How Artificial Intelligence Can Help Banks Improve the Customer Experience of Buying a House

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Abstract

Title: How Artificial Intelligence Can Help Banks Improve the Customer Experience of Buying a House.

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The focus of this thesis is to understand how artificial intelligence can help banks in general to improve the customer journey of buying a house.
Since the financial crisis, banks have been struggling to maintain profitability. The drivers for change in the industry are now the new competitors emerging in the financial landscape, new regulations implemented in the industry and the new customers' expectations regarding technology. This thesis argues that banks could use their natural advantage with mortgage loans and their investments in artificial intelligence to improve the customer journey of buying a house.
After conducting research, dept interviews and customer research, the customer journey was outlined and concluded that overall, the buying of a house is a complicated and unfamiliar process. Followed AI focused research, a new and enriched customer journey was drawn and complemented. It is suggested that banks implement AI to make the process more transparent and easier to navigate. A virtual real-estate agent powered by AI would assure the bank that the process is completed and guarantee the banks revenues for customer loans. Leveraging AI algorithms and customer information the bank can help the customer narrow down its searches presenting viable housing options to the customer which allows the bank to increase customer satisfaction, reduce customer churn, reduce the banks operational costs and ensure the revenues from mortgage loans.

Resumo

Título: Como a inteligência artificial pode ajudar os bancos a melhorar a experiência do cliente de comprar uma casa.
Autora: Daniela Ferreira Francisco
Palavras Chave: Inteligência Artificial, Bancos, Ecossistema de habitação
O foco desta tese é entender como a inteligência artificial pode ajudar os bancos em geral a melhorar a jornada do cliente de comprar uma casa.
Desde a crise financeira, os bancos têm sindo desafiados para se manterem lucrativos. Os impulsionadores da mudança no setor são agora os novos concorrentes que emergem no cenário financeiro, novas regulamentações implementadas no setor e as novas expectativas dos clientes em relação à tecnologia. Esta tese argumenta que os bancos poderiam usar a sua vantagem natural com empréstimos bancários e seus investimentos em inteligência artificial para melhorar a jornada do cliente na comprar de casa.
Depois de conduzida pesquisa através de entrevistas e pesquisa de clientes, a jornada do cliente foi delineada e concluiu que, em geral, a compra de uma casa é um processo complicado e desconhecido. Seguindo a pesquisa focada em IA, uma jornada de clientes nova e enriquecida foi desenhada e complementada. Sugere-se que os bancos implementem IA para tornar o processo mais transparente e mais fácil de navegar. Um agente imobiliário virtual impulsionado pela IA garantiria ao banco que o processo está concluído e garantiria as receitas dos bancos para empréstimos a clientes. Alavancando algoritmos de IA e informações de clientes, o banco pode ajudar o cliente a restringir buscas apresentando opções de habitação viáveis ao cliente, o que permite ao banco aumentar a satisfação do cliente, reduzir a rotatividade de clientes, reduzir os custos operacionais e garantir as receitas de empréstimos bancários.

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Chapter 1 – Introduction

Main objective

Topic presentation

According to Bain & Company, if banks want to emerge even stronger from the upcoming digital revolution, they will need to rebuild their businesses around customers (Baxter & Vater, 2014). Since the financial crisis, most European banks have been struggling to maintain profitability and the drivers that pressure banks are playing out with high impact across the financial services landscape (Cortet, Rijks, & Nijland, 2016).

One of the drivers impacting financial services is the competitive pressure caused by technology-driven innovation. From established giants such as Google and Amazon to smaller specialists such as Mint[1] and Feedzai[2], customers are willing to try these alternatives to traditional banking (Fleming, Fielding, & Roma, 2018). These new entrants in the form of FinTech or BigTech players are capturing market share by using disruptive technologies (Cortet et al., 2016; Walter, 2009). As if the entrance of new competitors wasn't challenging enough, new regulations, such as PSD2 and GDPR in Europe and Open Banking in the UK, force banks to open up consumer payment accounts for appropriately licensed, innovative (bank and non-bank FinTech) service providers (Bremus & Fratzscher, 2015; Cortet et al., 2016; Walter, 2009). The changes in consumer behaviour led by the prominent influence of digital technology in day-to-day activities are also driving consumer expectations regarding financial services to change considerably (Cortet et al., 2016; Walter, 2009). Roland Berger research suggests that customers like the flexibility and speed of the internet, especially when they are dealing with simple financial products. The same study indicates that less than seamless processes no longer sit well with customers (Storholm, 2018)

The digital revolution has upended the value and supply chains of many global markets, but so far has made little impact on the very largest: housing. The housing market is complex, and customers must make life-changing decisions while navigating legal obstacles and seeking customized advice. Digitalizing the housing market creates an ecosystem that reduces complexity for customers. A recent study by Mckinsey suggests that customers in the US and UK are either enthusiastic or open to, an ecosystem for home buying. Initial attempts at housing

[1] Mint is a company specialised in online budget planning
[2] Feedzai is a company specialized in fraud prevention with machine learning

ecosystems have focused primarily on selling mortgages and insurance, with the addition of home searches. This narrow scope ignores the substantial value inherent in an end-to-end approach that embraces many more aspects of the homebuying process; for example, transaction fees, home renovations, and moving from one property to another. Banks start from a strong position in the race to provide ecosystem solutions for housing, with their established place in mortgage lending (Baxter & Vater, 2014).

By entering the housing ecosystem and implementing AI in the process, banks would increase the transparency of the housing process for the customer and help the customer to improve its buying journey and so continue to stay relevant in customers lives, maintain its profits with mortgage loans and increase their revenues in adjacent areas.

According to a Gartner, "there is a substantial enterprise-level interest in AI projects and their potential to change the dynamics of business value fundamentally". On top of that, another Gartner survey to Chief Information Officers (CIOs) and IT leaders, has identified AI as the technology area which is expected to be the biggest game-changer for organisations in 2019, followed by data analytics and cloud services (Redshaw & D'Orazio, 2018)

Artificial Intelligence (AI), as an idea, first appeared soon after humans developed the electronic digital computing that makes it possible. And, like digital technology, AI, has ridden waves of hype and gloom – with one exception: AI has not yet experienced wide-scale commercial deployment (Manyika, Bughin, Silberg, & Gumbel, 2018).

AI uses technologies to help solve business problems; these technologies are machine learning, computer vision and natural language processing, robotics, autonomous vehicles and virtual agents (Bughin et al., 2017).

According to PwC's Global Artificial Intelligence study, the potential contribution to the global economy by 2030 is $15.7tr. For retailing and the consumer, the use case with the biggest potential is personalization of products and services. Similarly, to retailing, the personalization of financial planning is considered the use case with the highest potential.

Problem statement definition

The focus of this research is to understand how artificial intelligence can help banks in general, to improve the customer journey of buying a house.

As stated before, the banking industry is going through a phase of digital disruption. This thesis argues that, for banks to continue to be relevant in people's lives and thus guarantee customer

loans, prevent churn and maintain their profitability they should enter the housing ecosystem. As customers are becoming more technological savvy, and new competitors are emerging in the financial landscape, banks could use their natural advantage with mortgage loans and their investments in artificial intelligence, to improve the customer journey of buying a house.

To help solve the problem stated above in a focused and guided approach a list of research questions was created.

Research questions

1) Is the traditional business model of banks adequate to the new challenges in the Industry?
    a. What are the current challenges in banking?
    b. How can banks face these challenges and continue to be relevant?
        i. Should banks expand their offers to clients? For example, helping their customers buy a house?
2) What is the current customer journey of buying a house?
    a. What are the steps to buying a house?
3) How can artificial Intelligence be used to improve the customer journey of buying a house?
    a. What is artificial intelligence?
    b. What are the possibilities of using the AI in the process?
    c. What are the expected benefits?

Short Overview of the thesis structure

To help respond to the problem in question, in a structured and logical manner, this thesis was divided into Chapters. A brief description of each chapter can be found below:

- Chapter 1, includes the main objectives of the argument, as well as its own academic and managerial relevance;
- Chapter 2, reviews the existing literature that helps answer the research questions. This chapter is divided into three parts. Part one addresses the banking industry, part two the buying of a house and part three addresses the existing literature on AI;
- Chapter 3, describes the methodologies used to analyse and collect data;

- Chapter 4, analysis of the results from the data collected. This chapter also presents the two models of the customer journey of buying a house that were created;
- Chapter 5, gives the conclusions drawn from the research;
- Chapter 6, lists all the literature and authors cited in this document;
- Chapter 7, presents the moderator's guide and data display from the data collected.

Chapter 2 – Literature Review

The focus of this research is to understand how artificial intelligence can help banks improve the customer journey of buying a house. To do so, this chapter is divided in three parts:

- Part one – Banking Industry Overview – uses Porter's Five Forces framework to analyse the banking industry and its current challenges;
- Part two – Buying A House – analyses the customer journey of buying a house, the housing ecosystem and its current challenges, and the steps needed to buy a home;
- Part three – Artificial Intelligence – aims to understand what artificial intelligence is and what are it's current and potential uses in banking and other industries.

Part one - Banking Industry Overview

In this specific thesis, the position of banks in the financial services industry (FSI) is analysed by using Porter's Five Forces framework. The framework, and how to use it, is explained below, followed by the analysis of the industry.

Banking Industry Analysis - Porter Five forces

Porter's Five Forces of Competitive Analysis Framework was developed in 1979 by Michael E. Porter of Harvard Business School as a way of assessing and evaluating the competitive strength and position of a business organisation. According to Porter (1979) "the state of competition in an Industry, depends on five basic forces", which will ultimately determine the profit of the industry. By knowing the strength of these forces, it is possible to identify the position of a company in an Industry and define a strategy (Porter, 1979).

Digital transformation challenges almost every industry nowadays, and retail banking is mainly affected by the implications of digitisation (Schuchmann & Seufert, 2015). In the Banking Industry, the drivers for digital transformation are the changing habits of consumers and the new competitive environment (Bremus & Fratzscher, 2015; Cuesta, Ruesta, Tuesta, & Urbiola, 2015; Lane; Philip R., 2017).

For banks to establish a strategic agenda for dealing with these contending currents and grow despite them, banks must understand how they work in its industry and how they are affected in this situation.

Contending Forces

The threat of new entrants

"New entrants to an industry bring new capacity, to desire to gain market share, and often substantial resources. The seriousness of the threat of entry depends on the barriers present and on the reaction from existing competitors that the entrant can expect. The six major sources of barriers to entry are economies of scale, product differentiation, capital requirements, cost disadvantages independent of size, access to distribution channels and government policies"(Porter, 1979).

Specifically, in the banking industry, the risk of new entrants can be considered relatively small, as the capital to open a bank is massive. However, non-monetary challengers have been entering the financial industry. As said before, Big and FinTech's have been entering the financial market with more technological offerings that have been appealing to consumers. These companies not only increase the financial services industry competition but also erode income streams and reduce banks profitability (Lane; Philip R., 2017)

In the last few years, banks have been failing to provide web- and data-based financial products and services adequate to customer needs. Although banks have implemented some web-based services, for example home banking, non-bank technology driven providers (FinTech's) have been entering the financial market. FinTech companies have been exploiting the split between the new demands of the customer and the sometimes-outdated services traditional banks offer by unbundling the value chain of banks and specialising in their different components, such as payments, foreign exchange, lending, etc. This unbundling combined with lack of regulation, a flexible corporate structure and a start-up culture makes these companies highly disruptive of the traditional paradigms (Cuesta et al., 2015; Lu, 2018). According to Lu (2018), FinTech vendors are exploring AI to offer either with opportunities to help with transformational digital strategies or opportunities of IT cost optimization. A fintech vendor that addresses both aspects can scale up to be a potential threat to the financial services industry (Lu, 2018). On top of that, technology giants such as Alibaba and Amazon, and companies from other sectors, such as mobile phone carriers, have steadily encroached on traditional banking (Kahn; Barbara E., Inman; Jeffrey J., & Verhoef; Peter C., 2018; Lipton, Pentland, & Shrier, 2016).

Bargaining power of suppliers/customers

"Suppliers can exert bargaining power on participants in an industry by raising prices or reducing the quality of purchased goods and services. Customers likewise can force down

prices, demand higher quality or more service, and play competitors off against each other. The power of each supplier or customer depends on a number of characteristics of its market situation and on the relative importance of its sales or purchases to the industry compared with its overall business"(Porter, 1979).

In the banking industry, capital is the most essential asset (Adamkasi, 2017). Depositors are the banks' primary source of money, and employees, who supply the Human capital are the second most important resource. It is interesting to state that, for banks, most of the clients are also the capital suppliers, and although individually they have relatively little bargain power, altogether, suppliers/customers have reasonable control (Maverick, 2018).

According to Deloitte, consumers are becoming used to interacting via digital media to share information about themselves (Srinivas, Fromhart, Goradia, & Wadhwani, 2018), this digital interaction, increases customer expectations regarding the bank's customer service and product offering. More specifically, customers increasingly expect from banks more interactive, intuitive overview of their financial life's, a more customizable experience to their needs, a more immediate and fully digital experience and a better mobile experience (Gifford & Chang, 2016; Lipton et al., 2016; Van Der Heijden, Verhagen, & Creemers, 2003).

The threat of substitute products

"Substitute products, not only limit profits in normal times, they can also reduce prosperity in an industry in boom times. Substitute products that deserve the most attention strategically are those that (a) are subject to trends improving their price-performance trade-off with the industry's product, or (b) are produced by industries earning high profits. Substitutes often come rapidly into play if some development increases competition in their industries and causes price reduction or performance improvement"(Porter, 1979).

With the appearance of new technological competitors, new products and services appeared in the Industry. In general, the new entrants are beginning to offer specialized financial services that are similar to those within traditional banking with a more convenient, more accessible and personalised digital interaction, this is, a great customer experience (Fleming et al., 2018; Lu, 2018; Maverick, 2018).

Jockeying of position among current competitors

"Rivalry among existing competitors takes the familiar form of jockeying for position – using tactics like price/advertising competition and product introduction. Intense rivalry is related to

six factors: Numerous and equal in size/power competitors, slow industry growth, lack of product/service differentiation, high fixed costs, high exit barriers and diverse strategies and different company cultures"(Porter, 1979).

According to The World Bank, "competition in the banking system is desirable for efficiency and maximisation of social welfare" (The World Bank, 2017). However, banks are extremely scrutinized by regulators (Srinivas et al., 2018). That being said, banks face an intense competition by other banks which leads them to extend their offers to attract and retain consumers (Jayakumar, Pradhan, Dash, Maradana, & Gaurav, 2018; Maverick, 2018). New regulations such as open banking and PSD2 are allowing customers to switch banks more efficiently, which by consequence, will increase competition between banks (Bremus & Fratzscher, 2015; Cortet et al., 2016).

In conclusion, the current business model of banks is not prepared to deal with these disruptions. In the meantime digital-native competitors take attractive slices of the profit pool, such as originating loans. The traditional model of providing standard products and services through legacy organisations and traditional channels (branches, call centres, websites) does not have enough flexibility and speed to adapt to the coming changes (Fleming et al., 2018; Srinivas et al., 2018).

Strategic Action to be taken

Once the forces affecting competition in an industry and their underlying causes are identified, the strategy for the business can be formulated. Strategy can be viewed as building defences against the competitive forces or finding positions in the industry where the forces are weakest (Porter, 1979).

In this thesis it is suggested that entering the housing ecosystem should be the strategic action to be taken by banks to face the industry challenges. By doing so, banks would not only expand revenues but also continue to acquire new customers and provide them with end-to-end solutions.

According to Mckinsey, "banks start from a strong position in the race to offer ecosystem solutions for housing". Banks have an established place in mortgage lending, extensive knowledge of customers' financial habits, and digital banking capabilities (Dietz, Jenkins, Skau, & Taraporevala, 2018). Although banks may have a natural advantage in starting ecosystems, large technology firms, like Amazon, can capitalise on their existing relationships

and extensive data in their rich retail platforms to bring significant capital and flexible innovation to digital platforms (Dietz et al., 2018; Kahn; Barbara E. et al., 2018).

This thesis also argues, that banks could leverage technology advancements such as AI to enhance organisational agility and thus adapt to change faster and more efficiently (Kejriwal & Mahajan, 2018).

Part two - Buying A House

The digital revolution has changed the value and supply chains of many global markets. However, so far, has made little impact on one of the very largest: housing. Currently, the markets for buying houses are fragmented, slow-moving and costly, and they operate much as they did 50 years ago (Chappell et al., 2018). However, the housing market is one of the most significant products and service markets in the world, and its annual revenues earned for housing-related services run into trillions of dollars. McKinsey estimates that "by 2025, housing ecosystems will generate annual revenues approaching $3.8 trillion" (Dietz et al., 2018).

The housing ecosystem can be divided into four core value chains: buying, renting, living, and selling (Dietz et al., 2018). However, this thesis will only consider the home buying journey when referring to the housing ecosystem. Mckinsey & Company divided the home buying journey of the housing ecosystem into five steps: Planning and searching, developing financial options, place bids and purchases, get house insurance and move in, furnish and renovate(Dietz et al., 2018).

According to the United Kingdom Department for Business, Energy & Industrial Strategy (2017), the process of buying or selling a house is often claimed to be among one of the most stressful life experiences. "For most individuals, housing dominates the financial picture, making up their most significant investment and annual expenditures" (Dietz et al., 2018), however, the processes can be lengthy, uncertain and carry unexpected costs, especially if the sale collapses, and is often criticised for not being as efficient, effective, or consumer friendly as it could be (Department for business energy & Industrial Strategy, 2017). Koklic & Vida (2009) believe that "in the early stage of the buying process, decision makers usually do not have sufficient information and adapt their desires and goals accordingly" (Koklic & Vida, 2009).

By having a natural competitive advantage in mortgages financing, banks have started entering the housing ecosystem by digitising the complicated and painful mortgage application process (Dietz et al., 2018; "'Proptech' and banking: A new ecosystem for a better experience when

looking for a home," 2018). According to Mckinsey banks should look beyond home buying, traditional mortgage and insurance products to address the entire customer journey (Hart, Kaminski, & Martin, 2014), to secure the current mortgage revenues, and to build new revenue streams in adjacent areas, and thus creating a housing ecosystem (Dietz et al., 2018).

Because the consumers are often inexperienced in the process of buying a house, they often use real-estate agents. Real-estate agents educate and guide customers through much of the home-buying process, which gives them the lead position in the customer relationship. Consequently, real-estate agents are one of the first people to whom homebuyers turn for recommendations – especially when the buyers are new to the area (Hart et al., 2014; Koklic & Vida, 2009).

In conclusion, nowadays most banks do not offer an ecosystem solution for the process of buying a house, in fact, banks are mostly involved in the process by providing financial options to customers. When helping customers planning and searching for a home, the real estate agent is an important stakeholder and insuring the home still belongs to insurance companies; however, the bank could increase its involvement (Zumpano, Elder, & Baryla, 1996).

Part three - Artificial Intelligence

Artificial Intelligence (AI), can be defined as "the ability to think, imagine, creating, memorising and understanding, recognising patterns, making choices, adapting to change and learn from experience, exhibited by an artificial entity (computer or machine) to solve complex problems" (Vemula & Balasaidulu, 2018). To put it in simpler words, AI is "the ability of a computer to exhibit human-like behaviour" (Bughin et al., 2017). AI uses technologies to help solve business problems; these technologies are machine learning, computer vision and natural language processing, robotics, autonomous vehicles and virtual agents (Bughin et al., 2017).

As Mckinsey as stated in their report, *An Executive's Guide to AI*, "most recent advances in AI were achieved by applying machine learning to very large data sets". Rather than receiving clear programming instructions, by processing data and experiences, machine-learning algorithms detect patterns and learn how to make predictions and recommendation, and thus, improving efficacy over time. To be able to identify patterns and learn from them, algorithms use predictive (anticipations of events and occurrences) and prescriptive (goal achievement recommendations) statistical models (Mckinsey Analytics, 2018).

Although there are many machine learning types, there are four that stand out (Mckinsey Analytics, 2018):

- Supervised Learning: Uses algorithms of training data and feedback from humans to learn relationships between inputs and outputs and is used when the relationship between inputs and outputs are known and it necessary to make predictions to a new data set. Some of the algorithms used are linear regression, logistic regression, decision trees and Naive Bayes.
- Unsupervised Learning: This technique does data exploration without being given specific input and outputs. It is used to detect and classify patterns in data. The algorithms used are K-means clustering, Gaussian mixture model, Hierarchical clustering, Recommender system.
- Reinforced Learning: This technique works when an algorithm receives rewards for its actions and perform by trying to maximise those rewards. It can be used by investment banks helping them to maximise the returns of portfolios. The algorithm optimises its actions by correcting itself with the pass of time.
- Deep learning: This type of AI can process-wide data sets without previous human processing and is usually more accurate than other machine learning techniques (Mckinsey Analytics, 2018). This model mimics the way neurons interact in the brain. These "neural networks" create layers of fake neurons that process the data through the layers and according to Mckinsey Global Institute "learn increasingly complex features of the data at each layer" (Manyika et al., 2018; Mckinsey Analytics, 2018). Real applications of Deep learning are image processing that can be used to diagnose health diseases, detect Band logos and detect defective products in production lines. Deep learning is also used in text prediction, for example, to generate reports, provide translations and make predictions about fraudulent credit-card transactions.

According to a Gartner survey, "there is a substantial enterprise-level interest in AI projects and their potential to change the dynamics of business value fundamentally". However, 37% of organisations are still looking to define their AI strategies, while 35% are struggling to identify suitable use cases (Malinverno, 2018). On top of that, another Gartner survey to Chief Information Officers (CIOs) and IT leaders, has identified AI as the technology area which is expected to be the biggest game-changer for organisations in 2019, followed by data analytics and cloud services (Redshaw & D'Orazio, 2018).

Moutusi Sau, a principal research analyst at Gartner, has said that "Challenges particular to AI projects include unpredictability that just isn't found in other standard technologies. Business cases for AI projects are complex to develop as the costs and benefits are harder to predict than

for most other IT projects" (Malinverno, 2018). A recent survey conducted by IBM found that "only 11% of companies have made significant investments in AI, as with electricity and the internet, adoption will take time" (Standage, 2018). Moreover, the success of implementing new business enabling technologies relies on combining the disruptive technologies with the existing business infrastructures (Redshaw & D'Orazio, 2018).

A real example of the application of AI in banking is the Contract Intelligence (COiN) platform, recently introduced by JPMorgan Chase, COiN was designed to analyse legal documents and extract necessary data points and clauses. Results from initial implementation of this machine learning technology showed that the review of 12,000 annual commercial credit agreements could be reviewed in seconds, while previously used to take 360.000 hours (Sennaar, 2017) However, application for AI have been explored in other industries, such as in human resources management. Zheng (2017) proposes that AI could replace most of the repetitive operational work humans do. However, AI will not substitute human resources as a whole, but the work content will change from low-value and repetitive work to planning, judging, organising strategies and emotional input (Zheng, 2017). Another example is Netflix, which is using an AI algorithm to personalise recommendation of subscribers. Because, customers tend to give up if it takes more than 90 seconds to find something to watch, helping customers to quickly find desirable content has prevented a loss of one billion dollars annually due to cancelled subscriptions (Bughin et al., 2017).

For many firms, using AI techniques will mean accelerating their digital journeys, as otherwise, it will not be possible to deploy the technologies (Bughin et al., 2017).

AI limitations and repercussions

According to Bain and Company, there are 6 "Unintended Consequences" of using AI (Brahm, 2018):

- *AI can create hidden errors*

AI models represent the world in a statistical matter and so they are fallible. These models work limited to the data they are presented with, as so, it is crucial to feed AI algorithms with comprehensive and large data sets which are often a challenge (Brahm, 2018; Manyika et al., 2018).

- *AI can lead to a loss of skill, critical thinking and understanding*

Although it is still difficult to transfer the learning from one activity to another, this is, to generalise learning, there have been positive developments in this area (Manyika et al., 2018). However, generalised learning should be applied carefully, as it could lead to a generalised loss of understanding of the fundamentals of business (Brahm, 2018).

- *AI can open new hazards*

A real example of AI hazards are the social media and SEO (search engine optimisation) manipulations and that have been exposed in the past electoral seasons. Like a person, algorithms can also be manipulated, and by understanding the algorithm behaviour, it is possible to predict results and stimulate the algorithm to release the desired outcome (Brahm, 2018).

- *AI can institutionalise bias*

One of the challenges of AI is the complexity of specific techniques, such as deep learning. These techniques create problems of "explainability" as it is often difficult to understand the logic behind certain decisions or predictions. In specific industries, especially those that have social or human life implications, it might pose a problem to use such models unless it is possible to increase the models' transparency (Manyika et al., 2018).

- *AI can contribute to a loss of empathy*

The use of chatbots, virtual agent's other consumer interaction models like Siri[3] and Alexa[4] have concerned the workers that manage those algorithms. By distancing the company from the consumer, there is a increasing concern that managers and C-level executives distance themselves from consumers and decrease the level of empathy in their decision-making process which can lead to ethical, legal and regulatory challenges (Brahm, 2018; Bughin et al., 2017; Manyika et al., 2018).

- *AI can cause a loss of control*

Allowing AI algorithms to make decisions on their own poses great challenges across firms, developers, workers and governments (Bughin et al., 2017). Although there is still a consensus

[3] Apple digital assistant
[4] Amazon digital assistant

that humans should be involved in the decisions made by AI, with the booming of technology the human interaction with the algorithms can become unclear (Brahm, 2018).

In conclusion, although AI has been around for decades, only recently has been applied to real use cases. And although there is a substantial enterprise interest in changing the fundamentals of businesses using AI, only a few companies have made significant investments in AI. Moreover, the success of implementing new business enabling technologies relies on combining the disruptive technologies with the existing business infrastructures.

To access the true value for banks of the implementation of AI in the customer journey of buying a house, research was conducted. The results and key findings of the such research can be find in the next chapter.

Chapter 3 – Methodology and data collection

Methodology

As stated before, banks are going through a phase of digital disruption, and it is becoming more evident that the traditional business model of banks is no longer suitable to face new challenges in the industry. Although the paths banks choose to meet these challenges can be unclear and uncertain, the literature suggests that banks have a natural advantage in building ecosystems and technological implementations. To help banks understand, how to use these advantages to create new revenue streams, exploratory research was designed and conducted.

This exploratory research was divided into three parts, and as so, had three main objectives:

- Part I: Analyse the current state of the banking industry and identify its main challenges;
- Part II: Understand the ongoing customer journey of buying a house;
- Part III: Understand what artificial intelligence is and how can this technology help banks to improve the ongoing customer journey of buying a home.

Part I of the research was conducted by collecting and analysing secondary data. This data was collected from relevant sources such as academic literature, banks websites and reports, and industry experts reports and websites, such as consultancy and research companies.

Part II of the research dealt with the collection of secondary and primary data to help develop an understanding of the current journey of buying a house. The secondary data was collected from relevant sources such as academic literature, industry and government reports, and industry experts reports and websites, such as consultancy and research companies. The primary data were collected from in-depth interviews (or qualitative interviews).

Part III of the research was conducted by collecting and analysing secondary data. This data was collected from relevant sources such as academic literature, technology websites and reports, and industry experts reports and websites, such as consultancy and research companies.

Primary data collection

Overall, six interviews were conducted. The participants were chosen either because of their experience in the house buying industry, their experience in buying a home or their experience with AI. In appendix V can be found a brief description of the participants.

Although the interviews were conducted to allow the freedom and fluidity of the conversation, a moderator's guide was created to help the interviewer keep the discussion on the topic. Both

the moderator's guide for the home buyers (Mrs. Sara and Mr Fernando) and the Industry experts (Mrs. Isabel and Mr Rui) can be found in appendix I and III respectively. The moderator's guide for the AI experts (Mrs. Catarina and Mr. Bruno) can be found in appendix VII.

The moderator's guides that were created can be divided into two parts:

1) The *initial questions* where the participants were asked to talk a little about themselves and their experience with the housing market or their experience with AI.
2) The *key questions* where participants were asked to talk specifically about the process of buying a house.

The *key questions* from the moderator's guide where created following the Mckinsey structure of buying a house (Planning and searching, developing financial options, place bids and purchases, get house insurance and move in, furnish and renovate). Additionally, the Mckinsey structure was compared and adapted to the consumer buying decision process (need recognition, information search, evaluation of alternatives, buying decision and post-purchase behaviour). However, during the interviews, a learning process occured which allowed the interviewer to adapt and be able to ask more specific questions about the housing industry and customer journey and AI.

To analyse the primary data collected from the interviews, a four-stage qualitative analysis of the data was conducted.

Figure 1 Stages of qualitative analysis (Malhotra, 2007)

The data analysis began with the data assembly. At this stage notes taken during the interviews, the phone call notes and e-mail exchanges with the participants where gathered.

Proceeding the data assembly, a data reduction was conducted. At this stage, data was organised and structured, allowing the selection of insightful data while other data was removed. The data reduction involved a process called coding of data which implies "breaking down the data into discrete chunks and attaching a reference to those chunks of data" (Malhotra & Birks, 2007). This process allows the retrieval, organisation and interpretation of data by assigning "labels" to the notes token based no categorisation of the moderator's guide. This way, the data was

summarised into analysable units collecting similar ideas and themes where the essential insights were matched with the correct category within the moderator's guide.

Subsequently, the data display was constructed which involved "summarising the data and presenting the structure that is seen in the collected qualitative data" (Malhotra & Birks, 2007). Therefore, spreadsheets (see Appendix II, IV and VIII) and an extended text have been produced for the interviews with the home buyers and housing industry experts (see Appendix VI). The spreadsheets provide an overview that allows the general meaning and context of the data collected. This design helps to put the results face-to-face allowing to draw comparisons across the particular problems, bringing up differences and conformities.

At the last stage of data analysis, the data collected were compared to the secondary data previously obtained. This stage is called data verification and exists to "demonstrate that the researcher presented a correct meaning of the data collected. They need to show that the structure or meaning they see is not just a reflection of their views" (Malhotra & Birks, 2007).

Limitations of the methodology

Because the research conducted was limited due to time, budget and geographical constraints, the data collected was limited to secondary data and in-depth interviews. Furthermore, although secondary data was collected at a global scale, the in-depth interviews were conducted to Portuguese people.

Chapter 4 – Results' Analysis

Banking Industry Analysis

As literature suggests, the banking industry is suffering a digital revolution, as other industries have already suffered. Using Porter's framework (see Chapter 2 – Part one) it was possible to conclude that the current challenges in banking are:

- Changes in consumer behaviour. More specifically, the increasing expectations of customers from banks to have a more interactive, intuitive overview of their financial life a more customizable experience to their needs, a more immediate and fully digital experience and a better mobile experience;
- Technology-driven innovation, banks have been failing to provide web- and data-based financial products and services, allowing non-bank technology driven providers to enter the financial markets.

For the bank, a successful digital transformation of the end-to-end credit journeys enhance revenue growth and achieve significant cost savings. The digitisation of personal loans is becoming the norm for personal-loan applications following submission by mobile and a time-to-cash of just a few minutes. Banks could speed up the process of digitalising less complicated financial transactions once, research suggests that customers like the flexibility and speed of the internet, especially when they are dealing with simple financial products.

The current business model of banks is not prepared to deal with these disruptions. The traditional model of providing standard products and services through legacy organisations and traditional channels (branches, call centres, websites) does not have enough flexibility and speed. This can be concluded by the current success of FinTech and BigTech companies that are able to steal revenues from banks by offering specialized financial services with an excellent customer experience. Offering the customer, a more immersive experience can extend the banks offering across business lines and distribution channels, and thus extend the bank's reach and relevance.

To face these challenges, banks should accelerate partnerships with technology firms or retailers and consequently invest in customer experience and improve their digital capabilities. It is suggested that banks look beyond home buying and traditional mortgage to address the entire customer journey and by doing so secure the current mortgage revenues and build new revenue streams in adjacent areas.

Buy a House Analysis

After the interviews were conducted, the retrieved data was adequately treated and analysed as described in the previous chapter. The data display that was created to explain the depth interviews of home-buyers and industry experts can be found in Appendix II and IV respectively. Following the data display, an extended text was produced, which is presented in Appendix VI.

Secondary data was also retrieved and analysed to validate and complement the interviews and thus enrich the results obtained. The research key findings can be found below.

Customer Journey of Buying a house

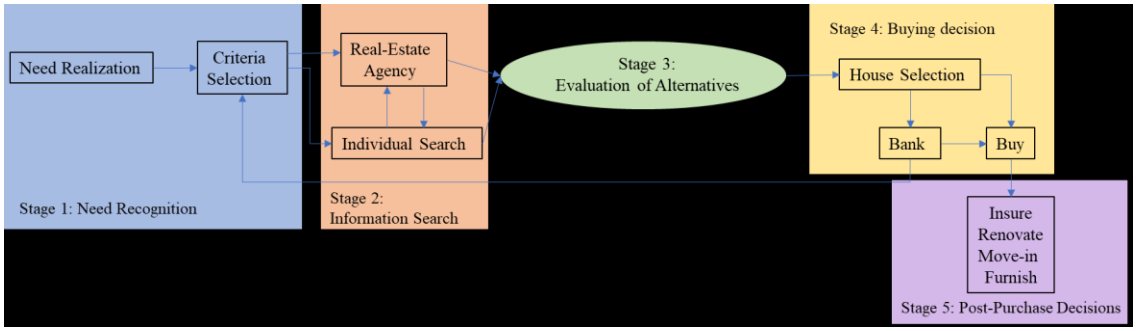

Figure 2 Standard Customer Journey of Buying a House

Building on existing literature and the data collected, the customer journey was outlined and divided into five steps, as it can be seen in figure 2.

Stage 1: Need Recognition

The first stage of the customer journey, need recognition, divides itself into two steps, need realisation and criteria selection.

At this stage, the consumer recognises the need for a house. Key insights from the interviews suggest that people look for houses as a necessity, the need realisation might appear from the growing of a family, the necessity to leave the parents' house or other factors such as cultural aspects or market conditions (high renting prices).

Regardless of the need, at this stage, the initial criteria for selection of a home start to appear, such as location and house size. From the data collected, it can be concluded that the price isn't always an initial criterion, and it only becomes a concern later in the journey. The research also confirms, that most consumers are not sufficiently informed about the buying process to make informed and reasonable criteria selection at this stage and adapt their desires and goals throughout the process.

Stage 2: Information search – Planning and searching, Developing Financial Options

The second stage of the customer journey, information search, divides itself into two steps, real-estate agency and individual search.

At this stage, the consumer is often faced with the choice to use a real estate agent or to begin the search on their own. During the information search, the two steps can occur simultaneously or one after the other. The use of a real estate agent is not independent of an individual search and vice-versa.

Research suggest that people mainly look up for houses online, that is, individual search is made on the internet in the real-estate agencies websites or e-to-e platforms like OLX[5]. However, some people still resort to word-of-mouth and street signs to look for houses.

Because the consumers are often inexperienced in the process of buying a house, they often use real-estate agents. They have and important role as people often have an idea of what they want but are not sure of what they can afford. Real-estate agents educate and guide customers through much of the home-buying process, which gives them the lead position in the customer relationship. Consequently, real-estate agents are one of the first people to whom homebuyers turn for recommendations – especially when the buyers are new to the area.

Stage 3: Evaluation of alternatives

When evaluation for other options, consumers often start house seeing, talking to sellers and opening negotiations. Research suggests that, when looking for a house, location is the most important factor in the purchase decision. Other factors such as price and house size were mentioned as important decision factors as well. However, at this stage, consumers may start revaluating their initial criteria and go back to the first stage.

The stakeholders identified in the process of buying a house were the Buyers, the Seller, the Bank (in case there is a mortgage loan), the Real-estate agent and the Notary.

Stage 4: Buying decision

At the fourth stage of the journey and after evaluating all possible alternatives, consumers start the step of house selection.

[5] OLX is a classified ads platform that allow the sale of products from houses to cloth

At this stage, and after consumers have selected a house, they can either buy the house using their own capital, or they can go to the bank to ask for a mortgage loan.

When approaching the bank to ask for a mortgage, the consumers might face the reality that their desired home is too expensive. The most important factors in the mortgage loan decision are cheap monthly payments, fees and spread. Mortgage loans are seen as a complicated and confusing process that could be presented to the client with more clarity and transparency.

It is at this stage, that consumers might go back to evaluating their criteria selection as they are faced with the reality that they might not afford the house they initially selected.

Stage 5: Post-purchase decisions – move in, furnish and renovate

After the house purchase is complete, the Post-purchase decisions stage begins. At this stage, consumers become home-buyers and they are faced with choices such as home insurance, renovations, moving-in and furnish.

Overall, there is no consistency regarding the consumer satisfaction with the process of buying a house. However, consumer research suggests that the most important steps of the home-buying process, such as mortgage application, research and plan the process and conveyance/closure of the process are also the least satisfying ones.

In conclusion, research identified 5 stages of the customer journey of buying a house. Overall, it was identified that customers are not familiarized with the process of buying a house which leads to uncertainty and delays. Leveraging AI technology and customer knowledge banks could help to improve the process by increasing the process transparency and making it more clear to the customer.

Artificial Intelligence Analysis

After the interviews were conducted, the retrieved data was adequately treated and analysed as described in the previous chapter. The data display that was created to explain the depth interviews of AI experts can be found in Appendix VIII.

Secondary data was also retrived and analysed to complement the interviews and thus validate and complement the results obtained. The research (interviews and secondary data) key findings can be found below.

Ultimately, by entering the housing ecosystem and implementing AI in the process, banks will continue to stay relevant in customers lives, maintain its profits with mortgage loans and increase their revenues in adjacent areas.

The figure below shows how the bank could enter the housing ecosystem, with the help of AI.

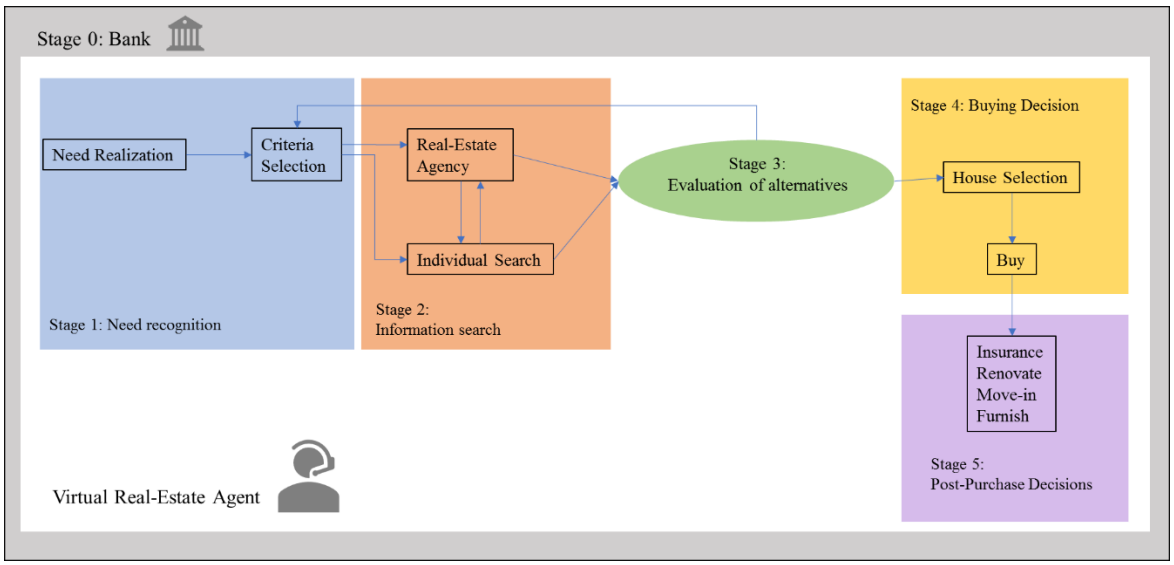

Figure 3 New Customer Journey of Buying a House

Stage 0: Bank

Contrarily to the Standard Journey, the Customer Journey of Buying a House starts at step 0, the bank.

As stated in the interviews, one of the problems with the standard journey of buying a house is the lack of transparency and sometimes unfamiliarity with the process and its costs. By entering the housing ecosystem in the start, banks can fully penetrate the journey, and with the help of a virtual real-estate agent (VREA) guide the customer through the whole process.

The recommended AI technologies at this stage are a virtual agent's technology to bring to life the VREA (like Siri and Alexa).

By using the VREA, the bank is not only guarantying that the process runs as smoothly as possible to the customer, but also that the customer completes its transaction successfully.

Stage 1: Need Recognition

At the first stage of the customer journey, the consumer recognises the need for a house and starts identifying its initial criteria for house selection. As stated before, consumers usually recognize the need for a house when growing their family starts to grow, by necessity to leave

the parents' house or other factors such as cultural aspects or market conditions (high rent prices)

At this stage it is recommended to use machine learning to help the customer identify the need for a house. Machine learning can use the customer data to identify the customer need and automatically begin the process of searching for a house and suggest it to the customer.

By implementing this technology, the bank can identify the customer need almost at the same time as the customer and introduce the process of buying a house as the need is recognized. This rapid introduction to the process can give the bank the advantage to contact the client before he has the chance to contact other banks giving it a first movers advantage. The bank can secure the customer in the beginning of the process preventing him to expanding his options and guarantee mortgage revenues.

Stage 2: Information search

At stage 2, customers start to look for houses that match their selected criteria. However, real-estate agencies and other companies, such as OLX, have access to a house repertoire that is bigger than the one most bank have. As said before, it is suggested that banks partner up with retailers and other companies, not only to share databases but also to create synergies in the housing journey.

The recommended AI technologies at this stage are machine learning and reinforced learning. Machine learning can help the bank filter housing data bases to present the customer with a set of houses that match their criteria selection, and reinforced learning can scan the customer financial life and guarantee that the houses presented are financially viable to the customer.

By using these algorithms, the bank can guarantee the customer that the options presented are financially viable and reduce the consumer searching time. As the options are all viable, the customer do not have to waist time approaching the bank to ask for a loan simulation. These algorithms will improve the process transparency and reduce the overall time of the house buying process.

Stage 3: Evaluation of alternatives

At this stage, customers are evaluating alternatives and may go back to the initial stage to reavalute critera.

At this stage it is recommended the use of artificial intelligence to help the customer evaluate housing alternatives. Machine learning can help the customer by analyse their options by

presenting to the customer the alternatives that best fit each one of the criteria previously selected. By doing so, the customer can better visualize his alternatives according to the variables he previously selected.

At this stage, by using machine learning, the bank is improving the customer experience and helping to alleviate the problem of revaluating criteria. By better visualizing the options for his criteria, the customer can identify the criteria that are not accurately selected.

Stage 4: Buying decision

According to the research made, customers are often inexperienced in the actual buying of a house. Customers often don´t know the total costs of the process and the bureaucracy behind the purchase of a house.

AI algorithms, such as deep learning can produce reports and do image and text processing. By doing so, this technology can help the customer scan important documents such as housing licences and technical papers and provide recommendations and warnings of extra expenses and illegal documentation.

At this stage banks can leverage AI algorithms, such as machine learning, to make predictions of the future demand for mortgage loans, which helps the bank to become more efficient in resource allocation.

The implementation of deep and machine learning in this stage, not only helps the bank to become more efficient in resource allocation, but also, by scanning customer documents, the bank, can identify problems areas for the customer, inform the customer and present solutions that will increase the customer experience and satisfaction and ultimately prevent customer churn.

Stage 5: Post-purchase decisions

At the last stage, the purchase has already been completed and the bank has access to the house specifications such as size, location, construction date, etc. Using this information, the bank can make recommendations for furniture, construction companies for renovations, companies to helping you move-in, and even Champagne recommendations for a welcoming party.

The AI technology recommended at this stage is reinforced learning. This algorithm can learn over time and improve its recommendations to become more adequate and specific. Once again, partnering with retailers would create synergies and provide more accurate recommendations to the customer.

By giving these recommendations to the client, the bank is increasing his revenues in adjacent areas such as insurance, and making sure that the customer keeps using the bank even when is locking for non-financial products and thus increasing its revenues.

In conclusion, the implementation of AI in the customer journey, can help the bank and the customer throughout most of the process.

Using VREA and other AI algorithms, the customer is guided through the process and provided with alternatives and recommendations for houses. The process becomes more transparent, personalised for customer needs and easy to navigate.

Ultimately, the implementation of AI allows the bank to identify the customer need at the same time as the customer, allowing to secure the customer in the beginning of the journey, to gain new revenues in mortgage loans and adjacent areas, improve customer satisfaction, improve the bank resource allocation and ultimately reduce customer churn by guaranteeing the completion of the process.

Chapter 5 – Conclusion

As it becomes more evident that the current business model of banks is not adequate to face new customer habits and changes in the competitive environment, banks are faced with the decision of how to face these challenges. This thesis proposes that banks should resort to artificial intelligence to improve the customer journey of buying a house and thus secure mortgage revenues and build new revenue streams in adjacent areas.

After conducting research, the customer journey of buying a house was outlined (Figure 2). The analysis of the customer journey led to conclude that overall, the buying of a house is a complicated and unfamiliar process. Because buying a house is a rare event in consumers lives, they often feel that banks and are not transparent when it comes to mortgage loans and the researching, planning and closing the process is an unsatisfying experience.

Followed by AI focused research, a new and enriched customer journey was drawn and complemented with new findings.

To face the lack of transparency of the journey, consumers often use a person specialized in the house buying market, the real-estate agent. However, in the new customer journey of buying a house, banks substitute the real-estate agent with a virtual agent that guides the consumer throughout the whole process. These VREA, assures the bank that the customer is smoothly guided through the process and the transaction is successfully completed.

In the standard journey, it was made clear that customers often have unrealistic expectations regarding their potential houses, as they do not have a clear vision of their own financial options. This unrealistic view often leads to process delays has the customer needs to revaluate their selection criteria. In the new journey these delays are prevent by AI, as the customer is only presented with housing options that are financially viable. At the selection of criteria stage, AI can help the customer to rapidly identify wrongly selected criteria.

Finally, when the process is completed, and the customer becomes a home owner and in the standard journey the role of the bank is over. However, the new journey proposes that banks continue their involvement with AI recommendations for complementary products for a house, such as furniture, moving companies and house insurance.

It was made clear in the previous chapters that AI needs data to run its algorithms. In fact, the more data, the better. Although banks have data about their clients and their financial lives, the bank databases regarding the housing industry are limited. To create a significant and consistent

data ecosystem, it is suggested that banks partner with retailers, real-estate agencies and technology companies such as Prop and FinTech's. Although banks might struggle with this idea, new regulations such as PSD2 and Open Banking are making the sharing of data a reality. It is no longer a question that banks will have to partner with other companies, the question now is with whom?

Further Research

In order to extend the exploratory analysis to other countries and regions, it is recommended that new in-depth interviews, ought to be conducted around the globe, to collect new insights and validate the data already obtained. Furthermore, it is suggested that, besides having a global scope, the interviews should extend to the banking and technology industries to broaden the spectrum of data collected.

It is also suggested, that conclusive research should be designed and run, which would allow the collection of new and quantitative data. Conclusive research would help banks to understand further the customer journey of buying a house at a global scale and would allow the identification of country-specific regulations and particularities of buying a home. Conclusive research will be essential before the implementation of AI in the customer journey of buying a home. This research would help the bank to measure the application of the technology in the bank's financial results and test its true viability for wide-scale deployment.

It is also recommended to explore the use of artificial intelligence, by banks, in the entire housing ecosystem, including renting, living and selling. Although this thesis focuses on the housing ecosystem, it can be argued that banks could enter other industries, such as transportation, retailing, telecommunications to expand their reach and relevance. Further studies are recommended in this area to analyse the involvement of banks in different industries and the application of AI in the respective sectors.

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Chapter 7 – Appendix

Appendix I – Moderator's Guide – House buyers

Initial questions

1. Name
2. Job
3. Age
4. Ask the participant to talk a little about themselves and his/her experience with buying a house.

Key Questions

Need recognition

1. Why did you decide to buy a house?
2. Was the decision of buying a house a conjoint decision or an individual one?

Information Search – Planning and searching, Developing Financial options

1. Where did you look for houses?
    a. Websites, e-to-e platforms like OLX, real estate agents, etc.
2. Did you use a real estate agent?
    a. Why?
    b. In what parts of the process did the agent help you with?
    c. What did you like and dislike when using a real estate agent?
3. How did the process of asking for a mortgage loan worked?
    a. Where you satisfied with the process?
    b. What would you improve?

Evaluation of Alternatives and buying decision

1. Ultimately why did you choose the house that you bought?
2. What were the factors that influenced your decision?
3. Would you repeat your purchase?
4. Ultimately why did you choose the mortgage that you chose?
5. Would you repeat your choice?
6. What were the factors that influenced your decision?
7. Who were the stakeholders involved in the processes?

Buying Decision – Get house insurance

1. How did you ensure your house?
2. Who were the stakeholders involved?

Post Purchase Behaviour – Move in, furnish and renovate

1. Did the house that you bought need remodelling? If Yes, how was that process?
2. How was the process of remodelling the house?

Overall were you satisfied with the process of buying a house? What would you change?

Appendix II – Depth-Interviews Data Display – House Buyers

Need recognition	Mrs Sara	Mr Fernando
1. Why did you decide to buy a house?	Because they wanted something that was theirs and they needed something that satisfied the needs of a growing family	1st - Because he wanted to live without his parents. He had left the military and wanted to live alone. 2nd – He needed a bigger and more practical house
2. Was the decision of buying a house a conjoint decision or an individual one?	A couple's decision	1st – Individual 2nd – A couple's decision
Information Search – Planning and searching, Developing Financial options		
1. Where did you look for houses?	Imovirtual platform and real state agencies platforms. The couple wanted a house near their parent's house.	1st - Word-of-mouth and personal contacts. At the time there was no internet. 2nd - Only Real-estate agents Currently uses the internet
2. Did you use a real estate agent?	Yes	1st – No 2nd - Yes
a. Why?	Because they could not find what they wanted	1st - Because at the time there were no intermediaries. 2nd - Because they had an idea of what they wanted, and real state agent was able to help.
b. In what parts of the process did the agent help you with?	He helped look for a house for the price we wanted.	House searching and negotiation
c. What did you like and dislike when using a real estate agent?	The first agency they used, the agent did not comply with our demands of price and location, which made us lose one year in looking for a house. The second agency was spectacular, in 15 days he found what we wanted and helped us negotiate the price and with the mortgage	He showed a house that satisfied our needs. The real-estate agent almost had no intervention. The wife was the one to mainly interact with the agent.
3. How did the process of asking for a mortgage loan worked?	It was a very complicated process. The couple contacted several banks, and	1st - He went to the only bank that had a mortgage loan and asked the credit. At the time, only one bank

	eventually, they needed the help of a company specialised in mortgage loans.	had a viable mortgage option. 2nd - He had good relations with the bank and wanted to mortgage with no insurance or other conditions and was able to get it.
a. Where you satisfied with the process?	No, they think that the banks are not explicit in respect to the costs of the whole process and how it develops. It was good to have the help of a financial company to help with all the bureaucracy.	Yes, both times.
b. What would you improve?	The banks should explain everything more directly and precisely. Revealing the costs of the process not in the day before the public deed, but at the beginning of the process.	Because both processes went well, he has nothing to add.
Evaluation of Alternatives and buying decision		
1. Ultimately why did you choose the house that you bought?	Because it was in the area that we wanted, for the price we wanted and in size, we wanted.	1st - Because it was a villa, with a garden and a sea view. 2nd - Because they were tired of stairs, wanted a balcony but no patio and no stairs
2. What were the factors that influenced your decision?	Price, area and house size. Only after those three where fulfiled, we evaluated the state of the house and the need for construction	Both times: Location, view and house size. According to him, the price was secondary as he only looked at houses in the price range.
3. Would you repeat your purchase?	Yes	Yes
4. Ultimately why did you choose the mortgage that you wanted?	It was the best proposal that we had. (the cheapest one)	1st- There was no other option. 2nd - The loan conditions (No insurance and interest).
5. Would you repeat your choice?	Yes, it is only difficult when the bank offers different proposals	2nd - Yes. 1st – Yes because he had no more options.

	depending on the part of the country that you live.	
6. What were the factors that influenced your decision?	Monthly fee, spread, years to pay, the percentage of the total amount received.	The ability to pay the mortgages.
7. Whom were the stakeholders involved in the processes?	Maxfinance, Predimed, Santander, Bpi	1st - Bank and collective 2nd - Agent, bank and seller
Buying Decision – Get house insurance		
1. How did you ensure your house?	It was part of the deal with the bank	He doesn't remember how the first one went. The second one he used a person that he knew to make the insurance.
2. Whom were the stakeholders involved?	Santander	Insurance mediator and himself
Post Purchase Behaviour – Move in, furnish and renovate		
1. Did the house that you bought need remodelling? If Yes, how was that process?	Yes, we remodel it ourselves.	Both times no
2. How was the process of remodelling the house?	Simple, we bought the material and did the work that needed to be done — the only part of the house that needed more constructions where the kitchen.	--
Overall were you satisfied with the process of buying a house? What would you change?	We were satisfied with the purchase, but the process was too long.	Yes, everything went fine, he wouldn't change anything.
Demographics		
Age	30	59
Marital status	Married	Married
When you bought the house	2016	1987/2000

Appendix III – Moderator's Guide – Real Estate Agents

Initial questions

1. Name
2. Job
3. Age
4. Ask the participant to talk a little about themselves and his/her experience with buying a house.

Key Questions

Need recognition

1. From your experience why do people usually buy houses?
2. Is it usually an individual decision or a conjoint one?
3. What are their needs and desires?
4. What is the level of information people have when they approach you? They already have a house, area, price in mind or they are entirely open to suggestions?

Information Search – Planning and searching, Developing Financial options

1. From your experience where do people look for houses?
    a. Websites, e-to-e platforms like OLX?
    b. Alternatively, do they only look for your help?
    a. Why do people use real-estate agents?
    b. Are people usually satisfied with the process?
    c. What is their biggest complain?
2. how did the process of asking for a mortgage loan worked?
    a. Where you satisfied with the process?
    b. What would you improve?

Evaluation of Alternatives and buying decision

1. Ultimately why do people choose the house that they bought?
2. What were the factors that influenced that decision?
3. From your experience would people repeat the purchase?
4. Ultimately why do people choose the mortgage that they chose?
5. From your experience would people repeat the purchase?

6. What were the factors that influenced that decision?
7. Who were the stakeholders involved in the processes?

Post Purchase Behaviour – Move in, furnish and renovate

1. Do people usually remodel houses?
2. Why?
3. What are the stakeholders involved in that decision?
4. How do people choose a contractor?

Overall what is people satisfaction level with the current buy a house process?

Appendix IV – Depth Interviews Data Display – Real Estate Agents

	Mrs Isabel	Mr Rui
Need recognition		
1. From your experience why do people usually buy houses?	It is a recent phenomenon before the 90's people did not buy houses — the interest in buying a home where too high. Before that, people stayed with the parents until they had enough money to ask for a loan. People only buy homes when it is cheaper to buy than to rent, so it depends on the moments.	It is a cultural aspect. The high price of renting a house combined with easiness on getting a mortgage loan helps people decide to buy.
2. Is it usually an individual decision or a conjoint one?	It depends, there are young people that when they can, they acquire it by themselves. However, their majority of houses are bought as a couple	More often I see couples' decisions. But single people also look for houses.
3. What are their needs and desires?	Independence, autonomy and creating a home for themselves	The cultural need of having something that is theirs.
4. What is the level of information people have when they approach you? They already have a house, area, price in mind or they are completely open to suggestions?	Usually, people have an idea of the area, size and price of the house. However, often people don't an idea of how much it costs a mortgage, and how much it costs to sustain a house. Sometimes people want something that is too expensive for them.	People have an idea of what they want, but most people are completely open to suggestions.
Information Search – Planning and searching, Developing Financial options		
1. From your experience where do people look for houses?		
a. Websites, e-to-e platforms like OLX?	Internet or agencies near their parent's houses or workplace.	Internet
b. Or do they only look for your help?		

2. Why do people use real-estate agents?	The use of a mediator is more helpful in big cities because is more difficult to look for houses.	The knowledge and safety that they transmit are key pieces for people.
a. Are people usually satisfied with the process?	It depends. Sometimes, big companies like Remax sell anything just because of the commissions. The client will only be satisfied if you really understand their needs.	From my experience, yes.
b. What is their biggest complain?	Clients often feel abandon by real estate agents. If the real estate agent is a good professional, and offer the client a good product, the client will be satisfied.	People sometimes feel a lack of commitment from the real estate agent.
Evaluation of Alternatives and buying decision		
1. Ultimately why do people choose the house that they bought?	Because they identify themselves with the solution presented. Sometimes a house doesn't even have all the features people are looking for, but people buy it anyway. However, location is the most valued feature.	Because the price and location fall within their desires.
2. What were the factors that influenced that decision?	Location	Price and location
3. From your experience would people repeat the purchase?	Mostly yes.	Yes
4. Ultimately why do people choose the mortgage that they chose?	There are not many options for mortgage loans. Spread, monthly fees and bank conditions.	Because it is the best solution for them
5. From your experience would people repeat the purchase?	Mostly yes, but some people regret the purchase.	Sometimes they regret it
7. Who were the stakeholders involved in the processes?	Buyer, Seller and notary	Buyer, Seller and notary
Buying Decision – Get house insurance		

1. How do people ensure houses?	Usually, people decide to ensure the house when they ask for the mortgage loan. It is all part	Either with the bank or with an insurance company
2. Who were the stakeholders involved?	Insurance/bank, Buyer	Insurance/bank, Buyer
Post Purchase Behaviour – Move in, furnish and renovate		
1. Do people usually remodel houses?	Yes, and the number of people that remodel their houses are increasing	Sometimes, but not always
2. Why?	Because they can. Usually, people want to build a home	If the houses need more amenities to suit their needs
4. How do people choose a contractor?	It depends on the budget	People look for people that they know
Overall what is people satisfaction level with the current buy a house process?	Overall people are satisfied. However, the most satisfied customers are the one that is able to express their needs.	Yes, extremely satisfied
What would you improve in the buy a house process?	The process should be more transparent and less deceiving for the client.	The training of real-estate agents
Demographics		
Age	60	42
How long have you been a real-estate agent?	22	17

Appendix V – Description of Participants

Mrs Sara is a thirty-year-old nurse that agreed to participate in this study as a home buyer. Sara, recently married, used to live in a small rented apartment with her husband, however, with the birth of their baby daughter, they felt the need for a bigger house, as Sara described it, a home for a growing family. Sara was chosen to be a participant on this study, as she as recent experience of buying a home.

Mr Fernando is a fifty-nine-year-old business owner that agreed to participate in this study as a home buyer. Fernando is an interesting participant in this study as he bought two houses resorting to mortgages loans. Both purchases were different. The first house Fernando bought, was as a single young man. While the second one bought many years later, with his wife, in addition, Fernando usually invests in the housing market by flipping[6] houses. Fernando was chosen to be a participant on this study, as he is an experienced home buyer.

Mrs Isabel is a sixty-year-old real-estate agent that agreed to participate in this study as an industry expert. Isabel is an interesting participant in this study as she began her career in a developing real-estate company as an administrative. In 1996, Isabel started her real-estate agency in Madeira and recently started working in Lisbon for Remax[7]. Currently, Isabel has her private real-estate developing company in Lisbon. Isabel was chosen to participate in this study because of her extensive knowledge in the housing market.

Mr Rui is a forty-two-year-old real-estate agent that agreed to participate in this study as an industry expert. Rui has seventeen years of experience as a real-estate agent and currently works in a small real-estate agency in Oeiras. Rui was chosen to participate in this study because of his extensive knowledge in the housing market.

Mr Bruno is a forty-year-old Artificial Intelligence Specialist. Bruno is the head of cognitive computing of a consultancy company. Mr Bruno has several years of experience working with artificial intelligence applied to the financial services, with a focus on mortgage loans and document analytics.

[6] Flipping houses is the term used to describe the purchasing of a house, to quickly sell it after remodeling.
[7] Remax worldwide leader in real estate brokerage

Mrs Catarina is a twenty-four-year-old Student of data science. Catarina works at a consultancy company in the financial services industry as a marketer and is currently doing a master thesis focused on using artificial intelligence to help banks deal with regulatory requirements.

Appendix VI – Interview Summaries

Need recognition

Both Mrs Sara and Mr Fernando had different needs when buying their first house. However, it can find that, when their families started growing, both felt the need for a bigger house. Although, when Mr Fernando was single, he bought a house for himself, when he started a family, the couple felt the need for more space. In both situations when the buying of the home was a family necessity, the decision was not an individual, but a couple's choice.

When the real-estate agents were asked about why do people usually buy houses, their answers were slightly different from the home-buyers. Although they recognise that people tend to look for homes when they start a family, the stated reason for people buying homes is the high prices of renting. As Mr Rui said, "buying a house is a cultural aspect", and the poor renting conditions combined with the easiness of getting a mortgage loan leads to people buying houses.

Both the real-estate agents agree that people feel the need of having something of their own, as Isabel said, "people want to build a nest". Nevertheless, when people start their search for houses, the size of the house seems to be an essential factor. People tend not to have an idea of the type of hose they can afford and the kind of costs involved when buying a house.

Information search – Planning and searching, Developing Financial Options

When participants were asked the where they first look for a house, the answers seemed to be consistent. Currently, the internet is the first resource for looking for a home. Although Mr, Fernando did not use the internet when he bought both his homes, he admits that more recently, when is looking for homes, he looks up on the internet.

Participants were also asked about the involvement of real-estate agents in the process. Both Mr Fernando and Mrs Sara used a real estate agent to help in the searching phase. Both had ideas of what they wanted, and a real-estate agent was able to search for them. Mrs Isabel and Mr Rui agree that most times people resort to real-estate agents because of their knowledge and expertise. The interviews with the real-estate agents confirm the data collected from the home-buyers that people use real-estate agents because of their experience and help provided in searching for a house.

Although Mr Fernando liked his experience with a real-estate agent, Mrs Sara had an unpleasant experience because the real-estate agent did not comply with the couple demands. However, once she changed real-estate agents, her experience was "spectacular". For the Industry experts,

Ms Rui and Mrs Isabel the main reason stated for dissatisfaction with real-estate agents, is the lack of commitment or abandonment that these sometimes show towards the client.

Regarding their experience with mortgage loans, only Mrs Sara and Mr Fernando where inquired, however, both stated to have very different backgrounds from one another. Mrs Sara believes that the process of applying and receiving a mortgage loan was very complicated and banks are not very explicit with the entire cost of the process. For her, the process was so confused, that she felt the need to get help from a specialised company. For Mrs Fernando, his experience, both times he obtained a mortgage loan was a pleasant one. For his first mortgage, Mrs Fernando went to the only bank that conceived viable mortgage loans. At the time, in Portugal, there was only one bank that conceived housing credit. Although he would have liked more options to choose from, he was happy with the experience. For his second mortgage, he contacted the bank with whom he worked regularly before, again, the experience went without problems.

When asked what would they improve in the mortgage loan process, only Mrs Sara had an opinion to give. She believes that the process should be more straightforward and more precisely explained to the customer, especially the entire cost of the process.

Evaluation of alternatives and buying decision

When participants were asked about how they chose the house that was eventually bought, the factors that influenced that decision are similar for all participants.

Both the home-buyers and the industry experts have consistently mentioned location as a factor that influenced the purchase decision. Although the price is significant (once you cannot buy something you cannot afford), location and size were also mentioned as important decision factors. Participants were also consistent when evaluating the decision of buying a house. Mr Fernando and Mrs Sara, both stated that regardless of the process they were happy with their purchase and would repeat it. From their experience, Mr Rui and Mrs Isabel also agree that most people would repeat their purchases.

When asked about the factors that influenced their decision, regarding the mortgage loan, both Mr Fernando and Mrs Sara had different opinions. While Mrs Sara looked for the cheapest option in the market, Mr Fernando looked for an opportunity that was cheap, and he was able to pay it, he also looked for a solution that had no additional costs, for example, Insurance obligations. Like the decision of purchasing a house, although there might have been some complications with the process, both participants would have repeated their choices.

Regarding the decision of a mortgage loan, both industry experts seemed to agree with each other. People choose the financial solution that is cheaper and with the best conditions (monthly payments, fees and spread), and although most people seemed satisfied with their choices, some people regret the mortgage loan that they got.

The stakeholders involved in the process of process of buying a house were described for all participants as being the Buyer, the Seller, the Bank (in case there is a mortgage loan) and the Notary.

Buying decision – get house insurance

When participants were asked about the decision of buying house insurance, the answers where consistent, with the exception for Mr Fernando, that preferred to look for insurance himself. Mrs Sara decided to get the insurance that was suggested by the bank, which is consistent with the experience of Mr Rui and Mrs Isabel. According to them, most people, when getting a mortgage, choose to accept the bank suggestion for house insurance.

Post Purchase Behaviour – move in, furnish and renovate

At the final stage of the questionnaire, participants were asked about house renovations.

Mr Fernando never renovated his own houses, and it had no experience in that area. However, Mrs Sara renovated her home but did not use a contractor. She decided to do the renovations with her husband.

In the topic of house renovations, Mr Rui and Mrs Isabel had different opinions. According to Mrs Isabel, house renovations are becoming more popular, and people tend to renovate a house ever they can. As Mrs Isabel has stated, "people like to keep modernistic", however, Mr Rui has a different experience. In his opinion, people only renovate when they need amenities, or the house does not suit their needs.

The opinion of how to look for a contractor is also different from one industry expert to another. While Mr Rui believes people tend to look for contractors among their acquaintances, Mrs Isabel trusts that that decision is budget related.

Finally, participants were asked about their satisfaction with the process of buying a house and were asked for suggestions for improvement. The answers obtained where all different from one another, and there is no consistency between home-buyers and industry experts.

Mrs Fernando believes that the process is fine as it is and wouldn't change anything. On the contrary, Mrs Sara thinks that the process is too long. Although she was satisfied with the

process overall, she would have appreciated if it would take less time. Mrs Isabel believes that the aspects to be improved are the transparency of the process. In her opinion, the process can be deceiving for the client. Lastly, Mr Rui points as an aspect of improvement of the training of real-estate agents.

Appendix VII – Moderator's Guide – AI Experts

Initial questions

1. Name
2. Job
3. Age
4. Ask the participant to talk a little about themselves and his/her experience with AI.

Key Questions

How can banks use AI to improve the home buying process in each one of these phases:

Need recognition, Information Search – Planning and searching, Developing Financial options, Evaluation of Alternatives and buying decision, Buying Decision – Get house insurance, Post Purchase Behaviour – Move in, furnish and renovate.

Appendix VIII – Depth Interviews Data Display – AI Experts

	Mrs Catarina	Mr Bruno
Need recognition	Use of big data to build a predictive model to identify customers that might have the need of buying a house. (Supervised learning)	Predictive algorithms (to identify potential customers).
Information Search – Planning and searching, Developing Financial options	Based on customer characteristics, recommendation of potential houses. (Supervised learning and deep learning)	Use of AI to recommend houses, mortgage loans and insurance to customers based on their previous choices or based on the customer data.
Evaluation of Alternatives and buying decision	More difficult to apply AI to this area. Helping with customer identify criteria factors.	Not Answered
Buying Decision – Get house insurance	Help the customer identify criteria.	Using predictive models, provide the customer with alternatives based on criteria, previously identified by the algorithm.
Post Purchase Behaviour – Move in, furnish and renovate	Use of AI to predict the customer future needs (furniture, insurance, etc..) and provide recommendations.	Recommendations based customer data.
Demographics		
Age	24	40
Job	Data Science Student and Marketer	Head of Cognitive Computing
Experience with AI	Currently doing a master thesis focused on using artificial intelligence to help banks deal with regulatory requirements	Applying artificial intelligence applied to the financial services, with a focus on mortgage loans and document analytics.