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**FINTECH COMPANIES: INNOVATION,
ALGORITHMS AND CUSTOMER CENTRIC
PERSPECTIVE**

A cross-sectional study on algorithmic trading in the Fintech
industry

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ABSTRACT

In the last years the financial sector has been subject to many changes, in particular since 2008 financial crisis many customers started to appreciate new digital financial companies, instead of traditional ones, that offer innovative solutions for financial services. In fact they are able to offer more effective, efficient and less expensive services than traditional institutions. However, their innovativeness doesn't consist only in a simple product or process innovation but they are characterized by a total innovation in terms of business model; they focused on particular elements that allow to get competitive advantage. A particular importance has to be given to leverage on technology as one of the main elements at the base of Fintech companies. Particularly interesting under this point of view are trading algorithmic trading fintech companies, in which algorithmic trading systems are a fundamental element to run their business and without it the business could not exist.

The purpose of this thesis work was to analyse the impact of algorithms in the Fintech industry, in particular on what concerns automatic investments by trading algorithms, and how they are able to take better and faster decisions than humans can do allowing people to invest in a less demanding and more secure and profitable way.

For this study the author has decided to use a cross-sectional design, interviewing respondents from companies and experts. All interviews have been a semi-structured form and have been done in 2021. The research evidenced many aspect about algorithms for trading in particular about their development, the automatization of trading activity and future expectations for the future.

The analysis of findings showed many important concepts: the great efficiency that characterized algorithm's use, the fundamental importance of the research process in the algorithm's development and the emotional aspect linked to algorithmic trading.

Keywords: Fintech, Fintech innovation, Fintech business model, Algorithms, Algorithmic trading systems

I INTRODUCTION

The scope of this chapter is the introduction of the topic and the research questions of this thesis. First, a background and problem discussion are explained a then the purpose and research questions. At the end, the researcher provides a description of the sector and analysed companies to conclude with limitations of the study and thesis disposition.

1.1 GENERAL BACKGROUND

We live in a world characterized by a great expansion and the huge variety of innovations and technologies lead to great changes in almost every aspects of life. Even the financial field, which affects individual's life, is changing completely. After the 2008 financial crisis The Basel Committee on Banking Supervision (BCBS) increased banks' regulatory reserve requirements in order to take account of individual contributions to global risk (Benoit et al., 2016), in the public opinion banks and traditional institutions were responsible for the crisis. Many customer, younger and holder began to doubt about traditional financial institutions and started to appreciate new digital companies that offered innovative solutions for financial services. Nowadays, a digital way of doing finance is replacing the traditional one, and new companies, defined as Fintech companies, base their businesses on technologies. These companies are mainly start-ups that "compete with traditional financial services, offering customer-centric services capable of combining speed and flexibility, and they are spreading throughout the world" (Nicoletti, 2017). Their customers are "more and more users of financial services" (Nicoletti, 2017). In particular these organizations have the capacity to listen customers' voice and balance the lack of customization typical of traditional institutions. Through the use of some instruments, fintech companies have the ability to personalize offer for customers in order to obtain a better customer experience. In this context, the concept of algorithms is fundamental because they represent the main vehicle by which customers communicate with the company. It is important to underline the aspect that customers of fintech companies, which are more users than customers, have an active participation in the value creation process; algorithms, collect data and feedback from users and market in order to make adjustments or improvements and allow them to obtain better investments with lower efforts . The result of this process is that "users expecting relatively high economic or personal benefit from developing an innovation and have a higher incentive to and so are more likely to innovate" (Henkel et von Hippel, 2004)

and algorithms can facilitate the innovation process in an automatic way generating a circular process in which value begin from customer and return to them passing trough algorithms.

1.2 PROJECT OUTLINE

This thesis project is based on the collaboration between the author and First to Know (FTK), a consultancy company established in Gothenburg. FTK has a partnership with the ‘University of Goteborg School of Business, Economics and Law’ which for numerous students to participate in meetings and workshops on topics like innovation and sustainability. In addition they provided to the author all the documentation regarding the topic that will be analysed in this thesis, considering their experience and knowledge of Innovation. The intention of the researcher is to show how Algorithms can impact on the whole Fintech sector. In particular, the author wished to explain how Algorithms can create value for users improving their investment experience. This research’s aim is to enrich the literature about this subject, it will be done by analysing different types of companies that work at different levels of the Fintech sector’s value chain and some experts, in order to have an analysis at 360° from different points of view.

First of all, the starting point was to read and investigate all the documentation provided by Mr. Ola Ekman, one of the owners and founder of First to Know. This Innovation Hub (FTK) and the passion for innovation and linked themes were fundamental to give birth to the process of the chosen topic for this master thesis. The researcher's continuous exposure to the ideas of the innovators, the hub and the companies we could refer to, helped to focus on the topic of interest that perfectly met the needs, the vision and the mission of the Swedish consultancy group. FTK made available to the author all their contacts that were relevant to the chosen topic, thanks to meetings in the 360 hub and online meetings with interviewees.

Since the author has been selected to participate in the Double Degree exchange program at “Luiss Guido Carli University”, in collaboration with the partner University of Gothenburg, an important contribution was given by the Italian and Swedish supervisors. The Professors Luca Giustiniano and Johan Brink enabled the author to find the meeting point between a purely pragmatic topic and the theory that links them, helping, above all, from an academic point of view. In addition, feedbacks and advices from other colleagues were fundamental to direct the research and build a good thesis’ path.

1.3 RESEARCH OBJECTIVES

The objective of this thesis is to analyse the impact of algorithms in the Fintech industry, in particular on what concerns automatic investments by trading algorithms. Decision making process about trading investments is very difficult, in particular due to the nature of products and the complicated dynamics of this field. For this reason people are always more adverse to invest on their own and lots of them would prefer their investments to be managed by someone else. Trading algorithms are able to take better and faster decisions than humans can do, so they could allow people to invest in a less demanding and more secure and profitable way.

First of all it is important to understand dynamics of fintech sector and, after an accurate literature review about, explaining fintech business model's main characteristics and particularities. Secondly, there will be an analysis of automatic trading, in order to understand how it could improve the investor's experience. Lastly, the research will give a vision of effects that algorithmic trading generates on the business of investment Fintech companies on a practical and point of view.

1.4 RESEARCH QUESTION

The most important thing for the research and its development is the research question. If formulated in the right way it allows to organize the entire research, making a good literature review and conduce interviews in the right direction; all in order to reach the objective of the research itself. The research question and its answer has to include all information about the chosen topic, providing an exhaustive outline that is important to consolidate the validity of the entire process (Bryman et Bell, 2011).

To find an appropriate research question, the author has analysed the entire topic in order to catch the most relevant questions about. In addition, thanks to the help of supervisors and First To Know he was able to find the best direction for the research identifying a good research question, which is:

How algorithms impact the Fintech industry?

The analysis that follows this question needs an explanation of Fintech industry dynamics and typical business model in order to catch reasons for this choice. However it remains a bit

general, for this reason, to be clearer, is necessary to formulate some sub-research questions to help the researcher answering in a more effective and complete way to the main one.

The first sub-question is:

How investment fintech companies deal with algo trading?

This first sub-research question is functional for two reasons. The first is to reduce the field of study, in fact the huge number and variety of Fintech companies could be a limitation for the research. The second reason is that investment Fintech companies are those with the greatest usage of Algorithms, for this reason they are suitable for this study more than other types of Fintech companies.

The second one is:

How automatic trading could improve investor's experience?

The aim of this sub-research question is to help the author to understand the way by which automatic trading is useful to improve investors' experience and show the importance of the automatization of trading.

Finally, the aim of this research is to provide a qualitative contribution to the existing studies about Fintech industry and Fintech enterprises, in order to help the development of this sector in the future.

1.5 RESEARCH LIMITATIONS

There are some main limitations for this study, they regards some aspects related to the research.

The first limitation regards the time availability in fact the lack of time bring to analyse just a small number of companies, for this reason the study could not be representative for the total sector. However for author's judgment the champion is enough to derivate some conclusions.

The second limitation regards the background of the researcher, in fact the study was conducted form an economic and managerial point of view; for this reason technical aspects of the analysed topic were not deepened. But in researcher's opinion this not undermine the research.

At the end there is a limitation due to the huge variety of services and companies that characterize the Fintech industry. The researcher will make a good sample which allow to reduce, as much as possible, the space of research.

1.6 RESEARCH STRUCTURE

Table 1: Thesis structure

I. Introduction:	General background, Project outline, Research objectives, Research question, Research limitations
II. Literature review:	Fintech, Business Model, Robo-Advisors, Algotrading
III. Methodology:	Explanation of research strategy and design, research method and data collection, data analysis, research quality
IV. Empirical findings:	Outline of data collected by interviews
V. Data Analysis:	Analysis of empirical findings
VI. Conclusions:	Presentation of conclusions, Research question's answer and future research proposal

II LITERATURE REVIEW

2.1 FINTECH

2.1.1 Fintech definition and background

The word “Fintech” born from the union of words Finance and Technology, and even if it has not a singular definition, it could be defined it in two ways:

- Fintech as *technology*: Technologies that allow or sustain to run businesses in the financial services industry
- Fintech as *initiatives*: “Initiatives with an innovative and disruptive business model which leverage on ICT in the area of financial services” (Nicoletti, 2017)

Talking in a more scholastic way, we can say that it is: “a cross-disciplinary subject that combines Finance, Technology Management and Innovation Management” (Leong et Sung, 2018). However this definition remains broad; in fact to be more specific we will provide a better definition which could be the following one proposed by Leong et Sung in 2018, “any innovative idea that improves financial service processes by proposing technology solutions according to different business situations, while ideas could also lead to new business models or even new businesses”.

The history of Fintech:

Even if this word born and known in the last twenty years, the previous definitions suggests something else. Studying financial sector’s history we can observe how lots of disruptive innovation in the past changed the financial service sector in several ways. In particular we can distinguish different periods of the Fintech evolution:

1. *Fintech 1.0* (from 1866 to 1967): It coincides with the invention of the first trans-oceanic transmission cable
2. *Fintech 2.0* (from 1967 to 2008): It coincides with the installation of the first ATM
3. *Fintech 3.0* (from 2008 to nowadays): It started with 2008’s financial crisis and continues nowadays
4. *Fintech 4.0* (from nowadays to ongoing): Financial service based on Data technologies

At the moment we are between the Fintech 3.0 and the Fintech 4.0 period; however, with the development of inventions as Industry 4.0, Internet of Things (IoT) and platforms, it is possible to imagine the next step for Fintech. Financial sector would be linked to technology more than ever seen before, in particular the financial sector will be based on data and what concerns them.

2.1.2 Fintech classification

Taking in consideration definitions we mentioned before, of Fintech as *Initiatives*, we can observe that the Fintech world is full of many different initiatives. For this reason is important to classify those, in order to distinguish them and have the clearest vision on the sector. The most used model for the classification is the “five Ws”; answering to the following five questions is useful to establish the category of a Fintech firm.

Who?

One of the classifications for Fintech firms could be made depending on the nature of subjects that have a relationship when a Fintech service is provided. Relationships could be:

- P2P: person to person

This type of relationship underlines the concept of customer's centrality, in fact Fintech companies act as facilitators or market makers matching supply and offer between customers.

- B2P: business to person
- P2B: person to business

These two types of relationship concerns the interaction between institutions and customers; by Fintech initiatives the interaction could be easier, as in the case ATM.

- B2B: business to business

It refers to relationships between two or more companies, which are hard to manage; Fintech companies that works with this type of relationship have to face with corporate customers and not individuals.

What?

This question concerns the area in which a company is specialized. A research made on fifty Fintech companies by H2 venture, KPMG and Matchi in 2016 shows the specialization share for each area.

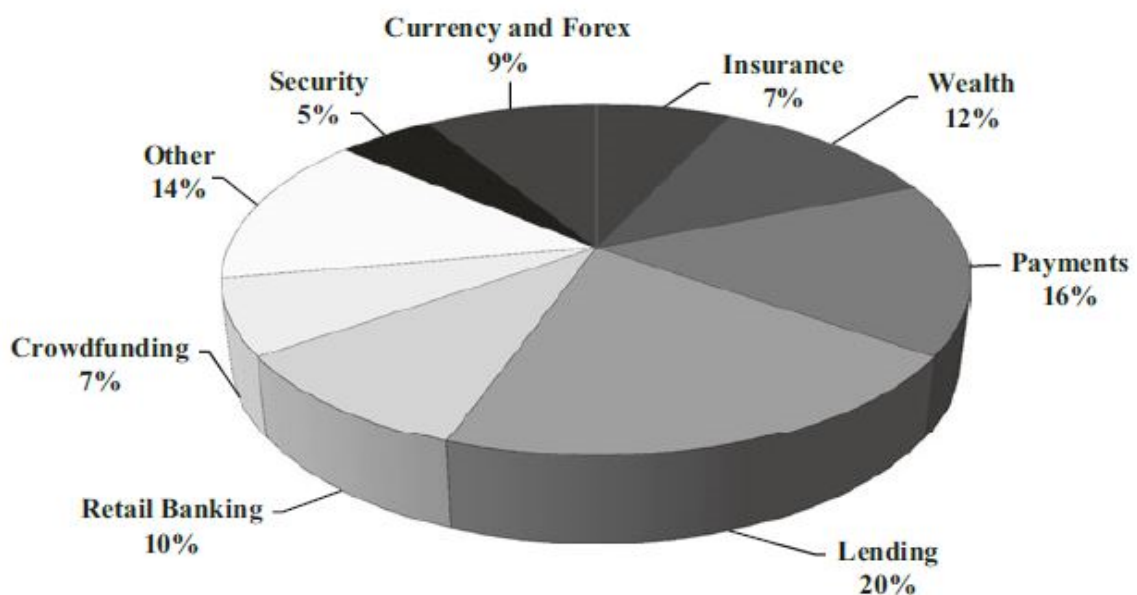


Fig 1: Fintech Specialization share

Source: Fintech 100, Leading Global Fintech innovators, Report (2015)

Where?

This question consider countries, regions and cities under an only geographical point of view, to establish and rank where the business idea starts and where its development starts.

When?

According to this question we can distinguish companies in two categories: Traditional Fintech and Emergent Fintech. The former category regards market players that operates as facilitators which use a traditional revenue model. On the other hand the latter regards players that are considered as disruptors with new technology and solutions which use different types of revenues streams.

Why?

We can divide Fintech initiatives in four main categories based on applications and services they provide: Payments, Advisory service, Financing and Compliance. The former regards payment aspects, in particular cashless one; for example, the Starbuck's financial report of 2017 ,show how mobile payments of the company increased to 30% of transactions in U.S. company-operated stores after the introduction of their own system payment. The second regards services as: portfolio management, risk management, investment advice, insurance, customer support and management decision making; in this case Fintech was particularly disruptive, in fact, thanks to some innovations as Internet of Thins, Softwares and Artificial Intelligence etc., in the next future these services could be full personalized and automated. The third concerns any acts for obtaining funds for business activities; thank to some instruments as platforms, companies have alternative ways for financing as crowdfunding etc.. The latter is about methods by which firms comply with regulations and policies; for example accounting softwares.

2.1.3 Fintech Ecosystem

In 1996 Moore defined a business ecosystem as “an economic community supported by a foundation of interacting organizations and individuals which produce goods and services for customers who are themselves member of the ecosystem” and whose “members tend to align the directions set by one or more central companies toward share visions finding mutually supportive roles”. A Fintech ecosystem has a full response to this definition, in fact it characterized by competitive and collaborative dynamics that allow to stimulate economy and innovation and generate many mutual benefits for participants. Diemenes et al. in 2015 identified five elements in the Fintech ecosystem:

1. Fintech start-ups (of types we mentioned before)
2. Technology developers
3. Government
4. Financial customers (people and organizations)
5. Traditional financial institutions

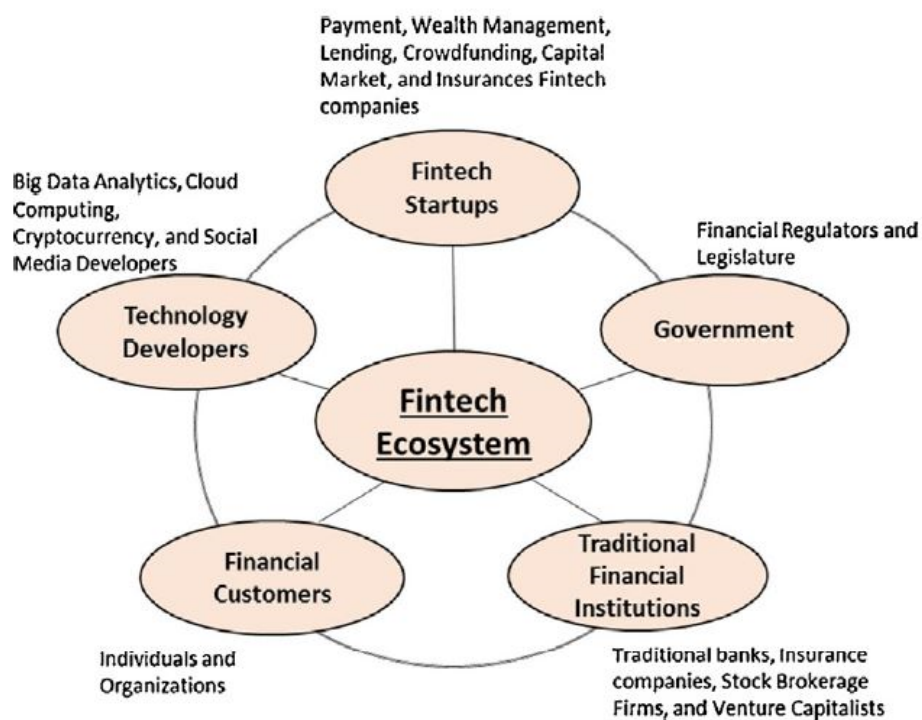


Fig 2: five elements of Fintech ecosystem

Source: Lee and Shin, 2017

Fintech start-ups are the central node of the ecosystem, in fact they are entrepreneurial and innovation drivers in many areas as payments sector, insurance etc.. In particular, as said by Walchek in 2015, they were disruptive for banks to the ability to unbundle financial services contrary to traditional financial institutions. This is allowed by typical characteristics of Financial customers, which are the major source of revenues for Fintech companies. In general they are, both singles and organizations, young and technology addicted, for this reason they are able to access to finance in easy ways and personalize all based on their preferences. They can do this thanks to Technology developers, that create the appropriate environment for Fintech providing instruments as platforms, devices, artificial intelligence, big data analytics, etc. . Other members of Fintech ecosystem are Governments and Traditional financial institutions. The formers provide different types of regulation, depending on their development plans, for Fintech companies and Traditional Financial Institutions; but in general they tends to stimulate Fintech innovation and global financial competitiveness. In fact, compared to Traditional Financial Institutions, Fintech companies have a less rigorous regulation that allow them to provide customers a more customized service which is inexpensive and easy to access at the same time. The last members are traditional institutions which are the biggest drivers of Fintech ecosystem. Thanks to their power, they have advantages in terms of resources and economies of scale; however they do not exploit these characteristics and prefer a collaborative approach with Fintech start-ups. They provide funds to Fintech companies and receive back insights in order to stay on the forefront of the technology (Yang, 2015).

2.1.2 Fintech Innovation

Fintech in general and Fintech companies are characterized by an attitude to innovation, in fact they leverage on innovations as new technologies and new ways of acting to run their businesses and obtain competitive advantage. According to Micheal Porter (1990), “Companies achieve competitive advantage through acts of innovation” and “they approach innovation in its broadest sense, including both new technologies and ways of doing things”. Fintech sector is one of the most innovative at the moment, in fact is evident how it is contributing to the economic growth. The innovation process could be seen in four main categories:

- Products or services
- Processes

- Organizations
- Business models

The first category is particularly important for Fintech field, in fact it is full of opportunities in terms of services. These services are much requested from customers, and Fintech start-ups are able to create value satisfying customers' needs better than incumbents. One of the main examples is in the health insurance and life protection case. Thanks to many applications, as IoT, devices and platforms, start-ups have the ability to create data networks to formulate risk models based on real time observations and offer customers, more effective and efficient solutions at lower costs. Product innovation requires also an innovation in terms of processes, in particular on what concerns the relationship with customers. The customer engagement process for Fintech companies consists in the construction of an intense relationship, which is more direct, simple and effective as before, above all thanks to the integration of digitalization in people lives. The process innovation implies also a change in the organization itself, in particular for what concerns effective contact centres in order to inform management about the quality and non-quality of the provided service (McKinsey, 2016). By the use of virtual channels as mobiles, web sites and platforms companies could achieve a deep knowledge of customer. As said by Nicoletti in 2017, "it is essential to have a way to "know your customer" (KYC). KYC is important from several points of view: not only risk management, but also marketing and finance" in fact, a deeper knowledge of customers gives the possibility to "uncover hidden patterns, unknown correlations, market trends, customer preferences, risky behaviours, and other informations to provide very personalized financial services". The most important innovation for a company of Fintech sector is in terms of Business Model, but an explanation in the next paragraphs will be more appropriated.

2.2 BUSINESS MODEL

To understand Fintech innovation in terms of business model in a proper way, we will go see Business Model on a theoretical point of view. The theoretical framework will start giving different definitions of business model provided by different authors which have different perspectives and opinions, all in order to analyse Fintech one in the clearest way.

2.2.1 Business model definition

A good product/service is necessary but not enough to allow the company to get success, for this reason is necessary for companies to transfer the intrinsic value of the product to the market in order to create more value.

Strategies and logics about business, that companies pursue to create value, are explained in the business model (BM), in order to organize ideas and having a clear working system with the objective to create and deliver value to the customer from every aspects.

Since 1990 BM became an interesting subject to be studied and many authors and experts enriched theory by their contribution. For this reason, the author will provides some basic concepts about BM taken from the literature. Author mean different things when they write about business models (Linder and Cantrell, 2000), in particular their definitions are based on different concepts.

Author	BM Definition	Basis of the BM Definition
Timmers (1998: 4)	<ul style="list-style-type: none"> • An architecture for products, services and information flows, including a description of various business actors and their roles; • A description of the potential benefits for the various business actors; and <ul style="list-style-type: none"> • A description of sources of revenues. 	Product architecture , Value proposition , Revenue sources.
Venkatraman and Henderson (1998: 33-34)	Strategy that reflects the architecture of a virtual organization along three main vectors: customer interaction, asset configuration and knowledge leverage.	Organization architecture, Organization Strategy

Rappa (2000: Online)	A BM is the method of doing business by which a company can sustain itself, that is, generate revenue. The business model spells out how a company makes money by specifying where it is positioned in the value chain.	Revenue sources.
Linder and Cantrell (2000: 1-2)	The organization's core logic for creating value. The business model for a profit-oriented enterprise explains how it makes money.	Value proposition, Revenue sources.
Petrovic et al. (2001: 2)	A business model describes the logic of a "business system" for creating value that lies beneath the actual processes.	Business logic, Value proposition
Amit and Zott(2001: 4)	A business model depicts the design of transaction content, structure, and governance so as to create value through the exploitation of new business opportunities.	Value proposition.
Torbay et al.(2001: 3)	The organization's architecture and its network of partners for creating, marketing and delivering value and relationship capital to one or several segments of customers in order to generate profitable and sustainable revenue streams.	Value proposition , Collaborative transaction
Stähler (2002: Online, 6)	A model of an existing business or a planned future business. A model is always a simplification of the complex reality. It helps to understand the fundamentals of a business or to plan how a future business should look like.	Current and future business reality simplification
Magretta (2002: 4)	The business model tells a logical story explaining who your customers are, what they value, and how you will make money in providing them that value.	Value proposition , Revenue sources.
Bouwman (2002), source: Camponovo and Pigneur (2003: 4)	A description of roles and relationships of a company, its customers, partners and suppliers, as well as the flows of goods, information and money between these parties and the main benefits for those involved, in particular, but not exclusively the customer.	Collaborative transactions , Value proposition.
Camponovo and Pigneur (2003: 4)	A detailed conceptualization of an enterprise's strategy at an abstract level, which serves as a base for the implementation of business processes.	Intermediate theoretical layer.

Haaker et al.(2004: 610)	A blueprint collaborative effort of multiple companies to offer a joint proposition to their consumers.	Collaborative transaction, Value proposition
Leem et al. (2004: 78)	A set of strategies for corporate establishment and management including a revenue model, high-level business processes, and alliances.	Organization strategy.
Rajala and Westerlund (2005: 3)	The ways of creating value for customers and the way business turns market opportunities into profit through sets of actors, activities and collaborations.	Value proposition, Collaborative
Osterwalder et al.(2005: 17-18)	A business model is a conceptual tool that contains a set of elements and their relationships and allows expressing the business logic of a specific firm. It is a description of the value a company offers to one or several segments of customers and of the architecture of the firm and its network of partners for creating, marketing, and delivering this value relationship capital, to generate profitable and sustainable revenue streams.	Business logic, Value proposition, Organization architecture.
Andersson et al.(2006: 1-2)	Business models are created in order to make clear who the business actors are in a business case and how to make their relations explicit. Relations in a business model are formulated in terms of values exchanged between the actors.	Collaborative transactions.
Kallio et al. (2006:282-283)	The means by which a firm is able to create value by coordinating the flow of information, goods and services among the various industry participants it comes in contact with including customers, partners within the value chain, competitors and the government.	Value proposition.

Table 2: Business model definitions

Source: Al-Debei et al., 2008

However, the most relevant definition for the author is “A business model is a conceptual tool that contains a set of elements and their relationships and allows expressing the business logic of a specific firm. It is a description of the value a company offers to one or several segments of customers and of the architecture of the firm and its network of partners for creating,

marketing, and delivering this value and relationship capital, to generate profitable and sustainable revenue streams”. (Osterwalder, 2005)

Osterwald identified also 9 elements of the business model and said that companies have to organize and deal with them to create and deliver value to customers, avoiding losses during the operations. For this reason, in the next paragraphs will be explained and listed the elements that compose a business model, in order to acquire a good comprehension of them and organizational dynamics.

2.2.2 Business model Canvas

As seen in the previous paragraph, there is a lack of a unique definition for Business Model and the literature is studying them yet in order to understand how they work and their organizational use. The most influential author in the researcher’s opinion, Osterwald, who gave also the most complete definition of Business Model, developed and studied the concept of Business Model Canvas (BMC) that allow to have a clear and complete vision on different business aspects. In particular, some authors (among which Osterwalder itself) see business model as an interface or an intermediate theoretical layer between the business strategy and the business processes. (Tikkanen, 2005, Rajala and Westerlund, 2005 and Morris, 2005)

As said before, Osterwald in 2005 identified the 9 elements that constitute a Business Model, that according to Magretta (2002) describes how pieces of a business all fit together. From these elements he started the construction of the BMC framework

Nine elements that constitute a Business Model:

1. *Value Proposition*: referred to what the company offers to customers. A good value proposition allow to give customers the maximum deliverable value by the knowledge of their needs and preferences.
2. *Customer Segment*: the segment of the customer chosen for the product/service and to which value is delivered. Identify the right segment allows avoiding losses in terms of value and efforts and obtaining advantages in terms of sales and profits.
3. *Customer Relationship*: concerns how the company interacts with the customer.

The interaction could be in different forms differentiated by the level at which customer interacts with the firm.

4. *Distribution channels*: it concerns how the firms get in contact with customers, so what channels they use. The presence of different categories of customers with different needs and preferences cause the creation of different types of interaction. For this reason companies have to use many different channels, by a multi-channel approach. There is not a unique way of use for channels, and sometimes the same customer gets in contact with the company through different channels.
5. *Revenue Stream*: it refers to the way by which the organization generates revenues and profits, so remuneration. There are many ways by which firms generate money, each revenue stream reflects the complex systems through which organizations operate and different strategies they could adopt.
6. *Key Resources*: These could be physical resources, intellectual resources, human resources or financial ones. These are those fundamental that allow to organizations to run their businesses.
7. *Key Activities*: what firms do to interact with clients, so how they can understand what customers want and how deliver them value.
8. *Key Partners*: suppliers, dealers, etc. have a central role in the value chain, without them would be impossible to obtain resources and run businesses.
9. *Cost Structure*: To run a business is important also to take costs in count. They are a very important part of the business and could affect it. They could come by different sources and sometimes they could be managed in order to reduce the impact.

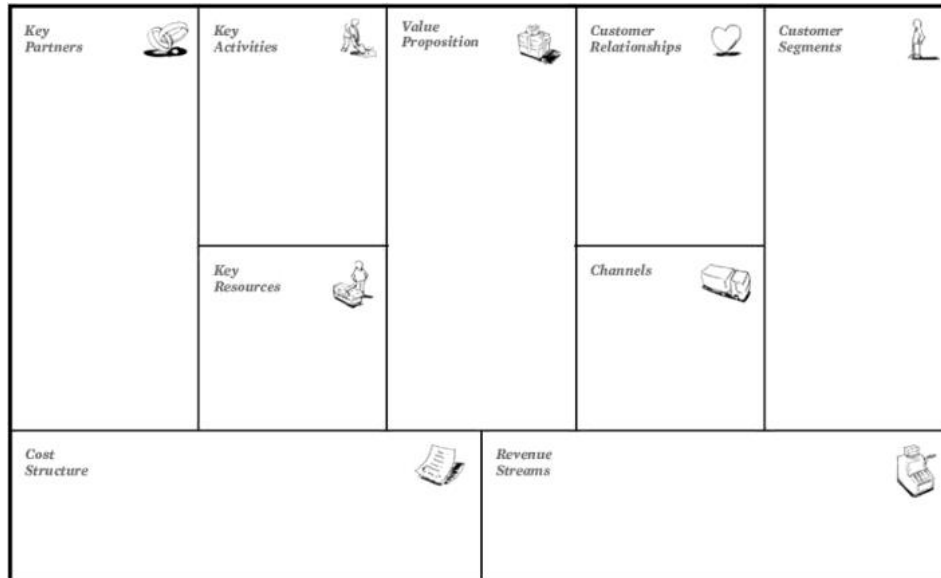


Figure 3: business model canvas representation

Source: Osterwalder, A., Pigneur, Y., Oliveira, M. A. Y., & Ferreira, J. J. P., 2011

BMC theory represents a starting point for studies relative to business models. Business model framework depends on organizational goals and by the organizational way to reach them. In particular due to continuous changes of businesses, environments and customers' needs, companies have to manage their business models in order to respond in the best way they can.

2.2.3 Business model innovation

As said in the previous paragraph elements of business change in a continuous way and in particular those that concern industry trends and customers both. For this reason firms have to adapt to these changes by innovation in terms of Business Model (Business Model Innovation, BMI). This type of innovation, as said by Gassmann et al. in 2014, take more advantages than a normal process innovation giving the organization an important competitive advantage; in fact Business Model Innovation generates changes in processes and products both and allow firms to offer and interact with customer by new a many ways in order to gain competitive advantage. (Goffin et al., 2010). Comparing BMI with Product and Process ones, is possible to observe how the first has greater impact and innovation potential on the same amount of time than Process and Product Innovations.

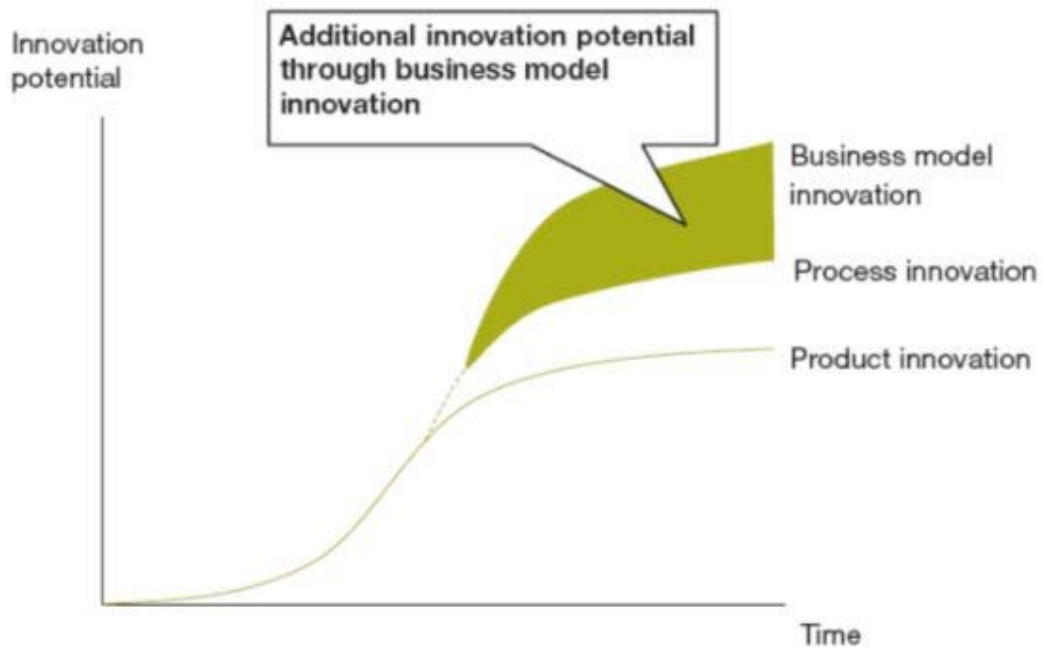


Fig 4: Gap between Business model innovation and Product and Process innovation

Source: Gassmann, O., Frankenberger, K., & Csik, M. (2014).

The reason is that BMI concerns all aspects of value chain and the adjustment of one element needs to reshape even the others; as explain by Gassman et al. by the “magic triangle” scheme.



Fig 5: Business model innovation “Magic triangle” scheme

Source: Gassmann, O., Frankenberger, K., & Csik, M. (2014).

However, even if from the previous figure (Fig 4) it may seem that BMI is something different from Process and Product innovation, it is important to underline, as done by Clinton and Whisnant in 2018, how Products and Processes are included in Business Model, so even their Innovations are included in the Business Model's one.

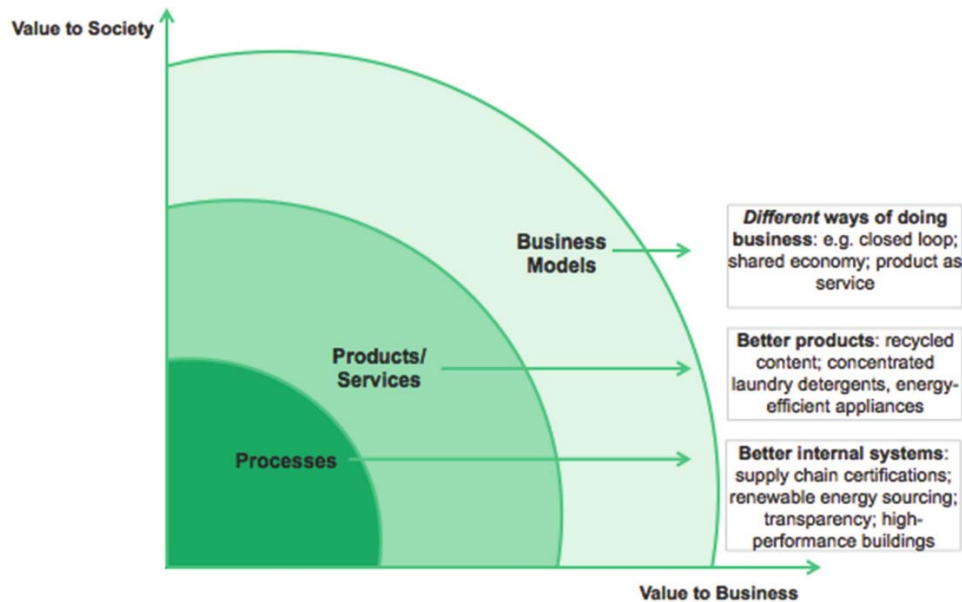


Fig 6: Business Model Innovation contains Products and Processes Innovation.

Source: Clinton L., Whisnant R., 2019

This explains why Business Model Innovation is possible for a firm to gain competitive advantage creating, capturing and delivering value. The value chain process is achieved by a combination of many factors including products and processes innovation.

Following Chesbrough's studies of 2007, it is possible to identify different types of business model from the most basic to the most articulated.

1. *Undifferentiated Business Model:* adoption of the same business model for different products
2. *Differentiated Business Model:* initial differentiation in the business model to provide customers different products or services;
3. *Segmented Business Model:* companies use the segmentation instead of a simple differentiation;

4. *Externally Aware Business Model*: openness of company in order to obtain new inputs and gain competitive advantages by innovation;
5. *Integration Of Innovative Business Model*: integration of the all the company's value chain, with the aim to innovate and gain advantages;
6. *Adaptive Business Model*: by this type of business model the company has the ability test and experiment solutions in order to respond to different needs just in time.

As shown in the previous list, every type of business model is suitable for a determinate situation, for this reason improvement and transformation of the BM are fundamental processes for firms to respond to needs and changes. In addition, Business Model transformation allows not only the ability to adapt but also to be competitive in the future.

However, making this process is not simple and there are some barriers that don't allow it. The most significant, as evidenced by Christensen in 1997 and Amit and Zott in 2001, the conflict between the business model already established for the existing technology and the new one provided for a disruptive one.

2.2.4 Fintech business models

2.2.4.1 General Guidelines

As said in the paragraph 2.2.2 about Business Model Canvas, there are 9 interconnected elements that constitute a Business Model and Innovation plays a fundamental role because it could be implemented in all components; anyway, innovation in one component requires adjustments also in the other components (Nicoletti, 2017). BMC of Fintech companies, which are mainly start-ups, shows some peculiarities and it is possible to give general guidelines about BMC's elements to explain how they work.

General guidelines BMC's 9 elements for Fintech start-ups:

Partnership and Collaboration Focus on Financial Institutions	Processes and Activities Focus on Marketing	Products and Services Focus on Value Added	Customer Experience Focus on Customer-Centric Approach	Market: <ul style="list-style-type: none"> • Customer • Competitors • Regulators Focus on Targets
	Resources and Systems Focus on Technology		Channels Focus on Social and Omnichannel	
Costs and Investments Focus on Risk		Revenue Streams Focus on Customer Lifetime Value		

Fig 7: Fintech Business Model Canvas

Source: Nicoletti, 2017

Market – Focus on Targets

Fintech companies approach is to focus their attention on customer groups that could provide a quick break-even and a solid ROI. In Kotarba’s opinion (2016) can be achieved either by going directly into existing revenue pools (classic banking, transactions, markets) or creating disruptive business models and exploring niches (mobile payments, personal finance management, account aggregation). Technology and focused ideas allows companies to provide personalized solutions in shorter times and a quicker adaptation to changes in customer behavior.

Products and Services – Focus on Value Added

When companies provide services is very important to act following a quality perspective. For this reason it should be: effective, efficient and economical customer process. In particular, is important to consider three main aspects of the service delivering:

- Service concept
- Service system
- Service process

(Edvardsson and Olsson, 1996)

It means that Fintech companies, in Business Models, have a great consideration for value added by their services, in order to associate these last with quality.

Channel – Focus on Omnichannel

Fintech initiatives can target their customers in a cost-efficient and effective way by their Omnichannel approach. It means that they can introduce new product and services combining and making transparent direct customer connections (email, call center, etc.) with indirect customer connections (social media, blogs, log files, and so on) (Nicoletti, 2016), to obtain a full view of customer. This allow to gain brand value and competitive advantage and, in the long time, to reduce communications costs.

Customer Experience – Focus on Customer-Centric Approach

In the Fintech industry, customers can themselves choose different personalized solutions considering their needs and expectations. However, they assume a central role during services' development and delivering. Fintech firms can survey their entire customer base and process results in a quicker and cost-effective way (Nicoletti, 2012), to obtain a truer picture of what customers need and want based on their responses. For Auerbach (2012) customer must play a pivotal role and the future belongs to banks that give the customer center stage in their business model. For this reason Fintech firms have a great potential; they are able to take into full consideration their customers, putting them at the center of their plans and strategies. They have the ability to identify and shape touch points with customers to guarantee a good customer experience and instill the brand image in customer's mind. In this way firms can increase sales and attract new customers having customer satisfaction and loyalty as success' parameters (Keisidou et al, 2013). Therefore, customer insights are fundamental in decision-making processes and all is driven by customer centricity orientation. In 2012 McKinsey gave some suggestions about the process for the creation of an effective customer-centric organization:

- Vision and positioning: “Create an institution that customers want to bank with and employees feel proud of.”
- Customer engagement model: “Design an organization that delivers exceptional customer service where customers expect it, and excites them where they do not.”
- Development agenda: “Define an integrated development agenda to drive short-term gains and long-term growth.”

- Organization, capabilities, and insights: “Build the insights engine, organizational capabilities, and governance needed to sustain momentum.”

Revenue – Focus on Customer Lifetime Value

For Fintech company is very important selecting customers and allocating resources to maintain and improve relationships with them. To achieve this objective firms have to leverage on external data for a more accurate pricing; data allows an appropriate pricing considering risks and customer’s usage. On an economical point of view there are three main concepts functional to customer selection to take in consideration:

- Customer lifetime value (Berger and Nasr, 1998)
- Value creation and exchange (Ballantine et al., 2003; Sheth and Uslay, 2007)
- Value co-creation (Grönroos and Voima, 2013)

They “enables managers to maintain or improve customer relationships proactively through marketing contacts across various channels” and “they also allow maximizing value added for the customers while leveraging cross-sell and upsell potential” (Nicoletti, 2017)

Processes and Activities – Focus on Marketing

Even if Fintech sector is full of unique products and services, the involvement of customer is fundamental anyway. Fintech companies have to leverage on their marketing departments in order to gain market share and acquire customer, with a consequent increase of resources to develop new products and solutions. The major aim of customer involvement is helping firms in making smarter financial decisions. There are four main solutions useful to leverage for a good marketing plan: Big Data Analytics, Open data, Customized Customer Content and Relational Marketing.

Resources and Systems – Focus on Technology

Firms in the Fintech industry have a constant need to innovate in order to survive to market changes in the future. They should focus their efforts producing and delivering leading-edge solutions develop for target market segment. Four main practices are useful for this objective: using data to find prescriptive and predictive information, using natural language processing and text analysis instruments for social media, enhancing search capabilities and optimizing call centers and middle offices.

Partnerships and Collaborations – Focus on Financial Institutions

According to Pollari's opinion (2016), many professionals have identified new trend about strat-ups which enable and optimize businesses run by traditional institutions, rather than disrupting them. The reason is that a collaborations between start-ups and traditional institutions allows to combine advantages in terms of technology and flexibility, typical of strat-ups with the credibility of traditional institutions. So this process in in two-way and the future will be characterized by a huge influence of Fintech start-ups these large traditional financial institutions' strategies and vice versa.

Costs and Investments – Focus on Risks

The most important costs that could arise in Fintech businesses are those associated with customer risks. They arise because of a greater range of product offers available via a mobile phone or other digital devices. Customer trust is a crucial success factor for Fintech initiatives, for this reason risk management process is necessary before customer protection problems arise for end users negatively affecting their trust. Anyway risks and customer associated to customer can be managed by lean and digitized solutions (Nicoletti, 2012) and risk officials can evaluate the loss and fraud propensity of existing customers in order to better price risk for new prospects. This helps in minimizing risks and costs associated with and pricing it appropriately. In addition, it can help also the improvement of real-time risk decisions.

2.2.4.2 Fintech Business Models classification

Even If in the previous paragraph were explained some general guidelines for Business Model in the Fintech sector, this industry is characterized by many different types of companies which offer a huge quantity of different services. For this reason is fundamental to distinguish some types of business models, in order to have a clearer vision about differences and approach between Fintech initiatives. For Lee and Shin (2017) there are six types of Business Models in the Fintech sector, depending on what companies offer as service: Payment Business Model, Wealth Management Business Model, Crowdfunding Business Model, Lending Business Model, Capital Market Business Model and Insurance Services Business Models.

Payment Business Model

Payments results as simpler than other financial products and services. Fintech Payment companies can acquire customers rapidly at lower costs, they are also able to innovate and adopt new payment capabilities. Their service is characterized by two markets: consumer and retail payment and wholesale and corporate payment. For BNY Mellon (2015) payment field in the

Fintech sector is full of different services like: mobile wallets, peer-to-peer (P2P) mobile payments, foreign exchange and remittances, real-time payments, and digital currency solutions. By these services is possible to obtain a huge improvement of the customer experience giving customers a better service in terms of speed, convenience, and multi-channel accessibility. In addition payment service are more conveniently and securely being used on mobile devices. Considering this aspect, two main kind of services could be identified: services associated with NFC (Near Field Communication) such as mobile payments without using credit card and P2P (Peer 2 Peer) payment services such as the ones offered by PayPal.

Wealth Management Business Model

Automated wealth management is one of the most popular Business Model, it consist in providing financial advice for a fraction of the price of a real-life adviser by the use of Robo-advisors. Robo-advisors use algorithms to suggest a mix of assets to invest based on a customer's investment preferences and characteristics ('Ask the Algorithm,' 2015). This business model benefits providing customers automated and passive investment strategies characterized by simple and transparent fee structure which allow low or no investment minimums (Holland FinTech, 2015).

Crowdfunding Business Model

Crowdfunding Fintechs allow the creation of new products, media, ideas and initiatives empowering people networks. In Crowdfunding initiatives three parties are involved: the project initiator or entrepreneur who needs funding, the contributors who may be interested in supporting the cause or project, and a moderator that facilitates the engagement between the contributors and the initiator. This last, usually a platform, enable contributors to obtain informations about the different initiatives and funding opportunities for products/services development.

Exists different types of Crowdfunding depending on objectives that parties have: Rewards-based crowdfunding, donation-based crowdfunding, and equity-based crowdfunding. Rewards-based crowdfunding are an interesting option for small businesses and creative projects to obtain funds. For a fund from supporters of a project, the business/project gives some type of rewards different from interests. Donation-based crowdfunding is a way to source money for a charity project by asking donators to contribute money to it. Parties do not receive anything other than some form of non-monetary recognitions.

Equity-based crowdfunding is an interesting option for small and medium-sized companies (SMEs) to increase their capital. It allows entrepreneurs to reach investors interested in acquiring equity in their business. By Equity-based crowdfunding contributors obtain portion of ownership from the entrepreneur in exchange of funds.

Lending Business Model

P2P lending fintechs allow individuals and businesses to lend and borrow between each other in an efficient way with low interest rate and charges. They match lenders with borrowers, and collect fees off of users. They operate through alternative credit models, online data sources, data analytics to price risks, rapid lending processes, and lower operating costs. The difference between P2P lending and crowdfunding is in the purpose. The primary purpose of crowdfunding is funding for projects, the purpose of P2P lending is debt consolidation and credit card refinancing (Zhu, Dholakia, Chen, & Algesheimer, 2012).

Capital Market Business Model

New fintech business models have a great importance even in capital market areas such as investment, foreign exchange, trading, risk management, and research. One important field in capital market fintech is trading. Trading Fintech Companies allow the meeting between investors and traders with all their possible actions like buy and selling shares and other financial instruments. Another important area regards foreign currency transactions; users can see live pricing and send/receive funds in various currencies securely and in real time. All made via their mobile devices in a more familiar way with lower costs and barriers. Some examples of Capital market Fintechs include Robinhood, eToro, Magna, etc.

Insurance Services Business Models

Insurance Fintech companies are able to guarantee a direct relationship between insurers and customers. These companies can personalize their offer, to meet customers' needs, based on data analytics. In particular they are able to collect data useful for risk analysis and consequently for pricing. For this reason Insurance Fintechs are disrupting the entire insurance Industry.

2.3 ROBO-ADVISORS INNOVATION

At this point, coming back to Osterwalder's theory, is possible to understand how any strategical or important change which allows to create, deliver and capture value could be classified as a Business Model Innovation. However, innovating a Business Model means much more than innovating a product or a process and, according to Lindgardt et al. (2009), "Innovation becomes Business Model Innovation when two or more elements of a business model are reinvented to deliver value in a new way".

From the analysis of the previous paragraph about Fintech Business Models, the reader can observe how much Fintech industry is focused and based on technology, for this reason people talk about tech organizations (Lamberg and Närvänen, 2015). Even if when dealing with Fintech initiatives is not simple to distinguish between BMI and a single product or process innovation, due to the high level of disruption caused by firms and technology in the financial services industry, they could be classified as BMI. In fact, Technology for these firms is an important source of competitive advantage, which allow disrupting the market and revolutionizing the completely the financial sector creating and delivering value in many new ways.

Business Model of Robo-Advisors Fintech companies is the greatest example of BMI in the Fintech sector. They have introduced a radically new business model, based on ICT infrastructure and investment algorithms that have disrupted and disintermediated the market from traditional financial institutions and other traditional organizations.

Partnership and Collaboration	Processes and Activities Marketing	Products and Services <ul style="list-style-type: none"> Automated advice Technology assisted advice 	Customer Experience <ul style="list-style-type: none"> Customer Centricity Clearness Transparency 	Market: <ul style="list-style-type: none"> Customer Competitors Regulators
	Resources and Systems <ul style="list-style-type: none"> Algorithms Virtual Robotics 		Channels <ul style="list-style-type: none"> Digital Channels <ul style="list-style-type: none"> Apps Web solutions Omnichannel 	
Costs and Investments			Revenue Streams	

Fig 8: Business Model applied to Robo-Advisors Fintech Companies

Source: Nicoletti, 2017

In 2016 Sironi argued that human face-to-face relationship in financial services has been complemented by online and digital services. Is possible to divide this process in two phases:

- From 1970s: when financial service providers targeted the U.S. middle class by introducing discount brokers. In this phase is possible to observe an increase in the financial market caused by reduced commissions and the entrance of new customers. However there was a lack of personalization in financial advisory and a small range of available products.
- From 1990s: the rise of World Wide Web allowed the availability of online financial services and platforms. In this way, new customer segments have been developed increasing more and more the market.

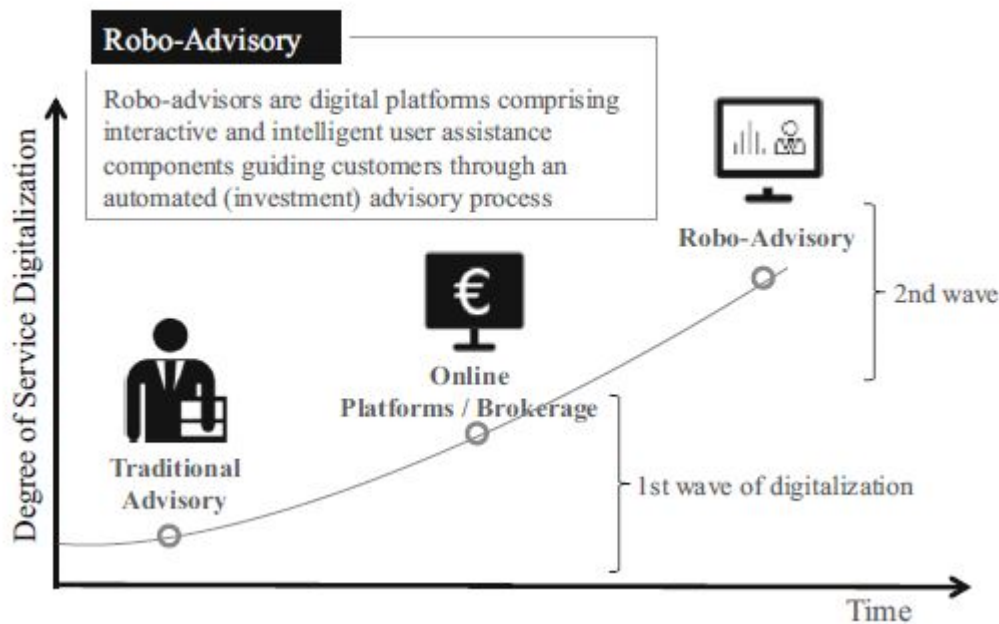


Fig 9: The digitalization of financial advisory services towards digital platform

Source: Jung et al., 2018

However, despite full digitalized solutions that providers offer, sometimes customers prefer hybrid solutions which allow them to search for information and compare products online but requesting human advisory before making an investment (Jung et al., 2018). For this reason Robo-Advisors should be seen not as a threat by human advisors, but as an opportunity of improvement and integration, considering that humans’ brain could never work like an algorithm and vice versa (Nicoletti, 2017).

2.3.1 Robo-Advisors

The financial services industry is one of the most affected by technological innovation. In particular by the use of virtual robotics. A “robot” is a technology or technology-enabled process that can perform functions previously performed only by humans. In the case of financial services industry robots tend to take the shape of “Robo-Advisors”. A Robo-Advisors are “Robo-advisors are digital platforms comprising interactive and intelligent user assistance components (Maedche et al. 2016) that use information technology to guide customers through an automated (investment) advisory process (Sironi 2016; Ludden et al. 2015). But a more precise definition could be Phoon’s one of 2018 “Robo-advisors are digital platforms that provide automated, algorithm-driven financial planning services with little to no human

supervision” which “collects information from clients about their financial situation and future goals through an online procedure, and then uses the data to offer advice and/or automatically invest client assets”.

2.3.1.1 How Robo-Advisors work

Following Nueesch’s studies of 2016 is possible to identify six phases for the traditional human advisory without the existence of digital service systems.

Instead, in case of robo-advisors presence is possible to identify three phases of robo advisory: *Configuration, Matching and Customization, Maintenance*.

Configuration: This phase is characterized by an information asymmetry between customer and advisor which has to be reduced following Kilic’s opinion (2015). This phase incorporates 3 phases of human traditional advisory (initiation, profiling, and concept and assessment).

Matching and customization: This phase consist in the transformation of collected informations into investment recommendation. Customers receive, helped by special algorithms, recommendations that could fit best with their needs. After, considering their preferences they decide the suggestion they likes more. If there is not a recommendations that satisfies their perceived needs, there is the possibility for users to reconfigure again their profiles in order to obtain alternative investment recommendations. Compared to other product configuration tools (like car configuration or clothing configuration), the characteristics of financial products can change unexpectedly (e.g., value or risk) (Jung, 2018). I

Maintenance: Decision making process in the financial sector is difficult. This is due to the nature of financial products characterized by the possibility to have great and unexpected changes in their features. For this reason in the third phase robo-advisors make a regular revision between the customer’s actual needs and the recommendation needs. It is made in order to obtain “reconfigurations of the product (rebalancing) need to be initiated in case of a substantial deviation due to economic developments or the changes of customer needs” (Jung et al., 2018). However this is a particular phase, because the existing robo-advisors can be divided in two categories depending on the level of action that customers have; they can reconfigure or specify the portfolio. The former means that customers can adjust the portfolio supported by robo-advisor addressing detailed and particular needs and requirements. The latter means that robo-advisors do not allow to adjust the portfolio in a completely free way but they

choose from sets of assets considering only preferences from the configuration step. In this case robo-advisors choose between sets of pre-determined investments which could fit with customer’s preferences previously expressed.

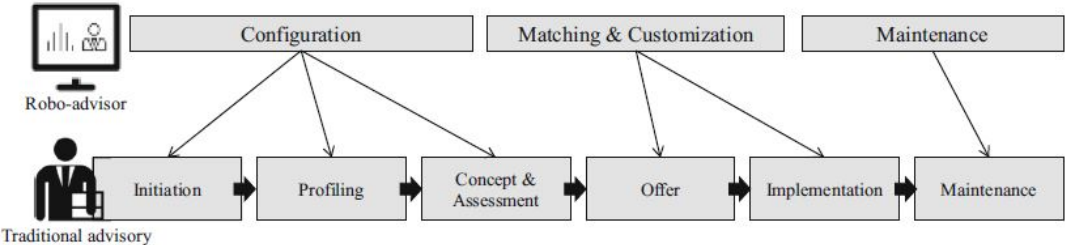


Fig 10: Comparison between Robot-Advisory and Traditional Advisory

Source: Jung et al., 2018

However, despite full digitalized solutions that providers offer, customers prefer hybrid solutions which allow them to search for information and compare products online but requesting human advisory before making an investment (Jung et al., 2018). For this reason Robo-Advisors should be seen not as a threat by human advisors, but as an opportunity of improvement and integration, considering that humans’ brain could never work like an algorithm and vice versa (Nicoletti, 2017).

2.4 ALGORITHMIC TRADING SYSTEMS

As said in the previous paragraphs, financial market dynamics are influenced by a huge number of factors. So is not simple for traders to predict what it could happen and trade in a better way. For this reason exists computers, based on computational techniques, which are able to carry out impossible operations for humans.

Algorithmic trading indicates the use of programmed and automated machines to execute market operations, such as buy and sell (Kumiega and Van Vliet, 2012). Thanks to algorithmic trading people don’t need to be aware about market values because the software can make operations for them immediately when a value is appropriate. Main values/factors taken in consideration are price, money and risk attitude of the investor.

2.4.1 Advantages and disadvantages

The first computer were introduced in the 70's to reduce costs and timing of market operations, but later the main scope of computer's use became the maximization of profits.

Considering this aim, Folder (2014) identified different advantages linked to algorithmic trading systems:

- *Lack of emotional component*: By algorithms, the system decides whether to carry out a certain kind of operation based on historical data. Human feelings cannot affect the choice, in positive and negative both. It makes operations free from pressure, fear, etc.
- *Discipline*: By the use of algorithms is possible to catch the right moment in which carrying out an operation. Some moments are unique and leads to better results.
- *Speed*: Algorithms allow to make many operations in a minimum period of time. As in the case of "high frequency trading", it consist in making lots of operations in a few time and each one of these has low return; however summing returns of all operations is possible to obtain a great amount.
- *Diversification*: The possibility to diversify, allow investor to adopt many investment strategies at the same time. It means that by the combination is possible to obtain higher levels of profits and minimize losses and risks.
- *Backtesting*: By using historical data is possible to conduct an analysis about an operation looking at similars made in past. In this way is possible to know about effects of some actions with a consequent possibility of prediction.

However the use of trading algorithms has even some disadvantages that have to be analysed:

- *Bugs and errors*: Sometimes is possible dealing with terrible consequences due to errors typical of technology as program fails etc.
- *Over-optimization*: Some strategies hypnotized by the system could not possible in the real life.
- *Technical knowledge requirement*: Computer and financial knowledge are both necessary to train machines in carrying out operations.

- *Change in circumstances*: Since it is programmed an algorithms could not be able to work due to changes in circumstances from which it was trained.

Due to the existence of important disadvantages is possible to affirm the same concept explained in the previous paragraph for Robo-Advisors: Algo-trading is only an instruments for humans to perform an activity. It is not possible to substitute completely the human work, humans have to monitor and control algorithmic trading in order to avoid failures and problems typical of machines.

2.4.2 Regulation about algorithmic trading

Events that happen in the financial sector could have huge effects on the entire economy and consequently on people's lives. For this reason it needs to be one of the most regulated economic activity. Even the use of algorithmic trading, being an important aspects of the financial field, is subject to some regulation.

On July 19, 2016, the European Commission published a document, supplementing Directive 2014/65/EU of the European Parliament and of the Council with regard to regulatory technical standards specifying the organisational requirements of investment firms engaged in algorithmic trading. In this document rules and requirements for algorithmic trading's use are established.

The final aim of European Commission was the possibility to limit and control the potential risk and problems generated by algorithmic trading. In particular the main sources of risk are the possibility to lose large amounts of money and potential advantages for some companies more than others.

2.4.3 Effects and impact of algorithmic trading

Thank to use of algorithmic trading is possible to observe a democratization of finance. All people are able to invest in a more quick, economical and less risky way doing few efforts. Algorithms, reaching great amounts of data, allow Investment Fintech companies to personalize their offers in order to give customers a better service improving the user experience. This leads to a greater customers' attitude to invest with a consequent increase in value generation process.

III METHODOLOGY

This chapter is about the methodology used by the author for this research. In the next paragraphs the author will give an explanation about decisions which regards research strategy and design; and the explanation of data collection and analysis. At the end of the chapter the author has dedicated a paragraph to the quality of the research.

3.1 RESEARCH STRATEGY

According to Bryman and Bell in 2011, a research can be Qualitative or Quantitative, the chosen option depends on the nature of the research and its objectives. The aim of this research is to analyse the impact of algorithms in the Fintech industry in order to enrich the theory about. In particular, about what concerns the use of trading algorithms to improve investors' experience and create value for them and provider both.

For this reason the author thinks that a qualitative research could fit better with the scope of the work. In fact by a qualitative research the researcher can collect opinions, insights and points of view of respondents about the analysed topic (Bryman et Bell, 2011). In particular, it allows to take into consideration the specific context of interviewees, enabling them to explain their opinion about specific situations without the influence of the researcher (Yin, 2011). Collected results will be in words and concepts by which the author will be able to discover and catch informations. In addition the choice to adopt a qualitative approach is due to the opportunity to conduct a more flexible research; making adjustments and corrections if necessary.

However, qualitative research strategy received many critiques which have to be considered. Bryman & Bell in 2011 identified four mainly critiques about the qualitative approach. First, It is considered much subjective because it could be influenced by biases and opinions of researcher and respondents. Secondly, due to missing standard procedures it is hard to replicate, however this aspect does not affect the study too much because replication is not the objective of the research. Third, a researcher could incur in generalization problems due to small samples, in fact interviewee could not be enough representative of a population. At the end, a miss of transparency in data collection and analysis could characterize this type of research.

In general, the qualitative research is associated with an inductive approach that conceives the fact that data guide the emergence of concepts, as said by Bryman and Bell in 2011. In this case

the researcher followed an inductive approach because his aim is not testing an hypothesis or theory but rather exploring the topic, in fact he will try to have explorative path through the collection of opinions to generate general concepts. However, they also said that often qualitative research does not create theory and it uses theory as background (Bryman & Bell, 2011).

At the end a Formal theory will be created from the research; for Bryman and Bell it has “a higher level of abstraction and has a wider range of applicability to several substantive areas”. For this reason in this research, quality of data is more important instead of quantity. In fact, this research starts analyzing something on a practical level arriving to a theoretical one.

3.2 RESEARCH DESIGN

Once explained the research strategy, is possible to proceed analysing the research design. Exist different types of research design, each one represents a different way to set the research work and thus to obtain the desired results (Bryman and Bell, 2011).

Possible design are:

- Experimental design;
- Cross sectional design;
- Longitudinal design;
- Case study design;
- Comparative design.

For each method, there is different way of work and therefore a different design for the entire thesis project. It depends on many aspects, which the main are: the topic, the sufficient availability of informations and the work process. The researcher can choose the most appropriate design for its work. The topic of this research is very new and even if there are lots of theoretical basis they remains very broad. In order to answer to the research questions the author decided to adopt a *cross sectional design* to have a wider view of the argument. In fact cross functional design has the following characteristics:

- A constant comparison between different cases
- The data collection takes place in a precise time frame

- The choice between qualitative or quantitative data
- The study of variables and their relationships

An important characteristic of cross sectional design is the fact that it allows the validity of results; in fact is possible to assume that interviewee are statistically representative. However the limits which indicated previously about the qualitative research persist, this fact has to be considered during the formulation of a theory.

Cross sectional design seemed to be a good choice to face with an argument as automatic trading. In order to make a wider research and try to obtain more informations about the topic, is important to adopt have a longitudinal vision and method. It allows considering different situations at different times and understanding how Fintech industry evolves in a parallel way with the evolution of automation.

3.3 RESEARCH METHOD AND DATA COLLECTION

To address research questions, primary and secondary sources of data were necessities. Bryman and Bell defined primary sources as informations related to the specific research problem, which the researcher disclose for the first time, while they defined secondary source of data which that are not directly collected by the researcher and are available from previous studies. The author had to provide a theoretical background about the topic of the thesis, for this reason he collected secondary data in order to include them in the literature review. For Bryman and Bell it is fundamental in selecting the research design, because allow the researcher to choose the right data collection and data analysis method. For this reason the researcher made the collection of secondary data since the beginning of the research using keyword about my topic as “Fintech” “Fintech innovation” “Business model” “Fintech business model” “Algorithms” “Algo-trading” “Robo-Advisors”. In addition, he used lots of sources as articles, books and libraries as the one of Gothenburg University.

There are two conduction methods for the literature review, which are the systematic review and the narrative review. The former is a detailed process that minimize biases with an exhaustive review of scientific articles with inclusion and exclusion criteria; while the latter in less specific and consist in acquiring initial knowledge on the topic addressed for the research. To conduce the literature review about the topic of my research the researcher chose the

narrative review because it fit well with the flexibility of the qualitative research and due to the nature of a student research project the narrative one is less time consuming.

This is an explorative research, and to give answers to the research questions the author had to collect also primary data from experts and from different companies, the list of respondents and interview info will be provided at the end of the paragraph. According to Bryman and Bell, to select the sample for a research is possible to use probability or non-probability approach. For the qualitative research the best method is the non-probability sampling, in which respondents are not chosen random but based on researcher’s judgment. As non-probability sampling approaches, it is possible to find: convenience sampling, purposive sampling and swonball sampling. Between these the author chose the *purposive sampling* to selects expert people which were able to answer to research questions.

To conduce this qualitative research he could choose between three methods: focus group, interviews and ethnography. The first method consist in a group of interviewees on a specific topic, the second regards a simple interview process, while the third concern an analysis from the researcher in order to observe and analyse people behaviour. Due to the nature of the research he considered better the *adoption of interviews*, prepared according to the research theory of Bryman and Bell in 2011.

It is possible to distinguish between structured and semi-structured interviews. For the writer the *semi-structured* form was better to leave space to respondents but having at the same time a focus on the research topic, in fact semi structured interviews find ground on a set of prepared and open questions that guide both interviewer and respondent (Flick, 2018) and ensure the comparability among interviews. In addition a comparison between Empirical findings from interview and theoretical findings from the literature has been made in a critical thinking way, to gather similarities and differences and reaching conclusions.

Table 2: List of respondents and interview info

Respondent	Title	Company	Date	Method	Lenght
Companies					
Antonio Simeone	CEO	Euklid	07/05/2021	Phone call	70 min
Anonymous	Quantitative Analyst	CIMalgo	24/05/2021	Zoom call	60 min

Experts					
Fredrik Wallinder	Expert	/	13/05/2021	Zoom call	45 min
Tommaso Gastaldi	Expert	/	12/05/2021	Zoom call	60 min

3.4 DATA ANALYSIS

In the fifth chapter the empirical findings of the fourth chapter will be discussed through the analysis of the interviews. Following the same structure adopted in the data collection, the author will give a comparison between empirical findings and theory. The same structure adopted for the chapter dedicated to the empirical findings will be useful for researcher and reader both in order to have a better comprehension of data. In addition the researcher will provide a good and complete interpretation of data in order to obtain valuable answers, all by adopting a critical approach. Before the analysis of data, interviews are analysed to organize the findings. The researcher started from the literature review, analysing the fit between each collected data and the empirical data. The focus of the author is on matches between theory and empirical data and on new insights that can contribute to previous research. For this reason, aspects mentioned just in the theory are abandoned. In conclusion, when theoretical aspect are in contrast with what found in the empirical collection, it will be covered in the analysis part.

The researcher preferred to disassemble data without a formal coding approach because by leaving full discretion to the author, despite the potential uncertainty that could be generated. In addition in order to overtake inconsistency and inaccuracy, the researcher will iteratively return to the empirical data many times to ensure that their dismantled topics are as faithful to the original data as possible (Yin, 2011).

3.4 RESEARCH QUALITY

Quality is a fundamental characteristic of a research work. According to Bryman and Bell (2011), to evaluate the qualitative level of a research it has to respect some criteria:

- *Validity*: It concerns how much information and findings are correct and accurate. There are different types of validity: construct validity, convergent validity, internal validity and external validity. The former regards searching our theoretical hypothesis from interviews. The second concerns in the comparison between the obtained results by different interview methods. The third regards the quality of the work itself, if at same conditions is possible to conduct another analysis obtaining same results of the research. The latter consists to see if is possible to apply research's conclusions in the real world.
- *Reliability*: Regards the level at which a research leads to stable and consistent results
- *Replication*: It is referred to the possibility to repeat the research work and obtain the same results in terms of research and quality.

In the specific case, this research respect all of the previous mentioned criteria.

Following other studies, is possible to add two criteria more: *trustworthiness* and *authenticity*.

- *Trustworthiness*: refers to the following four aspects (Anney et al., 2014 & Bryman and Bell, 2011):
 - *Credibility*: research and results have to be credible. The researcher have to make efforts about the topic in terms of research questions and in terms of literature review both. The researcher sent to each respondent the summary of the findings to control. Finding has been created following audio recording immediately after each interview so the author had everything in mind. In addition, during interviews if something was not clear, the researcher asked to respondents for explanations and clarifications. The researcher made a great study on the theory about the topic to be able to ask proper questions during the interviews.
 - *Transferability*: It means that conclusions of the research work could be applied in other situations and contexts. This research consist in a study among companies and experts in the same sector. For this reason, findings might not be completely generalizable but they could work as guidelines for Investment Fintech companies based on algorithms.
 - *Confirmability*: It means that the research should be free by all behaviour and bias, being much objective as possible. Full objectivity in business research is impossible; however, the research tried as possible to make conduction of the research, as possible free form the influence of personal beliefs and bias.

- Dependability: Results of the study should be based on the information obtained during the interviews' processes.

Under this point of, the dependability for this study can be achieved by “auditing approach” (Bryman and Bell, 2011). It is referred to the author’s action of keeping track of all phases of the research process from the beginning to the end in order to evaluate to what extent proper procedures have been adopted. In addition, to enhance the dependability of the research the author adopted a systematic approach for data collection and analysis.

- *Authenticity*: is described by Bryman & Bell with five sub-criteria: fairness, ontological authenticity, educative authenticity, catalytic authenticity and tactical authenticity (Bryman & Bell, 2011).
 - Fairness: relates to the fairly representation of different viewpoints, for this research companies and experts were interviewed so fairness might be present.
 - Ontological: regards the ability of the research to provide a better understanding of the social context. The scope of the research is contributing in the understanding of the social context regarding Investment fintech companies based on algorithms so there is ontological authenticity.
 - Educative: the possibility for the research to help people in a context understanding others’ opinion. This criteria is partially satisfied considering that the research has a not linked scope.
 - Catalytic: regards the ability of the research leading people in a context to take actions to change their situations. This criteria could be low in this research
 - Tactical: relates to the capacity of the study driving members toward the first steps of action. This kind of authenticity could be present in the research considering the generation of general insights for Fintech companies based on algorithms.

IV EMPIRICAL FINDINGS

In this chapter the data collection from primary sources is presented. The findings from semi-structured interviews are displayed per expert and per case company in order to provide a comprehensive view of each. Empirical findings are divided into three main categories: (1)

Trading Algorithms; (2) Automatization of trading and (3) Future expectations. These are derived from the combination between the literature review and the interview guide.

4.1 Antonio Simeone – Founder and CEO at Euklid *Euklid*

Euklid is a Fintech hedge fund, founded in 2018, whose head quarter is in Canary Wharf district, which is one of most important financial centres in London and in the world. It is a member of Level 39, a fintech incubator that manage the biggest techno-finance co-working space in the world. The main characteristic of Euklid is its capacity of using genetic algorithms, artificial intelligence and blockchain together giving investors the maximum level of objectivity, transparency and security. Its business is based on biocomputing, the new science that combines mathematics, physics and biology, in order to catch market trends in advance and generate profits.

The author had the opportunity to interview the founder and CEO of Euklid, Antonio Simeone, discussing about Euklid's work, the algo-trading field and perspectives for the future. The respondent gave the researcher his opinions, ideas and points of reflection in order to have a better understanding about algo-trading and Euklid itself.

4.1.1 Trading Algorithms

4.1.1.1 Development

The algorithmic trading is based on mathematical and statistical models that allow to make previsions and understand the market in advance. In this context the Artificial Intelligence based on models assumes a key role. Thanks to the possibility of analysing large amounts of data and variables from the environment, it can make previsions and take better decisions than a human trader could make. However trading environment is very tricky. It is characterized by an infinite variability, due to the huge amount of events that could determine the logics of the market. For this reason a single model of Artificial Intelligence in not enough to make forecasting and take actions in a good way. Model needs of a continuous development in order to respond to changes and adapt to the surrounding environment. Euklid is aware about it, so they have a team that works between eight and ten hours per day for the research of new patterns. Their trading algorithms have particular characteristics linked to some concepts, they are:

- *Fingerprints*, considering the fingerprint left by the collective psychology of the economic agents. It could be recognized only by Artificial Intelligence models and not by humans.

- *Horizontally arranged*, based on the assumption, opposed to a vertical arrangement, for which the same result can happen twice.
- *Biocomputed*, because they are based on Biocomputing, which allows to perform calculations involving the storing, retrieving, and processing of data.
- *Adaptive (to change)*, in fact they are trained to recognize conservative and innovative behaviours, selecting from chaos and randomness and obtaining the result of mutual dynamic interaction.

According to the respondent's opinion, the creation of good structures and models, which own the characteristics mentioned before, is a scientific process which is full of a continuous and systematic research. However, despite the scientific approach, in this process there is a fundamental aspect linked to the creativity and research team. These latter are formed by people who have totally different backgrounds and ways of thinking. This allows to have different points of view on a same thing in order to create more adaptive structures which take in count different visions and lead to many creative solutions.

4.1.1.2 Criteria

Trading algorithms works to discover patterns and dynamics of the market. Using a huge quantity of data they are able to make previsions about market trends and changes. Being able to make prevision means being able to make profits. As the respondent said, since the beginning of the activity they used to work with models which took in consideration many technical variables such as daily prices etc., only for Bitcoin for example they had fifty different models. At the end these models were combined in order to obtain a final algorithm that said what action had to be taken (between short, flat and long). Nowadays instead, they use to work even with complex numbers, equations, wave equations, quantum mechanics and machine learning to obtain useful mathematical models. The combination process to obtain a final model that describes a determined market is achieved through: Swarm Intelligence, Neural Networks and Genetic Logic. In particular this last concerns an adaptive system that changes its structure based on external or internal informations flowing through the net during its learning process; this concept is useful to explain the next aspect that the respondent underlined. As said in the previous paragraphs, markets are subjected to continuous changes and doesn't exist a model that fits every time. For this reason is necessary to act with an adaptive logic, responding to changes by the continuous creation of new models following the typical logic of an Artificial Neural Network. The research team is fundamental in pursuing this objective. Following the

previous concept of Genetic Logic, Euklid's algorithms are able to combine qualitative variables based on companies components' analysis, as the research team, and quantitative ones obtained from the market in order to find the best actions to obtain the best outcome. The most important example that the interviewee gave was about StonePrime. This is another company founded by the respondent that developed an artificial intelligence useful to analyse qualitative parameters of five hundred American biotech companies. The objective is to understand in advance if a research could be approved by the Food and Drug Administration and anticipate market trends.

4.1.2 Automatization of trading

4.1.2.1 Emotions and rationality

As the respondent reported, the seventy percent of US market is driven using algorithms. So he think in not the future but even the present. To understand the great work made by algorithms is enough to take example from the most performing fund in the world, Renaissance Technologies, founded by James Harris Simons in 1982. Numbers are fundamental for a better understanding; observing results, from the foundation till now, is possible to see they had a few amount of losses. They use to work with purely quantitative parameters, characterized by the absence of discretion. By the use of mathematic models characterized by objectivity is possible to eliminate cons of human operators' sensibility. Human decisions and behaviours could be affected by emotions and feelings, generating mistakes. In this sense emotions and feelings are set aside in favour of a greater objectivity and rationality.

4.1.2.2 Opportunities and Challenges

If the lack humanity has a positive impact on the algo manager side, due to the possibility to undertake actions in a more rational way, is not always the same considering the investor side. As the respondent explained, at the beginning in particular, they had lots of difficulties in making themselves understood. People were also scared about investing their money with the aid of a machine due to a lack of trust. On a rational level should be easier to trust in machines, in fact people could be sure that even in case of human's problems the machine can operate anyway by itself. But on an emotional level it is the opposite, being a detachment that does not allow people to perceive the machine and believe in it. However, is possible to inspire trust in

people by different ways; in particular, through the perception of people that works with those machines and models by investors and the achievement of concrete results in terms of profits.

4.1.3 Future expectations

In the respondent's opinion the future is in the direction of a complete automatization and algorithms' importance will increase more than happened till now. Machines will be able to catch relationships and nuances in the market more than humans could never do, in particular due to the great development in information technologies and the increasing in computation capacity. Every field in the future will be driven by algorithms and models, or at least the financial one, even considering aspects as sustainability and research. The great development of models is seen from many people as a challenge, because if everyone will use machines there could be a potential risk of missing profits and gain. However, for the respondent the market will benefit from the diffusion of machine's use, in fact it will have a great impact on the research and development due to the increase of competition. In particular with traditional players. At the moment traditional financial players and fintech start-ups are collaborating by a mutual exchange, fintech companies give traditional players the possibility to explore the fintech world obtaining back linkages to traditional financial logics. But in the future they could compete to survive in the environment. So it is possible to expect a continuous improvement in logics, dynamics and models development, all based on creativity, brave and entrepreneurship, which allow to fintech companies to compete against big players which own greater amount of resources.

4.2 Anonymous – Quantitative Analyst at CIMalgo

CIMalgo

CIMalgo is a FinTech Research & Development company for the investment management industry, founded in 2011. They provides quantitative trading solutions, customized portfolio models and global stock-market and equity analytics, as a vendor of financial technology and information services to professional clients; for this reason they never provide investment advices. The company is independent in from banks, financial institutions and other party interests. And this allow to focus on excellence in meeting with clients formulated financial objectives, and to always act within the framework of the policy conditions provided by the client. The policy that they follow allows to avoid conflict of interest with clients. CIMalgo's proprietary and patented methods are based on mathematical finance, computational

epistemology and machine learning. Their product offering is based on the delivery of standardised and/or customised outputs of equity portfolios and clients can choose from predefined universes and filters or choose to add or subtract their own.

The author had the opportunity to interview a Quantitative Analyst of the company who wanted to remain anonymous.

4.2.1 Trading Algorithms

4.2.1.1 Development

Development process for trading algorithms is a multiple step process, in which research is fundamental component. Everything during the development process is based on logics and assumptions, as what is true and what is not true. In fact, the first main step is the identification of a proper logic on which base the algorithm. It is possible to say that does not exist a unique logic on which algorithms work, but it depends from the developer, his beliefs and logic that makes sense for him. In a second step is important to find a sense for the logic according to the data, in particular it can be supported by looking at simple tests, or being disproved using data or the opposite could be shown. The following step consist in the identification and definition of a problem that the developer has to solve, problem in fact are also like part of the logic itself. The biggest problem is to find the most meaningful ways to solve the problem, and it is very important to link the problem to an effective solution method. Pairing these two things is the only and most effective way to create something good and something that's robust against the time.

4.2.1.2 Criteria

Trading algorithms operate with a data driven perspective, trying to read out something in place from data. In particular they use quantitative parameters to take decisions. Every developed model takes in consideration quantitative data reached from the market, such as historical pricing and volatility, and operates based on basic financial and statistical concepts, such as Capital Asset Pricing Model (CAPM) and common distributions, as the Normal and the Gaussian. This allow to the company of the respondent to have a limited number of products in terms of algorithms that are suitable for different kinds of financial instruments. In particular they are interested in predicting volatility and like minimising different kinds of risk. However,

is very hard to make predictions when special things happen, in particular if you are data driven and look at the historical data.

4.2.2 Automatization of trading

4.4.2.1 *Emotions and rationality*

The use of algorithms allows to take more objectives decisions, completely based on rationality. Every bias and belief of the investor is eliminate in favour of no discretion and in order to act in the most objective way as possible. In particular the use of quantitative parameters and data, allow to make predictions based on concrete objects as numbers put aside human feelings and emotions.

4.4.2.2 *Opportunities and Challenges*

A lot of people put much trust in algorithms and believe that algorithms can do everything, but they can solve only some problems. Is important for users to have a clear vision of what they are solving with each algorithm, looking at what, why and how come they can. The use of algorithms for trading allow investors to not be aware about trading activity, in addition they don't need to understand algorithms, but they can understand what algorithms are supposed to do. Thanks to the use of algorithms for trading is possible to assist to a greater access for people, with a sort of democratization, because everybody with an account can have a service by which you are able to perform the trading activity.

4.2.3 Future expectations

About the future, in respondent's mind will be a great improvement in technologies and processes related algorithmic trading. For what concern technologies he mentioned the more linked relationship between finance and machine learning, which will allow to a total optimization of the investment process. On the other side, for what concern processes, he believe that in the future will be developed new and modern techniques for finance that will substitute the old ones. The respondent talked also about the future perspective on trading activity for what regards the substitution of humans by computers. Even if he was a bit conflicted about, due to the impossibility for algorithms to solve every problem, he believe that

the future will be characterized by a full use of machines even considering the development of artificial intelligence and machine learning.

4.3 Fredrik Wallinder – Interim CTO at Swedforex and algorithmic trading expert

The author, thanks to the support of First To Know, has the opportunity to schedule an interview with Mr. Fredrik Wallinder. Mr. Wallinder has a background as physician, with a PhD in Astrophysics at Lund University, but since some years he changed path to the financial sector developing a deep knowledge in this field and in particular about what concern automatic trading. At the moment he covers the position of Interim CTO at Swedforex. This last is a company that develops automatic trading systems for the forex market using the latest computers and algorithms.

4.3.1 Trading Algorithms

The interview started with an introduction about algorithmic trading and the respondent gave a brief explanation about the topic. First of all he specified that “Algo trading is not new and has been around since the first computers. It is a way to process data from the financial market and trade assets using the rules set in the algorithm”. In a second time he made a real example talking about Renaissance Technology, the best hedge fund in the world based on algorithmic trading which was founded by the mathematician James Simons.

4.3.1.1 Development

The respondent gave the researcher an explanation of the development process for trading algorithms. As he said, trading algorithms’ development can be time consuming and difficult if the programmer writes down every line of source code. Fortunately, there are many tools that produces the source code using a graphical interface. The development process is articulated in many phases from the theory to the practice. There are seven phases before algorithms become effectively operative. The development procedure is as follows:

1. In the first phase a human trader, who have the function of researcher, studies an asset to discover a pattern that can give an edge
2. The second phase is characterized by rules’ setting to exploit that pattern

3. In the third phase rules are encoded into an algorithm, this the starting point of the practical approach to the development
4. The algorithm is backtested using historical data to see whether it works as planned and the potential performance
5. In this phase the algorithms is tested again, but this time using a demo account subject to live data
6. If the algorithms is good enough and satisfies requirements, a small account with real money is used to test it again
7. If that previous stage is passed, the position size is scaled up

This process follows a sort of lean methodology, in fact after the theoretical development it is subjected to continuous tests in order to monitor and in case make adjustments or start again from the beginning. Trading algorithms needs to be supervised and replaced when the efficiency goes down. “It is not a set-and-forget process”. In addition, in respondent’s opinion “is obvious that finding an algorithm that fulfils all requirements is very hard, for this reason the solution is often a portfolio of algorithms that work in different ways”.

4.3.1.2 Criteria

Trading algorithms works basing on data reached from the market, from the past and live both. Every decision and action that machines take is based on rationality, considering great amounts of data and objective parameters. However, to allow algorithms to respect some requirements is necessary to act in an adaptive way by testing and changing; considering that is not possible satisfying all requirements, as the respondent affirmed, the most common solution is the adoption of a portfolio of algorithms. The reason is the huge variety of logics that can change from an instrument to another, in fact every instrument or asset which a machine can deal with has different dynamics and patterns to analyse and predict.

4.3.2 Automatization of trading

4.3.2.1 Emotions and rationality

In the respondent’s opinion the ninety-five percent of all manual traders lose money due to psychology, for this reason the old generation, who is used to this, only sees the risk involved and they cannot a full understanding about trading by algorithms. On the other side, algorithmic trading is perceived as totally natural for younger generations since they have technical skills

to understand it. The new generation in fact, has access to internet forums, experience of crypto trading and lots of trading information from social media such as Youtube and Facebook. So the perception of algorithmic trading is a generational issue. A good fintech algorithmic trading company should be transparent and offer a lot of real-time information without noise to their customers in order to inspire trust in investors. “With real-time reporting and global investment opportunities the sky is the limit”. This means that people will be able to take control of their financial situation and become financially free. Even if they do not trust completely in machine operators, using a customer centric approach, and giving them the possibility to act for themselves, is possible to convince investors about their influence on machine actions. In fact, the possibility of intervention could be the key to make people feel safe about their money and investments and to reduce the detachment between humans and something that is not human.

4.3.2.2 Opportunities and Challenges

The automatization of trading is characterized by many opportunities and challenges about which the respondent gave his idea to the researcher. About opportunities, he underlined a particular aspect about the “democratization” of trading activity. Indeed in the past, only big hedge funds had the resources necessary for algorithmic trading, but nowadays all has changed completely and everyone with an internet connection in the world and good enough skills can now make serious money from trading. Instead, on the challenges point of view he think that a potential one can be to come up with algorithms that fulfil appropriate firm requirements, such as a very low drawdowns. Consequently, what is going on now is basically a war between algorithms, in which the best (i.e. the best programmers) win.

4.3.3 Future expectations

Talking about the future expectation about Algorithmic trading, Mr. Wallinder had a focus on two particular aspects: the first related to new technologies and the second related to financial ecosystems considering the relationship between fintech companies and traditional financial players. In respondent’s opinion tools that facilitate good algorithmic trading has a great future. This includes not only more advanced machines’ development but also the whole basic infrastructure such as programming tools, visualization tools, VPS servers and funding

companies that provide capital. On the second aspect instead he underlined as “typically, older firms do stock market trading on behalf of wealthy clients who pay very large fees” instead New fintech companies offer much better returns since they do not have costs for offices, staff etc. and can grow exponentially world-wide very rapidly via internet. The old banks and institutions are not available to lose their influence and they could make opposition to the new dynamics of financial sector “as it is happening for the crypto market”. A potential scenario could be a bloody competition between fintech companies and traditional players, since which “many old banks will not be able to survive”.

4.4 Tommaso Gastaldi – Professor of Statistics at La Sapienza University and algorithmic trading expert

Tommaso Gastaldi is a Professor in the Department of Statistics at “Sapienza” University in Rome. He is academically well known for his work on censored and fuzzy data, and his works are among the standard references of scientific papers on fuzzy data analysis. Along with his academic research, he has also developed an interest, both theoretical and practical, in algorithmic trading. In particular, his specialities are algorithmic trading systems for hedge funds, hedging techniques, automated trading, data mining, quantitative finance, trading methodologies and execution and automated fund management. He is also the author of a large and powerful algorithmic platform, whose effectiveness has been proven with live demos in public discussion on the top public forum, such as Elite Trader, for instance.

4.4.1 Trading Algorithms

Algorithmic trading is characterized by a close connection between a strategic component, that establishes the set of rules used for trading, and an operative component, related to physical infrastructures and asynchronous operations. After the algorithmic strategy has been developed, the architectural component also is of crucial importance, because possible execution problems or issues or mishandling in the management of asynchronous operations, may lead to unexpected losses.

4.4.1.1 Development

Algorithmic trading is based on a set of rules which govern buy-sell actions. In general, a strategy is also tailored to the specific instruments, because different categories of trading instruments may require different approaches. In particular, taking into consideration the huge variety of problems that could arise for each instrument, it is possible to imagine how long the development of an algorithmic trading platform could take in terms of time. There is no such thing as a good universal strategy and depending on the financial instruments and market situation, and also desired level of risk, several different approaches. For this reason, for the development is important to make constant and deep research to find the most appropriate logic suitable for a particular financial instrument, market and investor.

4.4.1.2 Criteria

Regarding the algorithmic platform, we could distinguish between two large classes. One is constituted by commercial, partially customizable platforms, where the user can implement his trading logic, through relatively simple programs stating the rules to buy and sell in response to market conditions. On the opposite end, there are custom-built algorithmic systems with a built-in logic, with a very large degree of sophistication, totally unachievable by “commercial” solution, that can engage in real “wars” of strategy, speed and intelligence against other machines and market makers.

4.4.2 Automatization of trading

In theory, one could imagine a full automated system running 24/7 forever, however, in practice, it is always necessary, and advisable, some form of supervision. Supervision means that, even if a machine can carry out thousands of orders a day, for a long time, in full automation and without any external intervention, still, some form of periodic supervision or monitoring, on the overall work, is advisable. Mostly because, for several reasons, there could arise unexpected technical issues in some part of the network. Nowadays, unless cases of Direct Market Access (DMA), in most cases a broker has the role of intermediary between computer systems, and some issues may also arise in the conversation with the broker machines, usually

carried out through specialized software (trading API), which is always inherently asynchronous.

4.4.2.1 Emotions and rationality

Financial instruments have no predefined paths, obviously, and their trajectories are random processes' sample paths, for this reason, it is quite difficult to devise systematically profitable and sustainable strategies. These movements could be favourable or unfavourable and, in particular, in the second case, there is a great psychological component that may come into play. When there are unfavourable movements, people emotions, and worries, in particular, tend to affect trading decisions, and sometimes shut down the machines or abandon a strategy. Even if someone established a logic to adhere to, sometimes it is human psychology that fails to comply with the established plan, especially when losses are involved. The emotional component is strictly linked to risk and the availability of resources. The risk cannot be removed completely, and larger funds allow to deal with a higher level of risk. Investors with lower resources are more subject to the psychological component being worried about not being able to bear losses. Using machines is possible to limit the influence of emotions and feelings in favour of objectivity; machines in fact can follow a specified established logic despite any events that could happen.

4.4.2.2 Opportunities and Challenges

In addition to the objectivity advantage mentioned before, there are also other positive effects related to the use of machines to make market operations. First of all, machines can analyse great amounts of data, so they allow to expand analysis about markets to discover the best possibilities in terms of strategy; in addition, they can make it with high levels of precision reducing the probability to make mistakes and errors with a consequent increase in the ability to be effective. Another advantage, related to efficiency, could be identified in the possibility to act in every moment allowing people to save time, which is a precious resource, and preserve the continuation of market operations even if a human operator cannot.

There are even some challenges linked to the use of machines. It is not possible to create an algorithm and let it run in a completely unattended way, they need some form of monitoring for what concern the management of the infinite events that can happen. Moreover, algorithms' logic or parameters may need changes or adjustments, in time, to adapt to the changes of the environment. In the end, it is possible to mention the risk in the challenges. Even if using algorithms help people in making market operations, they have to take into account the risk and being aware of the impossibility to eliminate it. It is important to be aware and prepared about losses despite algorithms' help.

4.4.3 Future expectations

In summary, it is not possible to expect a full replacement of humans in all the trading activities, because is usually necessary some form of supervision, to guarantee the desired continuity of all automated operations. And, in any case, the algorithmic strategies are first developed by humans and, then, executed by machines.

V DATA ANALYSIS

In this chapter the author is going to make a comparison between the outcomes of the data collection, the theory and between experts' opinions and companies' ones. To preserve the clarity and consistency, the analysis is divided in three main categories which are the same of the empirical findings: Trading Algorithms, Automatization of trading and Future expectations. The analysis was subjected to an iterative approach from theory to empirical data to case-company comparison, therefore following a pattern that can preserve clarity and consistency

5.1 Trading Algorithms

Algorithmic trading is defined by Kumiega and Van Vliet, in 2012, the use of programmed and automated machines to execute market operations, such as buy and sell. Following this last definition is possible to understand the importance of algorithms for Robo-Advisors, which are “digital platforms comprising interactive and intelligent user assistance components” (Maedche et al. 2016) that “use information technology to guide customers through an automated (investment) advisory process” (Sironi 2016; Ludden et al. 2015). To be more specific is possible to define them as “digital platforms that provide automated, algorithm-driven financial planning services with little to no human supervision” and “collects information from clients

about their financial situation and future goals through an online procedure, and then uses the data to offer advice and/or automatically invest client assets” (Phoon and Koh, 2018). All interviews made for this research were functional to obtain a deep knowledge about automatic trading. Definitions provided before respect what emerged from the empirical findings. In fact, as affirmed by all respondents, algorithms are able to take actions in a way that is impossible for humans; in particular, the respondent A talked about the possibility of operating with great amount of data in order to discover patterns and linkages between them and the respondent D talked about the reduction of time related to the manual programming.

5.1.2 Development

In 2017, Nicoletti wrote about the nine guidelines for Fintech strat-ups, derived from Chesbrough’s Business Model Canvas theory, as is possible to see in the Figure 7. In particular, three of these guidelines are more relevant talking about investment Fintech companies based on algorithms: the focus on value added in terms of product and services, the focus on technology in terms of resources and systems and the focus on a customer centric approach considering the customer experience. The first and the third guidelines will have a greater consideration in the next paragraph about the automatization of trading. Regarding the guideline about focus on technology, the theory affirm that firms in the Fintech industry have a constant need to innovate in order to survive to market changes of the future. In addition as said for Robo-advisors by Jung and others in 2018, machines make a regular revision between the customer’s actual needs and the recommendation needs in order to obtain “reconfigurations of the product (rebalancing) need to be initiated in case of a substantial deviation due to economic developments or the changes of customer needs”. In the empirical findings there is a great evidence for this statement. As emerged from interviews with the respondent A and the respondent C is very important to act with an adaptive logic, leveraging on a constant research to develop better algorithms and models. Even considering what said by the respondent B and E about the huge variety of different logics that work better for each different financial instrument and asset. In addition respondents A, C and D, talked also about the great importance of the development and use of physical and architectural infrastructures and tools, such as artificial intelligence, blockchain, programming tools, visualization tools, VPS servers and network. The respondent A talked even about the use of different sciences in combination: mathematics, physics and biology by the use of bioinformatics.

5.1.2 Criteria

Following the theory derived from Phoon's studies (2018) about robo-advisors, which are based on algorithms, the reader can understand the importance of data reached by customer, since machines "collects information from clients about their financial situation and future goals and then uses the data to offer advice and/or automatically invest client assets". These data are useful for the operative process explained by Nueesch's studies of 2016, in which robo-advisors helps humans in financial decision making. About criteria based on which algorithms work, respondents have given some considerations explaining in detail and in a practical way what are the main data and variables that algorithms take into consideration. First of all, every respondent underlined the objectivity of reached data, considering that lots of them are historical or live data taken from the market such as daily prices, risk level and volatility. In particular, during the explanation of algorithms development process, the respondent C mentioned one phase characterized by one of the advantages about algorithmic trading evidenced by Folder in 2014, the possibility of backtesting. This kind of data are fundamentally expressed in numbers, so they are quantitative measures characterized by objectivity since they could be interpreted in one way, as expressed by the respondent B. In addition the respondent A mentioned even the importance of a combination approach between quantitative data and qualitative data to elaborate better models. In fact algorithms can also find relationships and paths based on qualitative parameters, in particular reached into the company.

5.2 Automatization of trading

5.2.1 Emotions and rationality

In 2014, Folder evidenced into the advantages provided by using algorithms the "*Lack of emotional component*" saying that systems decides whether to carry out a certain kind of operation based on historical data. Human feelings cannot affect the choice, in positive and negative both. It makes operations free from pressure, fear and other human feelings and emotions, all in an optic of objectivity and rationality. Taking in consideration that humans' brain could never work like an algorithm and vice versa (Nicoletti, 2017). On the contrary, in the opinion of Jung and others (2018) despite full digitalized solutions that providers offer, customers prefer hybrid solutions which allow them to search for information and compare products online but requesting human advisory before making an investment. This is due to a lack of trust by users. During interviews emerged the strong presence of a psychological

component which is responsible for levels of rationality and trust. Regarding this aspect the respondent A talked about difficulties to trust in machines by users, because even if on a rational point of view should be easier to trust in machines on an emotional point of view is the opposite. The same respondent underlined the importance of trust to involve a user in relying to a machines for his investments. On another side the respondent C attributed this lack of trust to a generational problem sustaining that only old generations are adverse to machine due to the lack of tools for a better understanding, while new generations are more able to understand. At the same time the respondent D sustained that providers should put at the disposal of user some instruments as customizable platforms, based on a customizing logic and standard platform based on standard logics. This concept reflects the distinction between robo-advisors that make specification of portfolio and the ones that make reconfiguration, evidenced by Jung (2018). Anyway, all respondents have the same beliefs regarding the advantage of less emotional component in favour of a greater objectivity.

5.2.2 Opportunities and Challenges

Regarding the first and the third guideline previously mentioned (paragraph 5.1.2): the focus on value added in terms of product and services and the focus on a customer centric approach considering the customer experience, it possible to find some linkages with Folder's studies of 2014 about advantages and disadvantages of algorithmic trading and opportunities and challenges. The theory affirm that companies, in providing products and services, should act following a quality perspective being effective, efficient and economical customer process. From the empirical findings is possible to understand how this concept has a practical hit in the case of Fintech companies based on algorithms. The respondent D underlined what customers expect from trading algorithms to obtain advantages due to time reduction, with a consequent comfort, and reducing the error margin in an optic of effectiveness and efficiency. This reflects two advantages which are *speed* and *discipline*. Another advantage, the *diversification*, could be reflected in the words of the respondent C when he talked about the adoption of a portfolio of algorithms as the most common solution to respect all requirements that algorithms should have.

On another side, for what concerns challenges of trading automatization, is possible to catch from the respondent D some similarities with Folder's disadvantages. Folder indicates three main disadvantages: *bugs and errors*, *over-optimization* and *technical knowledge requirements*. The respondent D, evidence some challenges due to operative aspects and infrastructural

problems. In particular, he talked about problems related to asynchronous communication, partial orders and the infinite number of events that have to be managed. This concerns the first disadvantage. The second disadvantage, could be found in the words of respondent B who talked about the impossibility for algorithms to solve every problem. This disadvantage is seen by respondents A and C more as a challenge, in fact they talked a lot about the importance of research in order to develop optimized models which could operate with a greater efficiency. For what concerns the third disadvantage, is possible to catch a transposition from theory to reality from the word of the respondent A. In particular, he affirmed the importance of research team heterogeneity in which all have different backgrounds, even if non-technical, in order to develop creative solutions for model creation.

5.3 Future expectations

When discussing the future trends and expectations that will affect investments by algorithms in the future years the researcher has collected different visions from the respondents.

In the respondent A and B's opinions the future will be characterized by a full automation in every process that concerns investments. In the mind of respondent A, in particular, machines will be able to catch relationships and nuances in the market more than before, in particular leveraging on new technologies with a great computation capacities and new technological infrastructures. Moreover, he made some considerations even about the future of the research and development of new models, affirming that it will be pushed to resist to the potential great competition between fintech companies and traditional financial players. Availability of resources and traditional financial logics against great leverage on research and disruption of fintech companies. He talked also about the competition between algorithms excluding the possibility of a general Artificial Intelligence that drive the market. The respondent D, talking about expectations for the future, had a greater focus on the technological development, believing that invention and development of new tools could drive the automatic trading by algorithms. For what concerns a potential scenario in the environment, he assumed a strong position about the possibility of fintech companies to substitute completely traditional financial institutions too anchored to old logic and dynamics. But in the meanwhile there will be a war between algorithms to establish the best one. Under the point of a potential full substitution in human actions he considered it as impossible because algorithms needs to be supervised and replaced when the efficiency goes down and it is not a set-and-forget process. On this last opinion agree even the respondent D who said that on a theoretical way the substitution is

possible but is not the same in practice, human supervision will be always required. In fact, he has make an hypothesis about a combination between human work to ensure architectures and procedures and the work of algorithms in operations.

VI CONCLUSIONS

This final chapter aims at presenting conclusions of the study conducted by answering the research question and the sub-question.. Furthermore, the author remarks some personal comments concerning the study. Finally, suggestions for future research are presented.

6.1 SUB-RESEARCH QUESTIONS

Some sub-research questions have been identified in order to help the researcher answering to the main research question. Answering to these sub-research questions is useful to guide the research passing through an analysis of how investment fintech companies are dealing with algorithmic trading and after analysing the relationship between investor and machines considering the user experience.

6.1.1 Algorithmic Trading

The first sub-research question regards the way by which investment fintech companies based on algorithm run their business, considering concepts expressed in the literature review about their business model and their innovation. The sub-research question is:

How investment fintech companies deal with algo trading?

It is very important to understand which are the main concepts and principles behind algorithmic trading concept in order to obtain a proper understanding about how it is functioning. From the interviews emerged different concepts, all fundamental to understand what algorithmic trading innovation represent. What emerged from the research is a total innovative way to run the business of trading. Investment fintech companies that run their business through the use of algorithms represent a true innovation in terms of business model, in fact they not pursue only simple innovation in term of products and processes but they are a different way to run a traditional business as trading. They adopt what Chesbrough (2006) defines an *Adaptive Business model*, which is the most articulated kind, in fact algorithmic trading companies have the ability test and experiment different solutions to respond to different

needs just in time. This is due to the absence of conflict between business models already established for an existing technology and a new one provided for a disruptive one. Fintech itself in fact represent a disruptive concept compared to traditional financial logics. Algotrading fintech companies leverage on almost all elements that characterize Fintech BMC. First of all they have a great focus on the value added through products and processes, offering to investors an effective and efficient service with the minimum level of efforts. In fact, reaching and analysing great amounts of quantitative and qualitative data the can develop algorithms that can make previsions with a consequent maximization of returns. Secondly they have a great leverage on technologies, using advanced tool as artificial intelligence, machine learning and blockchain which allow to obtain great performances giving support to the business. Technology for these firms represent an important source of competitive advantage allowing to disrupt the market of financial sector creating and delivering value in many new ways. As third they focus on risk and even if it could not be completely eliminated they can work in order to reduce the level. To do this, as fourth point, they have a great focus on processes and activities in terms of research and development; algotrading fintech companies in fact put strong efforts in research, building strong research teams, in order to adopt and maintain an adaptive logic to responds to requirements that environmental changes impose. For what concern the environment, and the fifth and sixth points of BMC for fintech companies which regards partnerships and collaborations and market (competitors), the respondents gave their opinions about the relationship between traditional financial institutions and investment fintech companies. Fintech companies and traditional institutions are adopting a collaborative approach in order to obtain mutual benefit. The firsts discovering and learning from the seconds the traditional and pure financial logics and the seconds from the firsts exploring the fintech world to understand features and dynamics. However, from interviews emerged also a perspective of a future war between traditional players and fintech ones to control the market.

6.1.2 Automatization of trading

The second research question is related to the concept of automatization of trading, considering the investor perception of algorithmic trading and how algorithms could improve user experience. The question is:

How automatic trading could improve investor's experience?

In fact, in the literature review is evidenced how is important having the right business model in order to create and transfer value to the customers. To give an answer to this sub-research question is very important to look at interviews and empirical findings. The theory, as said by Auerbach (2012), affirm that customer must play a pivotal role and the future belongs to companies that give the customer center stage in their business model. Fintech firms are able to take into full consideration their customers, putting them at the center of their plans and strategies. This is another component of Business Model Canvas for Fintech companies, which regards the customer experience and which is centered on customer centricity, clearness and transparency. The theory affirm that investors prefer hybrid solutions which allow them to search for information and compare products online before making an investment. If on one side, using algorithmic trading people do not need to be aware about market values because a software make operations for them immediately when a value is appropriate, on another side the need tools as platform that allow the adoption of customizable logics and the control about investments. This is due to a strong emotional component based on trust. Even if thinking with rationality allow to understand the potentials of machine in obtaining better performances, the lack of human linkage doesn't allow to entrust investments completely to machines. As is possible to understand from interviews is important to inspire trust in people, showing them performances, giving them instruments to understand more about automatization of trading and using tools by which they can check and control their investments and financial situation.

6.2 MAIN RESEARCH QUESTION

The main research question regard the analysis of algorithms' impact on fintech Industry.

The question is based on the literature review and the knowledge acquired during the collection of the literature section and it is:

How algorithms impact the Fintech industry?

Fintech companies respect the innovation's definition of Micheal Porter (1990) because they "achieve competitive advantage through acts of innovation" and "approach innovation in its broadest sense, including both new technologies and ways of doing things". In particular they have the ability to create data networks to formulate risk models based on real time observations and offer customers, more effective and efficient solutions at lower costs. There is a great evidence of this last statement in the case of Investement fintech companies which base their

business on algorithms. In fact algorithms could be included in those information technologies and innovation that for Sironi (2016) and Ludden (2015) guide customers through an automated (investment) advisory process. In fact in Phoon's (2018) opinion, financial planning services driven by algorithms has little or no human supervision and machines can collect lots of different informations and after use them to offer advices and/or automatically investment to clients. The research confirmed what the literature say about difficulties in making predictions in financial markets due to the huge numbers of dynamics which are influenced by a huge number of factors. Computational techniques, as algorithms, are able to carry out these impossible operations for humans, making prediction through the analysis of different parameters, not only numerical but also qualitative. This led to a reduction of costs and timing of market of carrying out operations with a consequent maximization of profits. Even if the low availability of resources compared to those available for traditional financial players, algortihms allow to Investment Fintech companis to sustain competition in the market. This can be traduced in an increasing of competition, between financial institutions and between fintech companies themselves, to offer a better service to investors. The competition could push the research. Companies could employ more efforts developing better models, and technology development could benefit with many improvements. As possible consequence could be an increase in the value creation for the entire Fintech industry and linked ones.

6.3 IMPLICATIONS

This research project could help obtaining another point for the analysis of a recent and evolving topic as Algorithmic trading and Fintech companies based on algorithms. Concepts collected by interviews, in which were involved companies and experts, could be a very important source of additional knowledge that could give a better explanation and understanding about algorithms and the way by which the affect the business for companies in the fintech industry. In addition more informations about this topic could allow also to expand the existing research about Fintech companies and algorithmic trading systems, in order to provide more aspects to enrich the literature for future analysis. The way by which concepts were identified and explained is functional for a better understanding and analysis about the topic. This analysis of algorithms' work in the fintech industry has the important role to help understanding how theoretical fundamentals from the literature have a real effect in the practice. Identifying the main characteristics of Algortihms applications in the real world, organizations could benefit

for the future in terms of strategies, behaviors and dynamics and this research project could contribute to the fintech revolution in the whole financial sector.

6.4 FUTURE RESEARCHES

Investment through algorithms is not a new phenomenon, in fact it exists since 80s, however it is subject to a continuous development and improvement, even considering changes of financial sector, in order to obtain better performances. This characteristic could be the starting point for other new researches that could give an important contribution to the literature studying other aspects of the same argument. In addition future researches could give a contribution to companies in order to gain additional knowledge for the improvement and the use of algorithms. There are some points that could be starting points for other future researches. The first is could be about the research, which represent an important source of value for algorithmic trading fintech companies. Making a study about the research process, team composition and dynamics could be interesting in order to improve one of the fundamental element of innovation for fintech industry. Another interesting research could be about customer engagement and customer needs. As often specified regarding the customer experience, fintech companies put their customer at the center of their business and understand their need could be an important source of competitive advantage. A future study could be about the analysis of the relationship between algorithms and customer needs, to improve the service and the engagement both. A third interesting point could concern themes as open innovation and platforms, on a general strategical level or for what regard some particular aspects of the strategy such as marketing, finance and organizational aspects. This kind of research could give a great contribution in reshaping fintech ecosystem and fintech logics. Investment fintech companies based on algorithmic trading are something new in an industry that is new itself compared to the traditional finance's one. There is a continuous need of innovation motivated by continuous changes in the industry. Future research's proposals could be a very useful for the contribution to the fintech revolution that happened, is happening and will happen.

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Appendix

To conduct the semi-structured interview, the researcher used an interview guide consisting in some open questions in order to leave the respondents free to talk and to get insights from them. In this way every interview and results were free from author's beliefs and bias.

Interview guide

Info about respondent

- Background
- Company (for companies)
- Role in the company (for companies)

Questions about Algo-Trading

- How you would define an investment fintech company based on algo-trading?
- How automated trading algorithms can improve the user experience?
- How customers perceive automatic trading?
- Which are the main aspects to consider when developing an algorithm?
- What are opportunities and challenges could be for algorithmic trading?
- How is the relationship between traditional financial players and fintech start ups?
- How do you feel about algorithms substituting human activity?

- What are the most expected trends for algo-trading in the future?

Final remarks

- Comments or something else respondent wants to add to the interview

List of abbreviations

AI: Artificial Intelligence

ANN: Artificial Neural Network

BCBS: Basel Committee on Banking Supervision

BM: Business Model

BMC: Business Model Canvas

BMI: Business Model Innovation

DMA: Direct Market Access

FDA: Food and Drugs Administration

FTK: First To Know

ICT: Information and communication technology

IoT: Internet of Things

SMEs: Small and medium size companies

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