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Optimizing Digital Finance and Regulatory Systems Through Intelligent Automation, Secure Data Architectures, and Advanced Analytical Technologies

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Abstract
The increasing ubiquity of digital financial products and services represents a potential game changer for the fight for the financial inclusion of smallholder farmers in developing countries. Digital financial services are generally more convenient, potentially less costly, and have a greater footprint than other financial services. They can enable smallholders to engage more easily with agriculture value chains and, so, adopt more economically productive behavior. As a result, smallholder finance is increasingly regarded as the engine of rural development and poverty reduction. However, digital finance also presents challenges for some smallholders. Formal banking institutions may rely on credit scores and other risk-mitigating modes of evaluation that are not applicable to many, if not most, agriculture producers, particularly in developing countries. Millions of smallholders might, therefore, be left out of emerging smallholder finance value chain relationships. In Wage Guzma, only 17.6% of households have access to digital financial services. Made agriculture payments were received by only 11.7% of households.

Keywords: Finance and regulatory automatization - financial sector, digital transformation, cloud and on-perm. Graph databases, data lakes, blockchain, analytics, deep learning, AI, ML. Auto-Machine Learning (Auto-ML). Public, private, hybrid cloud. BI, data marts, data warehousing. API, SQL, artificial intelligence, on-premises, ETL, cloud functions, RDBMS.

1. Introduction

Digital Technologies like Artificial Intelligence, Big Data, Blockchain, Cloud Computing, and Internet of Things are big business. However, these technologies run the risk of skewing markets and personalizing information bubbles. Furthermore, they may be used against citizens. To counteract this development, regulators are urged to actively shape the development and use of digital technologies. This is significant if the political order is to be preserved in the digital age. Therefore, the establishment of a regulatory system for the use of digital technologies occupies an exceptional role in research, especially in the financial sector. Existing and new use cases within Treasury activities supported by Digital Technologies like Artificial Intelligence, Machine Learning, Application Programming Interface, Cloud computing, Blockchain, Application, and Big Data are scoped and analyzed.

On this basis, requirements are determined, and a reference architecture model is developed to support the digital transformation of such activities. Recent years have seen unprecedented technological change. Described as a fourth industrial revolution characterized by "cyber-physical systems" and the "Internet of Things," it is a revolution predicted to "disrupt" industries and economies with "entire systems of production, management, and governance" turning sentient or automated. This era is also marked by the rapid deployment of artificial intelligence, from voice recognition and decision-making algorithms to chatbots, image recognition software, and swarming drones. These applications are predominantly driven by data analysis which pessimists fear will further "deskilling" work forces all over the world, leading to mass unemployment and inequality. But who will be affected most? While populist politicians tend to put the blame solely on certain countries and thus robotics, the real answer is more complicated. Largely unnoticed by the public discourse, governments are automating their administrations by deploying intelligent software robots which perform knowledge-based tasks otherwise completed by government employees.

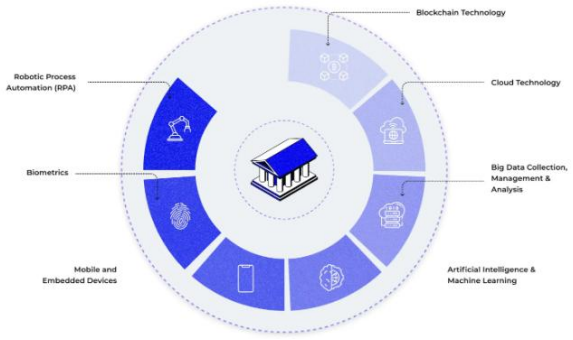

Fig 1: Digital Transformation in Banking and Financial Services

1.1. background and Significance

The financial industry landscape has undergone a profound shift. As a direct response to the 2008-2009 financial crisis, regulators globally focused on stability. Although that stability was accomplished, there has been an unintended side effect. The regulatory framework has become increasingly complex. This has led to growing expenses as overarching regulatory regimes have been translated into granular rules and requirements. A look at the US alone shows an industry that has been transformed by the Financial Services Modernization Act, the Sarbanes-Oxley Act, Dodd-Frank, and the Basel III Accords along with their resultant regulations. Meanwhile, annual compliance costs have skyrocketed into the billions. Regulations, as currently constituted, are geared to a reactive stance. They do not adapt well to new threats or changes in the environment. Meanwhile, a new financial market has been on the rise. The FinTech marketplace has been gaining a market cap of US$3.3b annually in the past five years. This new sector has a number of obvious benefits. The FinTech marketplace is largely divorced from the sunk costs of many traditional financial firms. This frees FinTech firms to engage in less conventional strategies and products. Moreover, the sector's reliance on platforms and algorithms allows for extensive data gathering and analysis. This, in turn, allows these companies a proactive stance against threats. More troubling, is that the oversight standard of the new Fintech industry is still in formative stages.

Equ 1: Secure Network Architecture

$$C = M^e \mod n$$

Where:

- C = Ciphertext
- M = Message to be encrypted
- e = Public exponent
- n = Modulus (product of two primes)

2. Overview of Digital Finance

Countries all over the world face common risks and challenges caused by the spread of the Covid-19 crisis. Its consequences are affecting both human lives and social behaviors and pose economic threats. In this scenario, digital finance is one of the most relevant economic sectors. On the one hand, it appears as one of the few sectors which is growing these days, due to the fact that, locked in their homes, households are shifting a portion of their consumption online. On the other hand, because of the technological complexity of services offered or provided by the sector, it poses new risks and challenges for both consumers and firms. There are at least four new risks: (1) New products are appearing that are, at the same time, complex to understand and easy to trade, (2) New providers are entering the market and not all of them are trustable, (3) The provision of trusted services by third parties is becoming essential for many other economic sectors, and (4) More and more trade of personal and economic sensitive information is needed for the provision of such services and for granting their safety. Under all these circumstances, filtering good digital finance is increasingly struggling and new policy instruments are needed to balance consumer trust and innovation incentives. On the one hand, they must be measured and pre-transparent in order not to jeopardize the financial inclusion motivation. On the other hand, they must be able to adapt fast enough to cope with consequences provoked by designs that had never been previously taken into account. These last risks and challenges explain the novelty of this special number within the novelty of the Symposium to be held in Bilbao in November 2022. Both novelties try to build up a bridge between, at the same time, theoretical and policy-oriented economics and economic law. Adding to such risks, there are the difficulties faced due to the newness of the analyzed problems. Nowadays, almost all financial services start to be digitized by using mobile devices. This fact disrupts and blurs the frontier between goods and services as, for instance, payments for services become normalized, this way creating new business relationships on the one hand, and becoming a source of concerns, on the other hand. While, in principle, the control and regulation of goods and services are very different matters, this boundary blurring interferes with such classifications. Hence, the novelty of a digital finance index

arises as the need to build a structured taxonomy if further steps are to be properly taken when filtering the market concerning digital financial services. This follows up the increasing interest shown by public institutions in monitoring the role of FinTech firms when, by providing their technological-based services to the (mostly) traditional credit market's players, they account for a growing portion of the credit share, this completely new behavior posing, therefore, new challenges in terms of regulation. In this environment, financial regulation poses not only as a balance between consumer trust and financial industry's innovation incentives, but also as a filter for macro and systemic consequences. In the international arena, some policy-makers reckon the desire to increase the financial integration and globalization process is coming to ask vital consequences, since the Lehman Brothers' crash; that, in contrast, the "de-linking" of financial sectors seen in times of high financial repression, places countries just like in the opposite side to that wishful growth path and hence better shelter in following more conservative regulations. Finally, it is also claimed that deep financial integration is a likely open door to the spread of financial crisis to the real sectors. On the opposite side, there are the ones arguing international openness may yield large benefits as long as gains of risk floor and better savings and lending opportunities, all that boost a higher investment and growth path. This globe debate is also present in the European resolution concerning the recent "Digital European Economy" strategy.

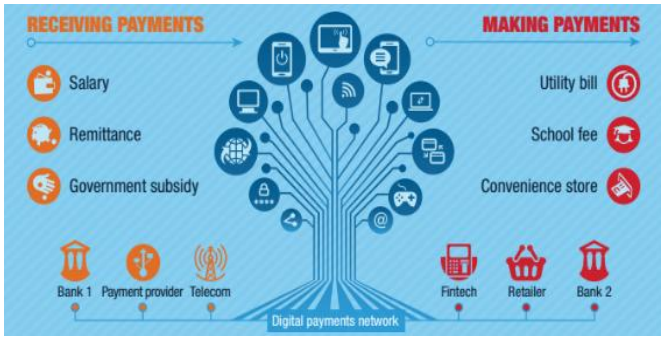

Fig 2: Digital Finance

2.1. Research design

In order to operationalise understanding of RegTech, research using interviews and desk research has been conducted. First, a brief background on RegTech, its relation to FinTech and Supervisory Technologies. Second, the research methodology is presented, detailing what sectors, businesses sizes, and firm types were surveyed, the questions asked, and how the results have been validated. The main challenges and outcomes observed by the Financial Conduct Authority (FCA) in the UK and the Hellenic Financial Stability Fund (HFSF), established to facilitate the recapitalisation and resolution of Greek banks, are discussed. Finally, the research provides a typology of RegTech and anticipates the development of the sector. In the United Kingdom, the FCA launched the Global Financial Innovation Network in conjunction with 11 other financial regulators from around the world. Underpinning these are governmental initiatives such as the Regulatory Decisions Committee (RDC) and the Innovation Hub. The focus of the discussion is the Regulatory Sandbox, launched in June 2016 to allow firms to test innovative ideas in a safe environment, and the lessons learnt. Regulatory Sandboxes are created spaces defined by regulators or by supervisory authorities in which FinTech companies can safely test their innovative solutions under the shelter of a live environment but without the full regulatory consequences that a similar pilot would have if conducted in public.

3. The Role of Intelligent Automation

Problematic loan and mortgage application processes are a common and persistent issue, often impeding customer experience. FinTech companies are seen to have potential in resolving this issue. Regulated organizations must, by law, have stringent processes to follow. This may involve an in-depth credit check for a relatively small loan, but it is also vital to ensure affordability for potential customers. There is a new breach for every regime, such as GDPR. Credit checks cannot be processed using standard services so time is wasted reaching out via email or contact forms. Typically, a complaint floor of communications lasts two weeks while contact is attempted by email. The requirements to proceed are frequently the same and requests to escalate are sent after resolution is achieved. In the largest proportion of cases, third-party service providers assess affordability. It is advantageous to note that a customer pays significant fees via these services and are making a credible profit. The hypothesis is that a FinTech solution could improve this process via automation.

Financial institutions operate in a heavily regulated environment and must comply with various laws and regulations, on a national and international basis. In particular, regulations pursue two main policies: prudential (to ensure financial stability) and conduct of business (customer protection). Despite the positive impact of rules and standards on financial stability, a tight regulatory environment can also be accused of making the credit supply cycle more complex, costly, and time-consuming. IT supported tools can help financial intermediaries in better understanding and complying with the regulatory sources by setting up and managing optimal data structures to facilitate the procedures. Banking institutions have to constantly adopt new monitoring systems to manage the evolution of regulations and the needs of regulatory and supervisory authorities. This deliberate approach on multiple systems leads to a material and functional organization of different solutions.

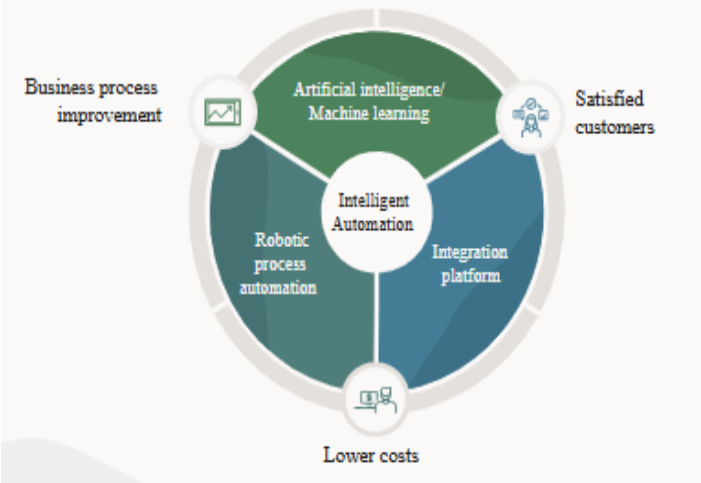

Fig 3: Intelligent Automation

3.1. Defining Intelligent Automation

Intelligent Automation can improve the security and resilience of finance and regulatory systems. Moreover, businesses need a new generation of highly secure, data architectures. These architectures must function equally well (or better) than legacy systems across ten dimensions. Among them, three are most important in order to leverage more secure data architectures and the analytic technologies that provide persistent defenses against complex and adaptive threats. Businesses need secure data architectures that fully protect and control data throughout its lifecycle. Intelligence automation enables systems that leverage data for key business insights, increasing the demand for more and higher quality data analysis. Advanced analytics technology can enhance such analysis, enabling more versatile and powerful tools for predicting important outcomes, such as security breaches, consumer behavior, or creditworthiness. Finally, businesses need secure data architectures to deliver data to AI and modeling tools in a form that is usable and analytics. Citizens should remain in the use of data security and user data protection mechanisms developed in highly regulated sectors. However, digital transformation of the economy and public life in the European Union and the significant reduction in the cost of computing and storage of data have led to a broad problem of informational security of personal data.

Intelligent Automation defines the Digital Transformation so that multiple projects with a common mission, in this case involving Finance and Trade, are implemented in multiple Districts. One of the foundational District requirements is the broad enabling of Controlled Unclassified Information sharing amongst the Districts, Industry Partners and other groups. There are a number of accommodations within the National Industrial Security Program Operations Manual and the Joint Special Access Program Implementation Guide that allow the sharing of level information in much the same way the Information Sharing Environment facilitates sharing between agencies. Undoubtedly, with the rapid advancement of technology landscapes, they constitute a very appealing choice that seeks to radically simplify the Finance and Regulatory System environments from the current scheme of regulation and data flows that must be carefully preserved. On this beat, Districts and Industry Partners are assumed to have consent groups already established and now require 2nd and 3rd generation potential IT solution approaches to foster seamless sharing of information.

3.2. Applications in Digital Finance

There is no question that next-generation digitalization in finance, notably when powered by sophisticated data architectures, analytical technologies, and automation, can enable the emergence of intelligent finance. Advanced technologies that underpin this digitalization can greatly enhance the efficiency of banking, insurance, and other financial services. As customer transactions in finance become increasingly digital, significant amounts of data are being generated in every aspect of their interactions; from creating and storing to managing and analyzing them, challenges, but also opportunities, arise. Applications can be found in every aspect of financial services, including secure transactions, operations, risk and compliance, or customer service, and are often supported by blockchain-based smart contract technology. Advanced data architectures highly enable the operation of financial systems. The blockchain is a distributed and synchronized data architecture that acts as a trustless asset database that appreciably reduces loss through cyber crime and ultimately enhances operational risk management. Financial contracts and cryptographic techniques are combined in the blockchain to automatically execute and enforce contract agreements between transacting parties. As the development of digital financial services reaches a critical mass, and the policy push towards data openness spreads around the world, it is likely that the importance of data architectures will be widely recognized. Emerging policy imperatives are promoting standards for easy transmission and access of financial data. There are several choices that can be made by regulators when considering these digital finance protocols. Risk-based, proportional, and flexible frameworks are recommended, as well as promoting market-led measures in the interoperability ecosystem of data platforms and channeling the role of public entities. Finally, applicable safeguards must be observed such as maintaining the privacy theme, both in terms of operational techniques as well as strategic policies.

Equ 2: Energy Optimization with Renewable Sources

$$\frac{dE(t)}{dt} = P_{\text{solar}}(t) + P_{\text{wind}}(t) - P_{\text{load}}(t)$$

Where:

- $E(t)$ = Energy stored in the system at time t
- $P_{\text{solar}}(t)$ = Power generated from solar at time t
- $P_{\text{wind}}(t)$ = Power generated from wind at time t
- $P_{\text{load}}(t)$ = Power consumption at time t

4. Secure Data Architectures

As the financial sector is a critical backbone of the global economy it has always been a target for cyber-attacks. Although banks are rigorously monitored and regulated by regulatory authorities, they have not been immune to such threats. A sector that is closely related to banks is the FinTech industry which has seen exponential growth in the past few years and has attracted tech-savvy attackers who are looking for new methodologies to penetrate the infrastructures. The results of this work serve as a wakeup call to stakeholders involved in this field, providing an insight into the most destructive threats across various sectors. Banks and FinTech organizations can allocate their scarce resources to secure themselves against the most critical threats. Regulators can use this review to come up with new regulations and compliance for the banks.

As a result of advances in technology in various sectors, there has been a significant increase in the number of organizations adopting digital platforms to offer its services to the customers. The financial services sector is not an exception to this trend, where over the years we have seen businesses adopting a wide variety of electronic and digital techniques to operate and fulfill the needs of its clients. As the popularity and usage of such platforms have proliferated, so has the potential spread of cyber-attacks targeted towards these systems. Cyber attackers can utilize a myriad of tools and mechanisms to launch targeted attacks aimed at stealing user data, infiltrating the institution's network, stealing money and assets, and causing denial of service to deter the services being offered by the institution. This work makes the following contribution to the field of cybersecurity in the digital financial industry:

Review and categorize common cyber threat vectors pertaining to the financial technology sector. For every category of threat vectors, the work provides an in-depth exploration of the threats faced. Provide insight into the mechanisms and approaches that cybercriminals adopt to launch such attacks on digital financial systems and the potential financial losses a company may suffer as a result. For every threat in this study, put forward potential cybersecurity solutions or measures that can be taken to mitigate the threat.

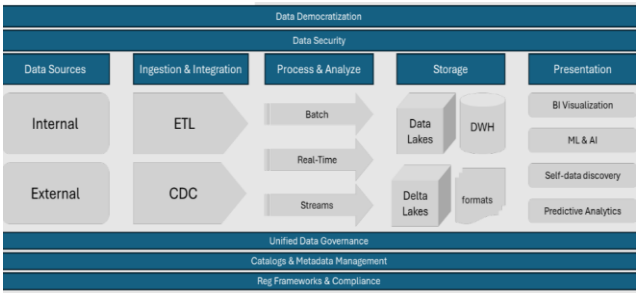

Fig 4: Data Architecture

4.1. Importance of Data Security

The security of personal and corporate data is very critical in digital financial research and development. It has good economic prospects and social influence due to the No. 1 leading market scale comparison of the online transaction and operation situations. In the cyber world, numerous cyber-attacks can lead to the data leakage of banks or customers, and even the bankruptcy of the financial sectors. The leaking investigation proposed in this study has shown dispersity caused by multiple kinds of leaks, with the number of leaked access paths highly relevant to the network dispersal. The access control information expansion defense has succeeded in reducing significantly the data leakage of geographic dispersion, and because of the low overheads is promising to be deployable in large scale networks. It is urgent to establish an advanced proactive control system, which is able to effectively counteract all kinds of potential attacking threats. To balance the severe requirement of low delay and the demand of rapid response to large-scale cyber-attacks, it is of critical importance and urgent practical significance to develop a highly automating, distributed and intelligent advanced security system, which is here named the intelligent security-based data-traffic-analysis system.

The imbalance distribution of flows can reduce the network utilization and degrade the service quality of legitimate users. Therefore, the intelligent security monitoring system needs to deploy the distributed detectors to counteract it. The middleboxes are widely deployed in the intranet of the data centers and common intervals. For the enterprise routers, the cost of adding the prevalent software IDSs just to achieve highly redundant monitors is usually prohibitive. The efficient and effective detection algorithms would be indispensable to make the privacy enhanced fast privacy leakage detection practical. Significant potential risks from the data leakage of access control, and its novel metrics have been designed to evaluate the wide potential impacts of the related information. Among the diverse defense strategies, the practical solution has been

proposed for effectively and efficiently increasing the resistance to the data inspection and simplification attacks of a variety of access control models.

4.2. Frameworks for Secure Data Management

The exponential growth of current and next generation data, as a result of increasing globalization and continuous technology evolution, is becoming a significant concern to organizations. In this evolving environment, personal devices constantly generate, collect and disseminate a continuous stream of data between users, enterprises, and systems worldwide. At the enterprise level, a run-off-the-mill data warehouse can accumulate from 250 to 750 TB of data per annum. As a result, managing all this data, as is, has become an incredibly challenging task. Also, this enormous amount of data, storable and analyzable at a reasonable cost, must be as qualitative as possible, because it relies on the correct decision-making of today's world-wide market endeavors vis-à-vis legal, health and cost constraints. It has been recently estimated that US businesses lose just under 600 billion due to low data quality. This loss may result from poor strategy definition; other reasons could be an unthoughtful data collection and loading operation, or bad integration with other data sources that the organization usually treats received data. Furthermore, in a real time environment required data may not be on hand, implied by unexpected operations on data warehouse tables, software issues or other occurrences, with negative outcomes for the whole process. Meanwhile, unlike apparel, data quality does not sell off as time goes by. This is forcing organizations to handle the entire data in-house and to put in place the necessary means to guarantee that every piece of it is accurate. Data quality thus becomes increasingly crucial for the correct operation of decision-making processes and operational systems. To facilitate development, a Model Driven Engineering framework is put forward. This framework furnishes an architecture description language to represent the architecture of on-line data-intensive applications, as well as an architecture framework to efficiently model architectures using MDE techniques. Raised from a generic meta-model, data-intensive applications can now use the proposed framework to model their architecture in a completely automated way. Once the model is generated it can be used to monitor the quality of the data that flows through the system, as well as to isolate the data areas of the architecture that impact data quality the most. Additionally, a domain specific language, tailored for the architecture of financial applications, is also introduced. This language follows an execution meta-model and, together with the provided code generator, amounts to a model-to-code solution. This generator targets three architectural pieces of the envisioned framework, the data source and data sink statements of the data quality monitors, and the mapping between messages and the data that needs to be stockpiled or retrieved. Architecture designers and financial experts now have at their disciplines' disposal a powerful tool that streamlines their workflow and also provides them with the capacity to make enlightened decisions supported by reliable data insights.

5. Advanced Analytical Technologies

The immense amounts of money that flow in banks every day in the entry, exit and transfer of funds lead to data sets featuring complex structures, which in turn, support a number of advanced analytical methodologies. This paper provides an overview of the rapidly growing area of computational and algorithmic analytics in the context of financial services, including e-finance and the FinTech industry. Special emphasis is placed on the sector of systemic banking investments and the vast amount of money that is transferred and invested through banking institutions. From the managerial point of view and with sponsorship from major public banks, investment agencies, and financial intermediaries, it is of prime importance to understand the market dynamics, current trends, the interdependencies among the driving forces of the market and the structure of the local and global network of investments in the banks' portfolio. In response to this, an extensive pipeline of computational and algorithmic services, including expert-driven mapping of the macroeconomic outlook into the banking investment structure; construction of investment profiles of the individual banks; monitoring and real-time pattern recognition of investment dynamics, detection of structural changes, and assessment of market risks and vulnerabilities; scenario-based stress-testing of alternative investment strategies. The methodologies developed blend contact-based risk metrics with techniques from network science, data mining, time series and text analysis. The effectiveness of the proposed methodologies is rigorously tested with stochastic models on real-world datasets and illustrated via insightful use-cases and thorough case-studies. The latter are conducted in the known-to-be volatile market of Greek financial institutions, but the methods are designed to be generic, scalable, and applicable to other banking systems as well.

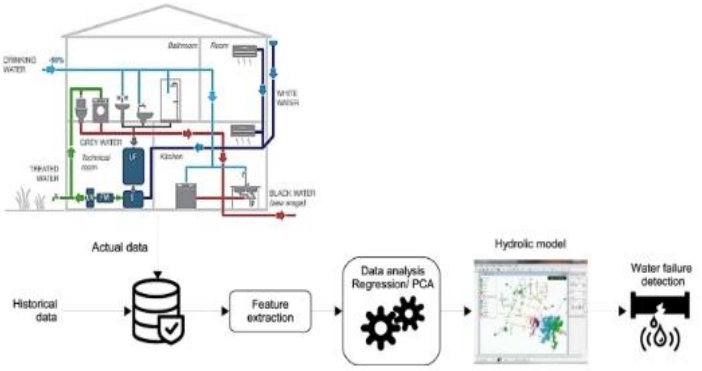

Fig 5: AI-big data analytics

5.1. Big Data Analytics in Finance

Digital technology alters how consumers access current accounts, purchase services and goods, and then manage funds and obtain credit, as well as how banks and third-party firms are innovating to improve customer service and commodity offerings. With this expansion of technology-driven innovation, an expanse of financial services have gone digital, necessitating an enhanced convergence of FinTech and regulatory solutions. This combines regulatory responses that enable technology to be harnessed in ways that enhance competitive financial services investment in the new digital era. Both FinTech and RegTech initiatives also have to turn over, as adjustments to operating in a digital world need to be made. In this setting, there is a growing number of applications for intelligent automation, secure data architecture, and data-driven technologies, intended to facilitate the advancement of both digital financial services and regulatory practices.

Much mainstream analyses on digital finance and digital technology disregard routine financial processes, scaling the actual amount of transactions that corresponds to the processed financial services. Mobile payments generally represent only a slither of those, but emerging large-scale financial dataset covering business-sector transactions reveal comprehensive financial flows and suggest that at a higher frequency scale, digital technology and finance are closely coupled. At aggregated levels, this relationship holds both in general and at the instance of Chinese composite activity indices, thus indicating that future analysis of financial or monetary crises and regulation might benefit from vector autoregression analysis that jointly model technical extremes and finance. The confluence between the digital technology wave and financialization might contain various ramifications concerning technological trend, business activity, and economic policies.

5.2. Machine Learning Applications

The financial sector comprises business establishments that manage financial transactions, investments, and capital sourcing including banks, asset management companies, insurance companies, and credit card companies. The financial sector provides a significant contribution to a nation's economy. A recent issue for the financial sector and the Bank of Korea is the increased share held by non-banking institutions. Due to the recent surges in disputes arising from financial fraud, issues regarding the protection of consumer information and the proper use or sanctions of personal financial information are constantly brought to light. Despite their growing interest and importance, studies on the implications of the protection of financial information are scarce. As a result, there is a need to heighten the importance of the issue via academic discussions on such topics. For this purpose, this study aims to enhance interest as well as an understanding of the issue by identifying matters relevant to guaranteeing the information security of financial consumers and proposing policy suggestions. The implications of this study can be useful for establishing safe digital finance and a financial regulatory system. All research subjects have exposure to various financial products including insurance, trust products, loans except personal financial information. Thus, it is that the propensity for a trade-in and for dissatisfaction would either go in many measures beyond the control, empirical research subject or are spurious as a measure of financial return risk. Taking into account such aspects, this research plans to utilize financial big data sets such as card payment, mobile transaction, asset management, and personal loan business license before the analysis. Therefore, financial data may not be defined by precocious consumer sensitivities that would then be measured with the aid of empirical research. Despite their good scrutiny condition, the analysis of financial exposure data is also forbidden.Nonetheless, a functional and operational sequence of on-premises, cloud, and third party components is offered that should provide a comprehensive overview of technology consideration and guiding principles, as well as potential architecture layouts that incorporate tested and feasible system designs and technological components.

Equ 3: Optimal Energy Distribution

$$\text{Minimize: } E = \sum_{i=1}^{N} C_i x_i - \sum_{j=1}^{M} P_j y_j$$

Where:

- E = Total energy cost
- C_i = Cost of energy production at source i
- x_i = Binary decision variable (1 if energy is produced at source i
- P_j = Power supplied by energy storage at node j
- y_j = Binary decision variable (1 if energy storage is used at node
- N and M = Number of energy production sources and energy

6. Integration of Technologies

Digital banking offers banks the opportunity to reduce costs and risks, to redesign and optimise business processes, and to create new business models at the intersection of banking, finance, and digitalisation. New digital technologies combined with advanced data analytics, such as machine learning and multivariate prediction algorithms, enable banks to develop intelligent automation for a great variety of (pre-) compliance and regulatory functions, which can be applied to treasury departments. A transformative data architecture will not only improve integration and management of data across reporting entities, but also facilitate cross-system real-time analytics which power advanced data modelling and research. A digital treasury architecture that integrates core systems via data warehouses and database monitoring tools is described, which could enable a new generation of intelligent automated applications combining analytics of transactional and positional data with minimum latency and maximal reliability and scalability. The overall digital design setup and tech stack is described, split into banking core, on-premises, and cloud infrastructure, as well as essential third party components. The bank is assumed to have decades of accrued data and IT infrastructure investment, with separate development, test, and production environments, physical data

recovery and proprietary middleware integration, such as job processing, message queuing, and data routing; thus, requirement solutions may need to be adjusted or substituted. Detailed descriptions of proprietary technology components and applications and systems are omitted, with the latter presented in a generic form. Any potential breach of intellectual property rights or disclosure of trade secrets attributable to the submission's or implements' contents is disclaimed. Data layout, data flow, and system architecture visualisations are not provided because the bank does not allow for that level of detail.

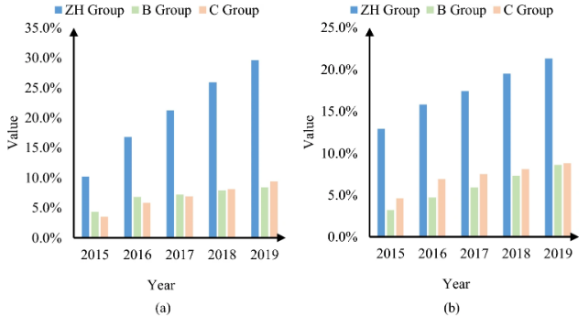

Fig : Financial big data management

6.1. Synergies Between Automation and Analytics

Digital finance and regulatory systems solutions are rapidly emerging, evolving, and integrating intelligent automation, secure data architectures, and advanced analytics solutions. In many cases, these solutions are synergistic and mutually advancing. For example, intelligent automation can streamline data registration and cleaning to make it usable and valuable for securing data architectures and advanced analytics solutions. The analyses of digital finance data produce accurate insights leading to regulatory action which can then be automated to streamline documentation and archiving, closing a loop for future applications and assessments.

Most financial institutions have risk detection teams. They generally use historical transactions to discover how past frauds occurred. Once they have identified and understood the behavior, they codify rules that they use for future monitoring. In many cases, the past behavior is static and rules are breached by smart criminals. Also, institutions need to comply with regulations to investigate consumer redress requests. This requires searching more than 10 years of transactions and investigating the events surrounding an authorized transaction. Conducting these analyses offline can be time-consuming, but intelligence automation solutions allow this in a time-effective manner.

6.2. Building a Cohesive System

One of the biggest promises behind FinTech and RegTech lies in creating an environment whereby technology vendors and regulators can create tools that both mimic each other whilst being able to communicate and interact seamlessly. The coherence, standardization and use of platforms, architecture and technology stacks between financial services, FinTech (RegTech), and regulators would be a fundamental basis to the emergence of healthy digital finance eco-systems.

There is a need to regulate the regulation of the generators and users of technologies employed in financial services. For example, the Open Banking initiative which allows third parties to access customer's data from banks once obtaining authorisation. This initiative requires that regulations are implemented so that this access is secure and only used for the reasons specified by the customer and during the specified period. The emergence of regulatory technology (RegTech) that can scan the space of open access and users of data to identify breaches of regulation is an interesting conversation that is only going to be facilitated by a coherent, secure and standardized data system between the generator and the user of FinTech. Such efficiencies between regulatory tools can equally grow around technologies such as DLT, Federated machine learning and agent-based models, amongst others. Given the complexity of digital finance eco-systems and their interplay across borders, there is an argument for the standardization of technologies and architecture design as generative of productivity gains - again with the implication of creating a level playing field between technology vendors, the regulated market and regulators.

7. Conclusion

With regard to the main results obtained, it seems evident that agile and accurate supervisory systems can be built to keep track of the fast-evolving financial phenomena. It is also shown that the implementation of such an uptodate information system allows to guide the design of proper counter-cyclical measures and to check in progress their overall effectiveness. Actually, the financial innovation and the entering into force of RegTech, together with their benchmarking implications, will play during the next few years a significant role in the reshaping of informatization prima facie models applicable to the financial regulatory framework.

Unfortunately, the rising deployment of financial derivatives is seen to conflict often with the goal of fostering the internalization of credit assessment through market signals. In general, a lower ability to perform informed choices on financial assets would also derive from an increasing intermediation upon structured securities. Some of the considered policy implications disclose new challenges to the monetary authorities facing this scenario, which range from the need of providing a wider investors protection to a likely revisitation of those concepts about the operation of large credits which underlie the acts of prudential supervision. All those factors are taken into account, when defining most. The second set of considered

policy implications is reflected on the more recent process of "perturbation" shouted by the financial markets and shows that implementation of RegTech may be paramount whenever a financial crisis originates in market distortions.

7.1. Future Trends

There are two likely scenarios for the future development of the new global digital economy in the financial sector. The first is a better scenario, with benefits for competition, innovation and efficiency. The second is a less positive future, dominated by a few global techs.

The digital economy promises to revolutionise the global economy, breaking down barriers to business transactions and yielding vast volumes of data on transactions and behaviours. At the same time, the banking system is going through a parallel revolution, integrating the new architecture of banking and surveillance. What implications do these changes have for financial regulation? This study investigates this question by analyzing an instance of the mutual transformation of economic practice and economic representation. It examines the emergence of financial economics as a field of expertise and policy relevance in the US in the 1950s and 1960s and its subsequent uses in developing monetary policy.

Automated trading and its development on Wall Street become the entry point for the blending of economics, business practice and policy. This study sheds light on that conjunction by revealing how the representation of the economy implied by financial economics as a field came into existence via a messy process, at the crossroads of different strands of economic reasoning. However, it also suggests that an acceptable representation of the economy could only be a partial one, and that the attempts to formalize the complex dynamics of regulating the various financial actors in a closed model were doomed to fail. The analysis of the transfer of ideas shows, therefore, that despite sustained efforts, financial economics could neither produce knowledge actionable for a comprehensive regulation of finance nor allow for a successful re-organizations of the monetary policy apparatus.

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