Modeliranje potražnje za digitalnim platformama za financijsko savjetovanje pristupom sistemske dinamike

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UNIVERSITY OF ZAGREB
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MASTER THESIS No. 528

DEMAND MODELING FOR ROBO ADVISORS USING A SYSTEM DYNAMICS APPROACH

Lovro Mutvar

Zagreb, June 2024

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MASTER THESIS ASSIGNMENT No. 528

Student:	**Lovro Mutvar (0036514164)**
Study:	Computing
Profile:	Data Science
Mentor:	prof. Zvonko Kostanjčar

Title:	**Demand modeling for robo advisors using a system dynamics approach**

Description:

As part of the thesis, it is necessary to analyze the applicability of system dynamics in modeling demand for digital platforms for financial advising. Digital platforms for financial advising, also known as robo-advisors, provide their users with financial advisory services and services for building and managing investment portfolios. First, it is necessary to review methods for assessing demand for digital products and compare them, highlighting the respective advantages and disadvantages. Then, it is necessary to select one method and use it to estimate the current demand for robo-advisors in the European Union. After that, it is necessary to develop a causal diagram and a corresponding system dynamics model that describes the diffusion of robo-advisors in the European Union. Based on the model, it is necessary to identify key factors for product diffusion, predict possible behavior patterns and trends in product adaptation, define acceptable behaviors, and develop necessary strategies to achieve acceptable behaviors.

Submission date: 28 June 2024

Zagreb, 4. ožujka 2024.

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Zadatak: **Modeliranje potražnje za digitalnim platformama za financijsko savjetovanje pristupom sistemske dinamike**

Opis zadatka:

U okviru diplomskog zadatka potrebno je analizirati primjenjivost sistemske dinamike u modeliranju potražnje za digitalnim platformama za financijsko savjetovanje. Digitalne platforme za financijsko savjetovanje, poznate još i kao robo-savjetnici, pružaju svojim korisnicima usluge financijskog savjetovanja te usluge izgradnje i upravljanja investicijskim portfeljem. Prvo je potrebno napraviti pregled metoda za procjenu potražnje za digitalnim proizvodima te ih međusobno usporediti, uz isticanje odgovarajućih prednosti i nedostataka. Zatim je potrebno odabrati jednu metodu i temeljem nje procijeniti trenutnu potražnju za robo-savjetnicima na području europske unije. Nakon toga je potrebno razviti kauzalni dijagram i odgovarajući model sistemske dinamike koji opisuje difuziju robo-savjetnika na području europske unije. Na temelju modela potrebno je utvrditi ključne faktore za difuziju proizvoda, predvidjeti moguće obrasce ponašanja i trendove u prilagodbi proizvoda, definirati prihvatljiva ponašanja te razviti potrebne strategije za dobivanje prihvatljivih ponašanja.

Rok za predaju rada: 28. lipnja 2024.

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Introduction

The financial advisory industry has experienced transformation in past decades, evolving from exclusive service, available only to wealthy investors, to more democratized and accessible platforms. Within this evolution, emerged Robo-advisory, which further revolutionized the industry. Robo-advisors advertise themselves as digital platforms that use advanced algorithms to offer personalized investment advice at lower cost compared to traditional advisors. These platforms offer a range of services including portfolio management, rebalancing, and tax optimization, traditionally provided by human advisors. The Robo-advisory trend began in the United States with the founding of companies like Betterment in 2008 and Wealthfront in 2011. Following the US market, the European market soon embraced Robo-advisors. However, adoption has been slower in Europe compared to the US.

We will begin this report by discussing what Robo-advisors are and how they work. Next, we will explain how the market evolved and conduct an analysis of the Robo-advisory market with a focus on the European market. We will explore the key drivers behind the adoption of Robo-advisors and identify the challenges and barriers that are slowing down their acceptance in Europe. Using this information, we will develop a model to explain the adoption of Robo-advisors. We will build a Causal Loop Diagram (CLD) that illustrates the adoption of Robo-advisors on the European market. CLD provides a deeper understanding of the market dynamics, illustrating how various factors influence the adoption of Robo-advisors and how they interact with each other. By understanding these dynamics, stakeholders of such platforms can better understand the opportunities and challenges that are present within the market.

1. Robo-Advisory

1.1. Evolution of Financial Advisory

The main goal of the financial advisory sector is to assist individuals and institutions in making informed investment decisions. Financial advisors offer a range of services, including investment planning, tax preparation, retirement planning, and estate planning, among others. Historically, personalized investment advice was a luxury accessible only to very wealthy investors due to the high fees associated with these services. However, the financial advisory market is changing and attracting more and more low-budget investors. [1].

This change was driven by various factors and events. During the 1950s and 1960s personal financial advice was a highly expensive service, focused on high net worth individuals as the only target customer. The 1970s experienced a significant shift with the appearance of discount brokers, who democratized access to financial services by offering reduced commission rates and execution services for trades without personalized advice. This democratized access to the stock market, as it was accessible to a broader public. Discount brokers acquired a significant amount of assets under management (AUM) since they emerged. In the 1990s, another significant change took place with the introduction of the World Wide Web, as the financial industry experienced a big transformation in connectivity and accessibility. The rise of the internet meant that online platforms made trading accessible to a wider range of investors, from wealthy individuals who used to trade with brokers to retail investors managing portfolios on their own. The conventional human dialog practiced by traditional investment advisors became less relevant with time for the wider retail investor base. As a result, traditional human advisors became less relevant for the average retail investor, continuing to serve mainly wealthy investors.

Advancements in technology, such as computers, smartphones, and tablets, along with accessible information, significantly lowered transaction costs. The emergence of algorithmic trading introduced fully automated investment options, creating new opportunities for potential investors. These platforms reduced the need for intermediaries, allowing individuals to manage their own portfolios with greater autonomy. In recent

years, technological advancements and the widespread adoption of digital tools, particularly among millennials, have driven a significant shift in individual investment behavior [2]. These developments create opportunities for new products, known as Robo-advisors, that aim to revolutionize the market by offering personalized advice and better user experience at a lower fee. They offer a range of services similar to traditional advisors, such as portfolio management, rebalancing, and tax optimization, but at a fraction of the cost. Paired with the advancements in technology, Robo-advisors have increasingly captured the spotlight in recent years, drawing greater attention to their potential in transforming the landscape of financial advisory services.

1.2. The Appearance of Robo-Advisors

Many people see investing as a difficult challenge, because of the complexity of the financial markets. As the number of investment options has increased over time, financial markets have gradually become more complex, especially for retail investors. Investors must understand a wide array of financial products, including stocks, bonds, ETFs, and even more sophisticated instruments like derivatives and cryptocurrencies. Many individuals from different generations find themselves struggling while navigating through financial markets. While younger generations might be more open to new technology, they often have very limited experience with financial markets. Older generations may face difficulties trying to keep up with all the trends and tech challenges. Additionally, many people lack fundamental financial literacy, which makes it even more difficult to save, invest, or plan for retirement. Generally, investors with lower level of financial education are more likely to make bad financial decisions. Moreover, as already mentioned, traditional financial advisors have historically been expensive, primarily due to high fees and substantial minimum investment requirements. As a result, many average investors have been excluded from accessing investment advice. Among these challenges, there arises a need for accessible assistance and advisory services at a reasonable cost.

Robo-advisors emerge as a solution in this challenging environment. Leveraging technology and algorithms, Robo-advisors offer automated investment platforms that provide personalized financial advice at lower cost compared to traditional advisors. By utilizing algorithms and sophisticated software, Robo-advisors can analyze investor's financial situation, risk tolerance, and goals to offer personalized investment strategies. Robo-advisors engage with clients digitally; a client creates an account on an online

platform by responding to different questions that usually include investment goals, risk preferences, assets, income and more. They use algorithms to recommend investment options that are considered suitable based on the client inputs. Such selections usually include exchange traded funds (ETFs) and low-cost mutual funds. Robo-advisors gather client information and preferences and allocate assets based on provided inputs, creating client portfolios. They also manage their clients' portfolios by rebalancing the portfolio periodically and reinvesting returns.

1.3. How Robo-advisors work

Robo-advisory has digitalized different phases of traditional financial advisory. It implements steps from traditional financial advisory in an entirely digital process. Illustration (Figure 1.1 Phases of Robo-advisory process) shows 3 phases of Robo-advisory process.
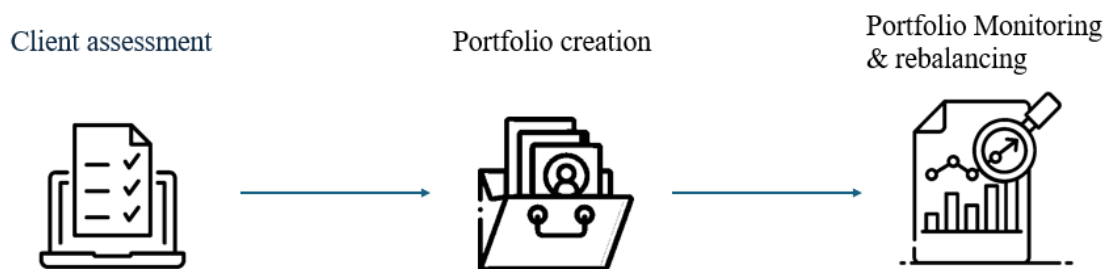

Figure 1.1 Phases of Robo-advisory process

The process starts with client registration on the platform. After a client performs registration, the first step is customer assessment. Here, clients undergo customer profiling, allowing the Robo-advisor to identify their investment needs and objectives accurately. Factors such as age, risk tolerance, and investment amount are evaluated. This information is gathered through an online questionnaire, and the answers are used to generate the prospective client's investor profile. This step is crucial for a personalized investment approach. Information gathered through such a questionnaire falls into 3 main categories. The first one is general information such as age, income, investment amount, source of income, spending and others. The second group of questions collect information about investment goals like time horizon, investment amount and end goal. The third category is

risk assessment where Robo advisor tries to assess investors risk preferences by gathering information about choosing portfolio risk level, dealing financial decisions, investment experience and self-assessment risk tolerance.

Online questionnaires differ across different Robo-advisors, both in terms of length and in terms of the questions. The EU framework (MiFID II) specifically requires financial advisors to also assess the financial literacy of their clients. First, an investment strategy is defined based on the client's risk tolerance and objectives. Once finalized, the Robo-advisor implements the defined strategy by selecting appropriate assets – portfolio creation. For a better understanding and user experience clients are often presented with a visual representation of their portfolio.

Finally, the portfolio rebalancing phase ensures the ongoing health of the client's investment portfolio. Continuous monitoring and periodic rebalancing are conducted to ensure that the portfolio remains optimal. Most Robo-advisors offer web or mobile applications where customers can check their portfolio performance. Such platforms usually offer various market information including different types of analytics and visualizations to improve customer experience and satisfaction. Robo-advisors use different communication methods to keep clients informed and engaged. This phase not only aims to maximize portfolio performance but also to share information with clients and focus on customer retention.

1.3.1. Robo-advisor's Investment Strategy

Robo-advisors use advanced algorithms and financial theories. They construct portfolios using different construction methods: Modern Portfolio Theory is one of the most popular techniques for portfolio optimization and asset allocation. Modern Portfolio Theory, developed by Harry Markowitz, aims to construct a portfolio that tries to maximize returns for a given level of risk through diversification. By using MPT, Robo-advisors create portfolios that balance risk and reward by selecting a mix of diversified assets based on client's responses to the questionnaire. The idea behind this strategy is a diversified portfolio, mostly constructed of exchange-traded funds (ETFs). ETFs are favored due to their low costs, tax efficiency, and liquidity. These funds often include many different asset classes such as equities, fixed incomes and sometimes commodities.

Based on client's inputs Robo-advisors choose portfolio from the efficient frontier. Once they selected portfolio from the efficient frontier, they choose ETFs to represent each asset class. When selecting ETFs for the portfolio, Robo-advisors typically follow a top-down approach, as illustrated on the image (Figure 1.2 ETFs Selection [3]) below. They start with a large number of available ETFs from which are excluded ETFs that are leveraged, or those that do not have a proper level of diversification or that provide niche coverage. Additionally, ETFs that have a short history or are not liquid enough are also excluded. Finally, ETFs that had poor performance relative to the market benchmarks are also removed. The final selection of available ETFs to invest in comes down to ~3-6% of all investable ETFs [3].
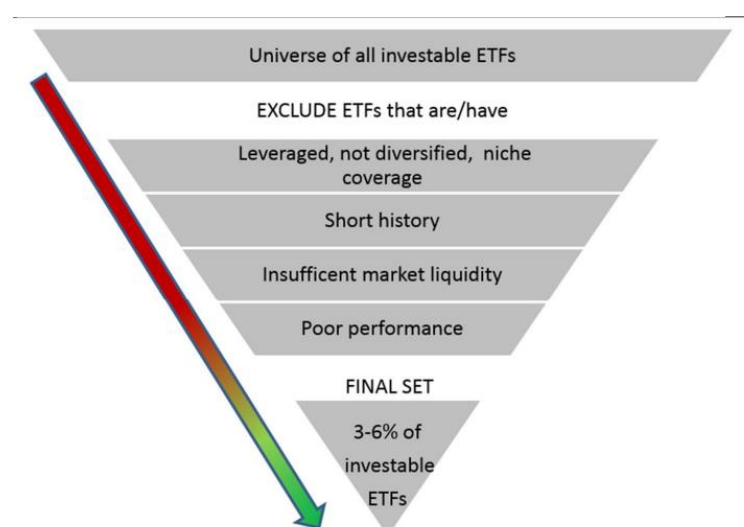
Figure 1.2 ETFs Selection [3]

The pie chart below (Figure 1.3 Robo-advisors Portfolio Selection [3]) illustrates the usage of exchange traded funds in robo-advice in Europe. Most of European Robo-advisory platforms use ETFs as a main investment instrument. Additionally, almost 60% of platforms base their portfolios exclusively on ETFs [3]. This situation is very similar in the United States, with most Robo-advisors focusing on ETFs for investing.
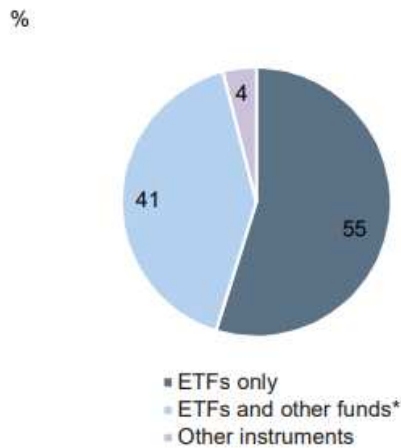
Figure 1.3 Robo-advisors Portfolio Selection [3]

It seems that, despite being marketed as personalized financial advisors that create portfolios based on client needs, Robo-advisors often provide limited customization. They tend to use a narrow selection of ETFs to construct client portfolios, resulting in a quite generic investment approach. This reliance on a small number of ETFs suggests that the level of personalization offered by Robo-advisors may be below what is advertised.

1.4. Competitive Landscape

Digital investment is any service that involves using online platforms and technology to buy and sell financial assets. This includes services like online brokerages, Robo-advisors, and mobile trading apps. According to Morningstar report [4], Robo-advisors occupy a niche between trading platforms on one side and traditional wealth managers on the other, as illustrated in the figure below (Figure 1.4 Robo-advisors Competitive Landscape [4]).

Brokerage platforms are software solutions used to support trading activities like buying or selling stocks. These platforms typically have easy-to-use interfaces, making them accessible to beginner investors. Many brokers offer these platforms for free or at a discount in exchange for maintaining accounts and executing a specified number of trades per month. Brokerage platforms primarily provide the tools for investors who want to trade on their own, and are not interested in recieving personalized investment advice.
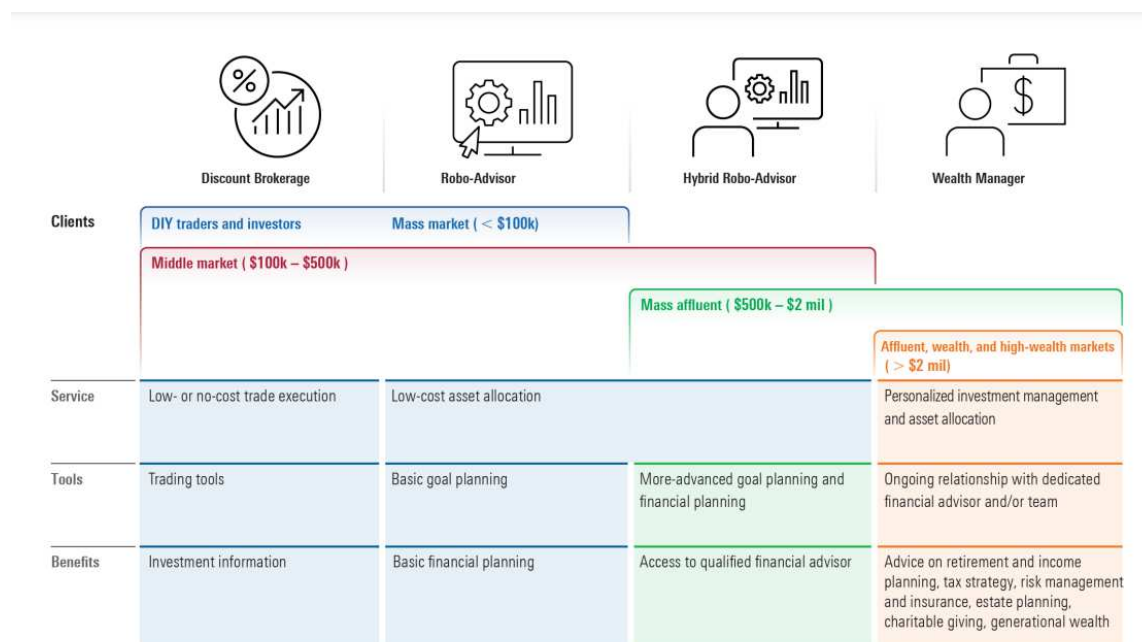
Figure 1.4 Robo-advisors Competitive Landscape [4]

Robo-advisors, in contrast, provide algorithmic portfolio construction and asset management. They use algorithms to construct and manage portfolios based on an investor's risk tolerance and financial goals. While they offer some level of portfolio customization, Robo-advisors charge a fee that is higher than discount brokerages but significantly lower than the fees charged by traditional wealth managers. This makes Robo-advisors an attractive option for investors who are looking for a balance between cost and professional management. Robo-advisors do not actually select products but generate portfolio suggestions based on client inputs and are typically limited to ETFs or index funds. Current Robo-advisors do not advise in the traditional sense, as they cannot provide detailed explanations or respond to client questions. Although some are designed to educate clients about portfolio properties, they still lack effective communication and personalized interaction.

On the other end of the spectrum, traditional wealth managers offer highly customized investment management. They typically meet with clients regularly, at least once or twice a year, and are available for calls to provide additional advice on key investment decisions or offer any kind of support. This high-touch service comes with a higher cost, as traditional wealth managers charge higher management fees and often require high minimum investments. These advisors build relationships with their clients, providing financial plans and strategies based on individual goals. The main drawback of traditional wealth managers is their high management fees together with the minimum investment

required, which can be a barrier for many investors. This is where digital investment advice, such as that provided by Robo-advisors, becomes attractive.

Robo-advisors offer a more affordable and accessible alternative for investors, particularly those with smaller account balances who might not meet the requirements of traditional wealth managers. Furthermore, other research [5] indicates that human advisors struggle to customize portfolios to client preferences, often introducing their own biases. However, pure Robo-advisors typically lack human touch and depend on client willingness to engage with new technologies. Although the growing number of investors in Robo-advisors indicates demand for this service, early adopters might not represent a broader market trend. Research shows that many people experience algorithm aversion, preferring humans over algorithms and abandoning algorithms quickly after errors. In investing, where mistakes are inevitable, this aversion could lead to only temporary usage of Robo-advisors. Given the challenges and strengths of both Robo-advisors and traditional wealth managers, a hybrid approach that combines the two might be best solution. Hybrid Robo-advisors leverage the benefits of technology and algorithms while maintaining the human touch and support. This model addresses algorithm aversion by offering human support, thus improving client confidence and retention. A hybrid model with traditional advisor and Robo-advisors working together, as already implemented by some financial institutions, might be the future of financial advisory.

2. European Robo-Advisory Market

2.1. Global Market History & Evolution

The concept of using computer algorithms to make investment decisions started in the early 2000s, driven by advancements in technology, data analytics, and quantitative finance. One of the first examples of automated investment platforms was the introduction of "black-box" trading systems by hedge funds and institutional investors [4]. These systems used complex algorithms to execute trades based on predefined rules and parameters. However, the idea of Robo-advisory as a retail investment service began to gain popularity only after the 2008 financial crisis. The crisis exposed distrust in the traditional financial industry, leading to a rise in demand for transparent, low-cost investment solutions. After the mentioned financial crisis, a new wave of financial technology (fintech) startups emerged. Robo-advisors evolved from two main trends in the early 2010s.

First, there was a rapid expansion of online, self-directed brokerages from companies like E-Trade and Charles Schwab. Second, financial startups leveraged the distrust in traditional asset management institutions caused by the global financial crisis in 2008. The first Robo-advisory platforms were companies Betterment and Wealthfront, founded in 2008 and 2011. During this initial phase, the main challenge was acquiring and retaining clients, especially for standalone startups. To attract more investors, many providers began to offer portfolios primarily composed of low-cost exchange-traded funds (ETFs).

As the industry evolved, traditional financial institutions began integrating and acquiring digital advice tools into their existing services. Banks, brokerage firms, and asset managers recognized the potential of Robo-advisory technology to enhance client engagement, streamline operations, and capture a larger market share. For example, Vanguard introduced Vanguard Personal Advisor Services, Charles Schwab launched Schwab Intelligent Portfolios, and Fidelity developed Fidelity Go [4]. These established institutions leveraged their resources and reputations to successfully enter the Robo-advisory market, combining automated investment management with their traditional financial advisory services.

As the Robo-advisory industry evolved, so did the sophistication of the platforms and the range of different services that they offer. Robo-advisors began to provide a broader range of financial services beyond just basic portfolio management, attracting broader audiences and increasing its assets under management (AUM). AUM of Robo-advisors continued to grow through 2023, but new start-ups are rare, most of the largest players are well established traditional financial institutions that added Robo-advisor services over the last decade, like Vanguard, Schwab, Wells Fargo and Fidelity.

This market consolidation indicates that the Robo-advisory industry is maturing, however it still holds substantial potential. Venture capitalists and other investors recognized great potential for Robo-advisors; for example, in 2015 venture capitalists in the US invested around $300 million in the business, believing in their potential [1]. Moreover, some forecasts even expected Robo-advisory adding up to around 10% of the whole wealth management industry in 2020 [1]. However, in 2023 it amounted to less than 1% of whole industry [6]. Additionally, only the largest Robo-advisors have reached the necessary scale to break even, with an estimated AUM of at least $10 billion required to cover fixed implementation costs (International Banker, 2019). This means that many Robo-advisors are still not profitable, which highlights both challenges and opportunities in this market.

Therefore, the market is still relatively immature and despite these challenges, the demand for automated financial services continues to rise, driven by a preference for low-cost, efficient investment solutions among younger investors. The integration of advanced technologies such as machine learning and AI is expected to improve the capabilities of Robo-advisors, enabling more sophisticated asset selection and personalized financial planning.

2.1.1. Current Landscape and Market Size

The global assets under management (AUM) of the Robo-advisors witnessed exponential growth rates in recent years. The AUM of Robo-advisory was around €1,7 trillion in 2023 and is estimated to grow to around €2,1 trillion by 2027, with the cumulative annual growth rate (CAGR) of 8,3% according to Statista report [7]. However, the market underachieved its growth projections which predicted AUM of roughly €6.5 trillion in 2024. Despite a slowdown in the expected growth AUM worldwide, the trend is still positive, and the number of clients using Robo-advisory services is still growing. In 2023, the number of customers of Robo-advisors reached 31 million worldwide according to

Statista, and the number of users is projected to grow up to almost 33 million in 2024 (Figure 2.1 Robo-advisory: Number of Users [7]. In terms of average assets under management per user, it is anticipated to be around € 51k in the year 2024.
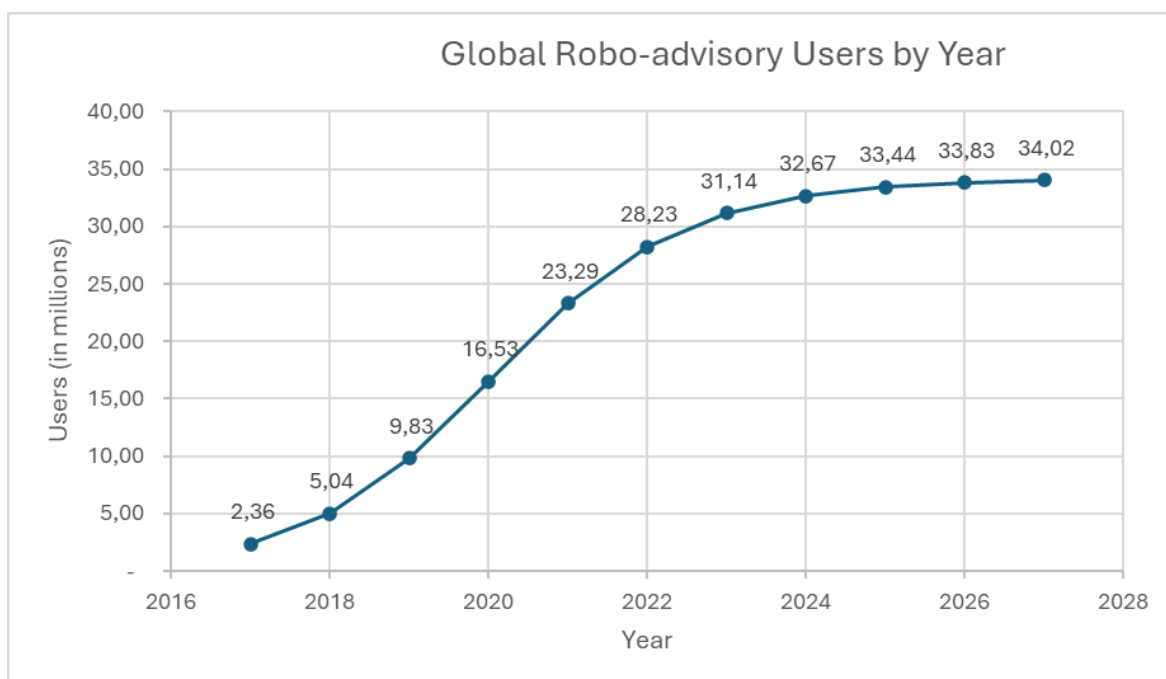

Figure 2.1 Robo-advisory: Number of Users [7]

Despite this impressive growth, Robo-advisory still represents a relatively small fraction of the overall financial markets, accounting for less than 1% of total AUM worldwide. Market penetration is not especially high either, considering that in most countries the percentage of people using a Robo-advisor is below 1% [8]. Nevertheless, the segment has grown strongly and while the absolute figures for Robo-advisory AUM seem insignificant compared to overall capital markets, between 2016 and 2020 the global Robo-advisory AUM experienced an average annual growth of around 50%. In the same period, the global equity markets have only grown about 8% per annum.

The rise of Robo-advisors in the fintech market has attracted the interest of traditional financial institutions. There is a trend of established financial institutions acquiring or partnering with the Robo-advisory platforms. While the reduced independence might lead to service improvements due to the resources of such institutions, it could also heighten the risk of conflicts of interest.

According to Statista, the United States leads the market by a significant margin, contributing the global AUM with more than € 1,3 trillion in 2024, with established players like Betterment, Wealthfront and Vanguard Personal Advisor taking biggest market shares.

The US is known for its mature and developed financial services industry, with a high level of technological advancement. For that reason, it is not a surprise that they are a strong market leader. Furthermore, America has a strong ecosystem of fintech startups, venture capital funding and supportive infrastructure, which contributes significantly to the development of such platforms. This infrastructure encourages development and scalability of Robo-advisors compared to Europe and the rest of the world. Another important aspect is regulation, Americans are generally more open to innovation and risk, while European regulatory frameworks is less agile and usually puts investors protection in the first place. All mentioned contributed to adoption and growth of Robo-advisory market in US. While Europe may be slower in terms of Robo-advisory adoption, the continent is witnessing a constant acceleration in the adoption of services. With several countries emerging as key players in the Robo advisory landscape, like UK, Germany, France, Spain and Italy.

2.2   European Market History & Evolution

Europeans are generally more risk-averse compared to Americans, which significantly impacts the growth and maturity of the Robo-advisory market in Europe. This preference for financial security and stability results in many Europeans keeping their money in deposits rather than investing in riskier assets. Cultural and historical factors have developed a cautious and risk averse approach to money management. This contrasts sharply with the U.S., where there is a cultural tendency towards risk-taking and investing in the stock market. The European regulatory environment, which is more consumer-protective than in the U.S., further reinforces this conservative mindset. Traditional banking products, such as savings accounts, are viewed as more trustworthy and reliable, discouraging many Europeans from choosing riskier investment opportunities.

In Europe, Robo-advisors appeared in the UK and Germany around 2013. Initially emerging in the United Kingdom and Germany, Robo-advisors entered the financial industry market at a time when digitalization was rapidly transforming the way people manage their finances. In the early years, the first Robo-advisory platforms such as Nutmeg and Scalable Capital captured the attention of investors by offering low-cost investment solutions with minimal human intervention. The emergence of Robo-advisors was recognized by traditional financial institutions. Established banks and asset management firms began to offer their own Robo-advisory services or formed partnerships with existing fintech startups to leverage their technological expertise. For example, in

2016, Deutsche Bank launched ROBIN, a Robo-advisory platform aimed at retail investors in Germany, signaling a shift towards digital innovation within the banking sector [9]. Even large global players saw the potential in the European market; in 2021, JP Morgan acquired Nutmeg, one of the key players in Europe. The European Robo-advisory market is slowly but surely developing, driven by increasing digitalization and the growing acceptance of automated financial services. In the next chapter, we will further analyze the European market landscape and its size in assets under management.

2.2.1 Current Landscape and Market Size

The European market remains smaller compared to the US and China. According to Statista report [10] the European Robo-advisor market represents a growing but relatively small share of the overall market, with its AUM of around €130 billion in 2024. The figure (Figure 2.2 European Robo-advisory: AUM by Year [10]) represents the historical and projected growth of the Robo-advisory market in terms of assets under management (AUM) in billion EUR from 2017 to 2028. The graph shows a clear exponential growth trend in the Robo-advisory market. In 2017, the AUM was around €0.5 billion, and it is projected to grow to over €170 billion by 2028.
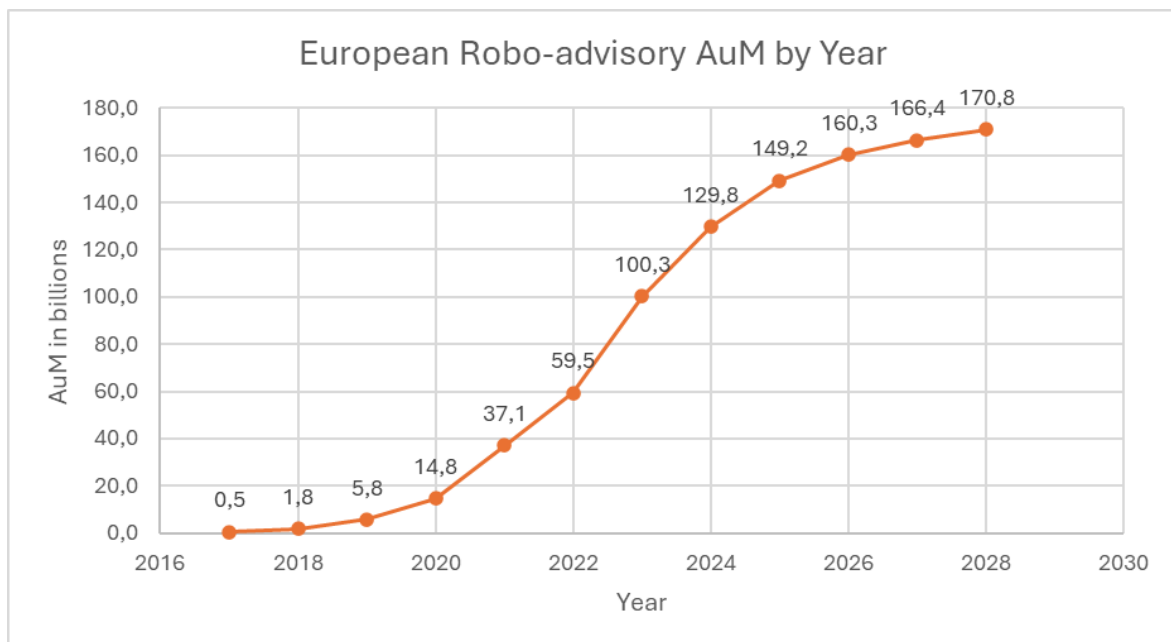

Figure 2.2 European Robo-advisory: AUM by Year [10]

From the graph, we can conclude that while the assets under management (AUM) by Robo-advisors are projected to continue growing, the rate of growth is expected to slow down over the coming years. However, this is just according to the Statista report [10] and

considering that the European market is still maturing, it is very difficult to predict future growth accurately. The number of European investors using Robo-advisors in 2024 is expected to be around 1.8 million in 2024 and is projected to rise to almost 2 million by 2027. In terms of average assets under management per user, it is anticipated to be around €60k in the year 2024. Interestingly, this is higher compared to the US, however in the US a significantly larger number of investors use Robo-advisory services. Graph (Figure 2.3 European Robo-advisory: Users by Year [10]) illustrates how the number of users changed over time. In 2024 it is estimated that in Europe around 1,8 million people use Robo-advisors.
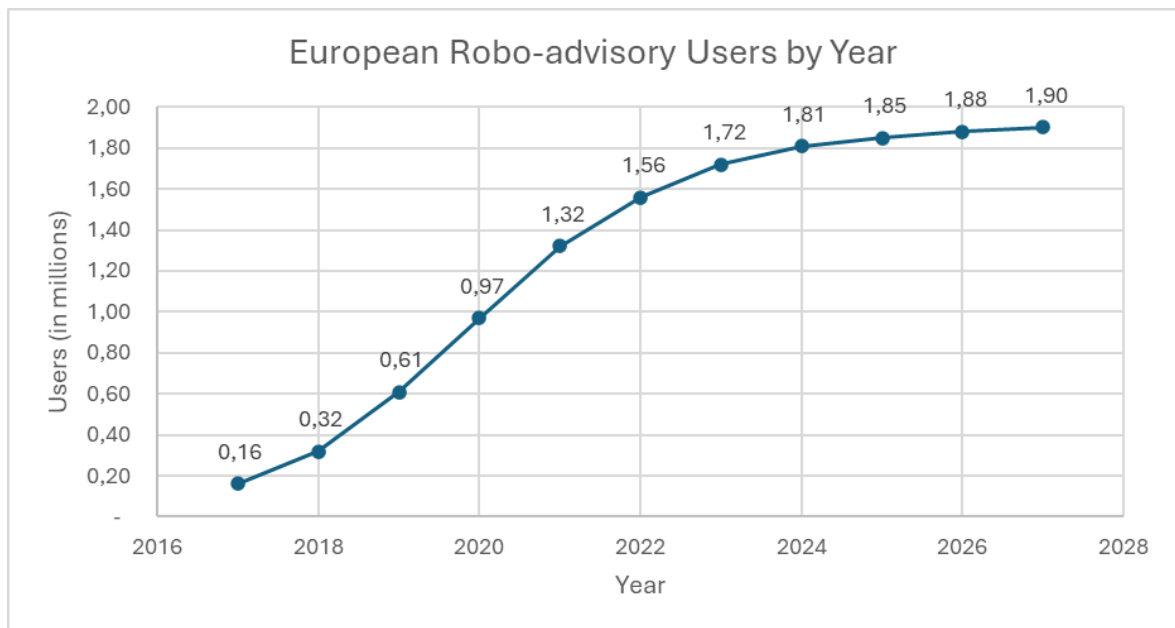

Figure 2.3 European Robo-advisory: Users by Year [10]

The European Robo-advisory market growth was mostly driven by retail investors. Typical clients of Robo-advisors do not invest much money. For example, in 2020 the average investment in Robo-advisors was €4,749, which is significantly lower than the average investment with traditional advisory [11]. However, the global average is even slightly lower at around €4,000.

The initial adopters of Robo-advisory services were mostly millennials, aged 24 to 35, who are quick to adopt new technologies and prefer self-service approaches [3]. Although 50-60% of clients were millennials in the early stages of Robo-advisory, this demographic has been shifting in recent years [3].. In the US, the average Robo-advisory client is now in their mid-40s, with account balances often reaching six digits, indicating a broadening client base that includes older and wealthier investors. In Germany, for example, Robo-

advisory clients are estimated to be around 40 years old, with a monthly salary of approximately EUR 4,000 and are typically university graduates [3]. In Italy, male clients outnumber female clients, and those with higher education levels and greater financial literacy are more likely to use Robo-advisory services. This trend is similar in other European countries, highlighting the importance of education and financial literacy in the adoption of Robo-advisory services.

The table [11] on the right provides a detailed breakdown of the Robo-advisory market size in Europe, measured in assets under management (AUM) in billion euros, split by country. It is important to note that these numbers are derived from Statista, a widely used source for market statistics. However, because the Robo-advisory market is still relatively immature, it is very challenging to estimate the AUM accurately and there can be some discrepancies in the reported numbers. Despite these potential conflicts, most available reports about Robo-advisory market use Statista as a primary source of information.

Country	AuM (in billion euros)
UK	27,14
Italy	23,58
France	20,41
Germany	18,59
Netherlands	10,41
Spain	7,87
Belgium	4,87
Sweden	3,96
Switzerland	3,42
Denmark	2,6
Poland	2,36
Finland	2,22
Ireland	1,45
Austria	1,20
Portugal	1,17
Czechia	0,79
Bulgaria	0,77
Greece	0,60
Hungary	0,40
Slovakia	0,32
Croatia	0,30
Luxembourg	0,28
Lithuania	0,25
Slovenia	0,25
Estonia	0,22
Latvia	0,20

The **UK** leads the European Robo-advisory market with an AUM of €27.14 billion. As a major financial hub with a strong economy, it's no surprise that the UK is the market leader in adoption of Robo-advisory services. This maturity is due to factors like higher digital and financial literacy, a strong fintech ecosystem, and a developed economy. However, considering the country's sophisticated financial sector, these numbers remain relatively insignificant. The UK financial advice market features over 27,000 regulated professionals and 5,000 companies advising on retail investments and pensions [12]. Traditional advisory dominates the market, accounting for over 90% of revenue, and primarily targeting wealthier clients. The average advised customer has over £150,000 in assets under advice. However, Robo-advisors target customers who cannot afford traditional financial advisors. Interestingly, research [12] from 2020 found that 54% of UK adults with £10,000 or more of investible assets, did not receive any formal support to help them make investment decisions in the last year. Of course, not all of these customers need or want support, some of them are not even aware they could benefit from financial advice, but this illustrates the potential market for Robo-advisors. However, in a survey [13]

carried out by FCA economists, 1,800 respondents were presented with investment advice offered by a Robo-adviser and were asked whether they would recommend accepting or rejecting the advice. Almost 60% of respondents rejected the advice from Robo-advisor. Key players in the UK Robo-advisory market are Nutmeg, Moneybox, Moneyfarm and Third Financial.

Germany is one of the key players on European Robo-advisory market, contributing with AUM of around €18.6 billion. Germany's strong and developed economy together with large population made it one of the leaders of the industry in Europe. Despite this, Germans are not typically known for directly investing in capital markets, preferring to keep a significant portion of their savings in deposit accounts. In 2018, Germans saved about 11% of their disposable income, one of the highest saving rates in Europe, compared to the euro area average of 5% and the UK's rate of less than 1% [14]. In 2019, retail deposits in Germany reached €2.3 trillion. Nevertheless, the era of zero interest rates in recent years has posed considerable challenges for many Germans in their investment and saving strategies. This presents an opportunity for Robo-advisors to capture a share of that market. However, Germans have shown relatively little interest in passive investment alternatives. Despite retail clients holding around €633 bn in mutual funds, only a small portion is held in ETFs, €30-35 bn. Moreover, additional research found that out of the 2,000 respondents, 60% said they could not imagine investing money digitally on the recommendation of a Robo-advisor, and only 1.1% had used a Robo-advisor in the past. Germany's strong savings rate and significant retail deposits present a big opportunity for Robo-advisors, but there are some considerable challenges due to the population's traditional investment habits and conservative approach towards digital investment platforms.

Italy one of the main players on European Robo-advisory market contributing with AUM of around €23,5 billion. This is particularly interesting given that Italy lags in adopting technology and in developing its fintech industry. Eurostat data showed that in 2017 only 30% of Italians used internet banking, against 51% of the European average. Moreover, when it comes to financial literacy, Italian fall significantly behind, with only 37% of adults being financially literate compared to 66% in Germany reported by PwC survey [15]. However, even with all these challenges almost 61% of millennials (18 to 34 years old) in Italy are likely to consider Robo-advisor as an Asset Management solution, compared to the 51% of clients aged between 35 and 50 and 24% between 51 and 71 years

old [16]. What is also surprising, according to the same report, 70% of surveyed high net worth individuals are open to try Robo-advisors against the 37% of mass affluent.

Despite the European Robo-advisory market reaching a size of around €130 billion, it remains significantly smaller compared to around €1,3 trillion in America. Around one-third of European Robo-advisors originate from the UK and another third from Germany. This implies that Robo-advisors in Europe are relatively small, and that some consolidation can be expected. The European Robo-advisory market has potential to grow but faces challenges in achieving wider adoption. While Robo-advisory shows great potential, there are still challenges like traditional preferences, distrust in Robo-advice and low level of financial literacy. The future success of Robo-advisors will depend on how effectively they address these barriers.

In the next chapter we will focus on discussing drivers and the challenges that contributed to the adoption of Robo-advisory in more detail. The focus will be on the European market, however because the market is relatively new, it is sometimes difficult to find relevant information about the European market. For that reason, in some cases, we need to rely on global or US data. We will cover the challenges that caused such disparity between European and US markets and finally we will discuss the key opportunities that emerge within such a market.

2.3 Market Drivers

Cost efficiency: European Robo-advisors typically charge fees ranging between 0.48% in the UK and 0.51% in the EU to 1.5%, which is lower than the fees associated with traditional retail investment distributors, often exceeding 1% and sometimes even rising above 2% [11]. This considerable difference in fees compared to traditional advisors highlights the cost-effectiveness of Robo-advisors, particularly considering the impact that higher fees have on investment returns. The cost-efficiency gains provided by Robo-advisors make them an attractive option. Better Finance report [11] highlights that because most Robo-advisors use passive management strategies, mostly based on ETFs, an investor could benefit more from automated advice after fees and inflation are deducted, compared to actively managed fund.

Low entry barrier: Another important advantage is the low minimum entry investment required by most European Robo-advisors. For instance, Scalable Capital, previously

mentioned, has a minimum investment of just €20 (monthly), while Whitebox, a German Robo-advisor, requires only €25 to get started. Some less popular platforms have even lower entry barriers, like €1, to attract clients. This low barrier to entry is a significant advantage in the European market, where many potential investors are hesitant to commit large sums of money due to their risk-averse nature. By offering such accessible entry points, Robo-advisors can attract a broader audience, including younger and less wealthy individuals who might otherwise be excluded from traditional financial advisory opportunities. For example, in 2016, almost 50% of the financial advisors in the UK rejected clients due to the small size of their investments. Furthermore, around 30-50% of consumers would like to use financial advisor if it was more affordable.

Performance: Probably the most important factor that clients consider when investing is portfolio performance. In order to justify higher costs, traditional financial advisors need to achieve higher excess returns compared to Robo-advisors. Line graph (Figure 2.4 Actively managed fund vs ETF [3]) below compares the performance of actively managed funds and passive investment alternatives in the US. All long-term mutual funds and EFTs are included, and all return all post-fees. It is easy to see that between 2006 and 2017 actively managed funds struggled to outperform ETFs, apart from 2007 and 2009 when they performed significantly better.
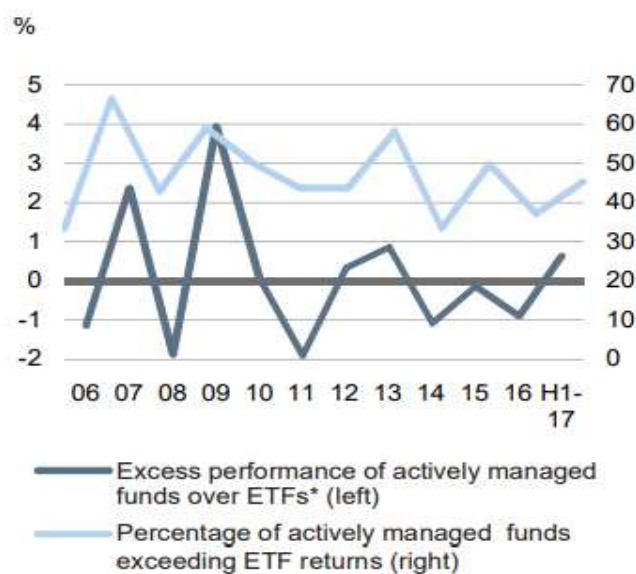

Figure 2.4 Actively managed fund vs ETF [3]

Unfortunately, we were not able to find such an illustration for the European actively managed funds and ETFs. However, an interesting report from the European Financial

Conduct Authority [17] states that, on average, active equity funds perform worse compared to their benchmarks in terms of net returns. In 2019 ESMA, in its Annual Statistical Report on Cost and Performance, observed that actively managed equity funds on average underperform passive equity funds with high heterogeneity across EU national markets [18]. This suggests that higher fees do not necessarily result in higher returns. In fact, some Robo-advisors may offer higher net returns despite lower fees.

We do not have a direct comparison for Robo-advisory performance. However, since Robo-advisors primarily invest in ETFs, the comparison between actively managed funds and ETFs provides a relevant benchmark. Performance is an important factor that Robo-advisors need to drive to stay competitive and attractive. However, for investors to fully understand and recognize the benefits of Robo-advisory services, financial literacy and awareness are essential. Educated investors are more likely to make informed decisions and recognize the potential of automated, low-cost investment solutions.

Accessibility and practicality: The advantages of diversification and personalization offered by Robo-advisors become particularly attractive when paired with the accessibility and practicality they provide. User experience should play an important role in the adoption of Robo-advisory services. Setting up an account can be accomplished within 15 minutes, so there is no need to arrange meetings with advisors together with paperwork and administrative processes. Clients can upload relevant documents online and can start investing straight away. With just an internet connection, investors can manage their portfolios anytime, anywhere through mobile applications. Given that many Europeans traditionally keep their savings in bank accounts, Robo-advisors offer a highly practical and time-saving alternative.

Non-conflicted advice: Conflicts of interest in financial advisory services are common whenever investment advisors receive incentives from other firms to recommend specific financial products to clients. Under EU law, such practices are categorized as "non-independent" advice and are considered to potentially interfere with the obligation to advise in the client's best interests. Since 2014, advisors based in the UK and Netherlands advising retail clients are prohibited from receiving incentives for their advisory services from anyone other than the client. However, unlike the UK and Netherlands, the EU has not completely banned the receipt of incentives by investment advisors. The business models of most Robo-advisors usually do not involve incentives. Therefore, most Robo-advisors can be considered to deliver independent investment advice, thus eliminating the

issue of conflicts of interest. Knowing that Robo-advisors typically do not rely on incentives from investment firms, European investors can trust that the advice they receive is unbiased and tailored to their financial goals. Trust is possibly the most important variable impacting clients when choosing their financial advisor. However, in order to be aware of this, investors need to have a relatively high level of financial literacy and awareness.

2.4 Market Challenges & Barriers

Tradition & Risk aversion: One of the primary reasons why Robo-advisors have not gained widespread popularity in Europe is the low participation rate of households in capital markets. Many Europeans prefer to manage their savings through traditional bank deposits rather than investing in stocks or bonds. This trend is largely driven by a high level of risk aversion among retail investors and a strong reliance on pay-as-you-go pension systems. This results in bank deposits (41%) and insurance and pension fund reserves (39%) taking considerable shares of financial assets [14]. Despite the substantial size of Europe's asset management industry, estimated at €23 trillion in 2016, the client base primarily consists of institutional investors and high net-worth individuals. However, this indicates that the broader retail market remains largely untapped, presenting a significant opportunity for Robo-advisors. As more European households begin to explore investment options beyond traditional bank deposits, the demand for accessible, low-cost, and efficient investment management services is likely to increase. It is worth noting that passive investment funds like ETFs on their own are significantly less popular in Europe compared to the US. Even though European ETFs' AUM experienced significant growth, rising more than 5 times between 2009 and 2019 [3], the absolute size of AUM is considerably smaller compared to US. This is partly because ETFs arrived in Europe much later than in the US. However, the main reason is likely the limited participation of retail investors in Europe. Industry estimates indicate that retail investors hold about 45% of ETFs in the US, while in Europe, they hold only about 15% [3].

High cost compared to other markets: Another important aspect is cost. As we already mentioned European Robo-advisors typically charge fees ranging between 0.48% in the UK and 0.51% in the EU to 1.56%, which is lower compared to traditional advisors. However, it is worth noting that European Robo-advisors generally charge higher fees compared to other markets, such as the US, Australia, and Singapore, where fees range

from 0.36% to 1.03% [11]. Another report estimates that European Robo-advisors charge 0.8% on average, while US Robo-advisors charge 0.4% on average. One reason is that size matters to cover fixed cost and many European Robo-advisors are still in start-up mode. Another reason are higher fees for traditional asset management services in Europe compared to US. As the Better Finance report [19] stated, a slow decline in overall fees charged by Robo-advisors is still observed over time. A further decrease in fees could potentially lead to greater demand for Robo-advisory services in Europe, as lower costs would make these services even more attractive to investors.

Lack of human interaction: While some investors appreciate the convenience of digital platforms, many prefer the personalized advice and human touch offered by traditional financial advisors, particularly when dealing with complex financial situations or emotional decisions. Especially in wealth management, where traditionally high net worth clients are present, personal contact seems to be more important. Studies indicate that only a small number of investors prefer managing their financial decisions entirely online. According to Phoenix Marketing and Cerulli Associates [20], just 5% of respondents showed a preference for online-only advisors. Additionally, a Vanguard survey [21] revealed that over 90% of clients with human advisors would not consider switching to a digital advisor, whereas 88% of clients using a Robo-advisor would consider moving to a human advisor. It's evident that people generally place greater trust in human financial advisors, even if it means paying higher fees and potentially experiencing lower average net returns. Trust is obviously a crucial factor for stakeholders in the Robo-advisory sector to consider, as gaining trust is essential for widespread adoption. One potential solution to bridge this gap is the adoption of hybrid models, which combine automated investment management with human support. Hybrid models can offer the best of both worlds, providing the convenience and cost-effectiveness of Robo-advisors while also offering personalized advice and reassurance from human advisors when needed. As the financial advisory evolves, hybrid models may become very important in attracting a broader client base and establishing long-term relationships built on trust and reliability.

Limited Personalization: Robo-advisors often face limitations in personalizing investment portfolios due to their relatively conservative approach in selecting ETFs. As we already mentioned in the first chapter; research indicates that the final set of available ETFs, that are used for each portfolio selection, typically represents only a small fraction, approximately 3-6%, of all investable ETFs. This restricted selection can result in

portfolios that lack the level of customization desired by investors, limiting their ability to tailor investments to individual preferences and risk profiles. While Robo-advisors offer convenience and cost-effectiveness, this constraint highlights a potential drawback in their ability to provide truly personalized investment strategies.

Moreover, multiple-choice questionnaires typically gather fundamental client information but may not provide a comprehensive view of their financial circumstances. For instance, they might overlook additional sources of wealth and detailed monthly expenses. Despite these limitations, it's crucial for financial planning to take into account the client's overall financial situation. Clients often require detailed financial assessment before determining their savings goals. Furthermore, standardized questionnaires may have a narrow focus or be overly simplistic, resulting in limited customization. To avoid these issues, using longer and more detailed questionnaires would increase personalization. However, longer questionnaires reduce the practicality of Robo-advisors, making the onboarding process time-consuming for users. This can negatively impact user experience, as potential investors may become frustrated or lose interest before completing the necessary steps to start using the service. Longer questionnaires could lead to another shortcoming: the risk of lower response accuracy in online settings, as respondents may lose focus or attention. To enhance digital client onboarding overall, a hybrid approach integrating robo-advice with traditional financial guidance could be advantageous. This blend leverages the efficiency of automated processes while ensuring personalized attention to client needs, potentially addressing the shortcomings of both fully automated and overly lengthy questionnaires.

Financial literacy: Financial literacy plays a crucial role in the adoption of Robo-advisory services across Europe. Unfortunately, the overall financial literacy in Europe is relatively low, which presents a significant barrier to the widespread acceptance of these digital financial services. We found a 2023 survey [22] conducted by the European Commission and other EU institutions published on Eurobarometer website about general financial literacy of members of EU. A representative sample of more than 26,000 citizens, aged 18 and over, in each of the 27 Member States of the European Union was interviewed. According to the survey, only 65% of respondents correctly understand how inflation works. Even fewer, about 56%, understand the importance of diversification in investing, and only 45% can accurately explain compound interest. Considering these numbers, it is easy to conclude that many individuals face significant difficulties in financial decision-making.

These gaps in financial knowledge directly impact the ability of individuals to make informed investment decisions, which is essential for utilizing Robo-advisors effectively. For instance, understanding the benefits of diversification and the effects of compound interest are fundamental to appreciating the benefits offered by Robo-advisors.

Additionally, less than four in ten respondents across the EU feel confident that investment advice they receive from their bank or financial advisor is primarily in their best interest. This means the lack of trust in financial institutions, and this is something Robo-advisors will hardly overcome. This distrust also points to a lack of financial education. Better Finance research [11] suggests that the tendency of "retail" investors to look for advice and take financial action is determined by the level of financial education and trust in financial markets.

Approximately three-quarters of respondents across the EU report feeling comfortable with using digital financial services, such as online banking or mobile payments. This means that some trends like digitalization in the financial sector are widely adopted and Robo-advisory might be the next one, however it will take time for these services to gain the same level of trust and adoption.

To fully realize the potential of Robo-advisory services, it is essential to improve financial literacy across Europe. The survey underscores the need for targeted financial education, especially among women, younger people, individuals with lower incomes, and those with lower levels of education, who generally exhibit lower financial literacy levels. Educating individuals about key financial concepts can help bridge the knowledge gap and enable more people to understand and embrace the benefits of Robo-advisors.

It is easy to conclude that although Robo-advisory is a growing market in Europe it still faces some notable challenges. The strong tradition of risk aversion and preference for traditional financial management methods among European investors is a significant barrier. Furthermore, while fees are lower than those of traditional advisors, they are higher compared to other markets like the US. The lack of human interaction and limited personalization also pose challenges, as many European investors still value the personal touch and tailored advice provided by human advisors. Relatively low financial literacy in Europe together with a small contribution of retail investors further challenges the adoption of these digital investment services.

However, because many people are not participating on capital markets, and the market mostly consists of wealthy investors, there is a lot of potential for the service. This gap presents opportunity for growth, as potential retail investors, who are the target customers for Robo-advisors, often lack participation in capital markets or are unaware of Robo-advisory services. In the next chapter we will use market insights to build a dynamic framework that will illustrate the adoption of Robo-advisors on the market.

3. Robo-advisors Adoption Model

In the previous chapter, we conducted a comprehensive analysis of the Robo-advisory market, examining the key factors driving its growth, the challenges it faces, and the opportunities that are present in the current Robo-advisory market. Using these findings, we want to synthesize our analysis into a dynamic framework that illustrates the adoption of Robo-advisors in the market. The idea is to build a framework or a diagram that would visually explain how various factors influence the adoption of Robo-advisors. Such a framework will provide deeper insights into market dynamics and reveal the interdependencies between variables of the system. This deeper understanding would help predict how changes in one part of the system might affect the whole, enabling any stakeholder to make more informed strategic decisions.

For that purpose, we will use Causal Loop Diagrams (CLDs). CLDs are powerful tools used in systems thinking to visualize and analyze the dynamic relationships between different variables within a system [23]. They are generally used to visualize system structure to better understand the dynamic behavior of the system. CLDs will enable us to visualize how various factors – for example, consumer trust, financial literacy or cost of Robo-advisors – interact and impact the rate at which Robo-advisors are adopted by the market. Through this approach, we aim to transform our market analysis into a dynamic model, offering a deeper understanding of the system.

3.1   Causal Loop Diagrams

In this chapter CLDs will be explained in detail together with their core components. CLDs are powerful tools used in systems thinking to visualize and analyze the dynamic relationships between different variables within a system [23]. By representing these relationships as feedback loops, CLDs help in understanding how different factors influence one another over time, providing insights into complex systems and their behavior. This makes them particularly useful in the context of modeling market dynamics.

A causal diagram consists of variables connected by arrows denoting the causal influences among the variables. Variables are related by causal links, shown by arrows. Each causal

link is assigned a polarity, either positive (+) or negative (-) to indicate how the dependent variable changes when the independent variable changes. Image (Figure 3.1 Casual Loop Diagram [23]) illustrates a CLD used to explain how the population changes considering other variables like birth rate and death rate.
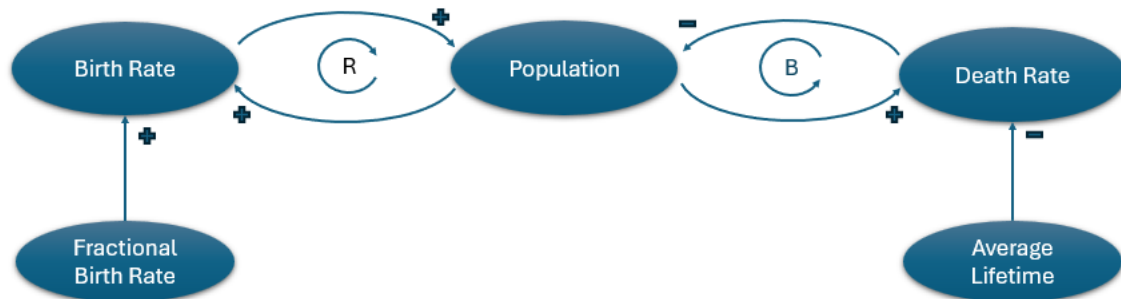

Figure 3.1 Casual Loop Diagram [23]

A positive link means that when the cause goes up, the effect also goes up compared to what it would have been, and when the cause goes down, the effect goes down too. For example, in example (Figure 3.1 Casual Loop Diagram [23]), if the fractional birth rate goes up, the birth rate (measured in people per year) will increase above what it would have been. If the fractional birth rate drops, the birth rate will be lower than it would have been. On the other hand, a negative link means that when the cause goes up, the effect goes down compared to what it would have been, and when the cause goes down, the effect goes up. For example, if the average lifetime of the population increases, the death rate (measured in people per year) will be lower than it would have been. If the average lifetime decreases, the death rate will be higher. So, if life expectancy goes up, the number of deaths will go down; if life expectancy goes down, the death rate will rise. Link polarities illustrate the dynamics of a system. They do not describe the behavior of variables. Instead, they describe what would happen if there was a change in a variable.

It is important to note that an increase in a cause variable does not necessarily mean the resulting variable will actually go up. A variable almost always has more than one input. In order to explain what actually happens, we need to know all the inputs. In the example above, the population depends on both birth rate and death rate. Even if we know that the birth rate went up, we cannot conclude whether the population increased without information about the death rate. That is why we use the phrase "above / below what it otherwise would have been", meaning if all other inputs remain unchanged.

Another important aspect of CLDs are feedback loops. In our example, important loops are highlighted by a loop identifier which shows whether the loop is a positive (reinforcing – R) or negative (balancing – B) feedback. All dynamics result from the interaction of just two types of feedback loops, positive (or self-reinforcing) and negative (or self-correcting) loops. Positive loops tend to reinforce whatever is happening in the system, while negative loops counteract and resist the change.

3.2   CLD Adoption Model

As we already mentioned we will use CLD to help us better understand what variables influence the adoption of Robo-advisory services. The central variable of such a diagram will be the number of adopters of Robo-advisory services. We have identified 5 key factors that directly impact the adoption of Robo-advisors.

The first variable that influences the adoption in our diagram is Customer Awareness, this refers to the extent to which people are aware of and informed about Robo-advisors. Awareness is obviously a critical factor in the adoption of any new technology or service. A customer needs to be aware of the product in order to understand the benefits it offers. As we already mentioned in the previous chapter, many potential clients of Robo-advisory services, particularly retail investors, are usually not aware of this service. This lack of awareness means that a significant portion of the target audience remains uninformed about the advantages and availability of Robo-advisors. We modeled the impact of customer awareness as the diagram (Figure 3.2 Customer Awareness) illustrates.
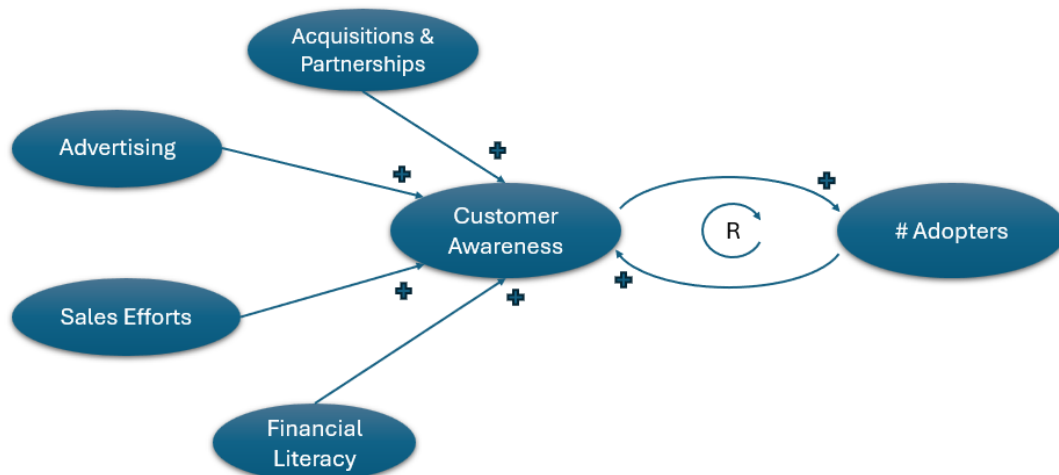

Figure 3.2 Customer Awareness CLD

The variables that significantly contribute to customer awareness are Advertising, Sales Efforts and Financial literacy. In the last chapter we covered how financial literacy contributes by enabling individuals to understand investment concepts and benefits of Robo-advisory. It is obvious how Sales Efforts and Advertising contribute to customer awareness. There is a positive link between those variables and Customer Awareness, meaning that these variables positively impact customer awareness. For example, if the Advertising of Robo-advisors increases Customer Awareness will be above what it otherwise would have been. Another important variable are Acquisitions and partnerships between Robo-advisors and larger financial institutions, which usually have a significant positive impact on Customer Awareness. Large, well-established corporations typically have a huge customer base and high brand recognition, which can effectively introduce Robo-advisory services to a broader audience.

Customer awareness has a direct positive impact on the number of adopters of Robo-advisors (# Adopters). This relationship creates a feedback loop between Customer Awareness and # Adopters. This is a reinforcing loop, which means that with the increase in Customer Awareness the number of adopters will increase, and this will further increase Customer Awareness, assuming all other factors remain equal. This reinforcing loop is very important because it highlights how initial efforts to raise awareness can have a compounding effect. As more people become aware of and adopt Robo-advisors, word-of-mouth and media would further raise awareness.

Next variable is **Customer Trust**, which is a critical variable for the adoption of Robo-advisors, as it directly influences users' willingness to rely on automated financial services for managing their investments. Some of the variables that impact Customer Trust in Robo-advisors are Regulatory Support, Transparency and Financial Literacy, and they all have a positive link to Customer Trust (Figure 3.3 Customer Trust CLD). A supportive and transparent regulatory framework enhances trust by ensuring that Robo-advisors follow certain standards and protect consumer interests. Transparency about how Robo-advisors work, their fee structures, and their investment strategies directly influence trust. Financial literacy is important to understand how regulation supports Robo-advisors and how clients can benefit from Robo-advisors.
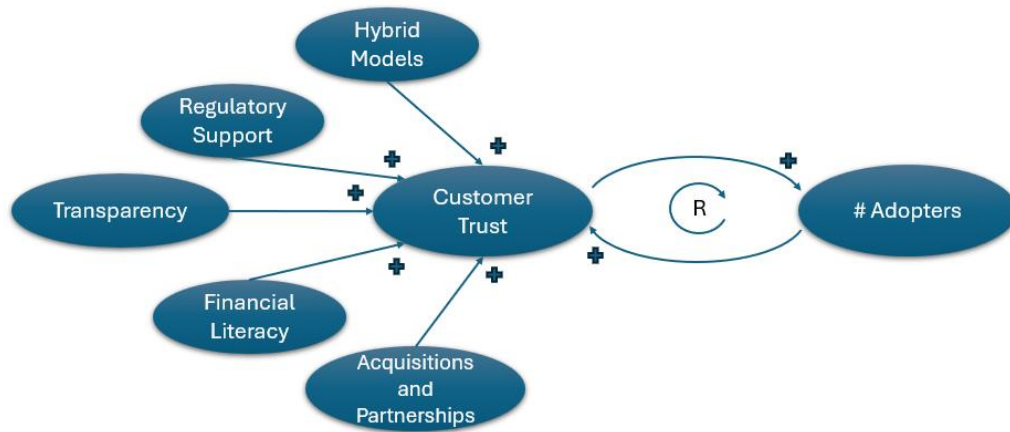
Figure 3.3 Customer Trust CLD

Hybrid models, as already discussed before, contribute to gaining customer trust. Human advisors in hybrid models provide additional reassurance and guidance to clients. Such models are especially beneficial when clients require customer support or seek additional financial guidance. Additionally, trust can be built when larger financial corporations acquire Robo-advisors to offer digital services or when they partner with Robo-advisory platforms. People generally have more faith in larger, well-established corporations, which contributes further to the credibility of Robo-advisory services.

Another positive link exists between # Adopters of Robo-advisors and Customer Trust. As more individuals adopt Robo-advisors and have positive experiences, their satisfaction and experience enhance the overall trust in these services. This link represents reviews and recommendations from active users. This forms a reinforcing feedback loop; as customer trust increases, it encourages more people to adopt Robo-advisors, and as the number of adopters grows, the increased usage and positive testimonials further build and solidify trust, assuming other factors remain equal.

Another important factor in the adoption of Robo-advisors is the current market demand, which refers to the number of people willing to invest in capital markets rather than keeping their money in deposits or not investing at all. We will call this variable **Investor Willingness**. It significantly affects the adoption of Robo-advisors because a larger pool of potential investors creates a bigger market for these services. Factors influencing Investor Willingness include economic conditions, and level of financial literacy (Figure 3.4 Investor Willingness CLD). By Economic conditions we mean how markets are

performing and generally the global or local state of the economy. When economic conditions are favorable, disposable incomes rise, and people are more likely to look for investment opportunities. Financial literacy plays the most important role in raising Investor Willingness. People need to have at least some level of financial education to set financial goals and create investment plans. Furthermore, people with some financial education can understand investment options and appreciate the benefits as well as understand the risks of investing. However, as the number of users of Robo-advisors grows, the pool of potential users willing to adopt the service will shrink. This suggests that while Investor Willingness positively impacts the number of adopters initially, it will gradually decrease as the adoption rate increases, assuming all other factors remain equal. We conclude that the growth in the number of Robo-advisory users would eventually slow down as the market becomes saturated.
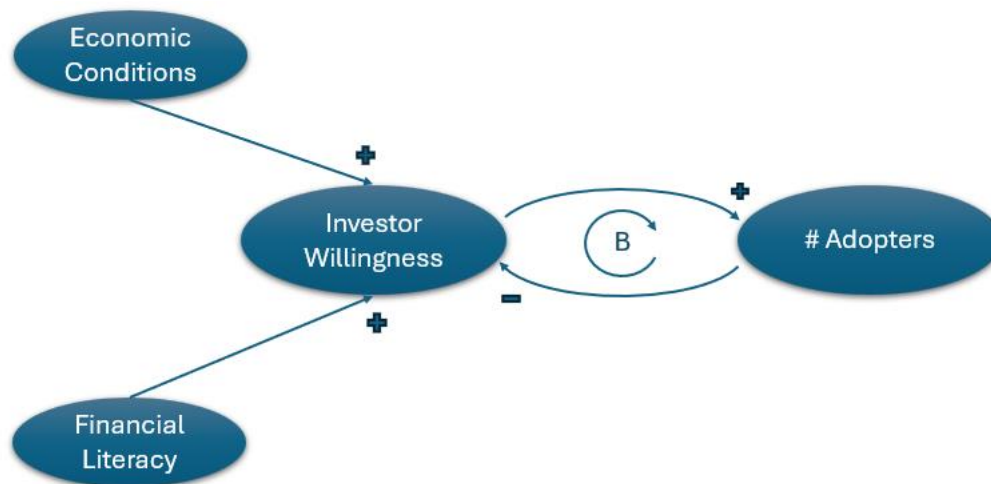

Figure 3.4 Investor Willingness CLD

Next important variable is Robo – advisory Attractiveness, it is a key variable influencing their adoption. It includes the features and qualities that make Robo-advisors appealing to potential users. When Robo-advisors offer attractive features and benefits, they become more appealing to potential investors, driving higher adoption rates. This means that the link between Robo – advisory Attractiveness and # Adopters is a positive link. Diagram (Figure 3.5 Robo-advisory Attractiveness CLD) illustrates variables that impact the Robo-advisory Attractiveness.
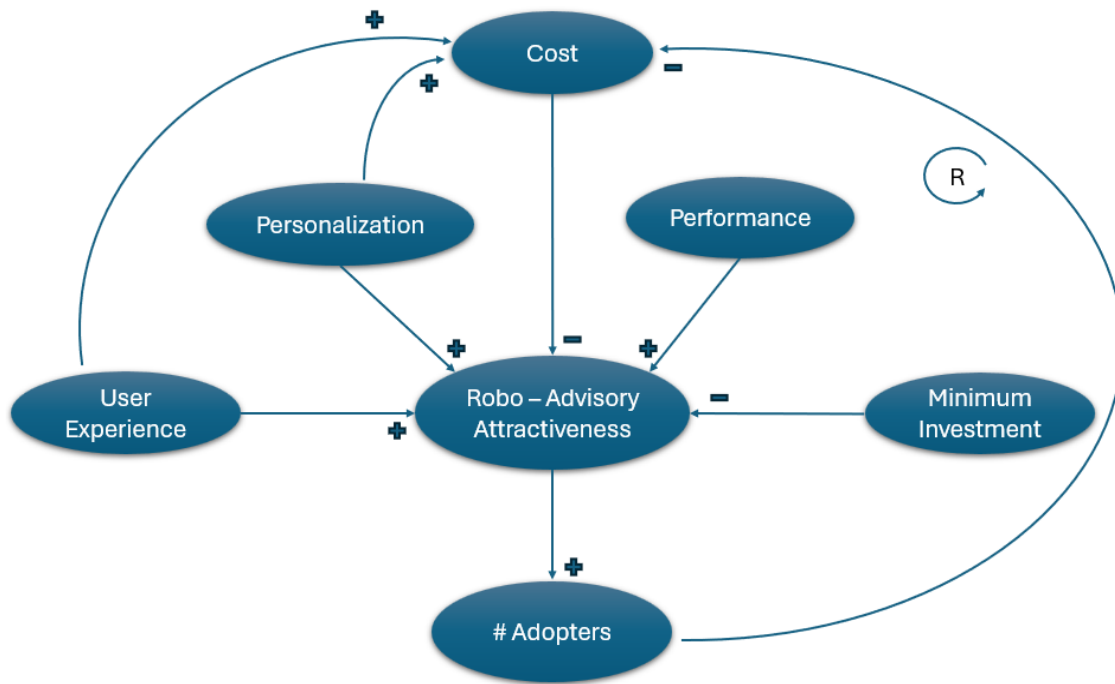
Figure 3.5 Robo-advisory Attractiveness CLD

First, we will consider User Experience, it has a positive link to attractiveness. Users are more likely to adopt a service that is simple and convenient to use. Features like intuitive and easy-to-navigate platform together with a time concise questionnaire increase the User Experience. However, while such features improve User Experience they come with additional cost, which is why we have another positive link to Cost. Next, Personalization is an important variable in adoption of Robo-advisors. Robo-advisory is advertised as a service that offers personalized investment strategies based on individual goals, risk tolerance, and financial situations. This means that a higher Personalization makes Robo-advisors more attractive. Just like with User Experience, improved customization adds to the cost because it requires better questionnaires and algorithms. The Cost of Robo-advisory service obviously has negative link to attractiveness. By Cost we mean any fee charged for the service. Higher fees make a product less attractive, assuming other variables remain equal. Strong historical performance and reliable returns increase the attractiveness of Robo-advisors, which is why Performance has a positive link to attractiveness. Minimum Investment needed to start investing with Robo-advisor is negatively linked to attractiveness. Robo-advisors generally have lower entry barriers compared to traditional advisory and they leverage that to attract potential investors. The number of adopters of the service has a negative link to the cost due to the partially fixed

cost of Robo-advisors and a high number of competitors, assuming other variables remain unchanged. This creates a reinforcing feedback loop.

Lastly, **Traditional Advisory Attractiveness**, which is attractiveness of competitive product. Minimum Investment, Cost and Performance have identical effects on attractiveness of traditional advisory as they have on Robo-advisory, as the diagram (Figure 3.6 Traditional Advisory Attractiveness CLD) illustrates. However, Traditional Advisory Attractiveness has a negative link to the number of adopters of Robo-advisory. With the increase of attractiveness of traditional advisory we can expect people choosing traditional advisory over Robo-advisory.
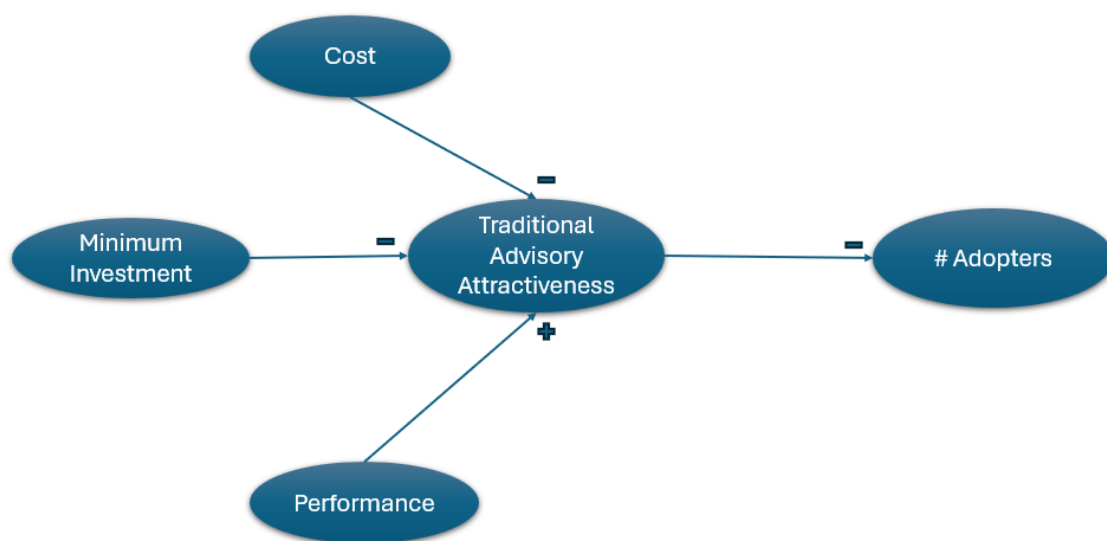

Figure 3.6 Traditional Advisory Attractiveness CLD

Finally, we can combine all variables and diagrams that we covered to create a final CLD for adoption of Robo-advisors. The causal loop diagram illustrated on image (Figure 3.7 Robo-advisory Adoption CLD) provides a comprehensive view of the various factors influencing the adoption of Robo-advisory services. Key variables such as Customer Awareness, Customer Trust, Robo-advisory Attractiveness, Investor Willingness and Traditional Advisory Attractiveness create a dynamic system that impacts the adoption of Robo-advisory services. However, stakeholders of Robo-advisory platforms can only influence some of the key variables. It is impossible to impact Investor Willingness or Traditional Advisory Attractiveness directly. Therefore, the focus should be on enhancing Customer Awareness, building Customer Trust, and increasing the Attractiveness of Robo-advisors. Increased Customer Awareness and Trust with comparable or better attractiveness compared to traditional advisory would boost the number of adopters of

Robo-advisory. Additionally, favorable economic conditions and financial literacy drive investor willingness to participate in capital markets, expanding the potential user base for Robo-advisors.
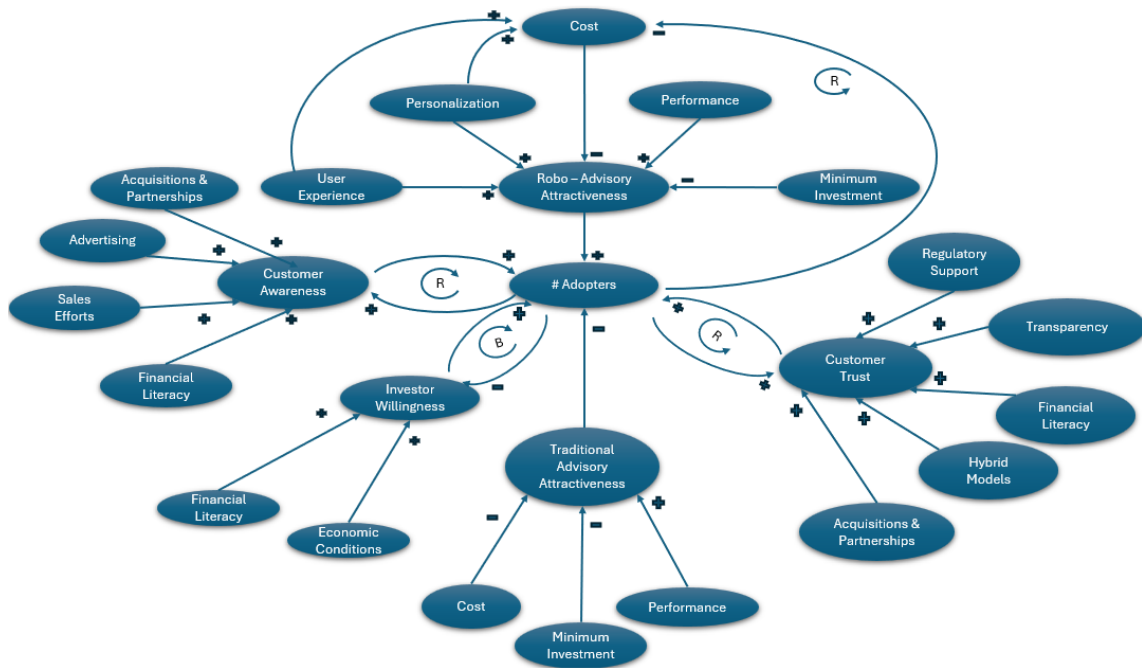

Figure 3.7 Robo-advisory Adoption CLD

Based on our research from the previous chapter and insights from CLD, we conclude that enhancing Customer Awareness and Customer Trust are crucial for increasing the adoption of Robo-advisors. The constructed CLD provides insights into the variables influencing Customer Awareness and Trust.

We have already covered that factors such as advertising, sales efforts, and Financial Literacy significantly enhance Customer Awareness. Investing in these areas can effectively attract more adopters to Robo-advisors. Moreover, partnering with established financial institutions proved to be beneficial in raising awareness and expanding customer reach. For instance, in 2015, BlackRock, the world's largest asset management company, acquired FutureAdvisor to strengthen its digital capabilities and reach new clients. Regulatory support, Transparency, Financial literacy and human support have a positive impact on Customer Trust. It is crucial to advertise transparent fee structures and provide additional human support were needed, because as we shown in our market research, many people lack the human interaction with Robo-advisors and are unwilling to interact exclusively with a machine. Human support together with a transparent fee structure and investment information would highly improve trust in Robo-advisor. Just like partnering

with established financial institutions enhance awareness, it also improves trust, because people generally have more faith in larger, well-established corporations, which contributes further to the credibility of Robo-advisory services.

In the previous chapter we discussed that on average European Rob-advisors still have higher fees compared to competitors in the US, and some additional decrease in fees is expected. Improved awareness and trust have a positive impact on the number of adopters. As the number of adopters grows, the cost of the service should drop, further increasing the attractiveness of Robo-advisors. The reinforcing feedback loop (R) highlights how initial efforts to raise Customer Awareness and Trust would reduce Cost by increasing number of adopters, assuming other variables remain unchanged. Performance is probably the most important variable for attractiveness. However, Robo-advisors use passive investment strategies and mostly invest in ETFs so performance is extremely dependent on ETFs performance, only the algorithms to better choose ETFs could be improved. Which leads us to personalization, meaning offering different portfolios to different customers with different goals. Portfolios need to better reflect customer needs and goals; we highlighted in the previous section how the current level of personalization presents a barrier in adoption. To attract a broader audience, Robo-advisors need to offer a higher level of personalization. Limited personalization of Robo-advisors could be improved in the future through the integration of artificial intelligence (AI). AI powered chatbots could improve client assessment and make the process reflect human interaction with financial advisor. Therefore, improved Personalization and User Experience would certainly increase the attractiveness of the service.

It is worth noting that financial literacy is a common variable positively impacting Customer Awareness, Customer Trust and Investor Willingness. This means that improving the overall level of financial education would make multiple positive changes. For that reason, we think Financial literacy is one of the key variables impacting the adoption of Robo-advisory. There are several ways to increase financial literacy; for example, partnering with educational institutions, and big organizations to conduct workshops and seminars, making financial education more accessible and relatable. Moreover, platforms could offer different types of educational materials and tutorials on platforms like YouTube or social media like Instagram.

Conclusion

In conclusion, the landscape of financial advisory has undergone serious transformation over the past decades, evolving from a service available only to high-net-worth individuals to one accessible to a broader public. Robo-advisory platforms try to attract a broader audience, retail investors, by democratizing financial advisory services by offering automated, low-cost, and accessible investment solutions.

This report covers the key drivers of Robo-advisory adoption in Europe together with challenges and barriers that slow down adoption. We have identified several factors that contribute to the adoption of Robo-advisors in the European market, including lower costs compared to traditional advisory services, low minimum investment requirements, together with practicality and on average better net returns. Despite these advantages, the market is still in its early stages and faces challenges. One major barrier is the low participation rate of households in capital markets, with a preference for keeping savings in deposits. Another notable challenge is general preference for human advisors and distrust in financial advice provided by "robots". Additionally, the low level of financial education among average households and generally very low awareness of the product further the adoption of Robo-advisors. Despite these challenges, the potential for Robo-advisors remains substantial.

A significant part of this report is dedicated to a causal loop diagram (CLD) model illustrating the dynamic interactions between various factors influencing Robo-advisory adoption. This model highlighted the importance of customer awareness, trust, and the attractiveness of Robo-advisory service for the adoption of the market. Based on European market research and insights from the causal loop diagram (CLD), we concluded that enhancing Customer Awareness and Customer Trust are crucial for increasing the adoption of Robo-advisors. We further discussed the strategies that can be leveraged to improve those aspects.

By addressing the identified challenges and leveraging the proposed strategies, Robo-advisors can increase their market penetration and play an important role in the future of financial advisory services. The insights and the model presented in this report provide a

valuable framework for stakeholders to understand and navigate the complex dynamics of the Robo-advisory market.

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Sažetak

Naslov: Modeliranje potražnje za digitalnim platformama za financijsko savjetovanje pristupom sistemske dinamike

Sažetak: U sklopu Diplomskog rada obrađen je razvoj i prihvaćanje Robo-savjetnika unutar industrije financijskog savjetovanja, s fokusom na europsko tržište. Provedena je detaljna analiza tržišta te smo uočili glavne pokretače i izazove koji utječu na prihvaćanje Robo-savjetnika na Europskom tržištu. Koristeći dijagram uzročne petlje (engl. causal loop diagram) razvili smo model koji ilustrira interakcije između varijabli koje utječu na prihvaćanje Robo-savjetnika na Europskom tržištu. Iz modela je zaključeno da su svjesnost potrošača o proizvodu, povjerenje potrošača te atraktivnost same usluge ključne za prihvaćanje na tržištu. Na temelju analize tržišta i uvida dobivenih iz modela, može se zaključiti da su svijest potrošača i povjerenje ključni izazovi u prihvaćanu Robo-savjetnika te da bi dodatne investicije s ciljem podizanja svijesti i povjerenja značajno povećala prihvaćanje usluge na tržištu.

Ključne riječi: Robo-savjetnik, financijski savjetnik, tržište kapitala, investicija, ETF, Europa, prihvaćanje proizvoda, dijagram uzročne petlje.

Summary

Title: Demand Modeling for Robo-advisors using a System Dynamics Approach

Summary: This work examines the evolution and adoption of Robo-advisors within the financial advisory industry, with a focus on the European market. We conducted a detailed market analysis and highlighted the key drivers and challenges impacting the adoption of Robo-advisors on the European market. We developed causal loop diagram (CLD) model illustrating the dynamic interactions between various factors influencing Robo-advisory adoption. This model highlighted the importance of customer awareness, trust, and the attractiveness of Robo-advisory service for the adoption of the market. Based on market research and model insights we concluded that customer awareness and trust are key challenges in market adoption and investing resources to overcome those challenges would significantly improve the adoption of European Robo-advisors.

Key words: Robo-advisory, financial advisory, capital markets, investment, ETFs, Europe, product adoption, causal loop diagram.