POLYTECHNIC OF TURIN

Department of Management and Production Engineering

Master of Science in Management and Engineering

ICT GOVERNANCE AND BANK PERFORMANCE: EVIDENCE FROM ITALY

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CONTENTS

INTRODUCTION

Ten years after the beginning of the financial crisis and at the height of the digital era, the banking system is working to recover profitability. The results of recent years for Italian banks have been mixed and marked both by economic and structural phenomena. One of the main problems is that a large part of the system is still committed to the legacy of the past. For example, loan adjustments, cost and network restructuring, management of excess capacity, rigidity in the ability to innovate and, not least, increasingly stringent regulatory compliance demand. After going through a phase of "compressive disruption", that is slow but constant erosion of value, also due to the entry on the market of new players (from fintech startups to web giants) and the advent of new business models, traditional Banks are slowly trying to regain competitiveness. However, continuing along the previous direction will not be enough to resume a path of sustainable growth, whose essential condition is to completely transform the entire governance, ceasing to be generalist Banks to adopt new specialized business models and creating winning digital ecosystems. Therefore, this situation induces this category of operators to consider and reconfigure their organizational models, the choices in the technological field, the rational expenditure and the investment strategies with the aim of making the operating machines more efficient.

The recent recognition of the ICT strategic role within the business organization of the Banks and the attention that the regulator has placed on issues relating to information systems, recalls the need for renewal interventions that require substantial investments that cannot be postponed anymore. In order to improve the services and business processes, organizations intend to plan, build and implement different kinds of ICT projects every year. Hence, due to this large investment on

ICT resources, measuring their performance and underutilization are major concern of the Banks.

It is not enough for corporations to have IT systems and expect them to deliver strategic value to them. Instead, there needs to be a mechanism in place to regulate, monitor, and govern the value creation efforts of the IT systems. This governance mechanism of IT systems deals with the performance and risk management of those IT systems in a manner that would create value for the organizations and ensure that the intended alignment of the IT and business objectives is on track. Hence, ICT governance deals with identification, establishment, and linking of the mechanisms of the ICT systems to both manage risks and at the same time ensure that their performance is in tune with the stated objectives.

The aim of this thesis is to carefully structure and analyze the role of ICT governance in the Italian banking system and how this affects the performance of financial organizations. In particular, it is intended to analyze the effects of digitalization on the operational and strategic model, placing particular emphasis on optimizing the management of ICT systems in order to better address the project portfolio which is characterized by a growing technological and innovation complexity.

The first part of the paper introduces the topic of digitalization in the banking sector and proposes an analysis framework with respect to the impact it has on the relationship with the client and in the improvement of the internal organization of the bank. Subsequently the main digital trends that are revolutionizing the banking system are presented and the impact of each of them on operations is analyzed.

In the second part, instead, the particular role of ICT Governance is defined considering its specific application in the banking industry. The related sourcing models are therefore analyzed, emphasizing the strategic nature of this activity. After, it is studied the incidence of ICT costs on total operating costs which is related to the type of organizational model and sourcing adopted and is linked to the renewal "cycle" of the information system.

Finally, in the third part, it is presented a case study which is the result of a specific project to which I have been assigned during an internship in a leading consulting firm for the financial services industry. The objective of the project consisted in the definition of technological drivers on which map all the projects initiatives of the department of Credit Products and NPL of a leading Italian Banking Group in order to address short- and long-term ICT investments. This activity allowed us to provide the Bank a high-level and innovation-oriented Technology view underlying which technologies solutions should be implemented in the department.

1. Banking Digital Revolution

As technology and digital services continue to ingrain themselves into more aspects of our lives, the financial sector has not been immune. New technology has given way to new services and with new services comes disruption of the old. The banking industry, in recent years, has been characterized by numerous innovations that are digitalizing the entire system in order to stay competitive with respect new actors and to offer new value-added services to customers.

The first paragraph analyses the impact of digitalization on the banking system which incorporates the implementation of two strategic business domains: new costumer experience from the outside and a lean, efficient and structured operating model from the inside. The new technological tools, the related value-added services, and new customer habits are all factors that contribute to this transformation, which will not only change the business models, but will also involve a redefinition of the operating and service models, that have to be reinvented based on a Digital approach.

In the second paragraph the main digital trends that are revolutionizing the banking system are presented and the impact of each of them on operations is analyzed.

1.1. Digitalization in the Banking Industry

The impact of new and emerging digital technologies in the banking industry has been quite impressive in terms of benefits, new revenue streams and cost cutting. The innovation topic has acquired strategic relevance in the strategies of Italian banks. In particular, the new experiences of mobile and online banking, introduced by new entrants that rely on “disruptive innovations”, highlight how

the distance between innovative business models and traditional bank models is rapidly expanding, both for the greater attention to the transparency of procedures and fees charged to the customer and in terms of customer experience and support provided to customers, or even in aspects such as intelligent and responsible management of their accounts. Moreover, the impacts of the crisis on the banks' income statement forces them to make both radical changes and initiate processes of profound renewal. The growing competitiveness of the sector and the persistence of the unfavorable economic situation, increasingly characterized by the contraction of consumption and a strong focus on costs, obliges them to rethink the commercial strategies, driving even more than in the past on improving the relationship with the customer and on a renewed attention to innovative channels.

It should be noted that in the global statistics no bank has ever appeared at the top of the most innovative companies: companies such as Apple, Goggle, GE, Toyota, as well as other players in the consumer electronics, healthcare and consumer goods. Their experience shows that the greatest results in innovation do not depend so much on the budget allocated to R&D activities, but rather on a unique combination of aspects such as people's talent, knowledge, technologies and tools, organizational procedures - in essence, all that contributes to create a favorable internal culture and promoter of Innovation. In addition, banks must now take into account several new entrants in the sector that are challenging them on their own ground, leveraging innovative ideas that propose a complete review of a bank's way of operating. In some cases, these are players from other market sectors, innovative start-ups exploring new business models, of "disruptive innovation" cases that aim to disintermediate traditional banking players by offering customers advanced mobile experiences, cost reductions, high transparency on the service offered and Personal Finance Management (PFM) tools.

In particular, digital banking incorporates the implementation of two strategic business domains: new costumer experience from the outside and a lean, efficient and structured operating model from the inside (figure 1).

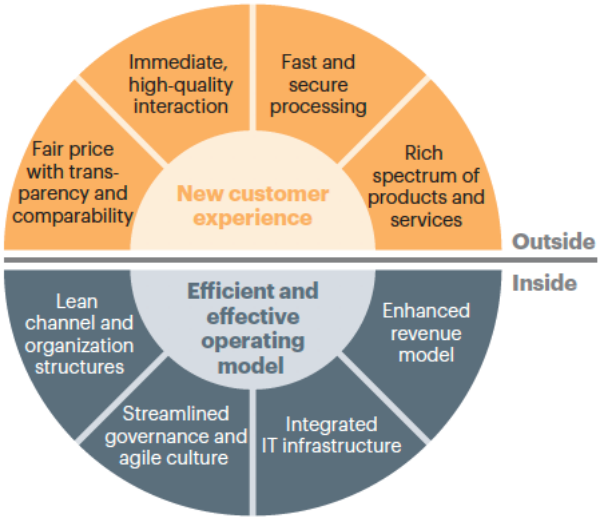


Figure 1. Digital Banking impact in the two business domanis

Advanced Customer Experience

Profitability and growth in the new digital economy are strongly influenced by the adoption of a customer-centric business model. This means that a bank should be able to deliver to the customer in the most efficient way the right level of the service at the right time containing the related costs. Several factors are driving this customer focus. Currently Italy is experiencing a moment of strong polarization of the banking market: more and more users are migrating to safer banks in terms of capital and with a more proactive business model. Users are evolving, adopting an attitude increasingly linked to omnichannel: practicality, simplicity, accessibility of digital platforms, are fundamental elements required by the new "digital customers". Today the Omnichannel Bank is used by around 17.3 million users who are progressively exploiting the advantages of mobile banking. These consist on the possibility to carry out online transactions without having to physically go to the traditional bank branch and receive information about current accounts, securities accounts, credit cards or prepaid cards. As a consequence, the bank is able to deliver an immediate and high-quality interaction offering a rich spectrum of products and services.

Another important customer expectation is the bank's capability to offer personalized products and services that are both timely and relevant with a high degree of customization. The priority is given to personalized pricing and portfolio mixes. In this way the bank is able to assess and forecast each customer's profitability and offer individualized or segmented products and pricing. The analysis of personal data and its correct management, in compliance with the regulations in force on privacy, represent a precious mine of information for banks. Banks enjoy an enormous privilege in being able to acquire large amounts of data that, if properly processed, can outline and predict the behavior of their customers.

The creation of a multi-channel "banking experience", connected and personalized at 360°, providing information that is always available, as well as access to data in total privacy and security, is determining a progressive transition of the customer from a more "conditioned" to a more "autonomous" role and active in the communication and information of its needs. This transition has led the bank to change the service model not only with respect to the specific environment in which the bank is located. All this inevitably goes beyond the mere credit and financial intermediation, offering and delivering new and high value-added services, specific to the individual customer. The bank thus adopts new and powerful tools to improve communication, marketing, sales and processes, allowing customers to offer complete and engaging multi-channel experiences.

Efficient and effective Operating Model

The disruption determined by the recent digital mega-trends (which will be discussed in the following paragraph) in the banking industry has led incumbents to rethink their operating model in order to stay competitive, manage technology and new entrants risks better while still focusing on customers' expectations. One of the main pain points to deal with consists on the huge investments in legacy infrastructure that in the past represented a strong barrier to entry. A more effective, digitally enabled operating model is needed for banks that want to build a more proactive and agile response to market changes.

Adaption starts from the optimal integration of three key elements across the front, middle, and back offices: technology, process and organization. Banks are focusing mainly in the process standardization with the subsequent consolidation of practices in order to gain flexibility in the implementation of new technologies and scale operations faster. In this framework, the application of the following improvements will be crucial to increase the convenience and value for costumers:

- Lean channel and organization structure – the application of lean principles can determine remarkable advancements in the operational efficiency of a bank. Each area of the organization is analyzed in order to identify waste and inefficiencies in the methodologies as well as non-value added activities in specific business processes in order to reduce their overall negative impact. In this way more time can be spent on process steps that create value for the customer. Banks' annual reports state that the subsequent improvements can reach up to 30 % of cost reduction within 12 to 18 months and maintain cost-efficiency ratios below the industry average while not requiring significant capital investment. The implementation of these principles requires well known techniques such as just in time, benchmarking, future state map, 5S, sigma six. The main challenge relies in the application method: Lean needs to be applied holistically, so from an organization-wide, cross-functional perspective. Moreover, since the 2008 crisis, the banking industry has experienced a notable decline in revenue rather than increases in overhead costs, determining a drop of banks efficiencies ratios: to drive substantial lean banking process improvements, it is necessary to improve revenue. Therefore, lean banking process improvement initiatives must include an analysis of sales and marketing, margin management, non-interest income management, as well as an ongoing review and improvement of these elements of lean banking operations.
- Streamlined governance and agile culture – agile development methodologies are fundamental to improve Banks reaction to four main challenges: complexity management of existing APIs, changing customer

behavior, increasing amount of data and non-traditional competitors. In particular, it has been demonstrated that an agile governance can accelerate speed-to-market, enhance quality, and increase flexibility while reducing costs and complexity. Focusing on the first challenge, traditional systems, with their slowness and rigidity, make it very difficult to promptly respond to new customer requests and emerging regulatory requirements. An approach that many banks are adopting to improve on this point is the Agile software development methodology, which involves benefits of time-to-market reduction and quality improvement thanks to DevOps, or the continuous interaction between development and operations. Greater flexibility through innovation comes instead from the management of APIs (Application Programming Interface), encouraged by regulations such as PSD2 and sector initiatives. Placing the APIs management in the strategic agenda will allow banks to more easily connect to new systems and data, quickly satisfying customers' growing expectations; collaborate more easily with third-party technology providers to accelerate product and service innovation; and move more easily to next-generation solutions.

- Integrated IT infrastructure – Information technology systems sustain every major banking process harmonizing the exchange of data and information between business units, customers, and back-office functions. Banking information architectures are typically formed by very different solutions - internal developments or commercial packages - stratified over time even after mergers and acquisitions. These traditional systems involve multiple risks, both operational and security. Operational risks arise from various factors. Traditional systems have little flexibility, they depend on an ever smaller number of people with very specific skills (because programming languages are obsolete and need knowledge of software customizations), they have system downtimes that are not compatible with current global scenarios, require complex incremental updates, and finally present a fragmentation of data in different application "silos". To mitigate these risks, it is necessary to migrate to more advanced

and integrated IT systems, which accelerate development and updating times because they are based on standard tools and methodologies. Furthermore, they limit the need for customizations thanks to the large number of configuration options, and unify the databases, allowing an overall view of customers and services. As for the security, magnitude and increasing number of data breaches in the financial sector in recent years arouse the greatest concern in the top management of the banks. Also in this case the best choice is to switch to the most up-to-date IT integrated technologies, because the traditional ones facilitate cyber criminals actions for various reasons: the inefficiency in real-time data processing, the difficulty of transferring data from a system to the other, the excessive complexity of vulnerability and patch management, the difficulty of encrypting data

- Enhanced revenue model – The international financial crisis has strongly impacted the banking industry (expansionary monetary policies, liquidity crisis, asset impairment, reduced margins) and an intensified regulatory and competitive pressure has disintermediated specific activities along the value chain. Therefore, there is the urgency for banks to redirect the business model to optimize costs, recover margins and identify new sources of revenue. Alternative revenue streams can be reached thanks to digital technologies and widespread innovation of channels, products / services and processes. Two main sources should be analyzed:
    1. Increased revenues from innovative new offers/products and operating models - the innovation of products/services goes through customization and simplification, originating new products and new sources of revenue (e.g. "adjacent" services to the traditional banking business, such as post and insurance). In process innovation, digitalization of banking IT architecture allows the progressive adoption of integrated digital platforms, allowing the reduction of back-office costs, the adoption of an omnichannel offer and increase security, flexibility and scalability. In particular, through channel innovation (distribution network and contact with

customers), web and mobile solutions allow banks to interact with customers (e.g. through social networks), reaching them everywhere, always with simpler, immediate and secure ways. Also, traditional channels, like physical branches, are rethought according to the Hub & Spoke model which, thanks to the “cluster" configuration ("main" branches and "Satellite" ones), reduces operating costs and offers services with higher added value, highly specialized and customized. Thanks to integrated multiplication of channels ("omnichannel"), the customer can control and use the different tools according to his/her own preferences and needs.

2. Increased revenues from new distinctive digital sales and using Big Data to cross-sell – Impact on banking processes are also determined by automation and dematerialization of processes and by the use of Big Data (huge amounts of data generated by the use of new technologies) which provides analytical tools to customize the offer, make consumption forecasts, reduce the inefficiencies and favor bank-customer interaction in the creation of new products/services (co-production). In particular, significant value can be derived through the application of advanced analytics to create targeted offerings for cross-selling and up-selling. This is achieved by making data usable in real time and combining the data with analytical tools to generate insights provided by “next product to buy” models or risk assessments, for example.

In order to give a simple and complete framework of the previous considerations, the following image (see figure 2) analyzes the changes and innovations that are taking place in the product and services portfolio of the banks with the related effects on the revenue model. From one side, core products variants and specific offerings will be gradually reduced in order to achieve an effective rationalization of the product base. The strategic goal is to reach a maximum number of customers with an optimum portfolio of products. An enhancement of the product lifecycle management is crucial since offering a wide variety of products can lead to a wider variety of customers, but an excessive complicated portfolio can erode

bank's profits. A large product range increases business risk as it becomes more difficult to ensure all regulatory obligations are met. It also leads to high maintenance efforts and additional operational costs of multiple systems supporting older products. From the other side, the number of value-added services will become broader, richer and more efficient to support customers' convenience, individualization and transparency. The pricing for enhanced services could be mixed, with some services paid by the customers and others paid by service providers that want access to the bank's client, with an increased revenue generation from advertising.

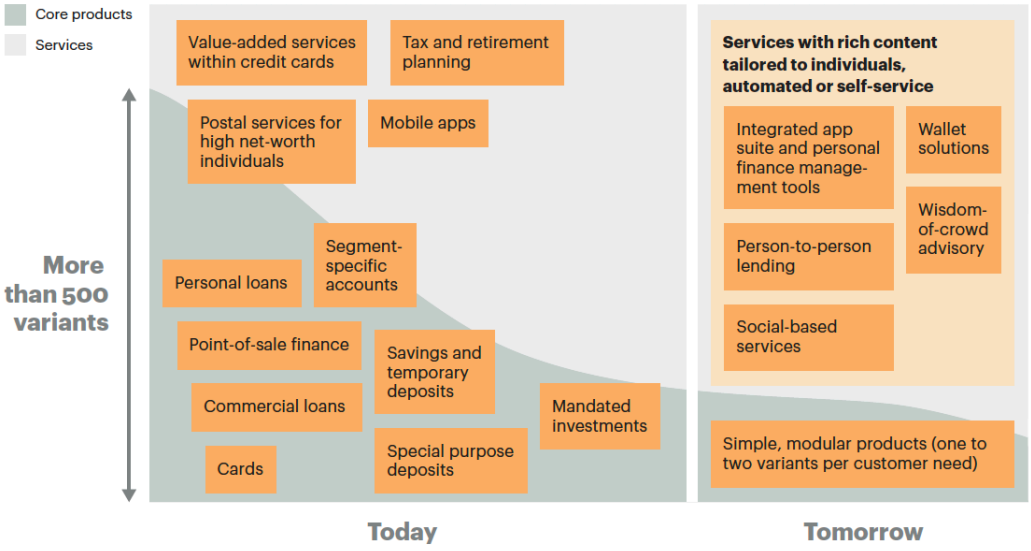


Figure 2. Digital Banking playground

1.2. Digital Trends Analysis

In the past years, extraordinary technology changes and shifting paradigms have strike the Italian banking system. Surviving and thriving in these times requires

banks to be extremely responsive to market changes and customer expectations. The current market is characterized by a progressive reduction of entry barriers in specific areas of the value chain and by reduced profitability margins. Because of this, the competitive arena is undergoing major changes both internationally and in Italy. In Europe there is a shift of revenues from traditional operators to new players of about 6-7% and, considering the last 12 years, 1 player out of 5 entered after 2015 (20%). As the rise of non-traditional competitors has had a significant impact on the industry on both technology and the business front, there is a growing trend of banks focusing on innovation by leveraging new technologies. Compared to the competitors of the other major economies, the Italian market is somewhat behind in the innovation process of the sector, but an ongoing radical adaptation is taking place that will soon align with the European parameters, both in terms of number of players and revenues. Below it is proposed an analysis with related implications about the leading innovations that are re-shaping the industry.

1.2.1. FinTech Partnerships

The evolution of the FinTech sector has been very rapid and characterized by the presence of diversified operators that can belong to two macro-categories:

- Companies offering banking services, based on digital platforms, with an innovative model compared to traditional operators - this category includes the segments of the Social lending, Payments in its various forms, Wealth management, including iRobo Advisor, Crowdfunding, InsurTech and Digital Currencies; usually these companies enter into direct competition with banks and financial institutions proposing an alternative offer.
- Companies offering solutions (B2B or B2B2C) that can be integrated into the information systems of the bank in order to support process digitalization - this category includes companies that offer RegTech solutions; the same RoboAdvisor companies but proposing a B2B model aimed at supporting the bank in its consulting activities; companies that have a technological offer which does not focus on a specific core banking

environment, but enables its process innovation such as Artificial Intelligence, Cognitive Computing, Big Data Analytics, Cyber Security and Blockchain.

According to data extracted from the Register of companies, there are over 9.690 innovative Startups in Italy (2018) of which 235 can be categorized as operating in the FinTech sector. The capitals collected by the Italian FinTechs in 2017 amounted to € 33.6 million, a relatively small amount compared to the amount of capital raised worldwide, however, it increased by 77% compared to 2016 (€ 19 million).

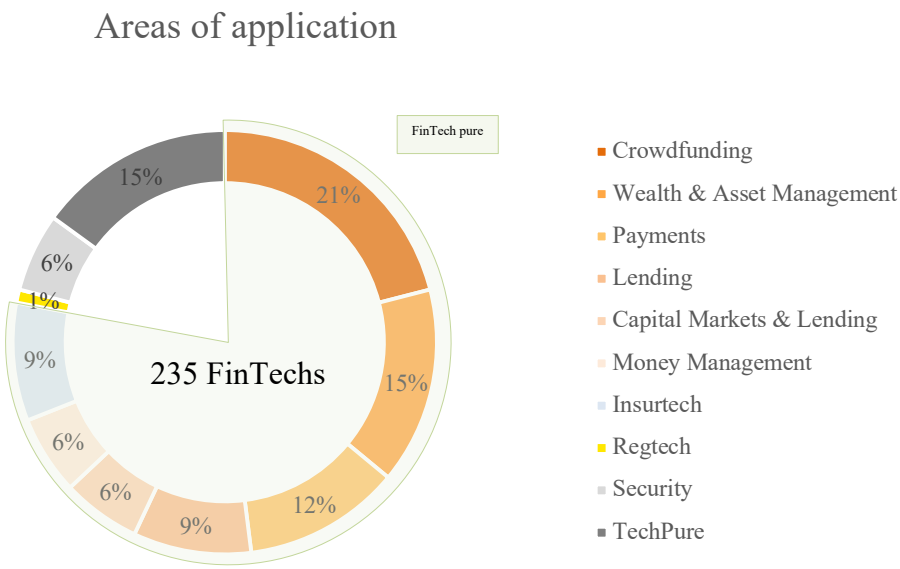


Figure 3. FinTech value proposition

In Italy, most FinTechs have a value proposition that can be categorized in the Crowdfunding area; the second main cluster is the one of FinTechs with specific services in the Wealth & Asset Management area, which brings together all the companies specialized in Robo Advisory & Financial Planning activities (e.g. MoneyFarm), as well as Alternative Investments (Equity Crowdfunding). The

remaining actors offer solutions in the field of Payments, a sector that appears to be the most mature today, and includes FinTechs with an offer aimed at innovating the world of payments: from Peer to Peer Payment (e.g. Satispay), to Technology Provider of solutions that enable digital payments (e.g. Jusp). It follows the Lending cluster, which brings together all the FinTechs that innovate the personal loans sector, credits and mortgages through social and collaboration platforms; the Capital Market & Trading cluster with companies that offer innovative technologies and solutions to support the trading activities of professionals and private investors; the Money Management cluster providing all the solutions to support the financial management of Retail customers (Personal Financial Planning), solutions that enable savings planning and treasury solutions for small and medium-sized companies (see figure 3).

FinTech is redesigning the world of financial institutions and is defining evolutionary dynamics that are innovating the Financial Services sector. In this scenario, a winner solution for the Incumbents seems to be the Fintegration. Three traditional integration paths are possible:

1) Startup acquisition by the Incumbents
2) Capital participation through the establishment of Corporate Venture Capital Funds or Accelerators
3) commercial partnership agreements between the parties

Other important cooperation solutions that are becoming more and more common are represented by sharing R&D activities, Open Innovation activities and creation of Joint Ventures (see figure 4). Rather than trying to quickly build FinTech systems, the Banks are opening towards the same realities that are threatening their business. FinTechs are positioned outside the bank environment free from infrastructural and cultural constraints, this means that their contribution is innovative and effective in building services and solving problems that are more difficult to identify internally. Moreover, traditional banks can help FinTechs to scale up their business by providing financial infrastructure, capital, and access to their huge customer base. Banks will also be able to deliver new value and services with faster time to market, reduced costs, and improved return on

investments. Collaboration will help both traditional banks and FinTech firms to focus on their core competencies and contribute in the areas of their expertise to have a better joint outcome.

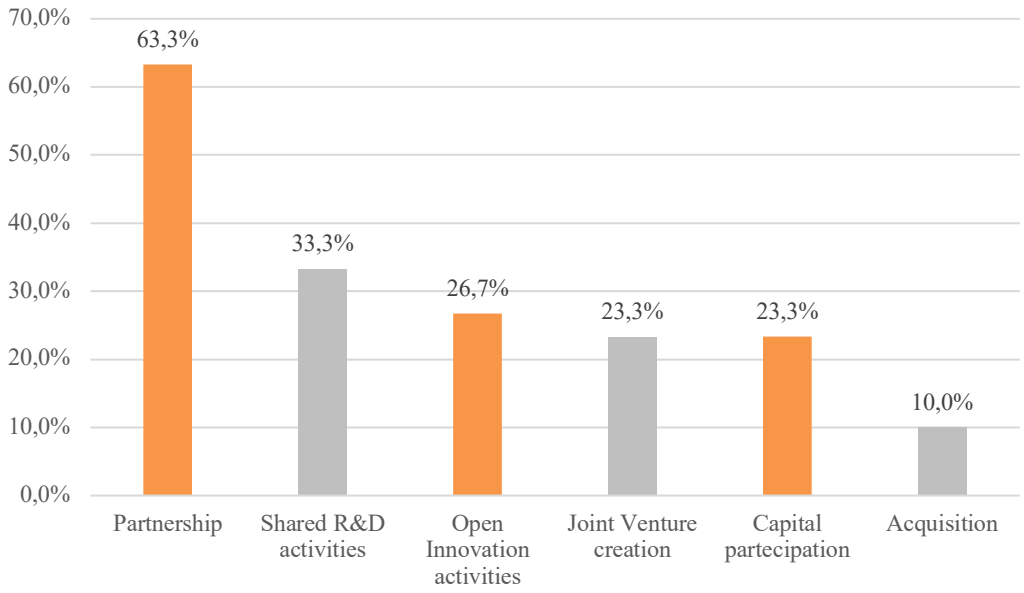


Figure 4. FinTech integration/cooperation solutions

1.2.2. Open Banking

The term "Open Banking" indicates the opening of the "value chain" of the financial services, both production and distribution sides, to operators outside the traditional banking system: the so-called third party operators or Third Party Providers (TPP), i.e. fintech or techfin companies. These third party actors may offer aggregation services of the information disseminated by customers in multiple banks (for example, summarizing the overall financial situation), payment services, or other types of financial services (such as loan provision or investment advice). The entry barriers reduction for TPPs through the opening of customers' information is favored both by European and national regulations, as in the case of European regulations on payment services (Payment Service Directive

II, PSD II), and by the initiatives of individual banks, which are seeking opportunities to propose innovative services. The technological prerequisite for this opening consists in the provision of interface programming applications (Application Programming Interface, API). The APIs are specific programs that allow third-party developers (techfin, fintech, GAFA or other incumbents) to access, for example, the huge amount of banks' customer data and develop information processing applications in a standard way (see Figure 5).

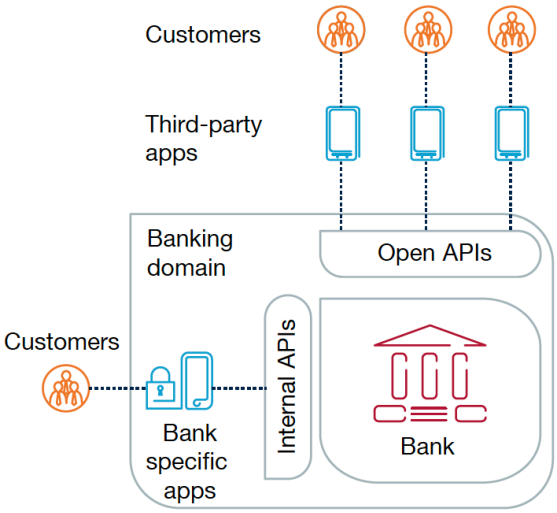


Figure 5. Open APIs framework

Therefore, the "opening" of banks, either collaboratively or by regulatory obligation, takes place through open Application Programming Interfaces (APIs), that is interfaces that allow communication between different softwares, in a secure and modular way, whose access is guaranteed to developers who respect certain rules. The objective is to create an ecosystem in which it is possible to co-create financial services between incumbents and TPPs, increasing competition in the banking system, in favor of the final consumer.

The potential competitive and strategic effects of this change in the business model and interaction with banking customers are far-reaching. As stated, Bank

opening involves a disaggregation of the value chain. From the paradigm of the "closed" bank, which produces and distributes financial services while maintaining control over the entire production chain, the system is moving on to a segmentation along this chain. Currently the end customer chooses the bank that offers him/her the best service on average, considering for example the offer of savings instruments, the provision of loans, assistance in the management of investments and payment services. In the near future, the end customer will rely on an aggregation and comparison platform that will provide him/her with an overall view of his/her financial position and will direct the customer towards the individual services offered by different single banks considered the best (see Figure 6).

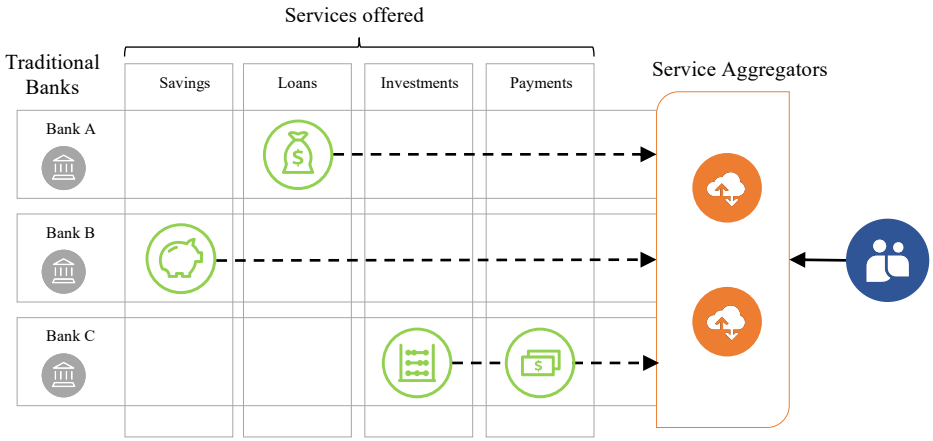


Figure 6. Example of Open Banking model

The banks that will not be able to adapt to the new business model will only occupy a part of the supply chain, in the role of service producers, and will lose the most valuable part of the value chain: the contact and management of the final customer. Depending on the position taken, there are three hypothetical roles for financial intermediaries in the future:

1. Demand aggregators: the bank maintains the relationship with the customers, delegating the production of the service to third parties. This role requires a strong brand positioning. Depending on the service

requested, it provides a personalized customer journey directing the consumer towards the various offers on the market

2. Service producers: the bank specializes in the production of certain financial services, leaving their distribution to pure aggregation platforms, thus losing the direct relationship with customers
3. Data and analysis providers: the bank intervene between the production and distribution of services, facilitating the meeting of the parties through the use of big data to connect and evaluate consumers and service providers, offering credit scoring services, Know Your Customer (KYC) and data security.

The potential disintermediation deriving from the emergence of these new competitive models will probably be possible only for the more standardized services, where personalization has a less important role. Examples are the payments sector (the main object of the PSD II regulation), the credit sector with the emergence of platforms for raising capital and, within certain limits, the asset management sector, through automated consulting (robo-advisory).

As mentioned, the drivers of change are primarily regulatory. In Europe, the transposition of the PSD II, already in force on commissions and allowances on payment systems, will be finalized in mid-2019, with the obligation for the banks to provide the necessary interface applications for programming activities by TPPs. In fact, the law grants third-party operators the possibility of accessing customer bank account information, with the consent of consumers. TPPs can belong to at least two different types of actors:

1. Account Information Service Provider (AISP), who can provide a customer account information service, collecting and aggregating information on various bank accounts in a single platform
2. Payment Initiation Service Provider (PISP), which can be placed between the customer and his/her bank account, directly providing payment services.

In some contexts, AISP and PISP may also provide third-party financial services. European regulation is therefore a first step towards the opening of bank data (forced, in this case). However, its scope of application remains limited: in particular, PISP and AISP will be able to use this data for the sole purpose of providing the service for which they are authorized.

Regardless of the thrust dictated by the regulator, some incumbent Banks are already examining the possibility of opening some data on customers to third parties, through open APIs, to improve their offer and thus gain a competitive advantage over the competitors, occupying portions of the market still free. Depending on the degree of openness to third parties and on the control of the bank on actors that access it, there are different types of APIs (Euro Banking Association, 2018):

- Partner API - open only to actors with whom the bank has bilateral agreements
- Member API - open to actors belonging to a community, with well defined access rules
- Acquaintance API - open to anyone who meets certain requirements, without a participation in a community
- Public API - open to anyone through a simple registration for tracing the identity of the members

This "voluntary" opening allows developers (other banking operators, FinTech or TechFin companies) to create new applications or co-provide services to banks. Although there is a low propensity for incumbents to share customer data externally, a fundamental source to preserve their competitive advantage, first movers in this area could benefit in terms of attracting new customers and innovation in the services offered.

Currently, Open banking is a phenomenon with uncertain outcomes, especially with regard to the reaction of the incumbent banks towards new emerging actors, the adoption of new services by customers and the timing of their development. However, in general, there is no doubt that this phenomenon also presents

opportunities for banking operators, as well as risks. The risks, due to a possible increase in the segmentation of the financial system, are represented by the potential "standardization" of some products, with a consequent reduction in the profitability margins (commoditization), greater difficulties in the cross-selling of financial services and less customer loyalty. The benefits for the eventual winners could instead be the improvement of the customer experience, due to an innovative service offering, and the possibility of attracting new customers, especially the younger and digital-oriented ones. Bank of England, in November 2017, has analyzed the potential effects of the new regulation on banks' balance sheets. In particular:

1. A reduction in the interest margin due to an increase in rates on demand deposits (i.e. greater difficulty in maintaining deposits due to the presence of Price Comparison Websites)
2. A reduction in commissions on overdrafts due to AISP, which make it easier for the customer to monitor his/her financial situation
3. A reduction in payments fees, as a result of a greater competition in the sector
4. A higher liquidity risk, due to the greater ease with which depositors will be able to move the funds
5. A greater difficulty in cross-selling and in the retention of customers
6. An increase in IT security costs

The estimated impact on the profitability of the banks is overall negative and equal to approximately -1.6% in terms of Return on Equity (ROE). Last but not least, the risk on data security and privacy. In fact, beyond the impacts on profitability, a probable consequence that banks will have to face in structuring data sharing operative systems is the increased risk of cyber attacks, with consequent impacts on reputation. This risk is passed on to consumers who, in the event of failure of computer security systems, may undergo a personal financial information violation. This topic will be later discussed in detail as an important digital trend.

1.2.3. Artificial Intelligence

Surveys and research on the use of AI by the major banks seem to reveal an industry enthusiastic about the prospects of a technology that can help cut costs and increase profitability. Many of them predict that 30% - 40% of jobs in the banking sector could be wiped out by AI in the next five to ten years. Almost all large consulting firms have published research on how AI will transform the banking sector: from "virtual assistants" who replace people at all points of interaction with the customer, to robots that prevent fraud, carry out complex deals or sit on the Board of Directors to support decision-making processes. There is limited consensus on how AI could or should be used in the banking sector and many of the current efforts to apply machine learning are bounded and patchy. The allocated resources vary from a few million to hundreds of millions of euros depending on the case and the dedicated staff varies from a few tens of operators to several hundred. Many experts say that there is a risk that too much investment will spill over into "hot" areas, such as chatbots, at the expense of investing in back-end processes where banks could make more significant gains. Uncertain and unrealistic expectations are not the only problems that banks are facing in assessing the opportunities and impacts that the AI world promises. If, on the one hand, the banks agree that artificial intelligence is an important driver for the sector, on the other hand their strategies to introduce it do not seem to be supported by a clear vision of the future of banking. Starting from what the banks consider as AI: from programs that perform multiple basic functions involving algorithmic logic, learning and self-correction, to a set of technologies and approaches that allow machines to do things that require intelligence if they are made by a human being, to arrive at a pervasive vision of AI that includes all processes, including those that are projected outside the company boundaries. The projects range from the optimization and automation of standardized and repetitive processes with low variability (middle and back end), the management and capacity improvement to take risks, the automatic learning to manage pricing formulation, the use of chatbots and voice bots for customer interaction and problem solving, to data analysis to calibrate the offer and generate personalized

communications and decisions based on the behavioral profiles of each client. One of the most explored areas, where AI can be a great resource, is the contact centers one, which, if properly implemented, free customers from the complexity of interaction, improve the customer experience and reduce costs by limiting the need for human cooperation. Banks are in a phase of experimentation focused on identifying areas that can generate greater value: selecting the "right" areas to use AI is a complex problem. Open banking and open payments (PSD2) are accelerating these developments. The new scenarios that are opening up in the world of payments in particular, require a massive use of AI, otherwise it is expected the marginalization of operators and the commoditization of services (see Figure 7).

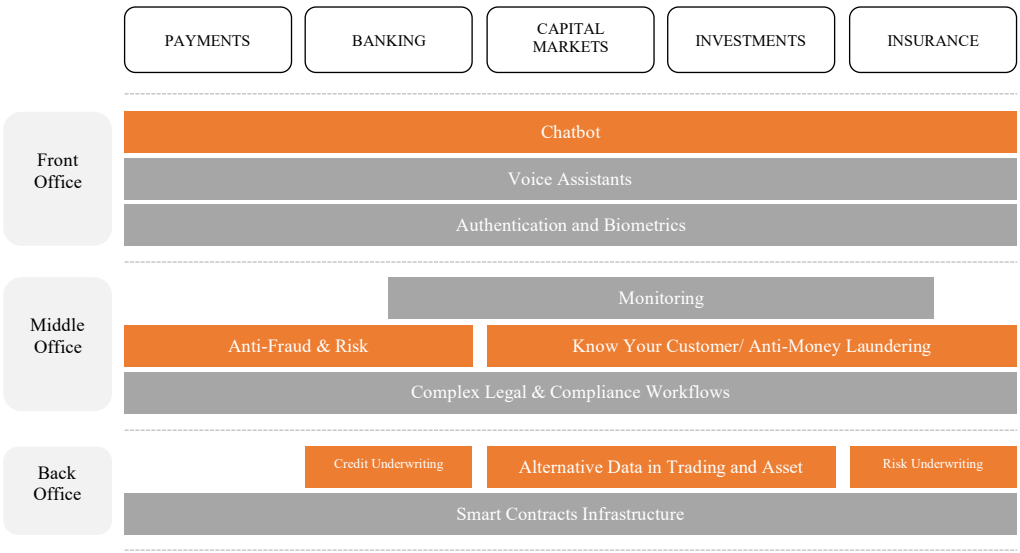


Figure 7. Maturity of artificial intelligence across Financial Services

In an attempt to analyze the AI state of adoption in the Italian banking system, almost 90% of the entities that participated in a first survey developed by ABI Lab, the research and innovation center for the banks promoted by the Banking Italian Association, has activated or is activating a project on artificial intelligence, in the pilot or production phase. Twenty-two companies between banks and banking groups participated in the research, as well as four of the main

external inter-bank suppliers, representative in terms of employees of three-quarters of the banking world in Italy. It turns out that artificial intelligence is having a pervasive and significant impact on Italian banks. The process areas mostly implemented by AI technologies are:

- Contact center area (73% of respondents) - in this field, more than two thirds of the initiatives have already passed the study stage and are in production or at least in a pilot phase
- Customer service processes (65%) - particular attention is given to evaluating the use of advanced tools for the construction of a customized offer based on user needs

Among the other areas of possible application, it is highlighted the world of knowledge transfer. The reference is to the internal help desk, internal knowledge management, and intranet services. 35% of the survey participants are working on this. Credit scoring is also an area of particular attention, on which initiatives are active in 38% of respondents. The main expected benefits of AI and Machine Learning in the banking industry are summarized in the following (see Figure 8):

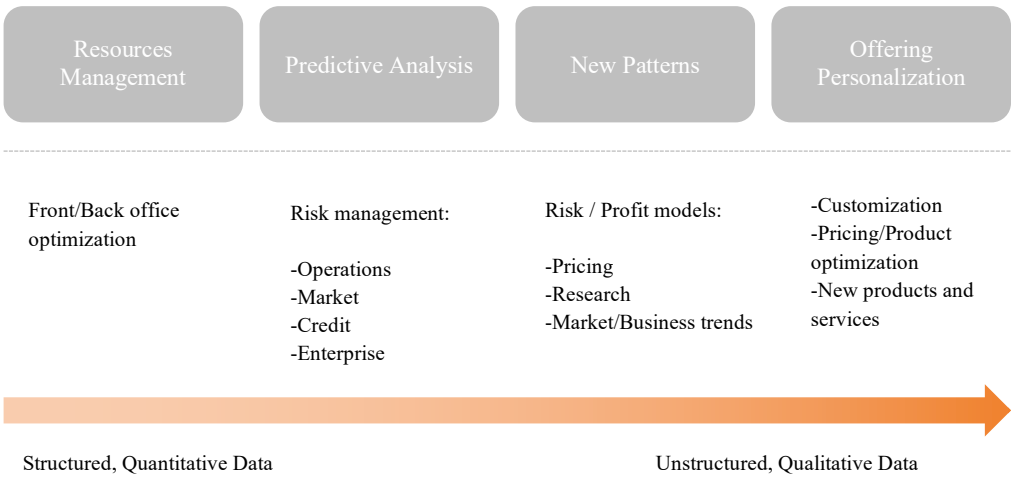


Figure 8. Expected benefits of AI and Machine Learning in the banking industry

Robotic Process Automation (RPA) can be defined as a software that replicates the actions otherwise performed by a human operator, typically the most repetitive and time consuming ones, with faster implementation times than traditional software without requiring intervention on existing systems. In addition to redesigning banking processes with the aim to optimize and improve efficiency, these technologies offer banks the opportunity to enhance their operational efficiency by reducing manual activities with low added value, improving customer experience by reducing, for example waiting times, and freeing up capacity and skills towards higher value-added activities, also rewarding the human resources involved that can be trained and reallocated. The increasing sophistication of automation technologies provides Banks with tools for improving the efficiency of the banking operating machine that complement Business Process Management (BPM) solutions that are widely available on the market today; in particular, the RPA technology has been the subject of extensive experimentation by the sector operators in the last two years, and is destined to have an increasingly significant role in support of digital transformations.

RPA solutions are a consolidated and widespread option for process automation across Italian banking institutions. More than 71% of Italian Banks state that the potential and limitations of RPA solutions are widely or partially known within the organization, while 62% state that they have launched an extended adoption program for RPA solutions ("Robotic Process Automation nei Financial Services italiani" – Pwc, 2018). This push towards the extended adoption of RPA solutions is due to a greater awareness of technology and the potential benefits achievable through its introduction into corporate structures. The totality of the Organizations that have carried out implementation activities declares that they have obtained tangible benefits and have reached an average 30% efficiency improvement of the processes involved. This increase in efficiency is primarily used to relocate resources on higher value added activities which can contribute to revenue growth (e.g. activities supporting business development) as well as on actions allowing a reduction in operational costs (e.g. the internalization of activities currently in outsourcing). RPA solutions also stabilize and reduce the variation of output quality and overall timing processes, increasing effectiveness and improving the

level of service towards internal and external Customers. This increase in effectiveness benefits above all processes that have a direct impact on the customer experience (i.e. products and customer care delivery processes) allowing to improve the quality of service and therefore having an impact on the increase in revenues and customer retention. Moreover, the output quality stabilization and processes timing reduction also guarantee a decrease of the operational risks.

RPA solutions have been mainly applied in repetitive and low-value added back office activities of the Operation & IT Area. Those areas, in addition to having processes for which automation initiatives are effective and easily applicable, are identified by a high allocation of resources and therefore they can guarantee the greatest increases of efficiency in absolute terms. The organizational areas on which there is greater potential for process automation through RPA solutions and, in general, Intelligent Process Automation are presented in Figure 9. Automation technologies also result increasingly applied in organizational areas characterized by more complex processes which provide cognitive activities by the operator as, for example, the Front-Office and second level control areas like the Risk Management and Compliance. This application is possible thanks to the increasing maturity of more sophisticated automation solutions (e.g. Smart Information Capturing and Natural Language Processing) which, if integrated with RPA and Business Process Management actions, enable the end to-end automation even of more complex processes.

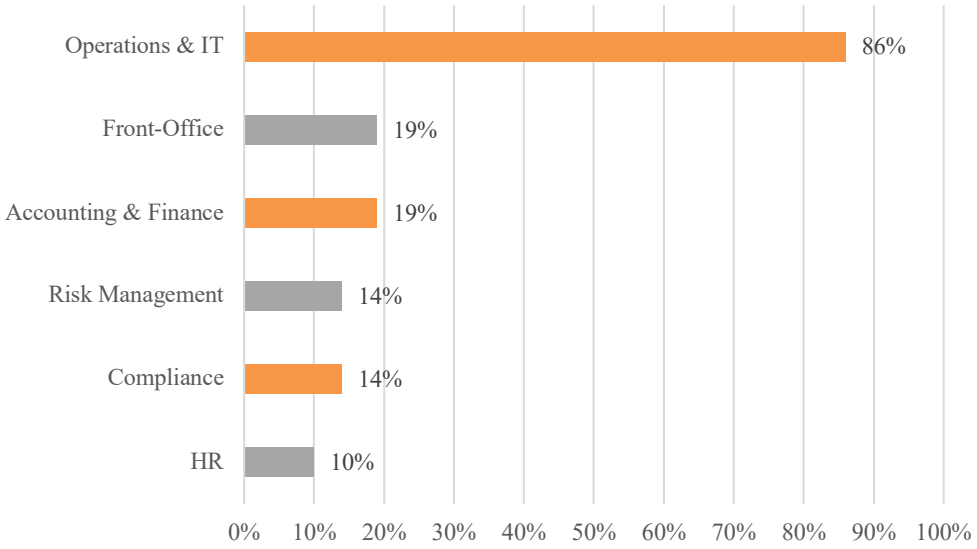


Figure 9. RPA application areas

1.2.5. Distributed Ledger Technologies

In order to understand the attractiveness that the Blockchain exerts in the banking sector, it is recalled briefly that it is a digital register of transactions, distributed and not alterable, each of which is validated and recorded by a computer network; after validation, no single user can change the transaction record. The blockchain technology is the ground of the development of algorithms for checking and verifying data at the base of Distributed Ledgers Technology (DLT), that is General Ledgers (accounting tool in any sector and in particular in banking) that can be updated, managed, controlled in a distributed way, by all the actors, with new levels of transparency, security and reliability. DLT technology is fundamentally the result of combining three technologies that existed previously:

- P2P networks: in these models, each participant of the network (node) acts both as a client and as a server, contributing and consuming resources

- Cryptography: specifically, asymmetric cryptography, which allows the secure exchange of information between two parties. Through its use, it is possible to authenticate the sender, guarantee the integrity of the message content and prevent through encryption that a third party can access the information in case he/she managed to intercept it
- Consensus Algorithms: they allow various participants, who may not know or trust each other, agree to add new entries to the registry. There are different mechanisms to achieve this consensus, that is, to ensure that the records of all the participants of the network are identical and that no fraud or duplicity occurs. The most popular is the so-called Proof of work, which involves the resolution of complex computational problems for the validation and creation of each new block of the chain

Some of the most promising projects are being developed in the field of payments, specifically, in relation to transfers of international funds. This type of initiatives allows to increase the speed of funds availability and to execute the related process with greater transparency, as well as to reduce significantly the associated costs. Some solutions allow the exchange of funds quickly and efficiently, which, in addition to the advantages for users, by carrying out the process in an instantaneous way, supposes the reduction of compensation and fraud risks, as well as lower liquidity needs. This means that Cross-border transfers will be cheaper and faster, thereby enabling a reduction in the settlement time since intermediaries will be removed. In the area of negotiation and post-trading of securities, DLT technology would enable the creation of a common digital base, where the ownership of the securities and custody of assets would be recorded, and that would be shared among those authorized to access. There is therefore potential to accelerate the settlement of financial operations, reduce the number of intermediaries and make the conciliation process more efficient. Another area in which projects based on DLT technology are emerging is the regulatory compliance one, known as regtech. Through the use of technology, the aim is to optimize the way in which regulatory requirements are met (e.g. reporting obligations, transparency, risk management, money laundering control and terrorism financing, etc.). Some of the aspects that could potentially be improved

would be the quality of the information, as well as reducing the costs of the processes, providing flexibility and enabling their outsourcing.

DLT technology has the potential to improve the design and, in particular, the efficiency of some markets in aspects such as:

- Elimination of messaging costs and reduction of backoffice costs, by lowering the need for reconciliation between parties because all the information is unified in a single shared registry, with synchronized copies
- Reduction in the complexity of transactions and greater traceability and transparency
- Greater processes speed in specific use cases or circumstances and, consequently, improvements in liquidity management

In particular, the data traceability is a fundamental requirement of any registration system, allowing a legitimated entity to verify the history of transactions. Compared to other traditional systems, where traceability is not always possible at all times and for all participants, it is one of the most advantageous characteristics of DLT technology. This important feature, in addition, has implications in terms of KYC (Know Your Customer), as well as prevention of money laundering of capital and financing of terrorism, as stated before. Traceability is linked to the immutability of transactions, which implies that, once registered, they can not be modified. This feature is crucial to guarantee data integrity and security. The combination of these two characteristics makes the system transparent and safe for its participants, who can access and check records at any time, with the confidence that they are reliable records, that they can not be altered in time, and the certainty that the other entities who participate in the operation have exactly the same information. Finally, Banks have been looking for a solution that might counter the increasing number of cyber attacks and fraud, Distributed ledger systems provide a significant security enhancement through decentralized public transaction records, especially in areas such as payments and credit card fraud (see Figure 10).

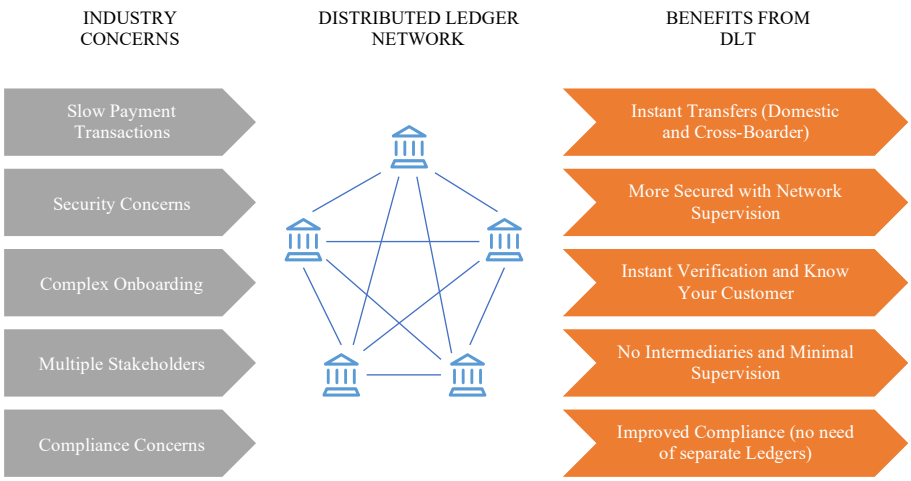


Figure 10. Benefits from the application of DLT technologies

On the other hand, it is necessary to underline some important constraints in the adoption of this technology. Currently, scalability in the number of transactions and their speed of registration present important limitations. This is true, especially for the case of public networks based on blockchain, for three reasons: the number of registered transactions in each block is usually limited, the blocks must be processed sequentially and the consensus mechanism is complex. As a result, the system can be congested leaving a number of transactions waiting. Although it improves for private networks, its efficiency in this area remains far below the benefits offered by other centralized systems today. Moreover, there are still doubts about the true robustness and resilience of DLT platforms, given that the technology is not yet sufficiently proven. There is no appropriate regulatory framework that gives sufficient legal coverage to the transactions annotations that occur in the distributed registry. For example, in the field of payments, it is not established when a transaction is overall determined. In the future, solutions based on DLT technology will need to comply with the regulatory framework, which will vary according to the area of each application. This will be a challenge because of its distributed nature and because it will probably operate cross-border to optimize its potential.

1.2.6. Cloud Computing

One of the most impacting digital solutions in the banking sector is the Cloud Computing. This technology is spreading because it shows the most effective way to increase the capacity to manage data and it allows banks an unprecedented level of agility, security and scalability. Cloud Computing represents a form of advanced technological outsourcing. In this way banks can entrust the management of one or more IT resources to a specialized provider which, from that moment on, are provided via the Web through an outsourcing contract. All this, without the company having to bear the costs of purchasing licenses or machines to take advantage of services indispensable to the business. The supplier will govern the overall infrastructure necessary to manage and distribute the services requested based on the demand and with a pay-per-use formula. The methods of use are established by contracts that provide for a certain fee, where the amount is defined on a periodic basis or on consumption. All with a subscription to specific service features (SLA - Service Level Agreement) and security features that guarantee business continuity.

Cloud service models offer financial institutions the option to move from a capital intensive approach to a more flexible business model that lowers operational costs. In order to reach this, is fundamental that business needs are perfectly aligned with the cloud service model chosen. Three different models are currently available in the market:

- Software-as-a-Service (SaaS) - It is a software distribution model in which a producer develops, operates (directly or through third parties) and manages a web application, making it available to its customers via the Internet. In this way, the bank can access the various applications it has purchased through a web or customized interface and access mode according to the contract. With SaaS, the bank does not control the infrastructure that supports the software: network, server, storage, operating system and management are entirely under the responsibility of the provider. The bank can only decide whether to limit the functionality

of the software through identity management features and access prioritization criteria with a set of dedicated configurations

- Platform-as-a-Service (PaaS) - with this model the bank is guaranteed a platform that supports the development of applications in cloud computing. The platform includes programming languages, libraries, services and dedicated tools, entirely developed by the provider. The elements that make up PaaS allows the bank to program, test, implement and manage business applications without the costs and complexity associated with purchasing, configuring, optimizing and managing the basic hardware and software needed for development activities. In turn, the main advantage is the possibility to develop advanced applications and application services such as collaboration solutions to support teams, the integration of Web solutions, database integration, as well as security management. All through a Web-based interface. Also in this case the bank does not have to worry about having to manage or control the cloud infrastructure at the network, server, operating systems and storage levels, but has full control over the applications implemented and the related configuration settings
- Integration-as-a-Service (IaaS) – rather than purchasing servers, software, data center space or network equipment, this cloud model allows businesses to buy those resources as a fully outsourced service. IaaS allows banks to outsource resources, managed at the infrastructure level by a supplier. Consequently, the bank can manage its storage, networks and all computing resources in a distributed mode, being able to view everything from a single centralized dashboard without having to worry about the details of motorization, monitoring, security and updating related to the machines that enable these online services.

Three key factors have been identified for banks to adopt cloud-based public services:

1. Agile Innovation - access to the cloud can increase banks' ability to innovate by improving agility, efficiency and productivity. It can also help

banks reallocate resources from IT infrastructure administration to innovation and rapid delivery of products and services to markets

2. Risk Mitigation - cloud computing can help reduce the risks associated to traditional technology, such as capacity, redundancy and resilience problems. Furthermore, the ability of cloud computing to scale can provide banks with greater control over issues such as security
3. Economic Benefits - the cost savings of public cloud solutions are significant, especially given the reduction in capital expenditure for traditional IT infrastructure. In addition, during peak periods of customer demand, the cloud can allow banks to manage computing capacity more efficiently. When the cloud is adopted for risk mitigation and for innovative solutions, the benefits in terms of costs derive from the consequent improvements in business efficiency

While investments in legacy systems are expected to continue, cloud based services are ideal for newer business areas. Cloud-based services are expected to provide the advantage of both lower investments in implementing business strategies and faster turnaround time for product and service offerings, especially those delivered over mobile devices and the Internet. The main application areas of this technology within banks' ecosystem are highlighted in Figure 11.

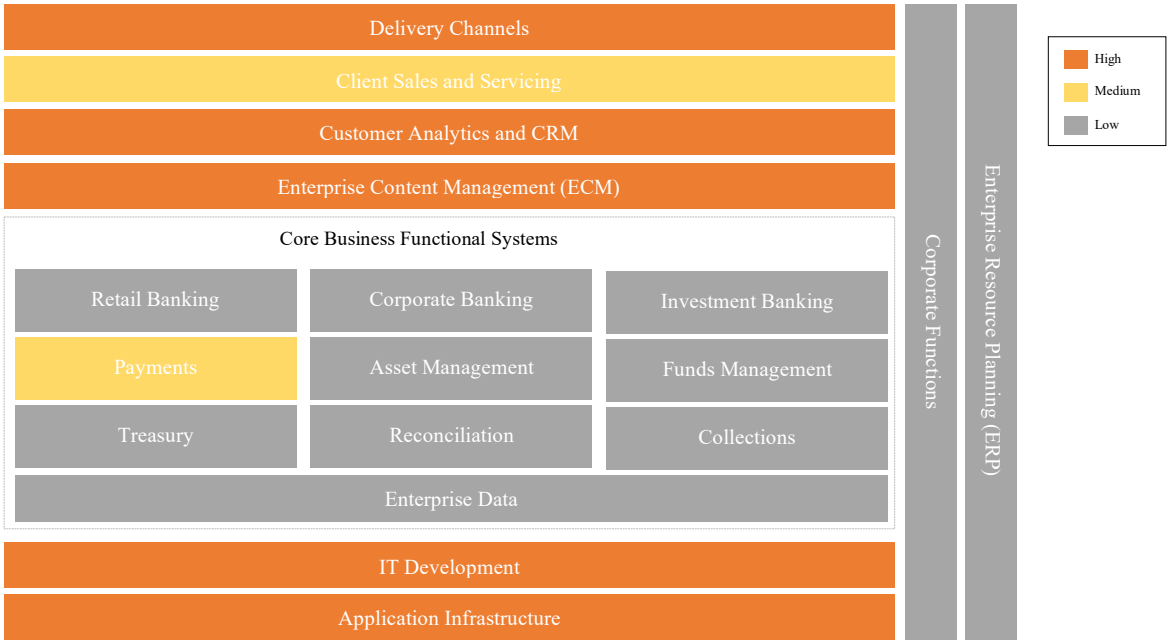


Figure 11. Cloud Computing Adoption Propensity

1.2.7. CyberSecurity

The technological revolution underway strongly impacts the scenario in which banks are operating in terms of cybersecurity strategies: it is necessary to reconcile the needs of protection, confidentiality and security with those of openness to the customer and speed of flows. ICT security in the financial services sector is a strategic aspect that directly affects the core business. In fact, Banks need to treat cyber-attacks risks as a business issue not as an IT issue, as poor security will not only lead to breach costs and litigations but it also erodes customer trust in the organization. In today's banking environment, business functions and technologies are increasingly inter-connected, requiring financial institutions to secure a greater number of access points. One of the most insidious methods used by cyber-criminals is the Ddos (Distributed Denial of Service), that is an artificially induced overcrowding of the system which actually slows down its operation until it is completely blocked. Another system frequently used is that of the "Man in the middle": the cyber-criminal secretly retransmits or alters the communication between two parties who believe they communicate directly with each other. Tackling and limiting cyber attacks weighs more on banks and insurance companies than on other companies. According to an Accenture Security study, in the last five years, the number of cyber attacks in this sector has tripled. The "Cost of Cyber Crime" research underlined that in the last three years the average cost of cybercrime at the international level sustained in the financial sector has increased by over 40%, going from $ 12.97 million per company in 2016 to $ 18.28 million in 2018 and reaching well above the average of $ 11.7 million for all industrial sectors. Banks may need to adopt a holistic solution. A dual approach, combining cyber security assessment and attack simulation, can lead to more valid results than individual strategies pursued independently. The cyber security assessment and attack simulation can provide information with absolute precision. Performed in parallel, these assessments highlight existing and potential gaps — and help banks establish priorities as well as demonstrate, at all levels of leadership, what investments are needed to ensure IT security.

2. ICT Governance

ICT governance is a broad, complex and problematic concept, extremely important but not easy to define due to the many dimensions that characterize it, therefore the following chapter aims at clarifying what is meant by ICT governance and what are the various critical issues faced.

The initial paragraph reports the main definitions and areas of application giving a high level description and conceptual model of the ICT architecture within a company. The second paragraph underlines the specific characteristics that the ICT systems must have within a banking group. The production of banking services is based on the acquisition, processing and organization of huge amounts of information. For this reason, compared to other industries, the banking sector has anticipated the large-scale introduction of the new information technologies. The banking information system is therefore more complex than that of many other companies due to its different functioning. A focus on the portfolio application is therefore presented highlighting the importance of its management: the overall system has often been built on a portfolio of core applications (current accounts, registers, payment systems, credit procedures) which has undergone stratifications over time that today make its management complex. The choice of the ICT services acquisition methods and related governance by a company is a strategic activity, which involves different decision-making levels and presents technical, economic and organizational implications, in particular on resources management. Hence in the third paragraph four models have been identified to characterize the reference structure adopted by banks for IT sourcing. Finally, the last paragraph presents the classic model for identifying and reporting ICT costs which is performed using two main key performance indicators; moreover, the costs trend since 2012 is described together with the relevant variables that have determined its increase.

2.1. Definition and Conceptual Aspects

ICT Governance is derived from the analogous Corporate Governance, which includes processes, practices, methods and tools for the governance of the entire organization and indicates the process for the control and direction of the Information & Communication Technologies to guarantee the achievement of the business objectives. According to the most qualified and accepted technical-managerial literature, it includes the following main areas:

- Strategic ICT alignment with the business and activities of the Company
- Costs control and "value" that ICT generates or can generate
- Risk management related to ICT and associated projects development
- Resource management of the ICT infrastructures, software programs, information-knowledge, people and supplier-partner companies
- Performance management and measurement, both of the ICT and more generally, of the business and activities (i.e. BPM - Business Performance Management)

The ICT Governance is therefore a process or a set of processes, dynamic and continuous (systematic and cyclical), it is an integral part of the Corporate Governance, whose responsibility is under the executive management, in particular the head of the entire company (CEO) and the Chief Information Officer (CIO). ICT Governance must be able to cope with the different perspectives of the several Stakeholders of the Entity, from the managers and internal staff to the external referents (customers and suppliers) both in the short and in the medium-long term. The main perspectives are economic and market oriented with a focus on the optimization of services in order to improve processes and competences of internal staff, as well as, obtaining a continuously improving management in the provision of ICT services. ICT is a tool characterized by an increasing complexity and pervasiveness in the structure and in all processes of a company. The birth of information technology has determined the related problem of controlling and managing it at different levels: from the software production level, with the need to control its quality, starting

from clear and systematic documentation of the developed software; to the functional and performance tests (before the transition from the development environment to the production environment) in order to verify the compliance of the software to the requirements and expectations of users and its effective interfacing and interoperability with other applications, data and systems.

There are no established reference solutions on the market: the most advanced solutions can be seen as a "container" under which various sub-systems are integrated, each focused on solving and managing a specific problem. In the wide offer available it is possible to identify two different approaches: the first is the supply of modules to carry out specific functionalities, the second is an integrated suite that include various functional modules allowing, modularly, a complete ICT governance. A conceptual model of ICT governance is proposed in Figure 12. The dotted line outlines the reference area. The elements of the Governance are a set of processes, organizational procedures and IT tools that can be grouped both by functionality and ICT environment, where the latter can in turn be divided in the systems and software programs development environment, in the test and pre-production environment and in the production environment. In particular:

- At the development environment level, the main elements include the typical tools for the functionality, performance and software quality control. Some of these tools are incorporated in an "Integrated Development Environment" (e.g. IDE and Rapid Application Development) others are specialized for specific controls and features
- At the test and pre-production environment level, the functional control and partly the performance of the production environment is tested on machines different than the production ones: the focus is on the functional, compatibility and interoperability aspects with the other modules and systems of the entire ICT system
- At the production environment level, two main groups of instruments can be identified: the first is the set of tools for the control and management of ICT systems and services, their performance and security; the second is the set of tools for managing users requests, whether they are ordinary or

strategic, such as the purchase or implementation of a new application. This second group includes decision support tools for value analysis, risk analysis, application portfolio management, improvements management

Conceptually and functionally, ICT governance is therefore seen as a broad "container" under which several processes and related tools can be considered and inserted. They can be divided into two large areas:

- processes and tools for the operational management of all the environments mentioned above, but especially of the production environment
- processes and tools for strategic management, in other words to carry out assessments and to make decisions

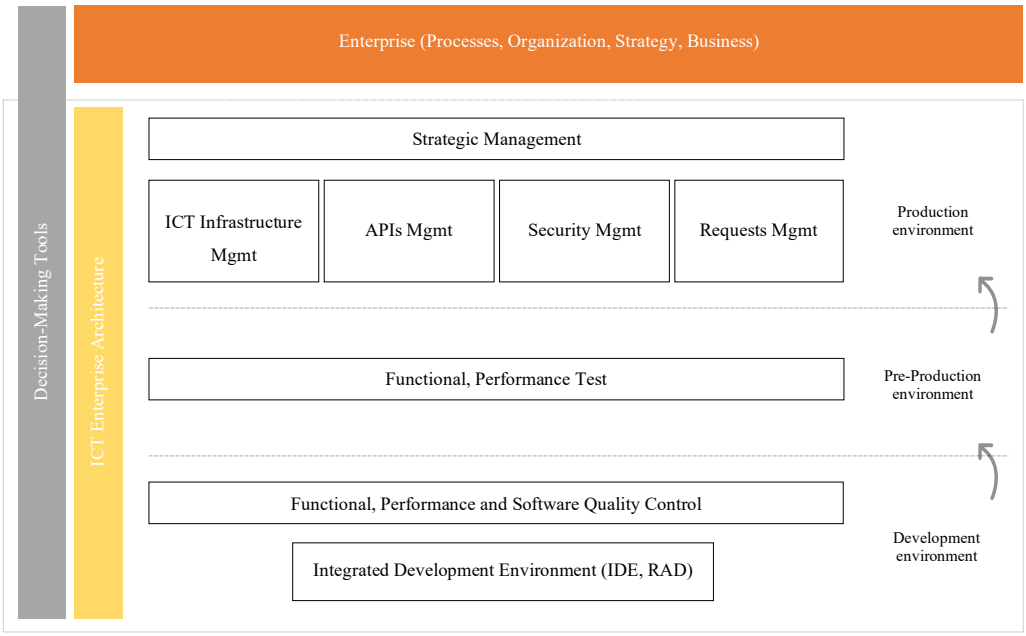


Figure 12. Conceptual Model of ICT Governance

2.2. Specificity of Banking Information Systems

The production of banking services is based on the acquisition, processing and organization of huge amounts of information. For this reason, compared to other industries, the banking sector has anticipated the large-scale introduction of the new information technologies. The banking information system is therefore more complex than that of many other companies due to its different functioning. In the national context the supervisory authority Banca d'Italia has taken on a primary role in pushing banks to adopt solid and reliable information systems. In relation to what was previously discussed, specific characteristics of banking information systems are:

- Technological Evolution - examples are the introduction of web-based systems, mobile phones or laptops with which banking services have been made accessible by the client in an autonomous manner
- New products and services
- The continuous regulatory evolution
- The strong accounting connotation of banking organizations
- The work of the supervisory authorities

The information content of the banking system is differentiated according to the recipient of the information, depending on whether it is the strategic summit, the intermediate levels or the core operating structure of the company. Therefore, the actors involved in the banking information system are:

- Customers, whose information needs are characterized by being constantly growing
- The management or governance of the system, also characterized by high cognitive demand
- Internal users, so the employees of the corporate structure
- External organizations, such as trade union and confederal organizations whose information needs relates primarily to customer protection

- The legislative and regulatory system, basically represented by the Bank of Italy and Treasury

The dimensions of the banking information system are closely related to the dimensional structure of the bank. Therefore, different types of architectures can be distinguished used for this purpose, which involve the sustaining of different related costs. The presence of the Mainframe or Host is fundamental, it is a central calculator to which the other computers used in the structure are connected and which has the function of controlling the entire system. Mainframes are used for critical applications, typically to process large amounts of data, such as those involved in financial transactions, censuses, industry and customer statistics, etc., with high performance and high reliability, and are typically present in banks, where they have always been widely used alongside the most modern technologies, supported by computers and dedicated ICT structures.

Banking Information systems can be essentially of two types:

- Legacy or Base information system - they computerize the activities that give rise to transactions with customers, such as the management of current accounts or deposits
- Decision Support Information System - they originate from data aggregation and is useful for making relevant decisions regarding the strategies to be set

However, it is possible to distinguish information systems based on other classification criteria, such as:

- the Organizational Structure – hence divisional, corporate or inter-organizational systems
- The Functional Area - hence accounting, finance, HR, management control, credits, foreign countries, auditing systems
- The Support Provided - hence the transactional system, the management system, the groupware, the MIS (Management Information System), the DSS (Decision Support System), the EIS (Executive Information System)

- The Reference Model – hence centralized, client server, web-based systems

2.2.1. Application Project Portfolio

The information system of a bank, with an adequate level of aggregation, is composed on average of about 250-300 applications of different size. The fragmentation of the application portfolio, which in recent years has not been possible to rationalize, also due to the new regulatory compliance, and which has actually increased, has negative impacts from various points of view. In particular:

- the costs of managing the systems for greater consumption of resource processing and maintenance heaviness of applications and interfaces
- the data quality, given the presence of redundant applications (old and new versions)
- process efficiency, particularly where the user is forced to use on a single process redundant or non-redundant systems not fully integrated (e.g. in the credit chain)

These are applications that are only partially controlled by internal structures, but in most cases by external companies or sometimes by individual professionals with a deep technical knowledge in a logic of body rental. Moreover, the overall system has often been built on a portfolio of core applications (current accounts, registers, payment systems, credit procedures) which has undergone stratifications over time that today make its management complex. Recently, some areas have been subject to a serious revision with the introduction of new applications that are now established on the market as standard. However, a renewal of the application portfolio based on its life cycle is underway, which is highly differentiated between central and departmental host applications. The main areas impacted are:

- Front-Office - following the rethinking of the distribution models and the improvement of branch operating models and integration with the different distribution channels, in the last five years a series of initiatives have been launched related to the renewal of Front-Office components. It has been observed that the life cycle of branch applications tends to go beyond ten years
- Collection procedures and Conditions definition - the life cycle of the traditional current account components reaches several decades, and this, given the high level of software stratification, over time makes the improvement actions costly and critical. At the end of the nineties, components concerning the management of "products/conditions /agreements" were introduced completing the current structuring of the application area. However, given the strong integration with branch systems, which have a shorter life cycle and have undergone a revision process in the last five years, a tendency towards application renewal in the sector has been observed (collection, liquidation, transparency). Often the renewal phase of the application has taken place through the acquisition of market application solutions (semi-finished packages) that propose a strong separation from legacy systems as a distinctive element, thus allowing the reduction of integration costs
- Register Office - the useful life of the fundamental components of the customer database exceeds twenty years. In fact, in many of the banking institutions the restructuring of the registry office, which is connected with all the subsystems, coincided with the recognition of its predominantly operational role and with the introduction of CRM systems. However, this remains one of the areas with the widest scope for action to achieve greater effectiveness
- Credit - the major changes in the area are linked to the offer of credit suites which include, in addition to new cores (mortgages/loans), the introduction of new workflow components, such as the credit limit practices (from the commercial approach to the resolution of the loan) and, more recently, the one concerning non-performing loans. The real

objective today is to build, at least in this sector, systems that allow credit monitoring before becoming problematic, to find the right solutions with customers for debt management/restructuring reaching the fundamental target of absorbing less capital and finding effective agreements

- Proceeds and Payments - the architecture is characterized by dated components of about 15/20 years, despite the implementations carried out following the SEPA and PSD regulations. The components concerning the proceeds and payments systems are therefore among the longest-lived of the banking architecture. In fact, to comply with recent compliance requests, solutions have often been implemented that have led to a stratification of the layers without the modification of the basic product. In the last two years, banks have launched projects to rebuild the sector with a "payment hub" perspective with strong technological and process innovation

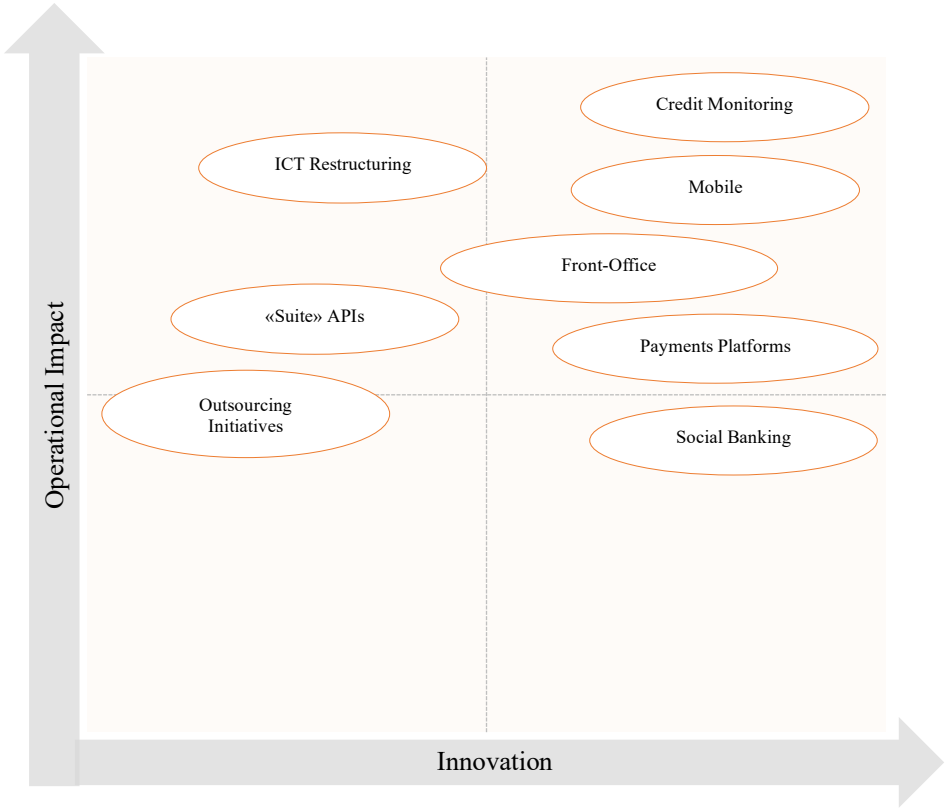


Figure 13. Ongoing Application Projects

2.3. ICT Sourcing Models

The belief that ICT technologies play a key role in building a competitive advantage against competitors is now largely widespread. But increasing complexity requires multiple strong specific skills. In this scenario, IT sourcing choices represent an important strategic opportunity, because they allow to take advantage from the contribution of specialized third parties capable of bringing indispensable skills and tools innovation. The choice of the IT services acquisition methods and related governance by a company is therefore a strategic activity, which involves different decision-making levels and presents technical, economic and organizational implications, in particular on resources management.

As reported in the survey "Rilevazione sull'IT nel sistema bancario italiano" carried out by CIPA and ABI, four models have been identified to characterize the reference structure adopted by banks for IT sourcing:

- Insourcing – the Data Center infrastructures (primary Hardware and Software) and the Applications are managed within the Organization
- Facility Management – the Data Center infrastructures (primary Hardware and Software) are managed by an external supplier while the Applications are managed within the Organization
- Outsourcing – the Data Center infrastructures (primary Hardware and Software) and the Applications are managed by several external suppliers
- Full Outsourcing - the Data Center infrastructures (primary Hardware and Software) and the Applications are managed by a single external supplier

The analysis shows that 45% of Banking groups respondents maintain the governance of the infrastructure and applications internally; 30% can be recognized in the Facility management model; 10% have adopted an Outsourcing model while 15% a Full Outsourcing structure (see Figure 14).

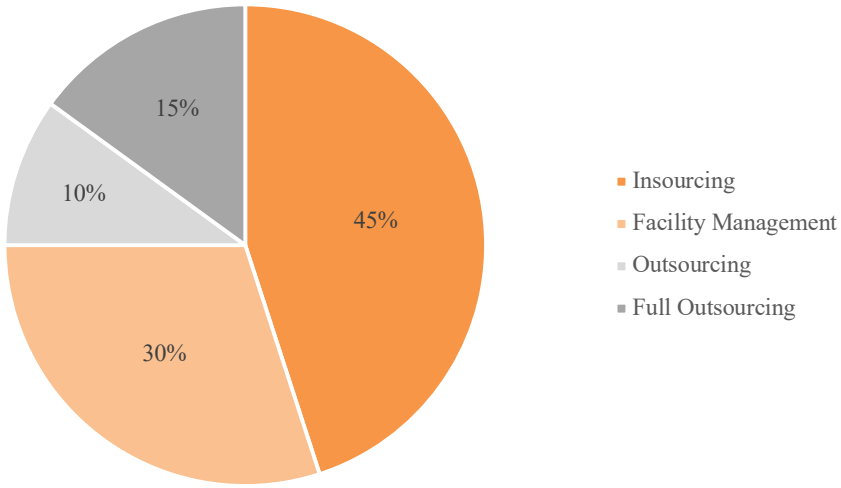


Figure 14. IT Sourcing models adopted by Italian Banks

The establishment of a dedicated ICT Company within the Banking Group is a solution undertaken mainly by the larger actors, which have sufficient volumes and investment capacity to obtain economies of scale. Often, the establishment of internal ICTs in the form of a 'consortium' is dictated by financial logics, which also allows tax leverage actions. The dedicated Company is normally entrusted with the management of the entire Information System of the banking group as a whole, achieving synergies above all in terms of ICT governance. An opposite solution, used mainly by small-medium sized groups, is the Full Outsourcing. This model allows Banks that do not have sufficient resources to manage the ICT infrastructure externally achieving economies of scale, managing costs and containing operational risks, without giving up innovation and adequate security levels, and concentrating internal resources on greater value-added activities. However, Full Outsourcing can be a solution that leaves the innovation process mainly to the outsourcer.

The main Sourcing choices made by the Banking groups for the development/evolution and the maintenance/management of IT services in the individual areas are reported below, distinguishing between the placement within the banking group, the outside assignment and the hybrid management. The analysis aims to identify the prevalent location of the activities in terms of "direct responsibility" (source: “Rilevazione sull’IT nel sistema bancario italiano”).

It should be noted that the groups mainly maintain within the organization the activities of development and evolution of IT services in the Decentralized Systems and Individual Equipment areas (15 groups out of 20) as well as in the Server Farm area (12 groups), followed by Mobile Telephony, ATMs and Applications (all indicated by 10 groups). It is also interesting to note that the development/evolution of Applications, in addition to being predominantly located within the banking group, is the less trusted area given in outsourcing (3 groups), as the groups opt for hybrid management (7 groups). Among the areas most delegated to the outside stand out POS (14 groups), Data Networks and Fixed Telephony (10 groups) and Mainframe (9 groups) (see Figure 15).

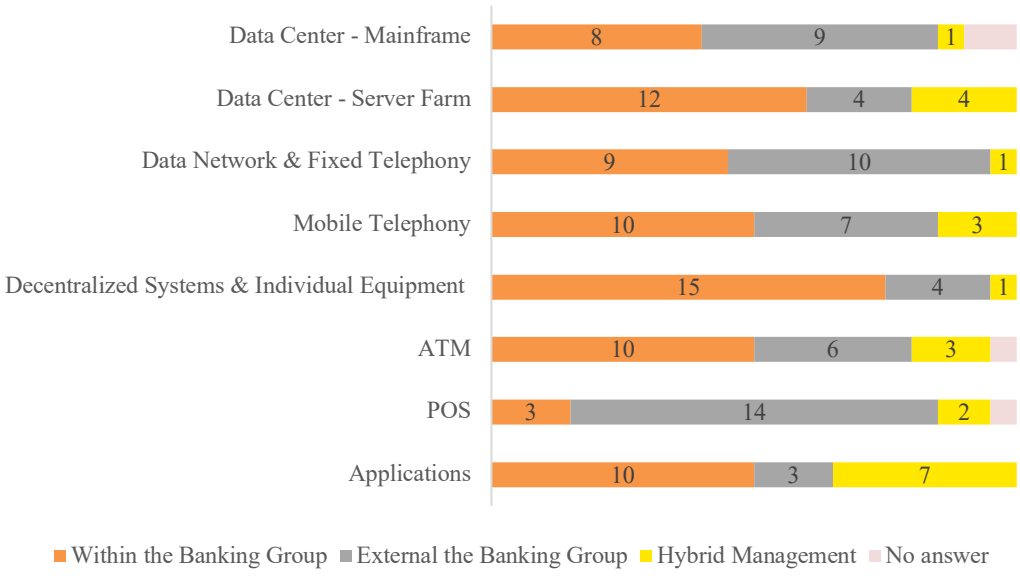


Figure 15. Placement of Development/Evolution activities of IT services by subject area, number of Banking Groups: 20

Analyzing, again by subject area, who is responsible for the Maintenance/Management of IT services, it is possible to observe a situation very similar to the one detected for the Development/Evolution, with a greater tendency to delegate activities outside, in particularly in the ATM (10 groups), Mobile Telephony (10) and Decentralized Systems and Individual Equipment areas (see Figure 16).

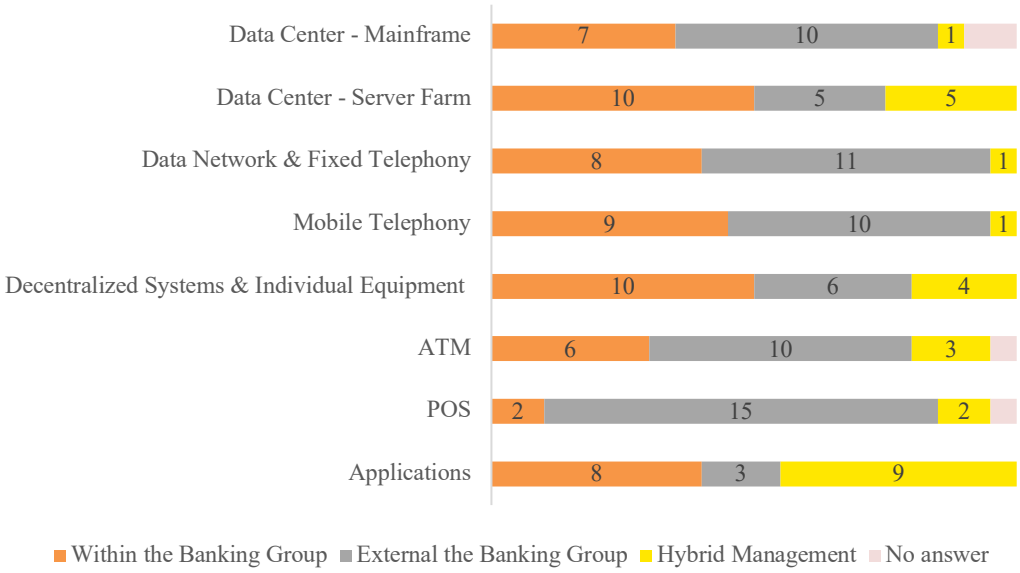


Figure 16. Placement of Maintenance/Management activities of IT services by subject area, number of Banking Groups: 20

2.3.1. An innovative management model: ICT-ISSC

The ICT Infrastructure Shared Services Company (ICT-ISSC) is an innovative variant of the previous sourcing models to optimize ICT structures and represent a real strategic alternative, especially for medium and medium-large groups. The idea is the creation of an ICT- ISSC, founded on the strategic collaboration

between the partners (different banking groups), which provides infrastructural services. Sharing together specific operational activities in common, this solution makes the Bank's ICT model more sustainable over time.

This service model requires the transfer of the operating activities to the ICT-ISSC, the relocation of the reference assets for the provision of the service and the focusing of the internal resources of the banking groups on connection and coordination activities with the specialized structures of the ICT-ISSC. The resources that remain inside the individual Bank Group (retained organization) must guarantee technological competences that allow interfacing with the ICT-ISSC structures and assess both the quality of the service provided and the validity of the proposals for the evolution of the technological platforms and infrastructure architecture. A company with these characteristics from one side implies a significant leap in terms of strategic vision, but from the other can make it possible to achieve deep and significative enhancements:

- manage ICT infrastructures with optimized service models in terms of efficiency e operational flexibility
- reduce the costs of the current perimeter of ICT infrastructure, leveraging economies of scale and technological innovation; also reduce the unit costs from each technology area
- service advantages from a highly specialized company in the management of ICT infrastructures, which is participated, addressed and governed by participating banks/companies, in order to focus ICT initiatives on core banking business aspects
- guarantee a sustainable evolution of the ICT infrastructure with quality and innovation, taking advantage of the greater structural dimension and scope
- create, in line with current trends, a specialized system player, able to exploit the dimension to increase purchasing power and influence against international ICT suppliers and telecommunications groups providers

However, the establishment of such a Company can create some critical management issues and for this reason a precise planning and a careful control of

the implementation modalities is necessary. Among the main aspects to consider, there are industrial and corporate/governance issues, which are relevant elements to ensure a stable future, a correct management approach and a strategic value to the initiative.

In economic terms the advantages that are potentially obtainable with the launch of an ICT-ISSC are very interesting. It is estimated, in fact, that it can bring savings for the banking groups involved of more than 20% of the total Total Cost of Ownership, net of internal resources costs. The assumed savings are slightly reduced when the size of the company does not reach a sufficient critical mass.

A correct implementation of this solution requires a transition phase in which execute the gradual shift of the infrastructure management from the bank to the ICT-ISSC. This ensures that, when fully operational, the ICT infrastructure components will be entirely covered while the governance and operative functions will remain under the responsibility of the individual Bank, also in compliance with the regulations in force.

Finally, the involvement of a Technological Partner that could guarantee greater savings in the short term but would require a very careful and clear dialogue for long-term innovation choices should be evaluated.

2.4. ICT Costs

The difficulties of the recent years to start a new growth economic cycle have led to an increasing pressure on margins and a decline in the profitability of the Italian banking system, it is therefore indispensable find new strategies aimed at recovering efficiency. Recently, a rationalization and containment trend of administrative costs has been observed within cost optimization initiatives, not only of internal resources expenses. In particular, an important share of operating costs is linked to branch proliferation and management. In this scenario, there are already some initiatives to rationalize the distribution network by the main Italian Banking groups, also in light of the development of new technologies and the

evolution of customer needs. In fact, the number of branches per inhabitant, steadily increasing from 1996 to 2012, has started to decline in recent years. In this perspective, the ICT area is strategic for banking groups and its rationalization can bring together benefits in terms of cost and operational and commercial effectiveness. ICT costs represent about 10-12% of the Banking groups' operating costs.

The incidence of ICT costs on total operating costs is related to the type of organizational model and sourcing adopted (insourcing, outsourcing, mixed) and is linked to the renewal "cycle" of the information system (those who have concentrated huge investments in recent times find high levels of depreciation in the income statement) and distribution models (number of branches). From this emerges the search by the banking operators to lengthen the amortization cycles related to the IT assets (extension of the useful life of the applications).

The classic model for identifying and reporting ICT costs of Italian Banks is performed using two main key performance indicators (see Figure 17):

- Total Cost of Ownership (TCO) - it is the main indicator used to analyze the trend of the Information Technology costs because it takes into account all the life cycle costs of the ICT area resources (equipment and applications). Banks use the total cost of ownership over the long term as a framework for analyzing business deals. Looking at the total cost of ownership is a way of taking a more holistic approach that assesses the purchase from a broad perspective. This analysis includes the initial purchase price as well as all direct and indirect expenses
- Cash-Out - is the sum of current expenses and investments for a given resource

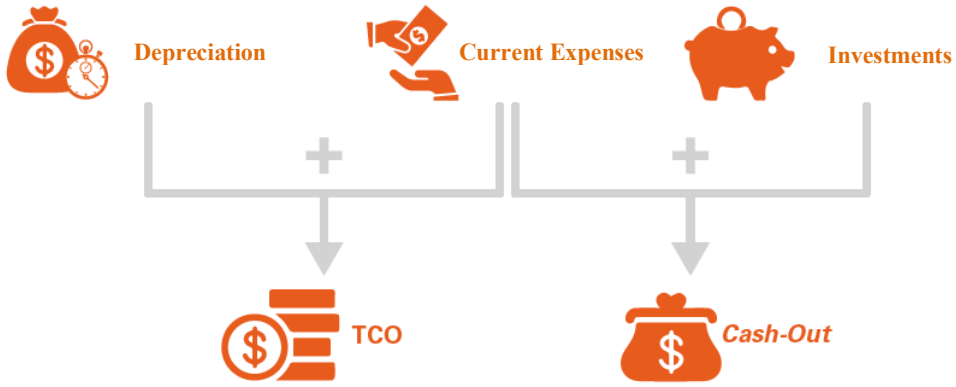


Figure 17. ICT cost definition

As reported in the survey "Rilevazione sull'IT nel sistema bancario italiano" carried out by CIPA and ABI, in 2017 there has been a significant increase in the ICT economic commitment sustained by the Banking groups, which confirms the previously growing trend in 2016. The TCO tendency, referring to a constant number of 17 groups, records an increase of 5.7%, bringing the total TCO to 4,233 million euros. Forecasts for 2018 confirm the positive trend, although with much lower growth (+ 0.3%) (see Figure 18).

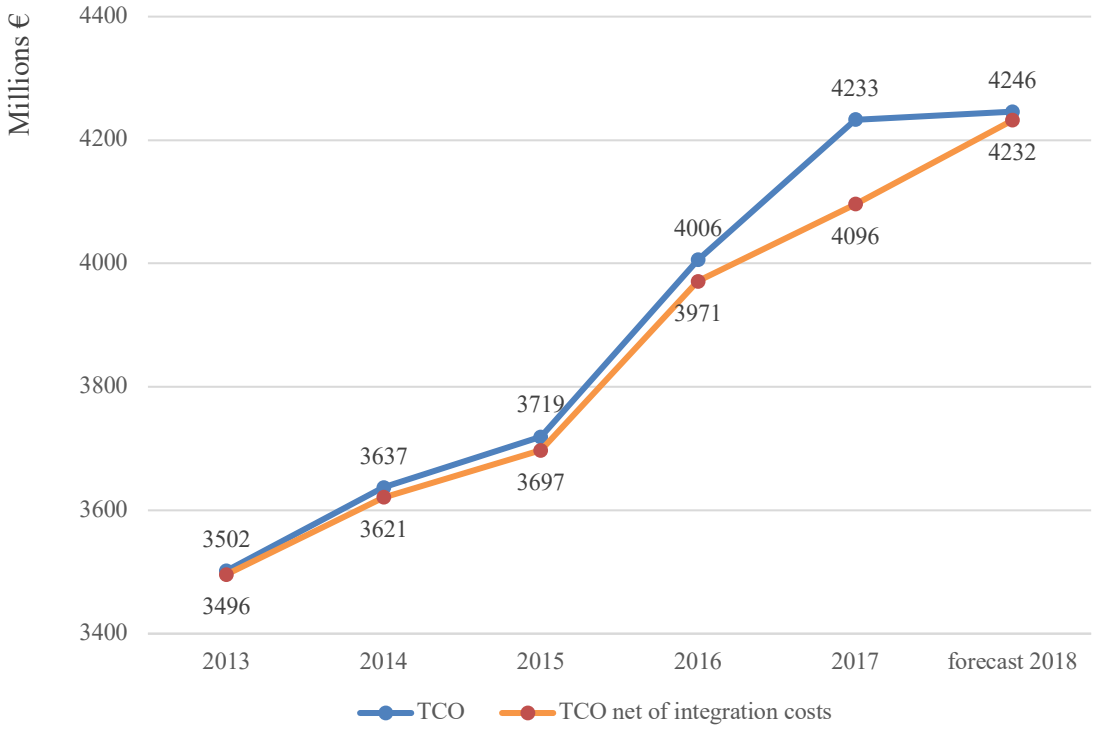


Figure 18. TCO Trend

The TCO increase is mainly due to the development of new initiatives, the strengthening of digital channels and mobile banking services, the modernization of systems and the initiatives of data governance, risk management and mitigation. According to the ABI Lab survey, at the top of the ICT investment priorities of the sector it is possible to find, following the European directive PSD2 (Payment Services Directive 2), the initiatives concerning Open Banking. Related to the strengthening of digital channels, the attention is on mobile banking services and remote identification of the customer, with the consequently enhancement of security components. The commitment to the modernization of core banking services and infrastructure adaptation remains considerable. Finally, these aspects are accompanied by a strong focus on data governance and data quality. The attention is also high on dematerialization initiatives, process automation, the modernization of technological infrastructures, also with a view to Cloud Computing, remote identification of the customer, the enhancement of

digital payment services and initiatives based on blockchain and DLT technologies. In particular, the groups have reported the following elements:

- New projects development
- Operation increase
- Available ICT budget increase
- Change in the groups' organizational structure
- Increase in products, services, IT consumption
- Change in technological structure/IT architecture
- Change in organizational and/or IT management structure
- Recovery of suspended or deferred activities
- Amortization increase

3. Case Study: Technology View definition for a leading Italian Banking Group

3.1. Project Characteristics

The following case study is the result of a specific project to which I have been assigned during an internship in a leading consulting firm for the financial services industry.

The objective of the project consisted in the definition of technological drivers on which map all the projects initiatives of the department of Credit Products and NPL of a leading Italian Banking Group in order to address short- and long-term ICT investments. This activity allowed us to provide the Bank a high-level and innovation-oriented Technology view underlying which technologies solutions should be implemented in the department. Each investment area has been divided in sub-categories depending on market trends and business needs.

Since the Application and technological structure of a Bank is strongly interconnected and built on different layers overlapped over time, a single project can have significant impact on the several drivers defined. It has been decided to express this impact in terms of percentage of the total project investment. In this way it was possible to define for each technological sub-category the relative amount invested during the year as a sum of the investment percentages of each project undertaken in that same area.

The main problem faced by the department was the rationalization of all ICT project information in order to be able to express budgeting assessments and descriptive statistics on the current technological situation allowing to successively make future strategic choices at the top management level. This is a recurring problem in multinational organizations where the project portfolio

reaches significant dimensions with impacts in different technologies and business lines.

The project has been divided into 3 main phases.

Phase 1 – Definition of Technological Drivers

The specific definition of each investment area and related sub categories are reported and deeply analyzed in the following paragraph. This phase represents one of the most burdensome activities since it was necessary to correlate the drivers deriving from the new technological trends of the market with those currently implemented by the department. The purpose of the matching is to obtain an effective project categorization without reporting too high variability with the consequent minimization or elimination of the impact of specific projects as well as considering redundant drivers. In addition to the analysis of general market trends, the drivers were defined through a deep analysis of the department's project portfolio, which was extracted from the reference information database. In addition to the information provided for each project defined in the start-up phase, it was necessary to broaden the information base through a series of long meetings with the Project Managers of each project in order to optimally calibrate the purpose of the project with its most general market trends.

Drivers have been divided into four reference macro-areas:

1. Technology Investment area – all the technological drivers are represented, with the exception of innovations related to hardware and software architectures. It is therefore considered all those initiatives related to the modernization of the application architecture and infrastructures, to the enhancement of procedures and processes, to the adaptation of business capabilities in order to accommodate Internet-based and mobile computing platforms and finally the implementation of Big Data softwares along with ICT and IoT security solutions
2. Delivery Model - Project management has become one of the most important pillars within any company having been recognized as one of

the fundamental factors for its proper functioning. Therefore, in this macro-area the adopted development methods of the projects are reported: waterfall, agile or hybrid. Important considerations can be made regarding the effectiveness of the new methodologies applied in a banking system and whether the theoretical benefits are real in an environment where traditional systems and procedures have played a predominant role

3. Application and Service Sourcing – all the sourcing models adopted by the department in relation to the management and maintenance of applications and services are reported. It is therefore possible to analyze the degree of outsourcing of each project with the related investment in such a way as to carry out assessments regarding the quality of the service obtained and therefore to consider the internal reallocation of the activities or increase the degree of outsourcing. It is important to underline that Organizations cannot undertake the IT aspects of a modernization program on their own. They need the support of world-class IT vendors offering industry-specific applications, middleware and SOA, and technology infrastructure and data storage. For this reason, sourcing drivers have been included in order to understand the impact that these organizational models have on ICT investments
4. HW/SW Infrastructure – it includes the ownership and management of Mainframe and Open System permises, Cloud and Data Network implementations as well as Facilities, Operating Systems and Databases enhancements. These drivers underline the modernization degree of the departments' core operating machine in order to assess the integration between legacy systems and new architecture innovations

Phase 2 – Projects Extraction

The project portfolio characterizing the Credit Products and NPL department included a total number of initiatives equal to 291 for a total value of € 132,691,000. The projects were clustered according to the following categories:

- "IT Stream level" – 15 IT Stream Levels have been identified, that is a set of macro-projects of considerable size in terms of resources used, budget

allocated and organizational impact, each consisting of smaller projects. An example is the IT stream level "Service Model Enhancement" which includes 38 projects worth € 18 million

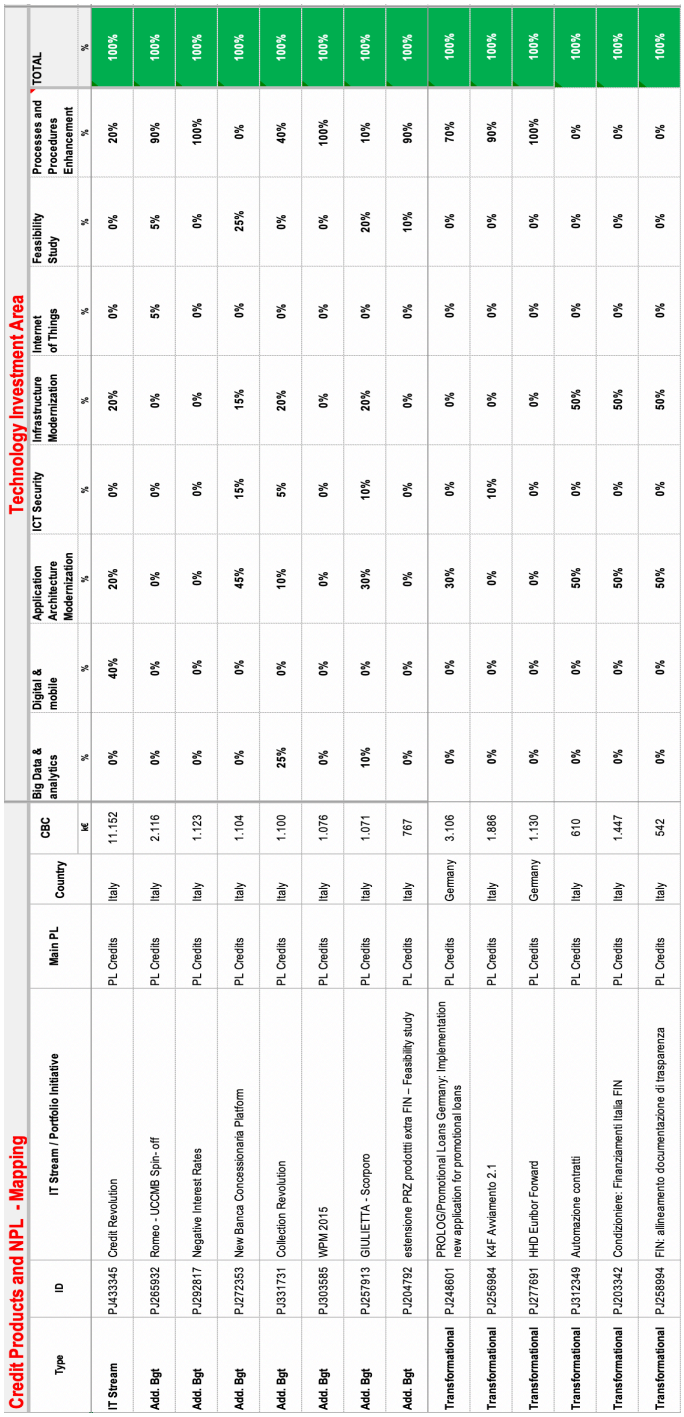
- “Additional Budget” – here are represented all those initiatives undertaken in previous years that require further allocation of money for various reasons: regulatory compliance, underestimated budget, delayed supplier services ... etc.
- “Transformational” – includes all those projects that determine a significant technological change in the current state of the applications and processes and that require new operational and management skills. Some examples are contract automation, changes to the mortgage management system and feasibility studies for "Fast Credit" solutions

With respect to the overall initiatives, I have been assigned the analysis and mapping, in relation to the technological drivers, of the IT Stream Level "Credit Revolution", 13 "Additional Budget" initiatives and 11 "Transformational" projects for a total investment amount of 32,205,000 €. The assignment of the projects within the team took place considering the reference Project Manager who was carrying out several projects simultaneously. In this way, the information load deriving from the meetings and questionnaires for the definition of the various impacts was more structured and linear as it was necessary to interface mainly with a single actor.

Phase 3 – Mapping Project Initiatives and Technological drivers

The objective of this phase was to quantify the impact of each project in a detailed and structured way with respect to the Technological drivers defined during the initial phase. A single project considered in its totality is equivalent to 100% of the initial investment made. Consequently, for each project the individual percentages of the initial investment to be allocated to the different drivers have been defined. Once the mapping was completed, it was possible to derive the total amount invested in each driver as the sum of the percentages of the individual projects allocated in the same sub-category.

The definition of the various percentages was mainly obtained from an internal management software of the department and then implemented and enhanced through information derived from meetings with project managers and questionnaires. A simplified version of the methodology described is presented in figure 19.



Credit Products and NPL - Mapping					Technology Investment Area							TOTAL
Type	ID	IT Stream / Portfolio Initiative	Main PL	Country	CBC	Big Data & analytics	Digital & mobile	Application Architecture Modernization	ICT Security	Infrastructure Modernization	Internet of Things	Feasibility Study	Processes and Procedures Enhancement	
					k€	%	%	%	%	%	%	%	%	%
IT Stream	PJ433345	Credit Revolution	PL Credits	Italy	11.152	0%	40%	20%	0%	20%	0%	0%	20%	100%
Add. Bgt	PJ265932	Romeo - UCCMB Spin- off	PL Credits	Italy	2.116	0%	0%	0%	0%	0%	5%	5%	90%	100%
Add. Bgt	PJ292817	Negative Interest Rates	PL Credits	Italy	1.123	0%	0%	0%	0%	0%	0%	0%	100%	100%
Add. Bgt	PJ272353	New Banca Concessionaria Platform	PL Credits	Italy	1.104	0%	0%	45%	15%	15%	0%	25%	0%	100%
Add. Bgt	PJ331731	Collection Revolution	PL Credits	Italy	1.100	25%	0%	10%	5%	20%	0%	0%	40%	100%
Add. Bgt	PJ303585	WPM 2015	PL Credits	Italy	1.076	0%	0%	0%	0%	0%	0%	0%	100%	100%
Add. Bgt	PJ257913	GIULIETTA - Scorporo	PL Credits	Italy	1.071	10%	0%	30%	10%	20%	0%	20%	10%	100%
Add. Bgt	PJ204792	estensione PRZ prodotti extra FIN – Feasibility study	PL Credits	Italy	767	0%	0%	0%	0%	0%	0%	10%	90%	100%
Transformational	PJ248601	PROLOG/Promotional Loans Germany: Implementation new application for promotional loans	PL Credits	Germany	3.106	0%	0%	30%	0%	0%	0%	0%	70%	100%
Transformational	PJ256984	K4F Avviamento 2.1	PL Credits	Italy	1.886	0%	0%	0%	10%	0%	0%	0%	90%	100%
Transformational	PJ277691	HHD Euribor Forward	PL Credits	Germany	1.130	0%	0%	0%	0%	0%	0%	0%	100%	100%
Transformational	PJ312349	Automazione contratti	PL Credits	Italy	610	0%	0%	50%	0%	50%	0%	0%	0%	100%
Transformational	PJ203342	Condizioniere: Finanziamenti Italia FIN	PL Credits	Italy	1.447	0%	0%	50%	0%	50%	0%	0%	0%	100%
Transformational	PJ258994	FIN: allineamento documentazione di trasparenza	PL Credits	Italy	542	0%	0%	50%	0%	50%	0%	0%	0%	100%

Figure 19. Simplified version of the methodology apllied

3.2. Definition of the Technological Drivers

As anticipated above, in the following it is reported a specific definition for each driver determined at the beginning of the project. It is interesting to observe how the Bank is proactively and constantly aligning its ICT strategy and governance with respect to the Digital Trends defined in chapter 1 at an international level. In fact, recently the Bank has been subject to a profound corporate reorganization in order to propose a renewed equal relationship between ICT and business which is the key that leads to effectively addressing the most important innovation issues, and which gives new relevance to the strategic role of ICT governance in digital transformation projects.

As these drivers are a framework applicable to all departments that conduct digitalization and technological transformation projects, their definition has been supervised by the "Transformation & Innovation Advisory Board". It is an internal group of the company which has the task of discussing crucial issues for the banking sector, such as technology and data analysis, consumer trends, fintech ecosystems, security and risk mitigation, with the aim of submitting concrete development opportunities to the CEO as well as updating regularly the Board of Directors. Moreover, the Advisory board is composed by high-level innovation specialist and senior managers with strong expertise in digital topics such as big data and artificial intelligence, customized mobile products, computer security and APIs modernization strategies.

TECHNOLOGY INVESTMENT AREA	
Category	Description
 **Big Data & Analytics**	Initiatives included in this category are aimed at obtaining new correlations and business insights from vast amount of structured or unstructured data. Common technology variations of Big Data and Analytics initiatives contain the following keywords: *Business Intelligence, Business Analytics (BI), Hadoop, Information Management, Data Extract, Transform and Load, Data integration, Datawarehouse (DWH)*
 **Digital & Mobile**	Initiatives included in this category are aimed at adapting and evolving business capabilities in order to accommodate an Internet-based and Mobile computing platforms-based consumption model of business products and services. Common technology variations of Digital and Mobile initiatives contain the following keywords: *Multi-channel, Omni-channel, Tablet, Smartphone, Internet-based, dematerialization*
 **Application Architecture Modernization**	Initiatives included in this category are aimed at modernizing legacy application architectures with new architectural and technological approaches. Common technology variations of Application Architecture Modernization initiatives contain the following keywords: *Open APIs, Microservices, Web Scale Architectures, Web Oriented Architectures, Containers, Lightweight Application Architectures, Mainframe offloading*
 **ICT Security**	Initiatives included in this category are aimed to enforce the security level to applications and IT infrastructures protecting Clients and Group companies against frauds, data losses and unauthorized access to data in order to assure integrity, availability and confidentiality of information. Common technology variations of ICT security contain the following keywords: *Antifraud, infrastructure Security and Data & Identity Protection Services, Threat Management, Threat intelligence, IT Risk Management, Proactive incident detection and response, Application firewall, Access Control, Data Loss Prevention, Data in flight protection, Identity Access Management*

 **Infrastructure Modernization**	Initiatives included in this category are aimed at modernizing legacy infrastructure architectures and components with new architectural and technological components and improving the resilience of the systems and applications delivered to customers. Common technology variations of Infrastructure Modernization initiatives contain the following keywords: *Unbundling, Integrated Systems, Modular Data, Disaster Recovery, Hardware renewal, Distributed ICT (fleet management)*
 **Internet of Things**	Initiatives included in this category are aimed at interconnecting and instrumenting physical objects that contain embedded technology to communicate, sense and interact with their internal states or the external environment. In banking environment are becoming relevant in leasing, credit underwriting and in real estate management (branch or head offices) Common technology variations of Internet of Things initiatives contain the following keywords: *Sensors, Intelligent Building, Building automation, Leasing asset monitoring, Biometrics and behavioral sensors*
 **Feasibility Study**	Initiatives included in this category are aimed at assessing the financial and/or technical feasibility of a specific future initiative. Common technology variations of Feasibility Study initiatives contain the following keywords: *Analysis, Assessment, Business Case, Feasibility, Return on Investment*
 **Processes and Procedures Enhancement**	Initiatives included in this category are aimed at enhancing or creating processes and procedures specifications related to the management and evolution of IT systems and applications. Common technology variations of Infrastructure Modernization initiatives contain the following keywords: *Process Enhancement, Process Improvement, Crescendo, Process Documentation, Process Owner, Process Interface Manual, Process Regulation, Regulatory compliance, Lean processes*

DELIVERY MODEL	
Category	Description
 **Waterfall**	In Waterfall methodology each phase of development is discretely defined with clear gating criteria into the next phase, i.e., Analysis, Design, Development, Integration, System Test and Implementation. Common keywords are: *traditional project development, Waterfall organization, RUP, release building, project phases, Detailed functional specifications*
 **Agile**	An umbrella term for highly iterative development methodologies, allows organizations to holistically deal with the causes of their problems by forcing teams to coalesce and create code in an adaptive and transparent environment. Agile's emphasis on business-IT collaboration allows co-development teams to create products that adhere to corporate strategy and that provide true business value with no organizational barriers. Common keywords are: *Agile, SCRUM, Extreme Programming (XP), Kanban*
 **Other methodologies**	Other development methodologies including, for example, software prototyping, Rapid application development (RAD), Spiral/iterative development, including methodologies used for infrastructure projects. Common keywords are: *RAD, Iterative Development, Non structured implementation*

APPLICATION & SERVICE SOURCING	
Category	Description
 **Insourcing on shore**	Spending for internal labor that are located in on shore Countries (IT, DE, AT) and for SW developed internally or purchased from ISVs/SW Vendors Personnel costs: man days related to UniCredit People - *Custom made SW*: is evaluated with Function Point (FP), a metric to define how much functionality an application or system contains from a user's point of view. Languages could be split in: 3GL (3rd Generation language: Cobol, C, RPG, Assembler, C++, …), 4GL (4th Generation language: Java, .NET, SQL, ….), ABAP (SAP development), DW (data warehousing and business analytics specific languages), JSP/ASP (Java Server Page JSP/Active server Page used for dynamic Web sites) and other languages -*Non sizeable activities* (man days): effort (or percentage of the total effort) dedicated to activities not sizeable with FP/CP methods like migrations, hardware configuration, etc. Packages costs purchased from ISVs/SW Vendors. It is measured with Configuration Point (CP), a simple and cost effective size measure for functional changes delivered through application configuration
 **Insourcing near shore**	Spending for internal labor that are located in near shore Countries (Polonia, Czech Rep., Romania, ...) and for SW developed internally or bought from ISV/SW Vendor Personnel costs: mandays related to UniCredit People, developing custom SW or delivering others activities not sizeable as defined above (e.g. Y4F) Packages costs purchased from ISVs/SW Vendors as defined above
 **Contractor on shore**	Spending for contract labor (typically man-days), which are supplemental to Unicredit's staff and "operationally" managed by in-house staff and is located in on shore Countries. Contractors develop custom SW or deliver others activities not sizeable according to the definitions previously provided. Includes Fixed Price *Typical examples is Accenture T&M staff extensions in Milan*

 **Contractor near shore**	Spending for contract labor (typically man-days), which are supplemental to Unicredit's staff and "operationally" managed by in-house staff and is located in near shore Countries (Polonia, Czech Rep., Romania, ...). Contractors develop custom SW or deliver other activities not sizeable as defined above. Includes Fixed Price *Typical example is External people T&M working in CZ for the SW factory*
 **Outsourcing / Work Pakage**	Work Package (WP): fixed price project that is (1) clearly distinguishable from other WP, (2) has scheduled start and completion dates with eventual interim milestones, (3) has an assigned budget and is integrated with the schedules of related WP Outsource contract (SLA Based) is defined as any situation in which the operational responsibility for IT is completely handed over to an external service provider The delivery is based in on shore Countries (Italy, Germany, Austria) Work Package (WP) or Outsource contract as defined above The delivery is based in near shore Countries (Polonia, Czech Rep., Romania, ...) Work Package (WP) or Outsource contract as defined above The delivery is based in off shore Countries (India, Vietnam, ...)

HW/SW INFRASTRUCTURE	
Category	Description
Mainframe on premises	This category includes the HW ownership and management expenses Computing: includes all hardware in mainframe server platform configurations, including internal disk storage (but NOT external disk arrays), processors, memory, cards, etc. Keywords: *IBM Mainframe 2817-M80, 2819-M32, ...* Storage: includes all dedicated mainframe storage devices including controllers, servers, disk arrays, tape libraries, optical jukeboxes Includes also the VTS costs for the above Keywords: *IBM DS-8800, HDS DS 8700, EMC Centera, ...*

 **Open system on premises**	This category includes the HW ownership and the management for OPEX expenses Computing: includes all hardware in Unix, Intel and Linux server platform configurations, including internal disk storage (but NOT external disk arrays), processors, memory, cards, etc. Keywords: *IBM AIX pSeries 7500, SUN Solaris Mseries, SUN Solaris LDOM, HP Proliant, Primergy, …* Storage: includes all dedicated SAN/NAS storage hardware devices including controllers, servers, disk arrays, tape libraries, optical jukeboxes Includes also the VTS costs for the above Keywords: *EMC DMX4, IBM DS 8700/8800, EMC Centera, Netapp, …*
 **Cloud**	It is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.
 **Data network**	Network HW including Switching & Routing (Multiplexers, Satellite, Boundary Routers, Backbone Routers & Switches), Terminating (Gateways, Modems, CSU/DSU), Internet Access / Proxy Servers, Accelerators, RAS Servers, Security Appliance (Firewall, Encryption), Other Hardware (DNS, DHCP, UPS), …
 **Facilities**	Include fully burdened costs for Datacenter and for office space dedicated to IT functions. Some examples include office space, furniture, electricity, maintenance, property taxes, security, and office supplies
	OPERATING SYSTEMS Both host and virtual OS licenses and virtualization software used to create and manage multiple OS instances on the same physical server, such as hosted Virtual Machine Managers (VMMs)

 **Other**	DATABASE Costs for DBMS licensing, both relational and non-relational. Include costs for both host and virtual OS systems
	MIDDLEWARE Costs for software to promote interoperability between different OS, DB or application systems
	CONTENT/ DOCUMENT MANAGEMENT Costs of software used to manage and track the location of and relationships between content elements within a data repository, in particular Web pages
	DEVELOPMENT/ TESTING TOOLS Application generators, compiler, debugger, prototyping tools, design aids, screen generators, process managers, integrated project managers, testing tools and repository structures
	SECURITY TOOLS All software used to provide access security and protection against attacks. Security Appliances are NOT included here.
	OTHER SOFTWARE Generic category to be used only if none of the previous definitions apply.

3.3. Results

The first area to be analyzed is the technology investments one (see Figure 20). It is underlined that most of the budget is allocated in the improvement of processes and procedures together with the modernization of infrastructures and architectures for a total invested amount equal to € 30,213,000 (81% of the total). Therefore, the strategic orientation of the department is mainly towards the restructuring of existing systems with a focus on emerging technologies such as

Artificial intelligence, RPA, DLT, Open Banking still in an embryonic stage. Despite this, the optimization and consolidation of ICT systems are fundamental to improve the effectiveness of business operations and to guarantee excellent customer service. In line with the growth of the multi-channel digital business, in 2018 the Bank continued the general reconfiguration of the ICT infrastructure, with the aim of making it more streamlined, efficient and cost-effective. From the analysis of the project specifications within the portfolio, good results were obtained in the disposal process, which allows a technological update thanks to the renewal of the applications and the underlying infrastructure. In particular, the 2019 target for applications has been exceeded by approximately 10%, disposing over 1,200 APIs since 2016; in addition, mainframe technologies have been reduced since 2017 by around 20% and open system technologies by around 9%. Furthermore, the technological infrastructure was updated to support core banking applications, making it more suitable for managing the exponential increase in digital flows and more cost-efficient. This action included the re-engineering of the core system programming language, which led to an increase in efficiency of 36% at the end of 2018.

The department initiatives related to the digitalization and Mobile banking have been exponentially increasing since 2012: this is demonstrated by the total investment of 4.461.00 € and above all by the broadening of the overall Italian mobile customer base equal to 8 million people. Regarding the enhanced services, in addition to the “basic” functions, the Department has started projects aimed at improving the trading services of financial instruments, direct payment services between people (P2P) and management functions personal expenditures. The various functionalities can be offered in a single reference app or with an ad hoc app for a specific service: the most obvious examples are the mobile wallet and the Mobile Pos.

Although ICT security investments (657.000 €) are lower than other categories, top management is paying particular attention to its fast development. In fact, the progressive digitalization of the Banks services requires the implementation of a global management strategy for the cyber security. This commitment is also

aimed at responding effectively to the regulatory environment in evolution in order to strengthen the confidence in financial systems and the protection of consumer rights. For example, the entry in force of the European General Regulation about Data Protection (GDPR) has focused the attention on the data protection topic, making even more important the improvement of security systems and the management of possible data breaches. The long-term plan for ICT security is founded on a model of continuous improvement and on a framework of dedicated policies and processes. In 2018, the main related investments were concentrated in the strengthening of the defense of the company perimeters, implementing solutions aimed at the identification of possible vulnerabilities as well as increasing verification actions to improve the safety levels of the applications. These measures are aimed at reducing the probability of cyber attacks and impacts arising from them. These activities have been integrated by launching a specific program to make more solid the access rights management and the definition and development of a compliance structure dedicated to cyber security, in line with the application of Payment Services Directive 2 (PSD2) and GDPR regulations.

TECHNOLOGY INVESTMENT AREA

Big Data & Analytics	€	589
Digital & Mobile	€	4.461
Application Architecture Modernization	€	8.409
ICT Security	€	657
Infrastructure Modernization	€	4.588
Internet of Things	€	106
Feasibility Study	€	1.180
Process & Procedures Enhancement	€	17.216
TOTAL	€	37.205

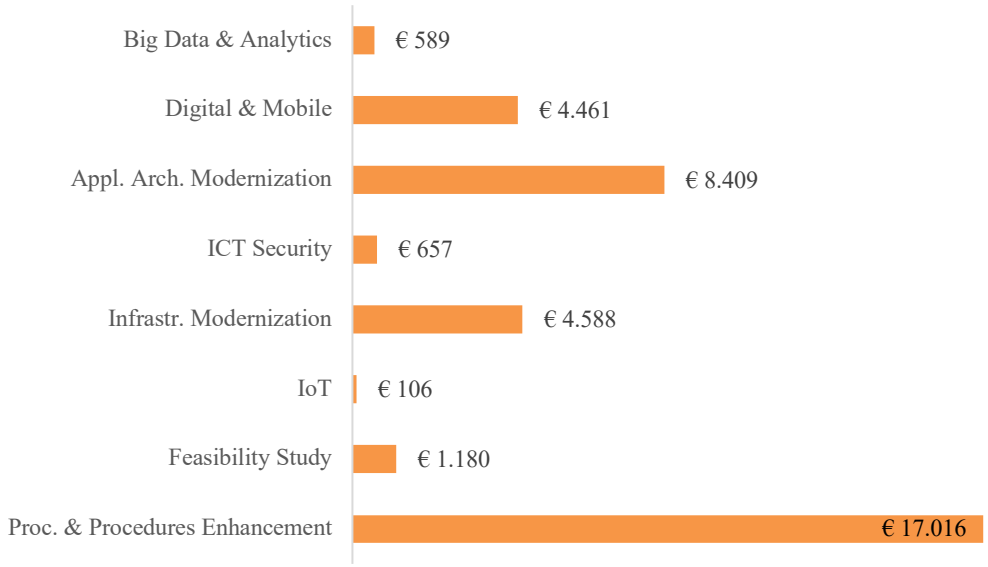


Figure 20. Investments in the technology area (data in K€)

The second area investigated is the Delivery Model and the results underline that almost the totality of the initiatives analyzed have been managed with a Traditional-Waterfall approach (see Figure 21). From this it is possible to underline a characteristic rigidity of an international-sized bank in conducting projects with high innovative content. In fact, the methodologies applied reflect the hierarchical and functional structure typical of a bank based on a portfolio project control according to well-defined protocols and where there is a tendency to not have large margins for disruptive changes. Hence, structures result dominated by a marked functional specialization of roles and by the centrality of the hierarchy in coordination and control. Even if the benefits of an agile approach and a lean organizational structure are known, the department has demonstrated a certain hostility in the application of new methodologies expressing greater interest in the already known advantages from a structured and rigorous traditional way. This procedure is well suited for ICT projects which are characterized by a strict sequentially of distinct phases, the need of well document each process and result, tight budget and time constraints.

DELIVERY MODEL

Traditional (waterfall)	€	33.749
Agile	€	3.456
Other methodologies	€	-
TOTAL	€	37.205

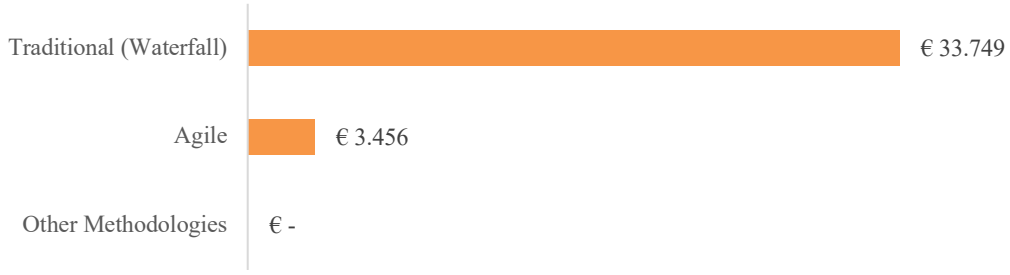


Figure 21. Investments in the delivery model area (data in K€)

The third area of interest is the Application & Service sourcing (see Figure 22). Is interesting to note the great amount of budget allocated to projects managed by Contractors on-shore, that is the spending for contract labor (typically man-days), which are supplemental to the department's staff and "operationally" managed by in-house resources and located in on-shore Countries. This allows allow to take advantage from the contribution of specialized third parties capable of bringing indispensable skills and tools innovation. Usually the use of external resources (defined as external leverage) is one of the operational elements that characterize the sourcing policies of ICT structures. Leverage is an index calculated as the ratio between the number of external resources and the number of internal resources, where generally the resources counted are those dedicated to Application Maintenance activities and which, with regard to external resources, provide an ongoing contribution (criteria to which the resources known as Time & Material typically respond). The use of external leverage and the increase in the size of the application portfolio represent the signs of a growing complexity in the management of internal personnel: the average age of people working in ICT

could determine a limit to the turnover of resources with specific professional skills.

APPLICATION & SERVICE SOURCING

Insourcing on-shore	€	8.361
Insourcing near-shore	€	3.413
Contractors on-shore	€	22.298
Contractors near-shore	€	2.645
Outsource / Work Pkg	€	488
TOTAL	€	37.205

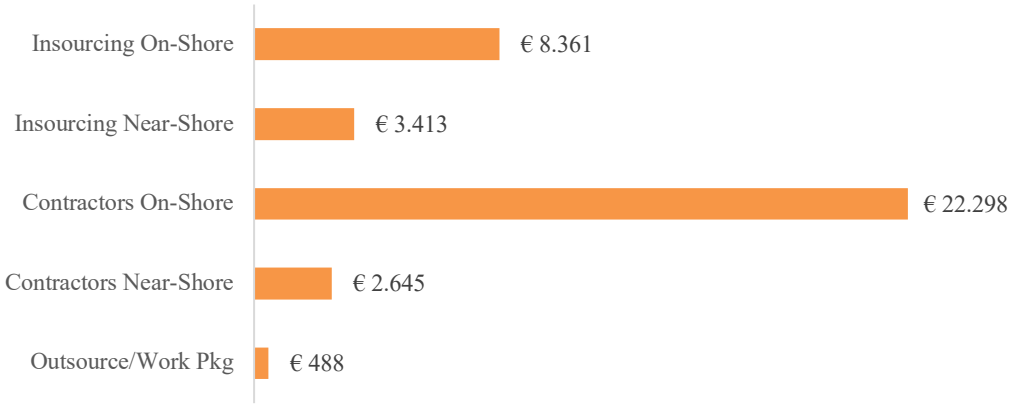


Figure 22. Investments in the application and service sourcing area (data in K€)

Finally, the last area analyzed represents the impact of the projects on the Hardware and Software Infrastructure. In this case it is necessary to specify that this impact is related only to the part of Infrastructure costs from the total investment (~ 12% of the entire investment). This choice derives from the need expressed by the department manager to consider only the costs that each project has determined in the impacted infrastructure driver.

HW/SW INFRASTRUCTURE*

Mainframe on premises	€	1.802
Open system on premises	€	2.020
Cloud	€	-
Data network	€	355
Facilities	€	12
Other	€	276
TOTAL	€	4.465

** Equals 12% of total investment*

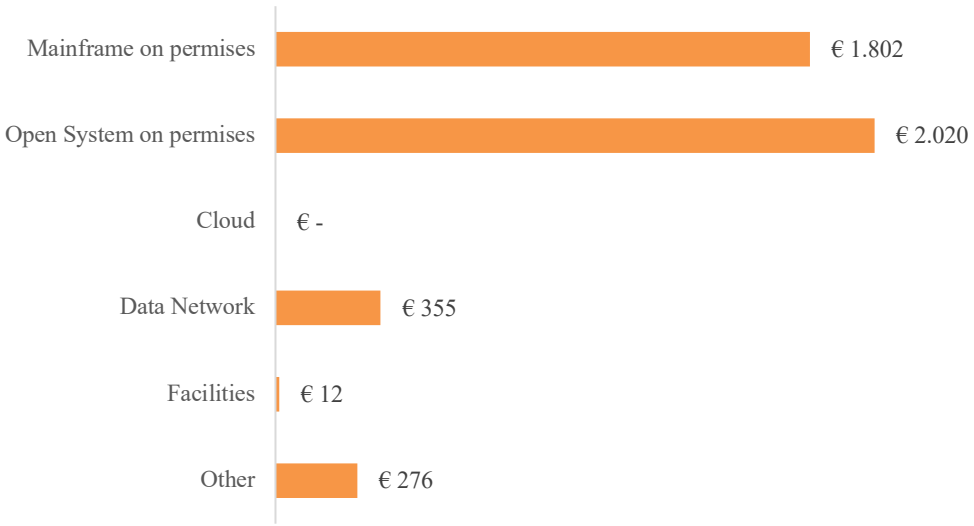


Figure 23. Investments in the hw/sw infrastructure area (data in K€)

CONCLUSIONS

This dissertation started by outlining the digital challenges that banks face today. They range from the need to generate strong revenues and healthy profits and to expand into emerging markets, though to becoming more customer centric and dealing with the growing regulatory burden. Moreover, the exponential advances in technology resulting from the digital revolution, coupled with the loss of financial leverage brought about by a new regulatory regime, have left the industry in a state of flux. As banks have scrambled to keep up with the more rapid changes in their business environment, the result has been an industry with a digitized business model supported by an analog operating model. As a result, banks are missing opportunities to delight their customers and the industry is more open to disruption than ever before. Now banks are being pushed to take the next step in the digital journey towards completely new technologies such as Artificial Intelligence, DLT, Robotic Process automation, Cloud Computing, Open Banking. In fact, an agile customer-centric business needs the right technology foundation and enablers to capitalize on opportunities and minimize threats amid new digital realities.

In this complex environment, the definition of a solid and structured ICT Governance is the key to manage these new disruptive technologies and remain competitive in the industry. Hence the second part of the research is focused on analyzing the characteristics of an effective ICT management within a Bank, giving particular insights on its architecture and strategic sourcing models. Although there is no single dominant re-organization strategy, common Bank structures all lean towards decentralizing IT, shifting it closer to end-users and melding the knowledge-base to business strategy. It follows that the ICT area rationalization can bring together benefits in terms of cost and operational and commercial effectiveness since ICT costs represent about 10-12% of the Banking groups' operating costs. Moreover, a fundamental requirement of success is the

strategic ICT alignment with the business and activities of the Company: this means the dynamic actualization of organizational goals and objectives and the operationalization of the IT strategies according to those objectives where the organizational objectives are expressed in terms of improved financial performance and sustained market competitiveness.

Finally, it has been presented a case study as the result of a specific project to which I have been assigned during an internship in a leading consulting firm for the financial services industry. Its purpose was the definition of technological drivers on which map all the projects initiatives of the department of Credit Products and NPL of a leading Italian Banking Group in order to address short- and long-term ICT investments. In particular, we wanted to analyze the current technological situation of the bank and assess whether it was aligned with the digital trends analyzed at the beginning of the paper. The derived “Thecnology view” was fundamental to describe the current strategic orientation of the department which is mainly towards the restructuring of existing systems with a focus on emerging technologies such as Artificial intelligence, RPA, DLT, Open Banking still in an embryonic stage. Despite this, the optimization and consolidation of ICT systems resulted essential to improve the effectiveness of business operations and to guarantee an excellent customer service.

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