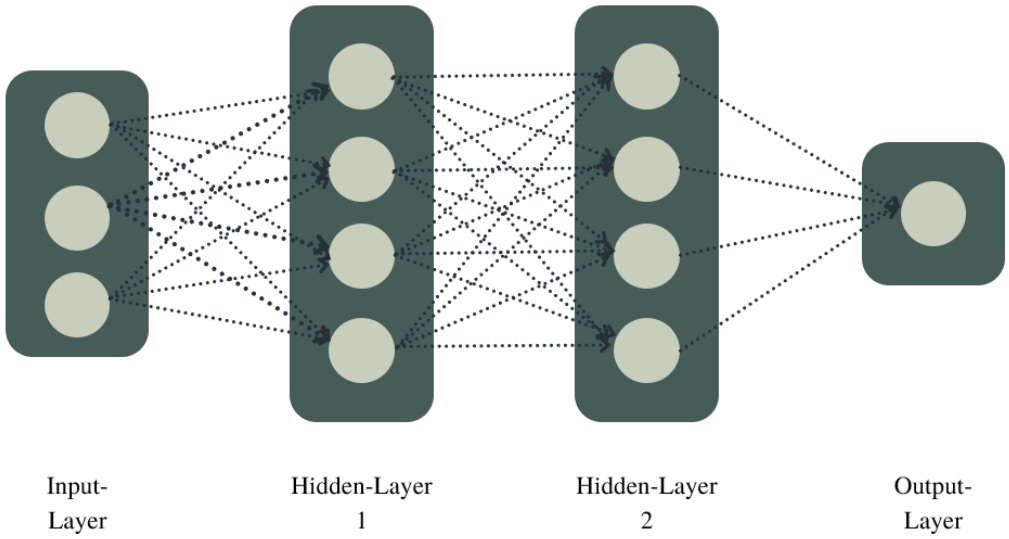
2.1 In order to embrace AI capabilities**, the most important asset is talent**! Big Tech companies such as Facebook, Amazon, or Google have invested big in hiring the best talent from the most important universities and AI departments. The application of AI in business is a recent trend and we are truly in an environment with scarce resources in terms of experts applying these techniques. We have a dedicated team of 30 data scientists and data analysts, with good algorithmic expertise and applicability experience in banking.

2.2 On the other hand, access to technology has been a stopper for many companies as it resulted in expensive dedicated infrastructure also maintained by hard-to-find specialists. **Access to cloud-infrastructures** is minimizing this gap and now it results affordable to have the technical capability. All our infrastructure is AWS hosted.

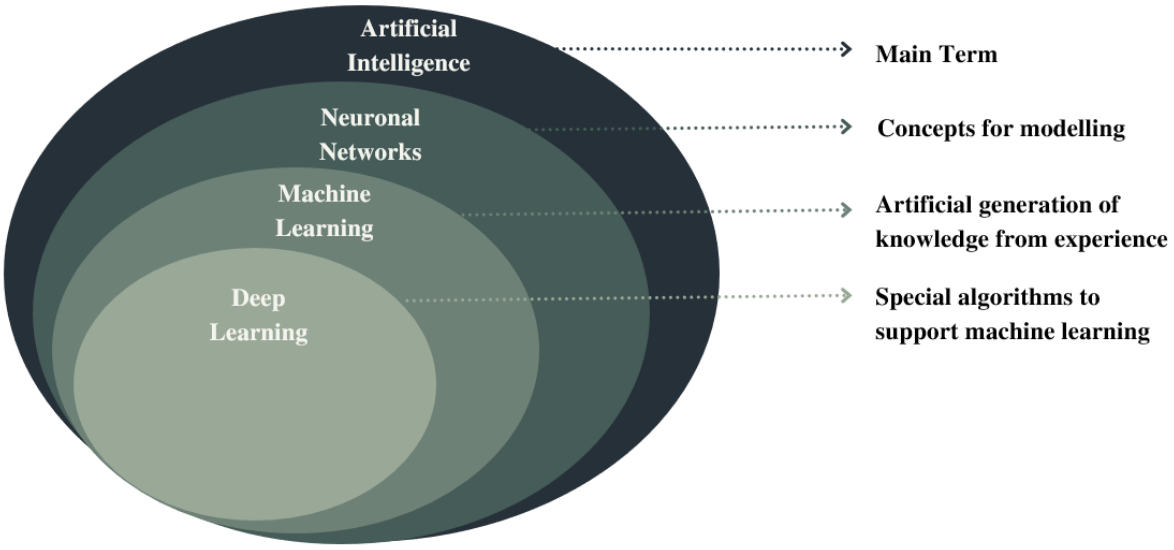
3. The hurdles of AI implementation – Can banks do it? Why not?

3.1 I would say that the most important asset is **access to historical data**, to fuel the functioning of ML models; with no historical data, algorithms are not able to find the patterns that can help optimize business.
Banks have traditionally been required to store data under regulatory constraints, and this has become a collateral asset for a AI driven transformation. Moreover, being Banking a regulated business, we have to implement an specific type of AI called Interpretable Machine Learning, which allows customers to obtain an explanation for every decision taken by an algorithm (much different than the strategies implemented in other non-regulated businesses). This methodology avoids us to use state of the art ML techniques (such as Deep Learning) but it results extremely useful as we can combine our predictive capabilities with the explanation about that prediction as an argument to start adapting customers experience with a sense.

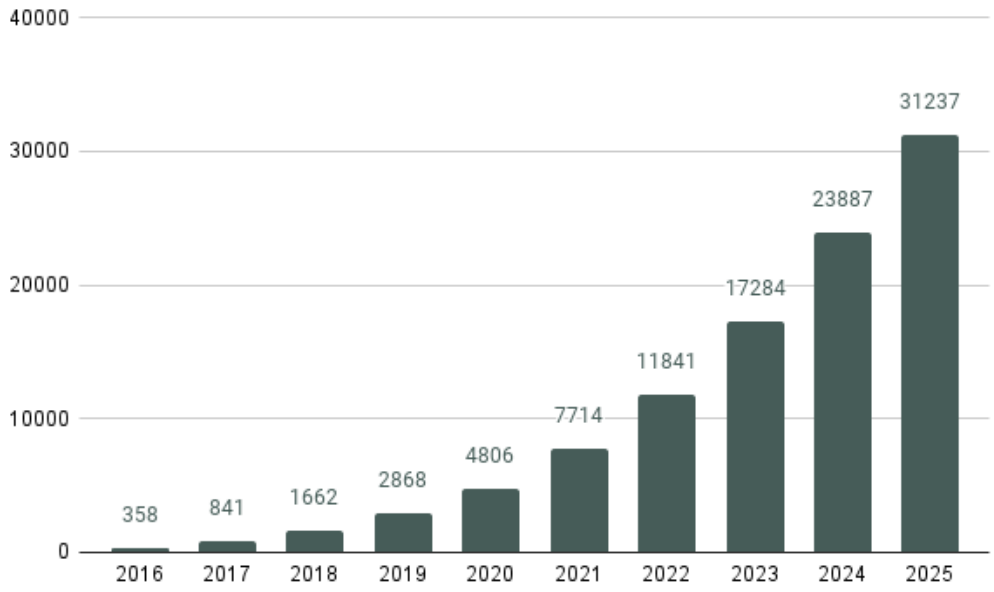
Appendix 7. Different layers in neural networks, based on (Arslanian 2019)



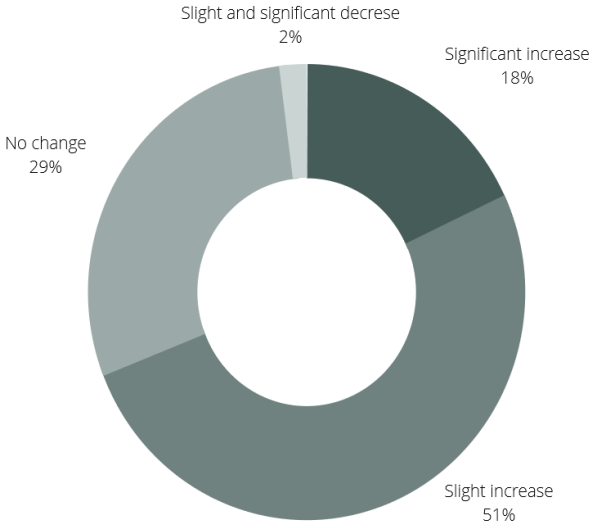
Appendix 8. Components of AI, based on (Arslanian 2019)



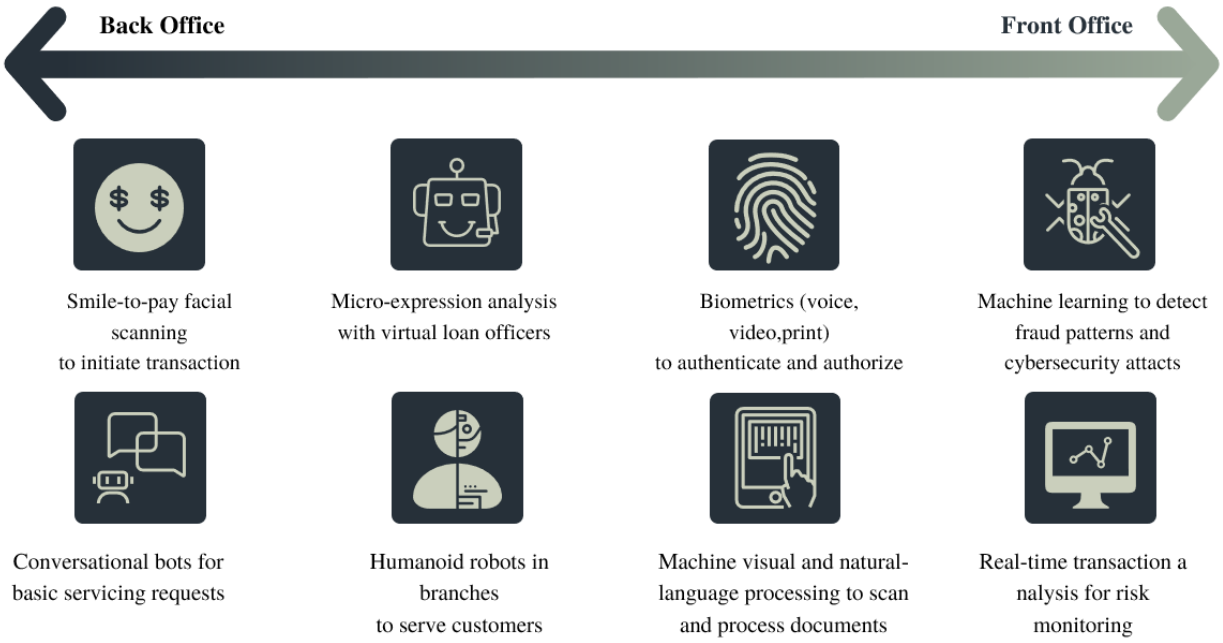
Appendix 9. Forecast of global turnover (in US million $) with enterprise applications in the field of AI, from 2016 to 2025, based on (Arslanian 2019)



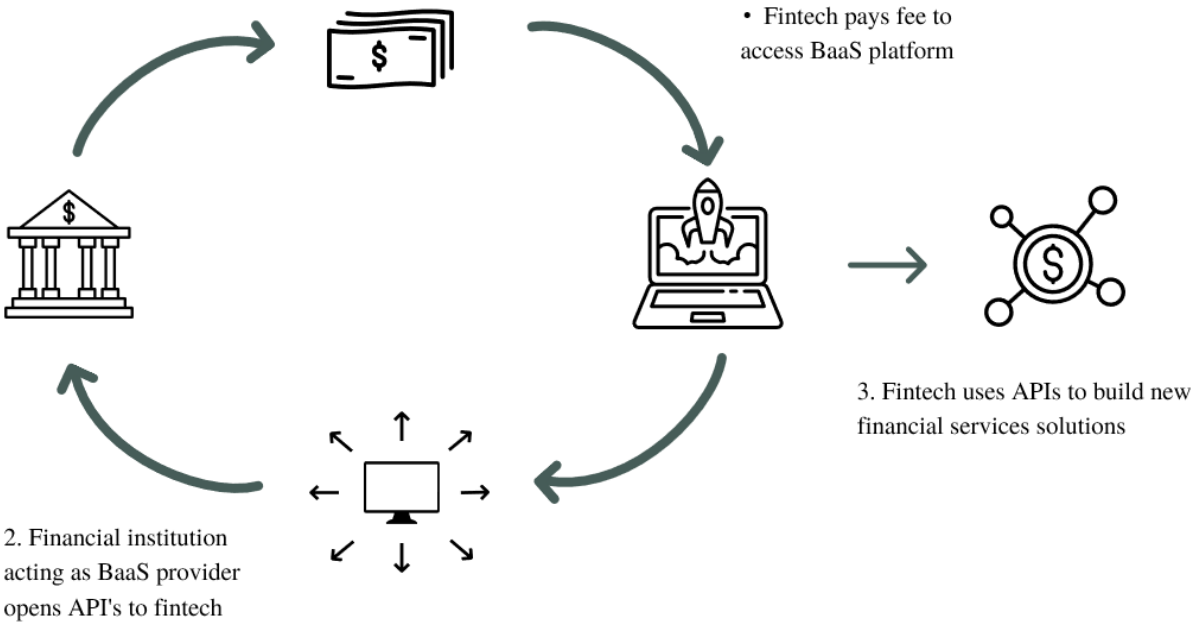
Appendix 10. Perceived impact of AI on profitability, based on (Ryll 2020)



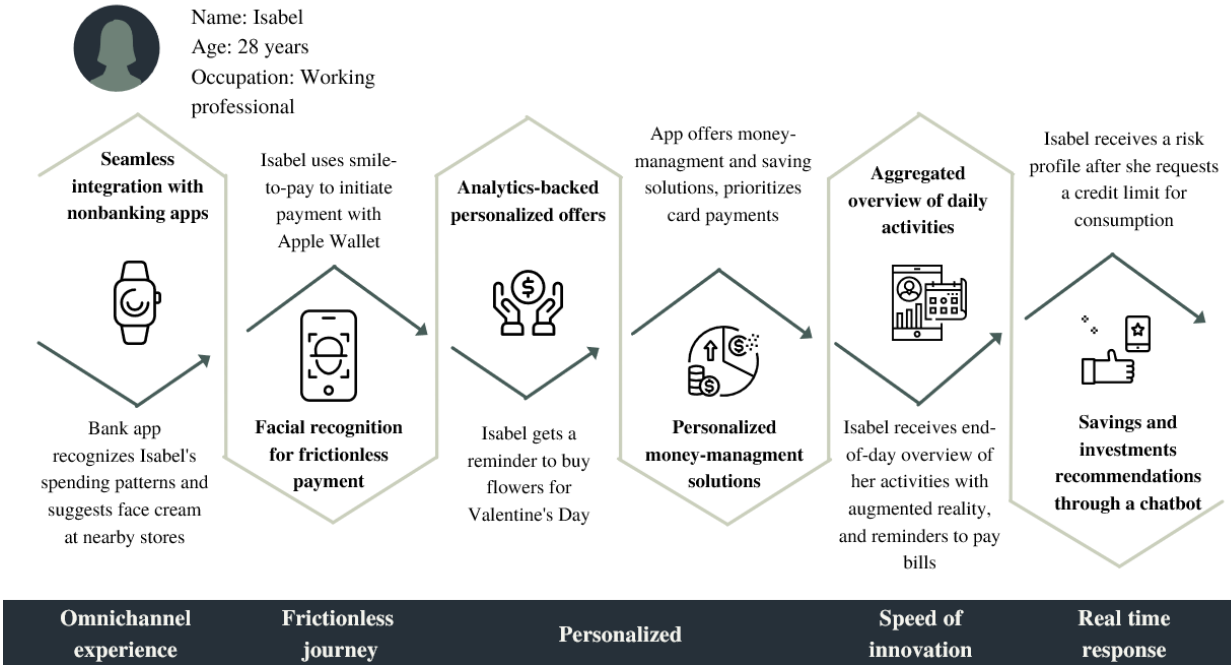
Appendix 11. AI – adoption to improve customer experiences within the banks value chain, based on (Biswas 2020)



Appendix 12. How BaaS works, based on (BTR Hub 2020)



Appendix 13. How AI transforms banking for a retail customer, based on (Biswas 2020)



Appendix 14 – Interview to Experts

Appendix 14.1. – Questions

1) How do you see the Food Supply Chain industry changing in the following years? What are the main trends now?

2) What are the future practical cases of AI within the Food Supply Chains and restaurants' performance that you expect?

3) Considering the supply chain landscape – Planning, Production/Farmers, Manufacturers, Storing, Distribution, and Consumer Experience – in which of these will AI be more useful?

4) The struggles of AI implementation – can restaurants, do it? If not or not now, why?

5) What should the industry players do to embrace AI capabilities?

6) Do you see all-in-one solutions and whole digitization as a game changer?

7) What about Katoo. Do you feel such tools can improve restaurants' performance nowadays? Why?

Appendix 14.2. – Profiles of the Experts

Expert 1 is a Co-Founder and COO / CPO at Katoo, and a previous consultant at BCG. He holds a BBA from ESADE Business School in Barcelona with an exchange in Cornell University. During his time at BCG, he specialized in Airline and Digital projects.

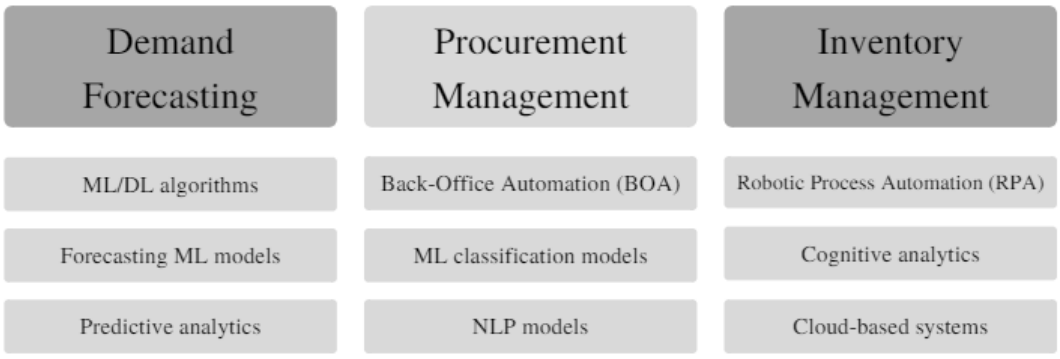
Expert 2 is the Head of Product & Design at Katoo. He holds a bachelor's degree in Digital Design, with a specialization in Design Management. Also, holds a master's degree in Multimedia Communication. At Katoo, he is responsible for envisioning how to solve the food industry

inefficiencies through digital tools, that will help standardize the processes and relationships between all the parties involved.

Expert 3 is Managing Partner Grupo Novacasta, detaining the franchising of 100 Montaditos and Pomodoro along +37 point of sale (PoS). As a previous Retail Director at Panda Security and previous Account Manager at "A vida é bela", has a robust experience within the national retail channel. He holds a master's degree in Energy and Bioenergy at Universidade Nova de Lisboa and a PAGE program at CLSBE.

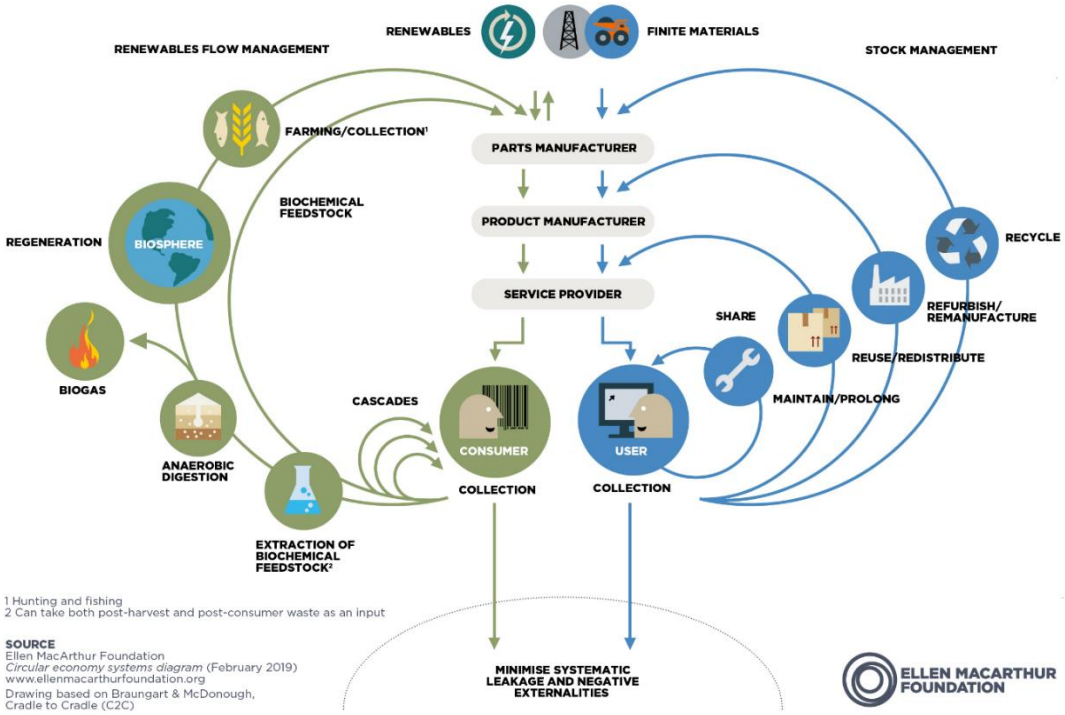
Appendix 15 – Figures

Appendix 15.1.: Key factors within Restaurant Supply Chain Management (source: own illustration based on inResto 2016)



Appendix 15.2.: Use-cases of AI in Restaurant Supply Chain (source: own illustration)

Appendix 16. Butterfly diagram. Ellen MacArthur Foundation (2019)



Appendix 17. Sustainability Survey (Survey by author).

Section A

Do you agree to participate?

Please read all the following information very carefully before agreeing to participate.

You will be asked about your opinion and understanding of different topics related to sustainability. Also, you'll be asked to share some of your experiences regarding the same subject. You will take around 10-15 minutes to answer the survey and there are no foreseen risks or discomforts in participating in this research.

The survey is anonymous, meaning the answers cannot be traced back to the respondent. There are no right answers and your opinion will never be judged.

The data collected will only be used in this research project for Giovana's master thesis at NOVA SBE.

- ○ Yes
- ○ No

Gender *

- ○ Woman
- ○ Man
- ○ Non-binary
- ○ Prefer not to say

Current level of study *

- ○ Elementary school
- ○ Middle school
- ○ High School
- ○ Bachelor
- ○ Master
- ○ PhD

Birth year (YYYY) *

O número deve estar entre 1900 ~ 2010

Nationality *

Insira sua resposta

Section B

Do you know the correct disposal method for most items you buy? *

- ○ Yes
- ○ No

Would you like to know what happens to your products after you dispose of them? *

- Yes
- No

How often do you see sellers/producers sharing information on how to dispose of their products after full usage? *

- Always
- Often
- Sometimes
- Seldom
- Never

Do you think they should make available information on correct product disposal? *

- Yes, should be mandatory for all
- Yes, should be mandatory for some types of product
- Yes, but should be up to the company
- No, they shouldn't do it

How often do you request from the seller/producer the correct disposal method for the product you are buying? *

- ○ Always
- ○ Often
- ○ Sometimes
- ○ Seldom
- ○ Never

In general, what do you do when you need to discard products? *

- ☐ Search online for the correct disposal method
- ☐ Throw away in the segregated bin you find most fit
- ☐ Throw in normal trash
- ☐ Take it back to the store where you bought it
- ☐ Sell it
- ☐ Donate it
- ☐ Outra

Have you ever used a reverse logistics service? *

Reverse Logistics definition: Reverse logistics comprises of the sector of supply chains that process anything returning inwards through the supply chain or traveling 'backward' through the supply chain.

Source: https://www.c3controls.com/white-paper/what-is-reverse-logistics/

- ○ Yes
- ○ No

How was your experience with the service?

0	1	2	3	4	5	6	7	8	9	10

Horrible Amazing

Please write down name of companies from which you have already used the reverse logistics service.

Insira sua resposta

How often do you buy second-hand items? *

- Daily
- Weekly
- Monthly
- Seasonal
- Yearly
- Never

How easy you think it is to find second-hand items that fill your needs? *

- Extremely easy
- Somewhat easy
- Neutral
- Somewhat not easy
- Extremely not easy

How does the following factors influence your decision when buying a second-hand item? *

	Never influences my decision	Seldom	Sometimes	Frequently	Always influences my decision
Product Quality	○	○	○	○	○
Price	○	○	○	○	○
Availability	○	○	○	○	○
Seller's Reliability	○	○	○	○	○
Return policy	○	○	○	○	○

Are there any other factors that usually influence your decision?

Insira sua resposta

Where do you usually search for second-hand items? *

- ☐ Physical Store
- ☐ Online Store
- ☐ Social Media
- ☐ Friends & Family
- ☐ Outra

Would you buy second-hand items from the following categories? *

	Never	Seldom	Sometimes	Often	Always
Apparel & Accessories	○	○	○	○	○
Auto & Parts	○	○	○	○	○
Books, music & video	○	○	○	○	○
Computer & Consumer Electronics	○	○	○	○	○
Food & Beverage	○	○	○	○	○
Furniture & Home Furnishings	○	○	○	○	○
Health, personal care & beauty	○	○	○	○	○
Office Equipment & Supplies	○	○	○	○	○
Toys & Hobby	○	○	○	○	○

Would you trust an automated system to find you a second-hand item that perfectly suits your needs? *

○ Yes

○ No

Section C

Do you usually trust when a company advertises that it is sustainable? *

○ Yes

○ No

Do you know any companies that have a CBM? *

- Yes
- No

In general, does having a CBM makes you buy a company's product more often than from companies with Linear Business Models? *

Linear Business Model: Take -> Make -> Use -> Dispose (everything is waste)

Source: https://medium.com/swlh/business-models-from-linear-to-circular-to-regenerative-9f10c19f337

- Yes
- No

Would you like companies to use recovered items as raw material for their products? *

- Yes
- No

Would you be willing to pay more for products from companies with CBMs? *

- Yes
- No

Section D

How often do you sell your own used items?

- ○ Always sell
- ○ Often
- ○ Sometimes
- ○ Seldom
- ○ Never

Would you be willing to share data with companies to help them train their AI algorithms? *

Examples of data: product condition, product destination, financial return, etc

- ○ Yes
- ○ No

What would you expect in return? *

- ☐ Discount on products
- ☐ Money
- ☐ Nothing
- ☐ Open access to data collected
- ☐ Outra

Would you be interested in using an app to help you select the best disposal option for the items below? *

Disposal options include selecting the correct bin, returning to the company, selling, donating...

	Never interested	Seldom	Sometimes	Often	Always interested
Apparel & Accessories	○	○	○	○	○
Auto & Parts	○	○	○	○	○
Books, music & video	○	○	○	○	○
Computer & Consumer Electronics	○	○	○	○	○
Food & Beverage	○	○	○	○	○
Furniture & Home Furnishings	○	○	○	○	○
Health, personal care & beauty	○	○	○	○	○
Office Equipment & Supplies	○	○	○	○	○
Toys & Hobby	○	○	○	○	○

In which functionalities would you be most interested when using the app? *

- ☐ Selling
- ☐ Donating
- ☐ Choosing correct Bin
- ☐ Returning to the company
- ☐ Finding collection points
- ☐ Outra

For you, what would be the main added value from the app mentioned above? *

Please rank the options from most valuable to least valuable

- Making sustainable choices
- Earning extra money
- Helping companies be more sustainable
- Buying cheaper items
- Helping people in need
- Reducing my carbon footprint

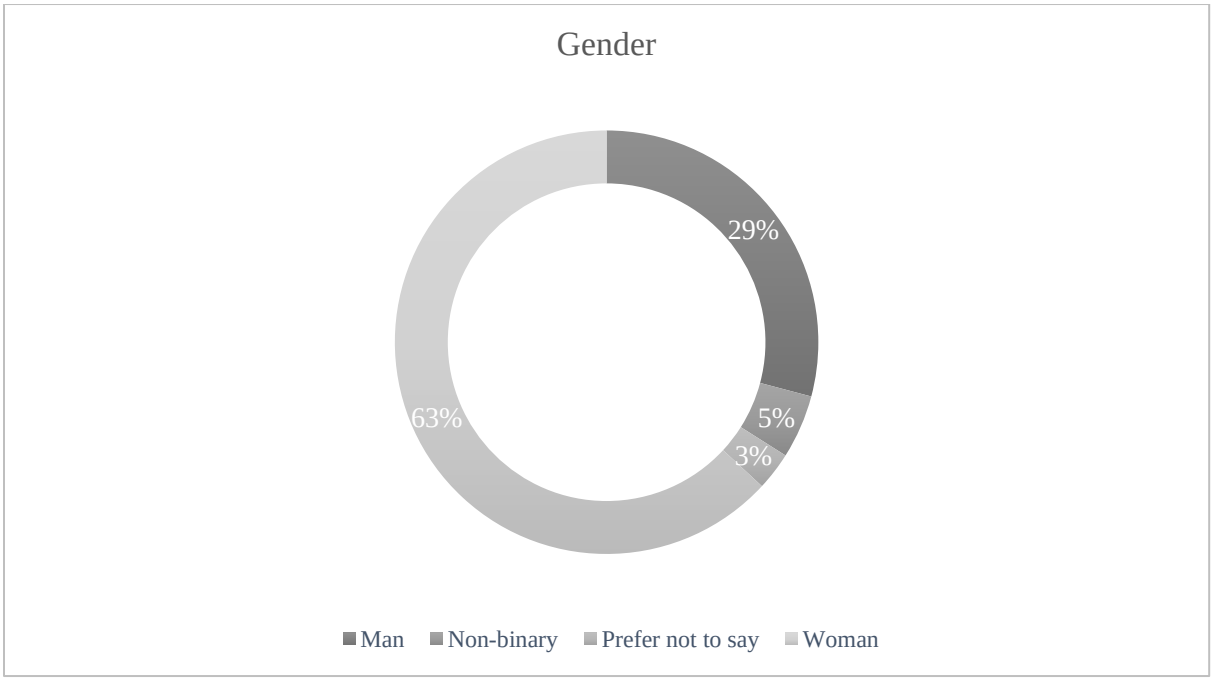
Would you trust an automated system to help you make the best choice for disposing your items? *

- ○ Yes
- ○ No

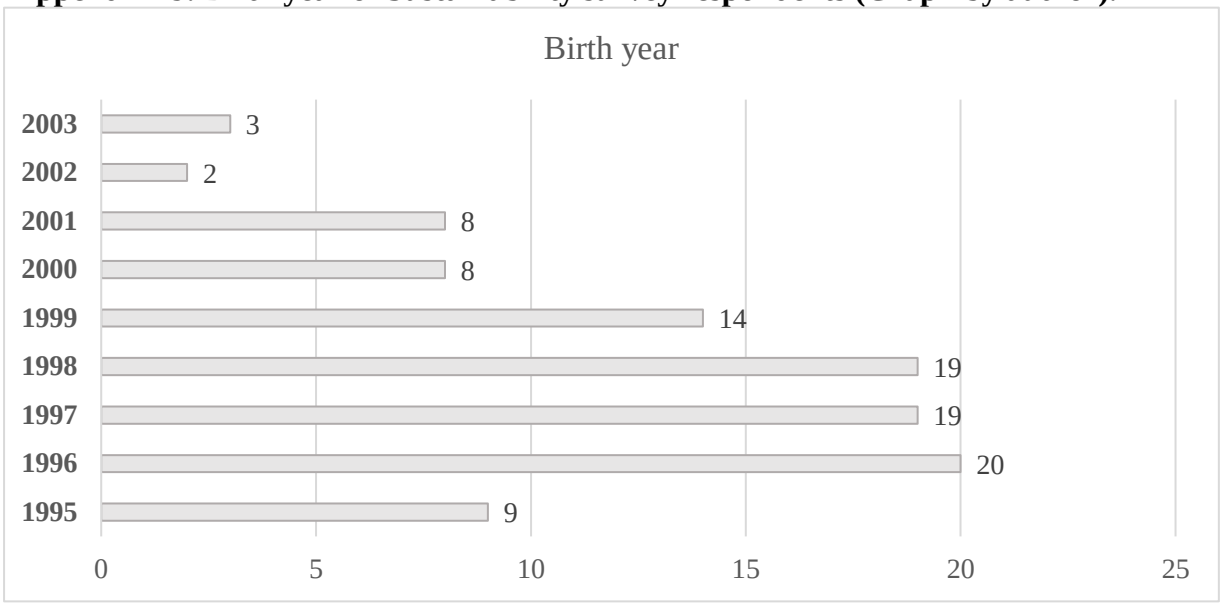
Would you be willing to pay for using the app mentioned above? *

- ○ Yes
- ○ No

Appendix 18. Gender of Sustainability survey respondents (Graph by author).



Appendix 19. Birth year of Sustainability survey respondents (Graph by author).



Appendix 20. Country of residence of Sustainability survey respondents (Table by author).

Country	N	%
Portugal	31	30%
Brazil	21	20%
Netherlands	16	16%
USA	10	10%
Germany	7	7%
UK	5	5%
Spain	4	4%
France	2	2%
Philippines	2	2%
Angola	1	1%
China	1	1%
Ireland	1	1%
Romania	1	1%
Pakistan	1	1%

Appendix 21. Level of study of Sustainability survey respondents (Table by author).

Level of Study	N	%
Master	47	46%
Bachelor	41	40%
High School	11	11%
Middle school	2	2%

PhD	2	2%

Appendix 22. Interviewees' profile (Table by author).

Interviewee	Gender	Age	Country of Residence	Level of education
Respondent 1	Female	19	Brazil	Bachelor's
Respondent 2	Female	22	USA	Master's
Respondent 3	Female	23	Portugal	Master's
Respondent 4	Male	24	Brazil	Bachelor's
Respondent 5	Male	25	Germany	Master's

Appendix 23. Interview questions.

1. *Section A - Profile:*
    a. Age?
    b. Country of residence?
    c. Level of study?
2. *Section B – Identifying personal sustainability practices:*
    a. Have you ever used a reverse logistics service? From which company? How was your experience with that?
    b. What do you think is the hardest part of recycling your used items?
    c. How does a quality of a second-hand product affect your purchase decision?
    d. What would make you buy second-hand items more often?
3. *Section C - Identifying perception over companies' sustainability practices:*
    a. What is your opinion and perception over companies' released information about their sustainability practices and status?

b. Do you know any companies that have a circular business model? How do you perceive them when compared to companies with linear business models?

4. *Section D - Identifying willingness to use AI-powered technology:*

   a. Do you believe the use of technology can help you take more sustainable actions?

   b. Do you believe AI technology can help you assess the quality of used products?

   c. Would you use, on a daily basis, an app that helps you give a sustainable final destination for your used items? How much would you be willing to pay for it?