Chapter 2

FinTech and SMEs - The Italian Case

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**ABSTRACT**

*In this chapter, a study on Italian SMEs understanding and the use FinTech technologies is presented. The study focuses on FinTech aided banking services, in particular, because of their wide presence in Italy. The study shows how, despite FinTech has entered in Italy only in recent times, and the Italian SMEs market whch is very active and fruitful for digital companies and desired customers for many banks.*

The chapter has three goals: 1) to analyze the wealth of digital possibilities, embedded as FinTech solutions and strategic partnerships, that are available for banks to improve their current portfolio of products and services 2) to provide the overview of the FinTech solutions for SMEs, with the focus to Italian banks and FinTech, and to provide the overview of two main venues for increasing their competitiveness: (i) online advisory and internationalization for SMEs, and (ii) product standardization and multichannel distribution 3) to analyze the main emerging and disruptive technologies in banking domain, adopted by the FinTech industry today (e.g., big data, data mining, text mining, blockchain, AI), which provide a rich source for future research directions for FinTech.

Keywords: FinTech, Banking, SME, Artificial Intelligence (AI), Blockchain, Human Digital Interfaces, Quantum Computing, data analytics

**INTRODUCTIOn**

In the last years, the term Financial Technology (FinTech) has been adopted in order to describe a wide range of services, aided by several financial technologies (Gabor & Brooks, 2017), for different types of organizations, which mainly address the advancement of quality of financial products and services supported by Information Technology (IT) applications. FinTech has become important due to several important factors, ranging from technical advancement, enterprises innovation, the need for reducing costs, and for improving the relationship with the customers. The high speed in which FinTech has been adopted caused a great challenge, due to the multidisciplinarity, advanced usage of integrated platforms, and increased demand for such services (Gai, Qiu, & Sun, 2018). FinTech is supported with the development of cutting-edge technologies, among which the most relevant are those that can discover hidden information from various sources and thus improve the decision-making process in SMEs, which influence security, and enable easier communication with customers.

In Italy, from the end of the first decade of 2000, almost all banks decided to follow new paths, starting a process of exploiting digital opportunities and moving clients onto more agile and less costly channels (i.e., Internet Banking and Mobile Banking) envisioning novel ways for serving clients and generating profit (Premoli, 2017).

The chapter has three goals. The first goal of the chapter is to analyze the wealth of digital possibilities, embedded as FinTech solutions and strategic partnerships, that are available for banks to improve their current portfolio of products and services. The second goal is to provide the overview of the FinTech solutions for SMEs, with the focus to Italian banks and FinTech, and to provide the overview of two main venues for increasing their competitiveness: (i) online advisory and internationalization for SMEs, and (ii) product standardization and multichannel distribution. The third goal of the paper is to analyze the main emerging and disruptive technologies in banking domain, adopted by the FinTech industry today (e.g., big data, data mining, text mining, blockchain, AI), which provide a rich source for future research directions for FinTech.

The abovementioned goals are attained by (i) conducting a comprehensive literature overview, focusing on cutting-edge research in the area of disruptive technologies (e.g., big data, data mining, natural language processing); (ii) investigating the grey-literature research in order to collect knowledge on Italian FinTech, such as case studies, white papers and industry position papers.

The chapter consists of the following parts. After the introduction, the background of the research is provided, focusing on Italian SMEs and their significance for the economy. The third chapter discusses FinTech as a new venue for advancing financial products and services, presenting the main technologies used for FinTech applications, the relationship between FinTech and innovation, and the role of FinTech as a disruptive technology in the Italian context. The fourth chapter aims at providing solutions and recommendations for FinTech and Italian SMEs, while fifth chapter provides the overview of future research directions for FinTech, such as big data, data mining, text mining, and others. Finally, a conclusion is provided.

**BACKGROUND**

***The relevance of SMEs in the Italian economy***

Small Medium Enterprises (SMEs) are the most widely spread companies in the European Union and are considered the true engine of economic growth. Indeed, SMEs represent 99.8% of European companies (93% are micro enterprises) in the non-financial business sector. For this reason, they also play an important role in the European labor market. Almost 90 million people were employed in SMEs in 2015 (67% of total employment), and they generated 58% of the sector’s value added (Muller et al., 2015).

In Italy and Spain, in particular, the share of workers employed by small companies are equal to 79.6% and 73.1% respectively (Figure 1).

*Figure 1. The share of SMEs participation in employment, and total number of firms in selected European countries*



*Source: Muller et al. (2015)*

Before the financial turmoil of 2007-2008, the number of jobs in SMEs ‘increased at an average annual rate of 1.9%, while the number of jobs in large enterprises increased by only 0.8%’, as indicated by the report European SMEs under Pressure: Annual Report on EU Small and Medium-Sized Enterprises. SME performance review (European Commission, 2010).

European Commission uses four quantitative criteria in order to define the size of the company (European Commission, 2003): ‘(i) the total number of employees in the enterprise; (ii) the annual volume of the turnover; (iii) and the total of the assets in the enterprise balance, and (iv) the degree of independence of the enterprise or the ownership over it’. Different values of these criteria according to four groups of enterprises according to size: micro, small, medium and large are depicted in Figure 2.

*Figure 2. Criteria for classifying companies according to size*



*Source: European Commission, 2010*

The number of employees (the ‘staff headcount criterion”) is the main criterion; introducing a financial and ownership ‘criterion is nonetheless a necessary adjunct in order to grasp the real scale and performance of an enterprise and its position compared to its competitors’ (European Commission, 2003). Therefore, to classify an enterprise, the condition a) must be present and accompanied by some employees and the size of the revenue or assets. Finally, the ultimate condition, the ownership, states that ‘the participation of a big enterprise in the ownership of a small or medium enterprise should be of no more than 25% of its share capital’ (European Commission, 2003, p.2). However, ‘in order to encourage the creation of enterprises, equity financing of SMEs and rural and local development, enterprises can be considered autonomous despite a holding of 25% or more by certain categories of investors who have a positive role in business financing and creation’ (European Commission, 2003, p.3).

Nowadays, the recovery from the financial crisis indicated the need for the economies to create employment opportunities for the citizens. Hence, given the contribution mentioned above of SMEs to employment, the growth and creation of SMEs are essential.

As shown in Figure 1, SMEs are extremely important in Italy, much more than in other European big countries, such as France and Germany. The result is expected, since many Italian SMEs, particularly in the manufacturing industry, are famous all over the world: ‘made in Italy” is considered a guarantee of the high quality of the products. The downturn of 2008 has created several problems for Italian SMEs, undermining their ability to generate profit and, not less important, to generate cash. From the beginning of the crisis to 2015, more than 82.000 firms have failed with the consequent loss of almost 1.000.000 employees. Many of them died not because they were not profitable anymore, but because of lack of cash. Banks were almost forced to deny credit to many small companies, more opaque and riskier than large corporates, thus deteriorating SMEs’ situation.

As already said, SMEs are the basic element for the Italian economy. Hence it is fundamental to sustain them during difficult periods and help them re-finding the path of growth. This can be done both with the politic support of the government, through ad hoc fiscal policies to unburden the firms, and with the monetary support, i.e., banks that give credit to companies in order to finance their day-to-day operations and new profitable projects.

Business clients are an important market segment for the banks (Rajaobelina, Brun & Toufaily, 2013) in particular the small and medium enterprises (SMEs). First, SMEs are the vast majority of companies, both in Italy and throughout Europe. Second, even if their turnover is substantially smaller than those of large companies are, SMEs still need a variety of banking products and services in order to support their day-to-day operations (Dhliwayo & Governor, 2014). Also, SMEs are less ready, than large corporations, to move from one bank to another in order to reduce their financing costs, such as the minimum possible interest rates (Sayani, 2015). Therefore, SMEs are potentially more profitable clients for banks.

Furthermore, successful SMEs have the potential for growth, and with the right support and the right choices of financial products, they can increase their turnover, and even grow to the size of large corporations. If a bank recognizes their potential early, such fast-growing SMEs can become the most loyal clients for the bank. Above stated indicate that banks are keen to innovate the portfolio of their products and services, in order to provide an attractive offer for the SMEs, providing not only standard digital products but also pushing on value-added services, supported with digital technologies (Chen, 2016).

**FinTech as a Disruptive Technology in the Italian context**

Following the 2017 report by ABI (Associazione Bancaria Italiana), innovations promoted by FinTech can not only be an opportunity to develop alternative services, but can also support the operations of banks, such as credit rating techniques (ABI (Giovanni Sabatini), 2017). Italian banks have already determined as a priority the relationship with FinTech.The present Italian scenario is made up of 136 FinTech companies that have launched 145 initiatives as shown in Figure 3.

*Figure 3. Italian FinTech Initiatives*



Source: Adapted from ABI (Giovanni Sabatini), 2017

The main Italian Groups and Banks are implementing new partnership strategies with the various FinTech start-ups through:

* the creation of dedicated investment funds, both Italian and international,
* commercial partnerships,
* targeted investments in the capital of certain FinTech start-ups,
* the creation of accelerators and incubators for the development of FinTech,
* international observatories for FinTech's innovation scouting activities, and
* joint research and development activities with the FinTech world.

As stated in the 2017 by the Italian FinTech Report (NetConsulting, 2017), banks and financial operators are beginning to show signs of concern about FinTech and the way it could pose a threat to traditional business, as emerges in PWC's Global FinTech Report 2017, which involved over 1,300 respondents (Financial Companies and FinTech) in 71 different countries around the world, including Italy.

The report highlights that 89% of European banks and 82% of Italian banks claim to see FinTech as a possible threat, in particular in some areas of the value- chain such as Payments, Robo-Advisoring, and Personal Financial Management. To avoid the possible threat of FinTech and turn it into an opportunity, 41% of traditional Finance operators have entered into partnerships with these start-ups, while 84% say that, in order to better face the challenges that the digital transformation requires, they intend to start cooperation programs with newly established companies in the next 3-5 years. The scenario is therefore in strong evolution, and the collaboration with FinTech represents an opportunity for banks to accelerate the process of innovation.

**FINTECH AS A NEW VENUE FOR ADVANCING FINANCIAL PRODUCTS AND SERVICES**

FinTech would not be possible without the advancements in the new technologies, as well as a rapid decrease in the prices of hardware and software solutions, as well as supported by numerous open-source initiatives. This, in turn, resulted in the explosion of innovations supported and developed by FinTech solutions.

**The Main Technologies used for FinTech applications**

FinTech is a term denoting financial services aided by technological innovation, which can take the form of new business models, processes or products, with a decisive effect on the financial markets, the institutions, or on the supply of services: the use of technology, therefore, constitutes a prerequisite to make financial innovation possible (Van Loo, 2018).

FinTech innovations include financial services supported with various information and communication technologies (Gomber, Kauffman, Parker & Weber, 2018). FinTech covers various services: crowd-funding, peer-to-peer lending, payment services (e.g., instant payment), virtual currencies (e.g., Bitcoin), and consulting services (e.g., roboadvisor). Also, it uses technologies for the decentralized validation of transactions (e.g., Blockchain), biometric identification (e.g., using fingerprint, retina facial recognition), and the support for the delivery of services (e.g., with the utilization of cloud computing and big data). FinTech is present in numerous banking and financial services markets. For example, it allows the entry of technological start-ups, and the giants of the information and social media technology (Google, Apple, Facebook, Amazon, Alibaba).

Morgan (2017) defines five broad technological areas currently adopted by the FinTech industry today: (i) artificial intelligence and machine learning, (ii) application technologies interfaces, (iii) Blockchain, (iv) human digital interfaces, and (v) quantum computing.

*Artificial Intelligence and Machine Learning.*

In recent years there have been numerous debates on the contribution that Artificial Intelligence (AI) and Machine Learning (ML) can make to the banking and financial world. In its broadest definition, AI is identified as mere cognitive computing, with the meaning that it can increase human intelligence, but not replace it. In the financial field, AI has made a fundamental contribution to the identification of innovative techniques for fraud detection. Another important area has been the definition of intelligent systems that satisfy a whole series of compliance regulations, capable of keeping companies up to date with regulations that are constantly evolving. AI-built chats are an excellent tool to help operators to handle customer requests accurately and quickly, or in some cases even to replace the human operator. In the financial sector, AI is used for simulations of financial stress situations or for building predictive models to support decision-making activities. However, its potential will be utilized to the greatest extent only if it is combined with big data, which is one of the most fruitful directions of the future research for SMEs and FinTech.

*Application Technologies Interfaces (APIs)*

The use of APIs has been a key element in making the landscape of new services, also in the form of mobile apps, more lively, which have made it possible to keep pace with the economic and business challenges that the financial industry has been facing for some years now. FinTech start-ups have been able to create high technological value software that has challenged, and in some cases surpassed, a consolidated but, for this reason, rigid banking sector. Banks had to incredibly increase their investments in technology both internally, improving their ability to create innovative mobile applications, and by participating in developer sandboxes through the release of APIs.

*Blockchain*

The blockchain is distributed architecture that make financial areas with a high risk of fraud more reliable and transparent. By establishing consortia, large financial operators are working together to create new infrastructures based on this new technology, with the aim to replace obsolete and non-integrated systems. This process is affecting both commercial financing platforms and cross-border payments. Thanks also to digital identification, Blockchain is becoming an important asset in overcoming financial mechanisms rigid due to the high rate of fraud and lack of transparency. By eliminating these rocks within business processes and by creating innovative networks, Blockchain is making the exchange of value through ecosystems effective and efficient.

Blockchain represents a type of disruptive technology having a big impact on cost-savings, labor-saving, transparency, security, and others, having significant implications in banking and finance (Cocco, Pinna & Marchesi, 2017). Guo and Liang (2016) point out issues of regulation, efficiency, and security. FinTech Network (N/A) quotes the following possible uses of blockchain: reduction of fraud, which represents one of the main challenges in the banking sector; Know Your Consumer (KYC) by including data of KYC; trading platform; new way of payments, allowing banks to operate 24h/day, and many others.

*Human Digital Interfaces*

Digital devices have long been part of our daily lives. Nowadays, they can accept both voice and touch screen commands. Biometric identification systems are widespread in many areas and can cover both fingerprint or face recognition and retinal scans.

*Quantum Computing*

A computer based on quantum computing uses qubits instead of bits, allowing it to go beyond encoding two-state information (0.1). A quantum computer can therefore greatly increase the amount of information it can store while consuming less energy. Although quantum computers cannot be expected to replace traditional computers in the foreseeable future, they are already used today to solve very complex computing problems, such as maximizing the return on investment based on a given risk profile. Through the combined use of artificial intelligence and automatic learning, they can make calculations that are extremely fast but also highly reliable. Areas such as fraud detection or money laundering are particularly promising for the use of quantum computing.

All these technologies play an important role in the Italian FinTech context as shown at the Italian FinTech Forum held in Milan on April 12th, 2018.

**FinTech and Innovation**

FinTech is an industry that continues to be at the forefront of innovation (Gomber et al., 2018; Leong, Tan, Xiao, Tan, & Sun, 2017). While security risks remain, the winners are consumers who see the benefit and functionality in their banking and financial experiences, thanks to these trends in FinTech technology (Lee & Shin, 2018). Therefore, the possible reasons for the success of the high number of start-ups active in FinTech and the giants of ICT, reside above all, in their inherent capacity to create technological innovation and, secondly, the speed with which these can implant the innovations achieved in old and new services, being free from pre-existing technological systems (so-called ‘legacy systems’). At present, FinTech companies can offer a wide range of services of financing, payment, investment and consulting with high technological content and at competitive prices; their activity contributes to the development of non-banking sectors, closing a gap in the capital market (Gai et al., 2018).

The current and prospective demand factors are important too. The demand of financial services with a high technological content is set to increase with the growth of the share of the population familiar with digital services, in particular, young people, the so-called millennials and digital natives (Jones, Ramanau, Cross, & Healing, 2010). However, at this moment, it is obvious that the FinTech innovations structurally simplify how customers use financial services. In that case, they will enable financial transactions to be carried out easily in each case, everywhere, and at any time, there is connectivity, using clients own mobile devices. What is even more important, even as they are primarily aimed at digital natives, FinTech also facilitates the most populous cohorts of older and less computer literate customers.

However, the future scenarios are uncertain. The first scenario is that a configuration of the financial system in which actors, currently outside the regulatory perimeter, would continue to remain outside, offering technological intermediaries and financial services preparatory to the development of new ways of intermediation (which would remain in the hands of the traditional intermediaries). The second scenario is that FinTech could mark the entry of the same computer technology giants and social media in the financial system, strongly stimulating the competitiveness of the financial system. In this case, the erosion of market shares would also occur thanks to the ability of these subjects to exploit the micro-data of their customers, profiling the characteristics of customers and offering them integrated services, including, for example, the online sale of products through payment or credit services dedicated (Aldás-Manzano, Lassala-Navarré, Ruiz-Mafé, & Sanz-Blas, 2009).

A secondary effect of the FiTtech is that the entry of new operators into the financial system already obliges intermediaries to react by investing more in technological innovation to reduce costs and to automate processes in order to re-modulate distribution channels for offering customers innovative and high-quality services. At the international level, it is estimated that the investment for the development of FinTech projects exceeded 25 billion dollars in 2016 (European Central Bank, 2016). North America is the leading region for investments (55 percent of the total), followed by Asia (34 percent) and therefore from Europe (9 percent). Investments in Italy are still limited compared to other European countries, such as the United Kingdom, Germany, France, and the Netherlands, due to a low presence of FinTech companies and a still traditional banking business model, moreover, the network of branches is not very automated and the entire system is mainly based on it.

Therefore, FinTech can be a driver for innovation in the financial industry, seeking new business models and recovering satisfactory margins of profitability. For smaller intermediaries, the probability of inaction could be even higher, due to the high investments required and the problems of coordination between a wide range of actors during the strategy definition and the implementation of platforms of services of common interest.

**FinTech Solution for Italian SMEs**

As claimed by the 2018 BeBeez Report on FinTech (BeBeez, 2018), the FinTech revolution began in Italy almost in silence, with the first web platforms of loans between private individuals born between 2012 and 2013. There was a jump between 2016 and 2017 in terms of new services, and now, thanks to the new European directive on payment services (Payment Services Directive 2 or PSD2), we are on the eve of another big leap, with a series of new services that individuals and businesses can use to pay, transfer money and check the status of their accounts. In this framework, all the start-ups that develop technologies to support these are then included services and thus technologies for mobile payments or services of big data analysis and structuring of Blockchain.

In the world, the FinTech sector has already attracted billions of dollars of investments by venture capital funds, but also by the private equity funds. The sector has already attracted investment of 5.42 billion euros in the retail sector. The data are from CB Insights, which specifies that this is the third value highest recorded since the beginning of 2013, after that of the third quarter 2015 at €5.5 billion and the second quarter of 2017 at €5.5 billion.

**SOLUTIONS AND RECOMMENDATIONS FOR FINTECH and ITALIAN SMEs**

In this chapter we focus to the main two venues for the Italian SMEs and financial institutions to utilize FinTech solutions in order to increase their competitiveness: (i) online advisory and internationalization for SMEs, and (ii) product standardization and multichannel distribution.

**Online Advisory and Internationalization for SMEs**

As previously stated, a great portion of NPL (i.e., the amount of non-performing loans over total loans) in banks’ balance sheets derives from corporate clients, especially the smaller ones. The reason behind this evidence is straightforward: many SMEs do not have sufficient financial knowledge. This is particularly true in Italy, even if it is a general problem of SMEs from all over the world. Generally, Italian entrepreneurs have great ideas and can deliver niche products, also requested from foreign countries. Thus, the default of many SMEs is often due to a lack of financial expertise and dangerous financial choices and not because of a poor product, difficult to sell on the market. Premoli (2017) provides the recap of some of the most interesting products that came out from the analysis of the Italian bank's services. Starting from

The actual relationship between banks and firms is based on a dispute for the lowest spread on the loan or the line of credit, without reasoning on the value-added elements. Usually, what SMEs need is deep support in financial activities, such as instruments of cash flow forecasting and the right advisory on how to finance an investment or what the main movement of the markets are. Indeed, many SMEs do not have an internal solid and specialized accounting, finance, and control business unit and, consequently, do not have a Chief Financial Officer (CFO) that takes reasonable decisions with a financial viewpoint. This lack of financial knowledge often brings small firms to undertake hazardous actions that in some years lead the business to fail.

*Online advisory*

In this field, the digital can have an important role. The online advisory is already a reality for the retail clients of many digital banks in Italy, such as Wediba and Fineco, and soon can affect the corporate segments. Such digital capabilities are playing a significantly greater role in the selection process of the banks. According to a research performed by The Boston Consulting Group (BCG), ‘after financial stability, service excellence, and business understanding, customers rated digital capabilities the most important factor in evaluating their business-banking relationship requirements.” In the same research, they highlighted the importance of human interaction that, however, must be accompanied by new digital solutions because ‘banking clients expect those one-on-one relationships to be complemented with smart, tailored, digitally enabled service” (Boston Consulting Group, 2016). By now, the two leading banks in Italy, UniCredit and Intesa Sanpaolo, have developed some interesting digital tools to support their small business clients. In particular, UniCredit merchants that need a POS to run their business can activate a service that gives to business owners a set of intuitive graphs and synthetic prospects, useful to deepen their business trends and the buying habits of their customers.

Another interesting product offered by UniCredit is a tool for all the SMEs that have more than one banking account. This product offers not only an aggregated view of all the expenses and financial situation of the firm but also help it to understand what could be the most suitable financing products according to its operations and its current situation. Furthermore, it is possible to manage autonomously advanced payment of account receivables. On the other hand, Intesa Sanpaolo offers to its small business customers an online platform where they can publish request of commercial collaborations, acquisitions, sales and meet online firms also coming from foreign countries.

*Internationalization*

It is known that export is a fundamental component of the Italian economy and foreign countries very well appreciate Italian products. Moreover, the increasing globalization of the market is pushing several companies to find new interesting customers abroad. Sometimes this is an issue for small businesses that are used to sell their products within their border and do not have sufficient means and expertise to go out of the country. For this reason, many banks are developing online platforms, such as the Intesa mentioned above Sanpaolo, able to support SMEs in their expansion abroad.

In Italy, this kind of digital solutions is also spreading through smaller banks that want to be among the first movers of the country. A practical example is BPER, that recently launched a platform developed to increase and improve the internationalization paths of the firms, providing directly online the resources and information needed by answering four simple questions. A similar product is also offered by some European banks. An example is provided by BBVA, the second biggest bank in Spain, which offers a digital web platform that supports Spanish SMEs that would like to expand their business overseas using advisor’s expert in different markets and sectors.

Nevertheless, different businesses belong to different sectors, and their related economics are different from one industry to another. For this reason, it would be better for some banks to specialize in specific industries and become a leader of that specific segment of firms. SMEs need an advisor that deeply understand the challenges of a specific market, that help them recommending where to invest and not to invest, and that can forecast possible development of the market and the connected impact on the cash flows of the firms. Logically, the choice of the target industry, such as agribusiness, energy or mechanic, will depend on the specific context of the local market, on the dimension of the industry and on the possibility to create differentiation with respect to other banks. Industry specialization would mean, for example, to create tailored products for that industry, to hire specialists coming from that industry that become valuable advisors but also useful risk managers because the economics of an agribusiness firm is radically different from the ones of an energy firm and experts would prevent to take unnecessary risks.

In Europe, Rabobank is one of the banks that provides a real application of this solution. The Dutch bank has developed, besides a generic but well-detailed platform that gives online advisory and insights of several markets, a specific platform for the agribusiness. FAR, that stands for Food & Agribusiness Research, and Advisory is a platform that provides many reports created by more than 80 food & agribusiness research analysts that collect information and spot opportunities using local knowledge and global reach.

Of course, not all the solutions described so far lead directly to an increase in the revenue of the bank. Nevertheless, they have two main effects that will be visible in the end. On one side, firms will become more autonomous and will not need to visit a branch to have financial advisory, with some clients that may ultimately opt for a digital self-service model. The digital approaches will enable the advisors to spend more one-on-one time serving as strategic advisors to high-value clients and to use digitally enabled tools and channels to streamline service and expand client reach. On the other side, banks may sustain those high-value small business clients during their growth, benefitting from the long run partnership and the different products and services that the companies may need to run their expanding business.

**Product Standardization and Multichannel Distribution**

Significant and unnecessary product complexity is a burden for numerous large banks (The Bain.com, 2016). This complexity brings to a wide number of superfluous costs that banks are not willing to sustain anymore. Often, each product has different risk management processes, as well as separate operations and technology. Moreover, the current banking service model is based on an undifferentiated product/service offering for each type of counterpart that carries to a strong reduction of margins, especially for small size financing.

Consequently, smaller firms have much more difficulties than larger ones in obtaining financing, avoiding them the possibility to invest and to grow. In order to manage this product complexity, some leading banks are pursuing different approaches for different segments of customers. According to Bain & Company, in general, small businesses with relatively simple needs, are interested in a modular bundle of standard products. Larger firms, instead, are more complex than SMEs and require more advanced auxiliary products and advisory solutions.

Thus, in order to make the process of funding to SMEs more efficient and to increase the satisfaction of this segment of customers, the credit offering to SMEs must be revised by the banks through new models. One possible solution is the creation of financing products easy to buy and rapid to access, similar to the ones already existing for consumer credit. Even if the rate is a fundamental component in a financing offer, it is not the only element that has to be taken into consideration by the borrower. Nowadays, banks should avoid the competition exclusively on the rate, which currently would bring just to a bloody war. Instead, the credit offering to SMEs should aim at satisfying other real needs of the firms, such as the reduction of the initial costs for the preparation of the procedure, transparency on the modality of costs calculation and reduction of both the scrutiny and issue time. Hence, among the critical success factors of SMEs financing, there are rapid credit access and a standard product offering with user-friendly interfaces and different channels. With this mind, banks should industrialize processes and build simple products regarding the offering, pricing and required guarantees with the aim of reducing the managing costs of these contracts.

One possible example of this type of product could be financing without a mortgage guarantee, with a fixed rate, sureties and definite and rapid time for the approval and the issue of credit (KPMG, 2016). This kind of product could be offered through digital channels, with the support of the digital sign, or through the net of branches, mainly to SMEs with a consolidated relationship with the bank. The simplified process is as follows: (i) SME requires small size loan, (ii) using website of the bank SME chooses the most acceptable product, (iii) SME sends the needed documentation over the web form, (iv) bank checks the eligibility of SME for financing, and (v) the amount is paid at the SME’s account. The benefits stemming from this solution would be the ease of offering and issue of credit and the extension of the services offered, useful for customers’ retention. Moreover, the creation of standard products would lead to a more industrialized process, with considerable benefits regarding efficiency and costs reduction. Currently, a Poland bank offers a similar product for retail customers and is aiming at doing the same also for corporates. Its process is quite simple and divided into three steps: (i) First of all the customer determine the amount and tenor of the loan, and the rata is immediately computed, (ii) Subsequently, it has to accept the terms and conditions of the loan, and (iii) at the end, the loan is available in around 30 seconds from the confirmation.

Of course, product offering must be aligned with the customers’ characteristics of the specific region but is indubitable that every bank requires a digital transformation. Nowadays, many banks offer a simple internet banking platform with a limited number of actions available. Usually a firm, but the same is valid also for retail clients, can only check its balance and manage its money in a limited way, but it cannot sign up for a loan or interact directly with a representative. The future of the bank will probably lead to an integrated multichannel offering where customers can perform the same activities through each channel in the same way. Going digital does not mean giving up branches, because the physical interaction with people will remain an important component, while it means that branches have to change their functions and have to be completely integrated with the digital processes.

**FUTURE Research DIRECTIONS for FinTech**

Big data and artificial intelligence (AI), use of machine learning (ML) together with data mining and texting or natural language processing (NLP) techniques, blockchain and new ways of human-computer interaction drive the growth of new opportunities which can influence business processes and strategies.

Analysis of researches shows the growing interest in technology innovations in the form of products which have an impact on business processes, models or strategy for the institutions. Deloitte (2018) identifies main issues critical for long-term growth: customer centricity and organizational agility, regulatory compliance aligned with business strategy, technology asset that differentiates the bank, greater protection of cyber risks, FinTech and BioTech for innovations, reinterpreting/defining new roles of the workforce with increasing automation and diversity.

**Big Data**

Big data is mostly analyzed through interactions among consumers, institution and technology. Big data is the key driver for successful machine learning. Banks and financial institutions use various research techniques to extract information from big data relating to structured, semi-structured or unstructured data, mostly agreeing on the following (Evry, N/A):

‘Big data was born out of the necessity of datasets growing so large and complex that traditional tools are no longer sufficient to process this data. By aggregating large amounts of data from many different sources makes big data very powerful for business decision-making, revealing insights and behaviors faster and better than otherwise possible with traditional BI’.

Therefore, one of the most fruitful areas for the future research directions in FinTech is the *big data*, due to the fact that most of the analysis in financial sector is performed on structured data, and appearance of big data has triggered analysis from semi-structured and unstructured data, e.g. appearing in customer reviews (BaFin, 2018).

Turner, Schroeck, and Shockley (2012) indicate that big data is today business imperative for a long-standing business challenge for banking and financial sector, but still hard to find out on what financial services they are based. However, big data is useful only when the collected large databases are analyzed using data mining and text mining methods. Recently, social network analysis has also proven to be a fruitful area of big data analysis.

Financial sector and banks are among early adopters of big data technologies, showing the main trends in big data analytics of financial sector (Alexander, Das, Ives, Jagadish, & Monteleoni, 2017; Moro, Cortez, & Rita, 2015; Srivastava & Gopalkrishnan, 2015; Turner et al., 2012). Some of the possible researches include: customer analytics (such as customer understanding and activation, customer segmentation and profiling, enhancing customer engagement, retention, and loyalty; detecting customer needs, quality analytics, sentiment analysis, best offer, customer gamification, and others), development of new business models (w-banking, increase in revenue, better understanding customer needs, use of historical data for predictive models, forecasts and trading impacts with real-time view of data, , new communication channels), operational optimizations (ability to collect data, aggregation and integration of a variety of data such as reports, transactions, e-mail, logs, social media, free-form texts, external data, geo-spatial, audio, images, sensors, and others), high-capacity of warehouse, data quality management, strong analytic capabilities, risk and fraud management (risk detection, credit approval, crime management, confidential information leaking, mail spamming), and others.

**Data Mining**

Data mining is the process of discovering patterns in large data sets, using different methods, among which machine learning (ML) the most often used. According to Moro et al. (2015) data mining is focused to extract useful knowledge (e.g. trends, patterns) from unstructured or semi-structured file, databases, XML files in order to create data-driven models, such as classification (if output data is a categorical value) or regression model (if output data is numerical value) or clustering. Today financial institutions and banks are faced with more demanding customers who seek low-risk investments and products relevant for their needs, while financial institutions re-evaluate the market situation and customer needs, searching for hidden information in unstructured data, which can influence the decision-making process. Mak, Ho, and Ting (2011) indicate that data mining in finance domain could improve workflow and deepen understanding of investment behavior.

According to Financial Stability Board (2017), financial institutions use machine learning methods (e.g., classification, regression, clustering) to analyze data on transactions and payment history to generate credit score and speed up a decision on lending or risks. On the other side, financial institutions turn to exploit semi-structured and unstructured data to extract more subtle customer opinions (e.g. opinion on some products, willingness to pay, to raise the loan) or data from social networks, text messages or mobile phone use. According to some researches, there is an increased use of voice-to-text communication, which can generate new amounts of data, which can be then integrated with existing data. However, usage of personal data opens issues on data confidentiality, privacy, and protection.

Customer-centricity is one of the key drivers of banks’ growth, as pointed out in numerous researches. Ivanauskienė, Auruškevičienė, Škudienė, and Nedzinskas (2012) analyzed factors of consumer-perceived values in the retail banking sector during the period of economic recession, conducted on customers of commercial banks in Lithuania. The study showed that in the period of economic recession in transitional economy the following factors were present: emotional/ affective factor (when contacting with bank personnel, positive atmosphere, security, trust in bank personnel, satisfaction with conducted transactions) and functional factors (quality of service, price, contact personnel competence, physical environment), but also social factor (including opinions of others, established relationship). Data mining (DM) is the method that can support banks in attaining these goals. Hassani, Huang and Silva (2018) analysed the most often used data mining implementations in banking, until 2013, indicating that data mining algorithms were exploited in the last decade mostly for improving customer satisfaction, marketing and optimization of strategic management, while recent applications target security and fraud detection, risk management and investment banking, as well as customer relationship management (CRM).

Through predictive and prescriptive analytics, banks use technology in a way to gain direct impact on business, such as possible customer churn, marketing, and sales activities, cross-selling activities, fraud detection, customer relationship management (CRM), workforce development, and others.

Asare-Frempong and Jayabalan (2017) performed an analysis of direct marketing focusing on customers who expressed likelihood by subscribing on products, offers, and other packages. They aimed to predict customer response to direct bank marketing by the classifier, i.e., neural networks, decision tree, logistic regression, and random forest, attaining the accuracy of 87%.

Sun, Morris, Xu, Zhu, and Xie (2014) presented Intelligent Customer Analytics for Recognition and Exploration (iCARE) framework to analyze banking customer behavior for retail banks from banking big data. Budale and Mane (2013) used predictive analytics in retail banking to gain insight in improving the relationship with the customer and devise mechanisms for marketing in order to prevent switching to another bank. Results were used to predict churn probability of customer, product preferences and customer lifetime value.

Somal (2017) suggested customer metrics relating to the customer itself, opinions, feelings and attitudes, customer profile and relationships, customer goals and objectives, with examples on Royal Bank of Canada, Toronto Dominian Bank, Bank of Nova Scotia, Bank of Montreal and Canadian Imperial Bank of Commerce. Levy and Hino (2016) evaluated the relationship between customers’ emotional attachment towards bank service provider and card loyalty, as well as customer satisfaction.

**Text Mining and Natural Language Processing**

Text mining is a particular type of data mining focused on the handling of unstructured or semi-structured text documents. In the process of text mining, relevant words and relationships are extracted in order to categorize or draw conclusions. Some of possible text mining techniques include information extraction, topic detection, summarization, classification, concept linkage, information visualization, and question answering, keyword detection, named entity recognition, gender prediction, sentiment analysis, social network analysis, and others. Key-word detection aims to detect relevant keywords from any monolingual or bilingual corpus, using language-independent statistically based techniques, rule-based methods or hybrid approaches, as in Seljan et al. (2009a, 2009b, 2013, and 2017). Named Entity Recognition represents an important step in text mining (Saju and Shaja, 2017) used on large corpora, which can be used in Information Retrieval (IR), Information Extraction, further in Natural Language Processing (NLP), Machine Translation and Question-Answering System, Speech Recognition, Natural Language Generation, Chatbot conversation, Machine Learning, Image Recognition, and others. Nopp and Hanbury (2015) used sentiment analysis to detect risks in the banking system. Srivastava and Gopalkrishnan (2015) analyzed sentiments for the banking sector in order to assess the opinions on the functioning of the bank. Topic modeling or topic prediction/ extraction is based on number and distribution of terms across documents by counting the probability of belonging to a certain topic. Moro et al. (2015) performed topic detection of a large number of manuscripts using text-mining techniques when detecting terms belonging to business intelligence and banking domains.

Social network analysis (SNA) is a different type of analysis in comparison to text analysis, but it is used here to show how text analysis and its results can be integrated with this analysis. Morales et al. (2014) used SNA to estimate bank financial strength during the financial crisis.

Natural language processing (NLP) tools can help to extract and detect information relating to sentiment analysis on trust in banks, e.g. from Twitter posts or text from a newspaper article, can be used for predicting banks attitudes of clients towards the bank, and thus predict the potential business risks. Various consulting companies point out cases to acquire, develop and retain customers using sentiment analysis, in order to:

* analyze customer opinions (e.g., Barclays);
* develop 360-degree customer-view to predict future trends or ideas, as well as customer churn behavior (e.g., OCBC bank in Singapore, Bank of Austria, Tatra Bank);
* conduct customer segmentation in order to divide customers into groups that share similar characteristics (e.g., Bank of America, First Tennessee Bank);
* to improve marketing effects (e.g., by serving consumers according to lifestyle, professional life, families, and retirees, as for Singapore Citibank);
* to offer loyalty cards based on customer habits (e.g., Bank of America), as well to increase card usage (e.g.,Barclays to target students), for the next best offer to predict future purchases (e.g., Westpac bank in Australia and New Zeland);
* to choose communication channel for interaction with customers ranging from mobile apps, social networks, clickable ads, stores, TV, publication platforms, and others, in order to provide preferred content through a preferred channel or to avoid undesirable ones (e.g., HDFC bank in India, OCBC bank in Singapore);
* to personalize customer experience on the chosen channel or preferred language (e.g., Bank of China), which would support the improvement of overall marketing effectiveness (e.g., Laurentian Bank of Canada).

**Human-Computer Interaction**

According to Saha (2017), banks are one of the first adopters of cutting-edge technologies, including human-computer interfaces which use natural language processing and speech recognition, connected with machine learning algorithms.

Researches and implementations of chatbots in the banking sector are often used as ‘live chat”. They access data and use artificial intelligence in the background to enable conversation and offer responses to customers. There are several possible uses of chatbots: to ask specific questions to consumers and, therefore, to collect data and learn customer preferences, or when integrated with machine learning solutions, to offer personalized products and offers via preferred mobile app, or to offer right content to the customer.Okuda and Shoda (2018) presented an artificial intelligence-based chatbot service, developed by Fujitsu, which aims to support users’ needs.

Another example of human-computer interaction is voice input, for information search, online communication or integrated with other technologies. Seljan and Dunđer (2014) performed research on combined automatic speech recognition and machine translation in the domain of business correspondence. Voice-activated home banking is presented in Isobe, Morishima, Yoshitani, Koizumi, and Murakami (1996) with a success rate of 85%. Some banks use voice-recognition to check an account balance or to hear a payment-due date.

Due to security threats, banks are interested in risk prevention, where biometric technologies can apply. Banking use of selfies, fingerprints, facial recognition or voice biometrics, representing the new horizon, which enables users to enrol in banking services through smartphones or telephone banking. Piotrowska, Polasik, and Piotrowski (2017) concluded that authorization using fingerprint is secure and convenient for consumers in mobile banking.

**Mobile Banking: Security and Gaming**

Banks and financial institutions have to satisfy mobile banking customers with instant access, but at the same time protect customer information, transactions, banks’ data from any threats in order to ensure the highest level of security. According to Vasco Data Security (2016), nearly all Android apps (95%) were hacked in 2014 and the security issue has become the main concern of financial institutions. This is of highest concern since according to Global FinTech Survey (2016), where more than 90% banks expect the raise in usage of mobile applications and 71% believe that in the next five years more than 60% of clients will use mobile applications at least once a month to use financial services. Therefore, special attention is given to the *security* aspect in mobile applications. He, Tian, Shen, and Yaohang (2015) explored blog mining as a research method to analyze blog discussion on security of mobile applications and used the current technology to simulate the scenario of emerging attacks on banking applications. They identified the main protection strategies for users and developers of mobile banking apps. Alotaibi, Furnell, and Clarke (2016) studied risks for each process from the authentication within the mobile application in order to understand various levels of risks. Hayikader, Hadi, Hanis, and Ibrahim (2016) examined issues of architecture and security issues on banking apps for everyday users.

Schaefer, Moormann, and Rosemann (2012) considered the concept of customer process to establish a customer-centric business model and presented the results of empirical research of smartphone apps for banking. The research pointed out a customer-centric approach which presented competitive advantage and important feature of the app where the customer could be present during the whole process which had a positive impact on trust, as well as value-added services. In this process, *gamification* can be used as the leverage to increase the quality of customer relationships. Torres-Toukoumidis and Marín-Mateos (2017) identified incorporation of game elements in the mobile application in the Spanish financial sector, using a sample of 38 mobile application of mobile banking, analyzing purpose, audience, technological strategy, play experience, and game mechanics. Results showed that the purpose of such applications was to enforce customer loyalty and expand influence on audience between 26-35, with technology strategy to adopt security and privacy systems and the meaning of gaming awards. Additionally, game experience was adopted in banking communication among Spanish banking entities. The research aimed to establish patterns for gamification in the banking sector, by measuring effects and effectiveness on clients and their communication.

**CONCLUSION**

The banking sector is strongly affected by the aforementioned disruptive technologies, challenging the traditional model, moving from purely monetary transactions to integrated financial experience which also includes technological, personal and social aspects. Use of new technologies requires specific attention given to security, privacy, data protection, and legal regulations. Banks offer new personalized approach and try to differentiate from others through customer-centric approach, effective use of technology and adapted business process. Data science combined with sophisticated analytic tools and computer power created new business opportunities.

Digital innovation is changing traditional small business banking. The continuous research of efficiency by the banks, along with the increasing demand of small business owners who are raising their expectations in their business banks, is pushing the transaction of banking institutions through digital solutions, also for small business clients. Banking is looking for ways to exploit digital innovation to support small business activities, solving their day-to-day problems and helping them to expand above their geographical border. Moreover, banks can often take advantage of the investments that have already been made in retail banking digital platform. As highlighted by Oliver Wyman in the report on European retail and SME credit, ‘banks that successfully digitaze their SME offering can benefit enormously. In North America, Bank of Montreal and PNC claim significant increases in customer numbers as a result of online and mobile banking offers targeting small business owners”. Nevertheless, as resulted from the analysis of the previous section, there is again room for improvement regarding a digital proposition for SMEs. For this reason, this chapter provides an outlook to the possibilities that could arise from the digitization..

The chapter focuses on FinTech aided banking services, in particular, because these are, at present, the most widely FinTech technologies available in Italy. We presented a study about how Italian SMEs understand and use FinTech technologies, indicating that despite FinTech has entered in Italy only in recent times, the Italian SMEs market is very active and fruitful for digital companies.

**REFERENCES**

1. ABI (Giovanni Sabatini) (2017). *Indagine conoscitiva sulle tematiche relative all’impatto della tecnologia finanziaria sul settore finanziario, creditizio e assicurativo (Cognitive survey on issues related to the impact of technology)*. Retrived from <https://www.abi.it/DOC_Info/Audizioni-parlamentari/Presentazione%20per%20Audizione%20DG%20Commissione%20FInanze%20Camera%204%2012%202017.pdf>
2. Aldás-Manzano, J., Lassala-Navarré, C., Ruiz-Mafé, C., & Sanz-Blas, S. (2009). The role of consumer innovativeness and perceived risk in online banking usage. *International Journal of Bank Marketing*, *27*(1), 53-75.
3. Alexander, L., Das, S. R., Ives, Z., Jagadish, H. V., & Monteleoni, C. (2017). Research Challenges in Financial Data Modeling and Analysis. *Big data*, *5*(3), 177-188.
4. Alotaibi, S., Furnell, S., & Clarke, N. (2016). A novel Taxonomy for mobile applications data. *International Journal of Cyber-Security and Digital Forensics*, *5*(3), 115-122.
5. Asare-Frempong, J., & Jayabalan, M. (2017). Predicting Customer Response to Bank Direct Telemarketing Campaign. In *International Conference on Engineering Technologies and Technopreneurship (ICET2T)*, IEEE, 1-4.
6. BaFin (2018). *Big data meets artificial intelligence: Challenges and implications for the supervision and regulation of financial services*. Retrieved from

<https://www.bafin.de/SharedDocs/Downloads/EN/dl_bdai_studie_en.pdf?__blob=publicationFile&v=11>

1. BeBeez (2018). *Tutte le Fintech italiane (o fondate da italiani) finanziate da venture, angel, o altri investitori (All the Italian Fintech (or founded by Italians) funded by venture, angel, or other investors).* Retrieved from <https://bebeez.it/files/2018/06/FintechBeBeez-giu2018.pdf>
2. Boston Consulting Group (2016). *Global Corporate Banking 2016: The Next-Generation Corporate Bank*. Retrieved from <http://image-src.bcg.com/Images/BCG-Global-Corporate-Banking-2016-Dec-2016_tcm80-217574_tcm9-167068.pdf>
3. Budale, D., & Mane. D. (2013). Predictive Analytics in Retail Banking. *International Journal of Engineering and Advanced Technology (IJEAT), 2*(5), 508-510.
4. Chen, L. (2016). From fintech to finlife: The case of fintech development in China. *China Economic Journal*, *9*(3), 225-239.
5. Cocco, L., Pinna, A., & Marchesi, M. (2017). Banking on blockchain: Costs savings thanks to the blockchain technology. *Future Internet*, *9*(3), 25.
6. Deloitte (2018). *2018: Banking Outlook: Accelerating the transformation*. Retrieved from

<https://www2.deloitte.com/content/dam/Deloitte/tw/Documents/financial-services/tw-2018-Banking-Outlook-English.pdf>

1. Dhliwayo, C., & Governor, A. (2014). Role of the banking sector in promoting growth & development of small and medium enterprises. In *2nd SME Banking & Microfinance Summit 2014*, 1-17.
2. European Central Bank (2016). *Financial Stability Review.* Retrieved from

<https://www.ecb.europa.eu/pub/pdf/other/financialstabilityreview201611.en.pdf>

1. European Commission (2003). *Commission Recommendation of 6 May 2003 concerning the definition of micro, small and medium-sized enterprises*. Retrieved from

<https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:124:0036:0041:en:PDF>

1. European Commission (2010). *European SMEs Under Pressure: Annual Report on EU Small and Medium-Sized Enterprises. SME performance review*. Retrieved from

<https://ec.europa.eu/docsroom/documents/15767/attachments/1/translations/en/renditions/native>

1. Evry (N/A). *Big data in banking for marketers: How to derive value from big data*. Whitepaper. Retrieved from <https://www.evry.com/globalassets/insight/bank2020/bank-2020---big-data---whitepaper.pdf>
2. Financial Stability Board (2017). *Artificial Intelligence and machine learning in financial service: Market developments and financial stability implications*. Retrieved from <http://www.fsb.org/wp-content/uploads/P011117.pdf>
3. FinTech Network (N/A). *Four Blockchain Use Cases for Banks*. Retrieved from

<https://blockchainapac.fintecnet.com/uploads/2/4/3/8/24384857/FinTech_blockchain_report_v3.pdf>

1. Gabor, D., & Brooks, S. (2017). The digital revolution in financial inclusion: international development in the fintech era. *New Political Economy*, *22*(4), 423-436..
2. Gai, K., Qiu, M., & Sun, X. (2018). A survey on FinTech. *Journal of Network and Computer Applications*, *103*, 262-273.
3. Global FinTech Survey (2016). *Customers in the spotlight: How FinTech is reshaping banking*. Retrieved from <https://www.pwc.com/jg/en/publications/fin-tech-banking-2016.pdf>
4. Gomber, P., Kauffman, R. J., Parker, C., & Weber, B. W. (2018). On the Fintech Revolution: Interpreting the Forces of Innovation, Disruption, and Transformation in Financial Services. *Journal of Management Information Systems*, *35*(1), 220-265..
5. Guo, Y., & Liang, C. (2016). Blockchain application and outlook in the banking industry. *Financial Innovation*, *2*(1), 24.
6. Hassani, H., Huang, X., & Silva, E. (2018). Digitalisation and big data mining in banking. *Big Data and Cognitive Computing*, *2*(3), 18.
7. Hayikader, S., Hadi, A., Hanis, F. N., & Ibrahim, J. (2016). Issues and security measures of mobile banking apps. *International Journal of Scientific and Research Publications*, *6*(1), 36-41.
8. He, W., Tian, X., Shen, J., & Yaohang, L. (2015). Understanding Mobile Banking Applications’ Security risks through Blog Mining and the Workflow Technology. In *36th International Conference on Information Systems*, 1-10.
9. Isobe, T., Morishima, M., Yoshitani, G., Koizumi, N., & Murakami, K. (1996). Voice-activated home banking system and its field trial. In *Proceedings of Fourth International Conference on Spoken Language Processing* (pp. 1688-1691). Philadelphia, PA, USA: IEEE.
10. Ivanauskienė, N., Auruškevičienė, V., Škudienė, V., & Nedzinskas, Š. (2012). Customer perceptions of value: case of retail banking. *Organizations and Markets in Emerging Economies, 3*(1/5), 75-88.
11. Jones, C., Ramanau, R., Cross, S., & Healing, G. (2010). Net generation or Digital Natives: Is there a distinct new generation entering university? *Computers & education*, *54*(3), 722-732.
12. KPMG (2016). *Nuovi modelli distributivi nel settore bancario (New distribution models in the banking sector).* Retrieved from

<https://assets.kpmg.com/content/dam/kpmg/pdf/2016/06/it-modelli-distributivi.pdf.pdf>

1. Lee, I., & Shin, Y. J. (2018). Fintech: Ecosystem, business models, investment decisions, and challenges. *Business Horizons*, *61*(1), 35-46.
2. Leong, C., Tan, B., Xiao, X., Tan, F. T. C., & Sun, Y. (2017). Nurturing a FinTech ecosystem: The case of a youth microloan startup in China. *International Journal of Information Management*, *37*(2), 92-97.
3. Levy, S., & Hino, H. (2016). Emotional brand attachment: a factor in customer-bank relationships. *International Journal of Bank Marketing, 34*(2), 136-150.
4. Mak, M. K. Y., Ho, G. T. S., & Ting, S. L. (2011). A financial data mining model for extracting customer behavior. *International journal of engineering business management*, *3*(3), 59-72.
5. Morales, M., Brizan, D. G., Ghaly, H., Hauner, T., Ma, M., Reza, S., & Rosenberg, A. (2014). Application of Social Network Analysis in the Estimation of Bank Financial Strength During the Financial Crisis. NLP Unshared Task in PoliInformatics. Retrieved from

<https://www.researchgate.net/profile/Michelle_Morales4>

1. Morgan, R. (2017). The Top Fintech Trends Driving the Next Decade. *American Bankers Association. ABA Banking Journal*, *109*(5), 22.
2. Moro, S., Cortez, P., & Rita, P. (2015). Business intelligence in banking: A literature analysis from 2002 to 2013 using text mining and latent Dirichlet allocation. *Expert Systems with Applications*, *42*(3), 1314-1324.
3. Muller, P., Caliandro, C., Peycheva, V., Gagliardi, D., Marzocchi, C., Ramlogan, R., Cox, D. (2015). *Annual report on European SMEs*. Retrieved from

<http://ec.europa.eu/DocsRoom/documents/16341/attachments/2/translations/en/renditions/native>

1. NetConsulting (2017). Le aziende del Fintech in Italia 2017. Retrieved from

<https://www.pwc.com/it/it/industries/FinTech/docs/2017-FinTech-report.pdf>

1. Nopp, C., & Hanbury, A. (2015). Detecting Risks in the Banking System by Sentiment Analysis. In *Proceedings of the 2015 Conference on Empirical Methods in Natural Language Processing* (pp. 591-600). Lisbon, Portugal: Association for Computational Linguistics.
2. Okuda, T. & Shoda, S. (2018). AI-based chatbot service for financial industry. *Fujitsu scientific & technical journal, 54*(2), 4-8.
3. Piotrowska, A. I., Polasik, M., & Piotrowski, D. (2017). Prospects for the application of biometrics in the Polish banking sector. *Equilibrium. Quarterly Journal of Economics and Economic Policy*, *12*(3), 501-518.
4. Premoli, F. (2017). *The impact of digital innovations on the current banks’ offering towards SMEs*. Retrieved from <https://www.politesi.polimi.it/handle/10589/136364>
5. Rajaobelina, L., Brun, I., & Toufaily, É. (2013). A relational classification of online banking customers. *International Journal of Bank Marketing*, *31*(3), 187-205.
6. Saha, A. K. (2017). *Review of Design of Speech Recognition and Text Analytics based Digital Banking Customer Interface and Future Directions of Technology Adoption*. Retrieved from <https://arxiv.org/ftp/arxiv/papers/1712/1712.04640.pdf>
7. Saju, J.C., & Shaja, A. S. (2017). A Survey on Efficient Extraction of Named Entities from New Domains Using Big Data Analytics. In *2nd International Conference on Recent Trends and Challenges in Computational Models (ICRTCCM)*, 170-175.
8. Sayani, H. (2015). Customer satisfaction and loyalty in the United Arab Emirates banking industry. *International Journal of Bank Marketing*, *33*(3), 351-375.
9. Seljan, S., & Dunđer, I. (2014). Combined Automatic Speech Recognition and Machine Translation in Business Correspondence Domain for English-Croatian. *World Academy of Science, Engineering and Technology (WASET) - International Journal of Computer, Electrical, Automation, Control and Information Engineering, 8*(11), 1980 - 1986.
10. Seljan, S., Dunđer, I., & Gašpar, A. (2013). From digitization process to terminological digital resources. In *36th International Convention on Information & Communication Technology Electronics & Microelectronics (MIPRO)*, 2013 (pp. 1053-1058), IEEE.
11. Seljan, S., & Gašpar, A. (2009a). First Steps in Term and Collocation Extraction from English-Croatian Corpus. In *Proceedings of 8th International Conference on Terminology and Artificial Intelligence*. Retrieved from <http://ceur-ws.org/Vol-578/paper21.pdf>
12. Seljan, S., Dalbelo Bašić, B., Šnajder, J., Delač, D., Šamec-Gjurin, M., & Crnec, D. (2009b). Comparative Analysis of Automatic Term and Collocation Extraction. In *2nd International Conference “The future of information sciences (INFuture 2009): Digital resources and knowledge sharing”*, 219-228.
13. Seljan, S., Stančić, H., & Dunđer, I. (2017). Extracting Terminology by Language Independent Methods. In Zybatow, L. N., Stauder, A, Ustaszewski, M. (Eds.), *Forum Translationswissenschaft: Translation Studies and Translation Practice* (pp. 141-147). Peter Lang GmbH, Frankfurt am Main.
14. Schaefer, A., Moormann, J., & Rosemann, M. (2012). The rise of smartphone apps: opportunities for customer-centric retail banking. *Banks and Bank Systems, 7*(1), 73-82.
15. Somal, H. K. (2017). Big Data & Analytics: Tackling Business Challenges in Banking Industry. *Business and Economics Journal, 8*(2).
16. Srivastava, U., & Gopalkrishnan, S. (2015). Impact of big data analytics on banking sector: Learning for Indian banks. *Procedia Computer Science*, *50*, 643-652.
17. Sun, N., Morris, J. G., Xu, J., Zhu, X., & Xie, M. (2014). iCARE: a framework for big data-based banking customer analytics. *IBM Journal of Research and Development, 58* (5-6), 4:1-4:9.
18. The Bain.com (2016). *Divide and Conquer: A Guide to Winning SME Banking Strategies*. Retrieved from <http://www.bain.com/publications/articles/divide-and-conquer-a-guide-to-winning-sme-banking-strategies.aspx>
19. Torres-Toukoumidis, A., & Marín-Mateos, P. (2017). Gamification in mobile applications for banking services in Spain. *Revista de Ciencias de la Administración y Economía, 7*(13), 59-72.
20. Turner, D., Schroeck, M., & Shockley, R. (2012). *Analytics: The real-world use of big data in financial services*. Retrieved from <https://www-935.ibm.com/services/multimedia/Analytics_The_real_world_use_of_big_data_in_Financial_services_Mai_2013.pdf>
21. Van Loo, R. (2018). *Making Innovation More Competitive: The Case of Fintech*. 65 UCLA Law Review 232. Retrieved July 22, 2018 from [https://ssrn.com/abstract=2966890](https://ssrn.com/abstract%3D2966890)
22. Vasco Data Security (2016). *Mobile Banking Applications: Balancing Security and Convenience*. Retrieved from <https://www.vasco.com/images/Mobile-Banking-Applications-White-Paper-redux-MondayApril4_tcm42-46736.pdf>