COMPUTATIONAL MODELLING APPROACHES TO FINTECH INNOVATION

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Computational Modelling Approaches to FinTech Innovation

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FOREWORD

The Book Titled **"Computational Modelling Approaches to FinTech Innovation"** is for AI experts, fintech visionaries, entrepreneurs, researchers, and policymakers, which provides unique insights into the field of finance exploring the impact of AI and deep learning on the financial sector. Additionally, the book provides the consideration and impact of technologies on the lives of all stakeholders including employees, customers, government, and policymakers.

This book would be beneficial for researchers, scientists, engineers and BBA-MBA professionals (Fintech), Advanced students (MBA, PhDs, Postdocs) of Fintech, and for AI&ML applications. It will be relevant for new generation readers of any domain as it is multidisciplinary, includes sustainability, and comes with supplementary material, case studies, appendices, problems and solutions, self-testing, summaries, tables, glossary, *etc.*

Christo Ananth
Samarkand State University, Uzbekistan

PREFACE

Computational Modelling Applications have brought revolution in the field of finance and this book explores the market dynamics by gaining insights from experts in the field of finance, investment, computer technology, and entrepreneurship.

This book provides a pragmatic overview of various computer technologies that have made drastic advances in the field of finance resulting in reduced cost, automation, transparency, and reduced fraud in the field of financial services. Fintech has resulted in better customer experience.

The above book talks about computer technology and finance. The book considers the scenarios with technology augmentations of AI/ML in financial services. Few chapters also include case studies related to the above-mentioned topics and provide readers with a glimpse of how beneficial it would be to integrate technology into financial services to make them more customer-friendly and safe additionally making it profitable for businesses.

This book discusses computational modeling approaches such as resource-based view, agent-based modelling, system dynamics, machine learning, network analysis, data granular approach, credit scoring models, logistic regression, Monte Carlo simulations, machine learning algorithms, Value at Risk (VaR) models, stress testing, scenario analysis, simulation models, scenario analysis, fault tree analysis, machine learning for anomaly detection, liquidity gap analysis, cash flow forecasting, anomaly detection algorithms, machine learning models, statistical analysis, computational risk modeling, ResNet-50, and CoViaR.

This book comprises 17 chapters and covers topics like socio-cognitive approach, greenwashing, predictive analytics in insurance, portfolio risk, financial risk management, behavioral finance, data granular approach, green bond market, green finance, green securities market, sustainable financing, and sustainable banking goals.

Chapter 1 explores interrelations with trade, industrialization, capital formation, and environmental regulations to establish their overall effect on sustainable finance—in particular, how FinTech works in resource management optimization through human capital.

Chapter 2 investigates the complexities of green security issuance, the difficulties presented by unfriendly choices, the essential drivers of market extension, and the developing techniques utilized by financial backers.

Chapter 3 establishes the relation between these two aspects *i.e*. computational modelling approaches to fintech and financial inclusion, and also aims to identify mediating variables.

Chapter 4 develops a socio-cognitive roadmap that mitigates information asymmetry and greenwashing, thereby improving the efficacy of sustainable finance.

Chapter 5 has three main sections. An overview of the green bond market, discussing various types along with their issuance levels and geographical distribution, is discussed in the first section. The second section discusses the reasons for the green bond market growth and the challenges that impede its development. The final section discusses specific computational models applied to green bonds in detail.

Chapter 7 explores the Resource Based View (RBV) theory and draws findings from a

qualitative case-based approach to present the implications of predictive analytics in the insurance industry.

Chapter 8 proposes a hybrid risk predictive model. It uses a combination of ResNet-50 (to analyze and quantify spatial image data) and CoViaR (risk prediction) models.

Chapter 9 utilises computational approaches to evaluate how fintech solutions influence women's financial autonomy in banking.

Chapter 10 explores the computational modeling approaches for sustainable finance like blockchain, *etc*.

Chapter 11 discusses the integration of machine learning, network analysis, and other techniques to enhance risk identification, scenario analysis and decision support in financial institutions.

Chapter 12 examines the motivation and strategies essential for supporting and developing the FinTech sector in India.

Chapter 13 explores the link between behavioural finance characteristics and investing choices, specifically examining the role that is gender-specific.

Chapter 14 contributes to the growing body of research on green finance and sustainable investing, providing valuable insights into the midterm risk-return dynamics of green bonds.

Chapter 15 contributes to sustainable HR by establishing that sustainability can be driven by technology, values, and engagement of the employees.

Chapter 16 discusses green energy, and energy financing as a lot of concerns related to climate change are coming to light.

Chapter 17 discusses the significance of hearty norms and administrative structures to keep up with market believability and advance certified ecological effects through green securities.

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CHAPTER 1

Expanding the Horizon of Green Finance: A Computational Modelling Approach to FinTech and Sustainable Development

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Abstract: While green finance and FinTech are essential in incentivizing sustainable development, their interrelations with trade, industrialization, capital formation, and environmental regulations have been relatively unexplored. This chapter explores these relationships to establish their overall effect on sustainable finance— particularly how FinTech works in resource management optimization through human capital. The study embeds different economic and regulatory factors in analyzing green finances and FinTech. For example, trade policy affects the flows of sustainable investment, industrialization patterns, the demand for green technologies, capital formation processes, funding availability for sustainable projects, and environmental rules, setting guideposts on green finance. That broad approach will allow for a nuanced understanding of how different elements influence sustainable financing. The present study focuses on the role of FinTech within the context of resource management. Innovations like blockchain, artificial intelligence, and big data analytics assure efficiency, transparency, and inclusiveness within the financial sector. The chapter presents the entire discussion on how the concerns interlink with FinTech and green finance projects. This study draws from various literature that has developed cumulative effects on the debates to fill research gaps toward sustainability outcomes. In particular, these findings pertain to emerging economies from long-term growth. The chapter thus provides insights and recommendations for policymakers, financial institutions, and stakeholders concerning the opportunities and challenges of using FinTech for sustainable development. The present research enhances existing knowledge on sustainable finance.

Keywords: Artificial intelligence, Big data, Blockchain, Computational modelling, Environmental regulations, Financial sector, Financial system, FinTech, Green finance, Green projects, Green technologies.

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INTRODUCTION

The relationship among FinTech, green finance, and environmental sustainability has been one of the fast-emerging topics in recent research and practice. While individual effects of FinTech and green finance on the environment have been well understood, further research is needed to elucidate how these fields interact with other variables relevant to influence trade, industrialization, capital formation, and environmental regulations. This chapter fills this gap by discussing how these additional variables could be fitted into FinTech and green finance research.

FinTech has made inroads into the heart of traditional financial systems and steered transparency and efficiencies that can significantly aid sustainable finance. Chen *et al.* [1] and Manta *et al.* [2] have investigated FinTech solutions, including blockchain-based technology, big data analytics, and artificial intelligence, that might help develop accountability, streamline financial flows, and better manage resources. The larger-scale effects of these developments remain rather unclear. This chapter aims to provide a comprehensive assessment of the complex consequences of sustainable finance in the presence of factors like trade, industrialization, the process of capital formation, and environmental restrictions. Thus, after synthesizing the extant literature, this versatile view would help explain how these elements interact to affect the efficacy and impact of green financing efforts. Our study is premised on the fact that sustainable development requires a holistic approach since, by nature, it is complex [3, 4]. Additional dimensions in FinTech and green finance research are required to find effective strategies that will drive progress [5]. This study will particularly seek to find these relations and synergies between these elements with insights that would lead to future research, formulation of public policy, and practical implications.

Therefore, this chapter addresses knowledge gaps and provides insightful views on how FinTech can drive sustainable development in varied economic contexts. Its further objective is to push the debate on sustainable development and to build financial systems that are more shock-resistant and more inclusive by drawing prominence to the relationships among green finance, FinTech, and other key variables [6, 7].

THEORETICAL UNDERPINNINGS FOR GREEN FINANCE AND SUSTAINABLE DEVELOPMENT

According to the literature review, several theoretical frameworks support the convergence of green finance and FinTech in explaining their respective roles and possible consequences for sustainable development. This chapter will assess three

theoretical perspectives: institutional theory, financial innovation theory, and sustainable development theory.

Sustainable Development Theory

Sustainable development theory is a clear expression of the fact that there should be no trade-offs between social and environmental welfare for the benefit of economic growth. Instead, they emphasize the interconnectedness amongst economic, social, and ecological dimensions for long-term success. The World Commission on Environment and Development (WCED) [8] defined sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs".

The prime objective of green finance as a sustainable development tool is to channel finances towards environmentally friendly projects and green innovations that help slow down global warming and maintain ecological balance. Green finance refers to the "provision of financial services supporting the flow of financial resources towards environmentally friendly projects like sustainable agriculture, energy efficiency, and renewable energy" [9].

Sustainable development theory justifies and underlines the intrinsic role of finance in the transition toward low-carbon economic development by emphasizing the integration of sustainability concepts into financial decision-making processes. Green finance, therefore, strives to bridge this gap to achieve climate objectives and sustainable development goals. The UN estimated that it would take $2.5 trillion annually from developing countries to achieve the SDGs by 2030, thus indicating a financial gap of trillions of dollars. Therefore, green finance has become very important for mobilizing investments in sustainable development in technology, underlying infrastructure, and innovation.

The theory of sustainable development emphasizes triple-bottom-line accounting, where the impact of a financial decision on society, the environment, and the whole economy is considered. A holistic approach ensures that financial operations have positive implications for each of the three dimensions of sustainability. In view of social and environmental concerns, long-term sustainability and resilience can only be attained by integrating them into the financial decision-making process.

Financial Innovation Theory

Financial innovation theory dwells on the study of how new financial instruments, technology, and institutions emerge, as well as their consequences and implications for the market. According to Tufano [10], financial innovations

CHAPTER 2

The Green Security Market: Issuance, Unfavorable Determination, Main thrusts, and Financial backer Techniques

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Abstract: The green security market has seen critical development because of an uplifted consciousness of natural maintainability and the squeezing need to battle environmental change. This chapter investigates the complexities of green security issuance, the difficulties presented by unfriendly choices, the essential drivers of market extension, and the developing techniques utilized by financial backers. Backers utilize green securities to finance ecologically valuable undertakings while confronting examinations concerning the validity of their green cases. Unfavorable choice remains a huge issue, with the potential for 'greenwashing' compromising business sector respectability. The review distinguishes administrative help, financial backer interest for practical speculations, and monetary advantages of green bonds as key development drivers. Financial backer techniques uncover a pattern toward the thorough expected level of efforts and an inclination for straightforwardness and confirmed green qualifications. The discoveries highlight the significance of hearty norms and administrative structures to keep up with market believability and advance certified ecological effects through green securities. To deepen the analysis, computational modeling approaches can be integrated, offering insights into market dynamics, investor behavior, and the effectiveness of regulatory measures. Techniques such as agent-based modeling, network analysis, machine learning, and scenario analysis can simulate complex market interactions, predict trends, and assess risks, ultimately contributing to the sustainable growth of the green security market. In this chapter, scenario analysis is used to determine the green security market.

Keywords: Backers, Bonds, Case, Climate, Greenwashing, India, Issuance, Market, World Bank.

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Sonal Trivedi, Balamurugan Balusamy & Prasad Begde (Eds.)

INTRODUCTION

Lately, the worldwide monetary scene has seen a huge shift toward maintainability, driven by mounting worries over environmental change and natural corruption. In this specific circumstance, green bonds have arisen as a crucial monetary instrument for funding projects with positive natural effects. These bonds are reserved for interests in environmentally friendly power, energy proficiency, practical foundation, and other ecologically advantageous drives [1].

As per the Environment Bonds Drive, green bonds are characterized as “fixed pay, fluid monetary instruments devoted only to environmental change arrangements and activities, including alleviation and transformation” [2]. They address a combination of monetary development and natural stewardship, interesting to financial backers looking to adjust their portfolios to manageability objectives while creating returns. The significance of green bonds lies in their capability to assemble capital toward an economic turn of events [3]. To deepen the analysis, computational modeling approaches can be integrated, offering insights into market dynamics, investor behavior, and the effectiveness of regulatory measures. Techniques such as agent-based modeling, network analysis, machine learning, and scenario analysis can simulate complex market interactions, predict trends, and assess risks, ultimately contributing to the sustainable growth of the green security market. As legislatures, organizations, and monetary foundations progressively perceive the earnestness of changing to a low-carbon economy, green securities offer an instrument to support projects that moderate ozone-depleting substance emanations, monitor regular assets, and improve versatility to environmental influences [4].

Administrative Structure and Guidelines

Key to the validity of green bonds are the administrative structures and guidelines that administer their issuance and utilization of continue. The Green Security Standards (GBP) laid out by the Global Capital Market Affiliation give intentional rules to guarantors to guarantee straightforwardness, divulgence, and arrangement with natural targets. Additionally, the Environment Bonds Norms set models for ensuring green bonds, requiring autonomous confirmation of natural effects to forestall 'greenwashing' — the distortion of ecological advantages [5].

Market Development and Extension

The idea of green bonds started in 2007 with the European Speculation Bank's issuance, denoting a critical second in economic money. From that point forward, the market has extended all around the world, driven by expanding financial backer interest in socially capable speculations [6]. The Green Bond Standards

(GBP) and Environment Bonds Principles have given systems to confirm and normalize green bond issuance, upgrading straightforwardness and validity [7].

The green security market has encountered remarkable development since its beginning, mirroring a worldwide change in outlook towards supportable money. In 2021 alone, worldwide green bond issuance outperformed $300 billion, denoting a huge achievement in supportable speculation [8]. Fig. (**1**) outlines the development direction of worldwide green security issuance throughout the last ten years, featuring a consistent increment driven by administrative help, financial backer interest, and extending market mindfulness. Since 2008, the World Bank has issued nearly USD 19 billion equivalent in Green Bonds through more than 220 bonds in 28 monetary forms/currencies [9].

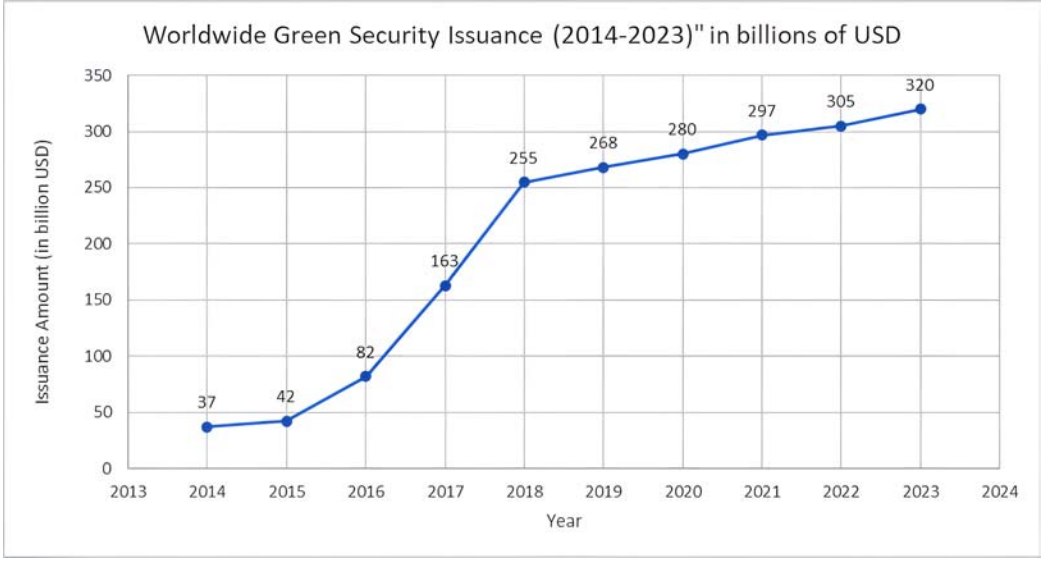

Fig. (1). Development Direction of Worldwide Green Security Issuance (2014-2023). Source: www.worldbank.com

Patterns and Information

The information uncovers a sharp vertical pattern in green bond issuance, with remarkable spikes as of late. This development is credited to a few variables, including administrative motivations, for example, charge exclusions and sponsorships for green tasks, which boost guarantors to take advantage of the green security market. Besides, institutional financial backers progressively coordinate environmental, social, and governance (ESG) models into their venture systems, driving interest in green bonds as a reasonable speculation choice [10].

CHAPTER 3

Exploring How Computational Modelling Approaches to Fintech Innovations Drive Financial Inclusion: the Need for Sustainable Financial Development

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Abstract: Over the past several years, improvements in computational modelling approaches to fintech have had a notable influence and are valuable to the advancement of financial development. Decreased levels of financial inclusion in remote areas of India instigate the penetration of computational modelling approaches to fintech in those areas. Financial inclusion can be used to measure sustainable financial development by showing the areas that demand attention and improvement to provide better financial services. Ease in the use of finance in rural regions can be attained by introducing technology in the field of finance in the present scenario. Financial growth and development can be measured by evaluating financial inclusion; thus, there is a need for the study to be conducted to establish the relation between these two aspects, *i.e*., computer-based modelling approaches to fintech and financial inclusion, and also to identify mediating variables. This explorative study is conducted in the northern rural region by collecting the data of 275 respondents with a stratified random sampling method; the study aims to find the relationship between computational modelling approaches to fintech and financial inclusion, the effect of computational modelling approaches to fintech on variables - economic cost, level of customer trust on computational modelling approaches to fintech firm, easy usage of the service. These are mediating variables used to find the contribution of computational modelling approaches to fintech in enhancing financial inclusion. SPSS is used to analyse the data by applying multiple regression.

Inducing computational modelling approaches to fintech in rural areas to measure usability, trust level, and perception regarding cost is notably counted in evaluating the results from the respondents. Results show a critical perception of rural regions towards computational modelling approaches to fintech adoption.

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Keywords: Banks, Computational modelling approaches, Customer trust, Digital financial services, Digital payment, Economic cost, Financial inclusion, Financial products.

INTRODUCTION

Financial Inclusion in India

Specifically in rural regions, financial inclusion, *i.e.*, accessibility, affordability, and awareness of financial dealings, is crucial for promoting economic development and alleviating poverty. It ensures that businesses and individuals can access affordable and convenient financial products and services. Despite India's initiative to expand access to financial services, many people in rural areas still face financial exclusion, *i.e.*, less accessibility, affordability, and awareness of financial dealings. As stated in a study, many rural Indians do not have their bank accounts opened. The study shows that approximately 190 million individuals fall into this number and are still in the same position. Access to formal financial services hinders economic development and enhances poverty and other economic and social sufferings [1].

The enhancement of financial technology or computational modelling approaches to fintech has proven effective in handling these issues. Technologies such as digital payment systems, blockchain technology, mobile banking, and online banking are a few areas of innovation within the computational modelling approaches to fintech. These can reduce economic transaction costs, improve access to financial services, and allow for online lending of funds [2]. Computational modelling approaches to fintech solutions can effectively cater to individuals in need of mobile banking access by offering a wide range of financial services and products.

The constant use of mobile phones in rural areas has led to severe good impacts of computational modelling approaches to fintech on financial inclusion, with India being a crucial mover of this trend. The money used in rural areas is a highly significant change due to technological advancements and the Internet. According to the Telecom Regulatory Authority of India, there has been a high rise in mobile phone users in remote India, with over 500 million individuals now having mobile phones. It indicates a significant increase in mobile phone usage in the country. Computational modelling approaches to fintech solutions can operate on any platform due to the high mobile connectivity. By uplifting financial technology, rural households can have a broader range of financial services, which leads to cost savings [3].

Financial inclusion has seen a proper boost due to government plans such as the Pradhan Mantri Jan Dhan Yojana (PMJDY), which actively promotes the opening of bank accounts among the population. As of 2020, a high number of bank accounts have been opened under PMJDY, with most of these in rural areas [4]. Computational modelling approaches to fintech companies are addressing the challenge of tailored financial products, such as microloans and insurance services, to meet the uniqueness of rural customers.

Financial Challenges in India

Rural Areas

India's rural communities tackle various financial challenges to create economic progress and reduce poverty. Rural region populations continue to tackle challenges that affect their financial aspect despite the efforts made by various governmental and non-governmental associations. Developing solutions promotes financial inclusion and economic progress in these regions, and we deeply understand the challenges and problems.

One of the financial challenges that rural India is dealing with is the absence of banking services. The problem faced by individuals living in remote areas dealing with financial services such as insurance, loans, and savings accounts is due to the few bank branches in the regions. Many individuals are bound to focus on informal banking systems due to less access, which mainly results in high interest rates and a lack of security.

The lack of financial literacy in rural areas must be checked and solved. Individuals who want to make informal choices regarding investing, borrowing, and saving should have a better knowledge of financial dealings and services [5]. Research reveals that the not-so-good levels of financial literacy in rural India, compared to cities, lack the ability of rural region Indians to use the services entirely. This information gap could lead to a risk of financial mismanagement and exploitation [6].

In addition, the financial challenge is essential in rural areas where income instability is always due to dependency on agriculture, cheap labour, and the market. Agricultural incomes can vary throughout the year, affected by weather conditions and market prices [7]. These changes form challenges for rural houses regarding long-term financial planning, constant savings, and loan repayment. As a result, their creditworthiness and ability to use financial services are affected. Financial inclusion exhibits a difference between genders. Women in rural areas have to handle challenges in accessing financial resources and services, which can differ from men. A study revealed that certain factors, such as women's

CHAPTER 4

The Future of Finance: A Socio-Cognitive Guide to Integrating Sustainability in Financial Decision-Making

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Abstract: The primary purpose of this study is to develop a socio-cognitive roadmap that mitigates information asymmetry and greenwashing, thereby improving the efficacy of sustainable finance. It aims to provide a theoretical and practical foundation for integrating sustainability into financial decision-making. The target audience includes individuals from the industry. The findings are particularly relevant for those seeking to enhance the transparency and integrity of sustainable finance for better performance. This study explores the efficacy of sustainable finance, addressing information asymmetry and greenwashing mitigation through technological disruption and socio-cognitive integration. Market fictions are examined using a sample of 150 participants selected by stratified random sampling. The study finds that technological disruption plays a dual role in sustainable finance: while it can exacerbate information asymmetry, it also offers tools for mitigating greenwashing. Socio-cognitive integration is a critical factor in enhancing the efficacy of sustainable finance, promoting transparency, and fostering trust among stakeholders. Integrating sustainability into financial decision-making requires addressing information asymmetry and greenwashing through a socio-cognitive approach. Technological innovations should be leveraged to support transparency and stakeholder engagement. The proposed roadmap offers a strategic direction for enhancing sustainable finance practices. This study provides valuable insights for financial professionals and policymakers aiming to promote sustainable finance. It underscores the importance of transparency and socio-cognitive integration in mitigating greenwashing and reducing information asymmetry. The findings suggest that embracing technological disruption can enhance the efficacy of sustainable finance initiatives.

Keywords: Cognitive approach, Domputational modelling, Decision making, Finance, Financial innovation, Financial integration, Financial sector, Financial system, Green finance, Greenwashing.

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Sonal Trivedi, Balamurugan Balusamy & Prasad Begde (Eds.)

INTRODUCTION

The future of finance is increasingly intertwined with sustainability, necessitating a socio-cognitive roadmap to integrate sustainability into financial decision-making. This study examines the role of information asymmetry in hindering the efficacy of sustainable finance and explores strategies for greenwashing mitigation. By analysing market fiction and the impact of technological disruption, the research aims to develop a comprehensive understanding of how socio-cognitive integration can enhance sustainable finance practices.

Sustainable finance is crucial for achieving long-term economic stability and environmental protection. However, information asymmetry and greenwashing challenge the credibility and effectiveness of sustainable finance initiatives. This study addresses these issues by proposing a socio-cognitive framework to integrate sustainability into financial decision-making processes.

Over the last decades, with increasing evidence of environmental and social externalities as relevant determinants to long-term value-creation, incorporating sustainability into financial decision-making has emerged as a new paradigmatic development in modern finance. As the latest mobile financial era emerges, investors will increasingly struggle to fit sustainability into old-school metrics and regulations. This research investigates the socio-cognitive determinants of this integration to provide insights into how cognitive biases, social influences, and information asymmetries affect financial decision-making about sustainability. Populism (and the anger that drives it) may complicate things, but it also provides an opportunity amidst this for advocates looking to reintegrate sustainability into financial decision-making. On the one hand, populist pressures may drive more rapid adoption of sustainable practices as environmental and social issues are elevated in prioritization. A populistic approach, on the other hand, can also result in short-term policies influenced by political elections rather than sustainability. This article proposes that it is essential to understand the relationship between populist speech and investor behavior when designing financial strategies, which can contribute to sustainability (more broadly) under a socio-cognitive view. Studying the impact of populism on financial decision-making processes and sustainability integration is key to identifying opportunities for enhancing sustainable finance by building more effective, responsive, and adaptable strategies in a populist-driven world [1]. The main goal of the present paper was to determine if and how ideation socio-cognitive processes affect decision-making concerning task performance in high accountability pressured environments. The paper explores the interplay of cognitive diversity with social dynamics and external expectations to impact board effectiveness in yielding organizational outcomes. Examining how boards manage complex decision-making situations,

the research presents implications for better governance mechanisms and practices around making decisions and ways to improve board performance when critical issues are at play [2]. The focus is on understanding how technology and socio-cognitive frameworks can be integrated to enhance transparency, mitigate greenwashing, and address market fiction. Ultimately, this exploration offers actionable insights for investors, policymakers, and financial institutions, helping them navigate the complex terrain of sustainable finance and contribute to a more resilient and equitable financial future.

COMPUTATIONAL MODELLING APPROACHES IN SUSTAINABLE FINANCIAL DECISION-MAKING

Overview of Computational Modelling Approaches

Computational modelling methods are vital to harmonizing values across financial decision-making with sustainability. These models can also simulate market dynamics, predict investors' behaviour, or assess the influence on environmental and social governance (ESG) aspects by gaining insights to fight information asymmetry, greenwashing, and valuable fiction in markets. They improve socio-cognitive aggregation, helping sustainable finance strategies in the quickly veering landscape of tech disruption.

To understand how various sustainability factors may affect financial markets and investor behaviour, computational modelling methods have become important in making investment decisions. The models allow for analysing large datasets with broad variables and testing circumstances that some traditional financial models may disregard.

Network Analysis

Network analysis sheds light on these structural relationships and the connectivity within financial markets, with an emphasis on information dissemination and investor dependence. It is also useful in sustainable finance, where issues of information asymmetry and greenwashing are common.

Network analysis involves mapping connections among investors, firms, or other stakeholders and helps identify the key nodes of influence (and thereby potential vulnerability) within extremist finance. The method may also reveal, for example, a fuller picture of how socially transmitted sustainability investment practices affect investor behaviour and fuel-specific market trends. This was illustrated by Brummitt *et al.* (2013) [3] who analysed the systemic risk of sustainability-related shocks *via* network analysis of financial markets.

CHAPTER 5

Computation Modeling Approaches for Green Bonds Pricing and Market Development

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Abstract: Computational modeling approaches evolved due to financial technology innovation within the green bond market. Green bonds are debt products that finance environmental and sustainability projects. Their global popularity and increasing investor interest make investors use them to align their portfolios with their sustainability goals. This chapter has three main sections. An overview of the green bond market, discussing various types along with their issuance levels and geographical distribution, is discussed in the first section. The second section discusses the reasons for the green bond market growth and the challenges that impede its development. The final section discusses specific computational models applied to green bonds in detail. These include financial pricing models, life cycle assessments, risk assessment models, scenario analysis, portfolio optimization models, agent-based modeling, and network analysis. The chapter argues that as the market evolves, computational models will play an increasingly crucial role in pricing, impact assessment, and performance tracking, ultimately contributing to the financial sustainability of green investments. All financial services industry stakeholders benefit from inputs and insights drawn from this chapter on how computational models provide insights into green bonds.

Keywords: Bond pricing, Computational modeling, Financial pricing models, Financial services, Financial technology, Green bond market, Green investments, Impact assessment, Sustainability, Technology.

INTRODUCTION

Green bonds are becoming popular financial instruments, considering the positive environmental impact that they can bring. Institutions and governments globally

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are using them to fund sustainable projects and to accelerate low-carbon transition. With increasing issuers and choices of green bond selection available, there is an increased need for investors to take advantage of the investment opportunities that they provide. Consequently, several computational models that have been applied to traditional financial instruments are now extended to work on green bonds for applications like bond pricing, risk assessment, and portfolio management.

This chapter has three major sections. The first section introduces green bonds, outlining the market, the use of proceeds, geographical distribution, and its evolution. The second section discusses critical factors driving green bond market growth and the barriers hampering market development. The third section focuses on computational models such as financial pricing models, life cycle assessments, risk assessment models, scenario analysis, portfolio optimization models, agent-based modeling, and network analysis.

GREEN BOND MARKET – AN OVERVIEW

Green bonds are fixed-income products. They are used by various stakeholders such as governments [1], municipalities and local governments [2], corporations [3], and other organizations to finance climate change and environmental projects and initiatives. Green bonds are innovative financing options for projects promoting green economy adoption. The term "green finance" began in the 2010s and was described as a type of debt security issued to raise capital for sustainable and waste management practices. The critical feature of the green bond is that whatever funds generated through green bonds are allocated explicitly to clean transportation initiatives, energy efficiency improvements, sustainable land use, and other environmentally beneficial endeavors to develop renewable energy and promote sustainability projects will be financed. However, these bonds suffer from various impediments [4] and must satisfy the additional transparency and reporting requirements to ensure the funds are used for their intended green purposes. These bonds present a chance to match monetary gains with long-term benefits [5].

Growth and Expansion

Green bonds are vital in raising funds since implementing sustainable practices is inevitable globally. Therefore, green bonds have seen significant growth and evolving trends over the past decade, reflecting the increasing focus on sustainable finance and responsible investing. Investor demand, government backing, and international climate initiatives are all helping [6]. The market's evolution and diversification indicate that green bonds are essential for moving to a sustainable economy.

Increase in Issuance Volume

A rapid increase in green bond issuance volume shows an improving trend in sustainable finance. The European Investment Bank (EIB), in July 2007, was the first to issue a green bond called "Climate Awareness Bonds." These bonds are designed to finance renewable energy and energy efficiency projects. Only $37 billion worth of green bonds were issued worldwide in 2014. However, by 2021, that number had grown to $633 billion. In 2022 and 2023, the amount of green bonds issued decreased slightly to $487 billion and $620 billion, respectively. The cumulative issuance of these bonds crossed $1 trillion, marking a significant milestone in sustainable finance.

Diverse Range of Issuers

Only multilateral development banks initially started issuing green bonds to support sustainable project financing. The markets were diversified with the entry of various issuers raising funds through different instruments. The International Capital Market Association (ICMA) established the Green Bond Principles (GBP) to provide procedures for green bond issuance, promote transparency, and protect the integrity of the green bond market. Climate Bonds Standard (CBI) was tasked with certifying whether green bonds meet stringent environmental standards.

Geographical Expansion

There is a significant geographical contribution to green bond markets from the EU and North America, and these two regions have historically led the market in green bond issuances. Subsequently, there was a rapid increase in green bond markets from emerging markets like Latin America, Africa, and Southeast Asia, contributing towards global diversification of the green bond market. The USA and China are the largest issuers of green bonds globally, while Germany and France lead among EU countries.

Supportive Policies and Regulatory Frameworks

The governments have taken some initiatives to promote investments in green bonds globally. These are the policies to encourage and support green bond issuance, including tax incentives, subsidies, and flexible regulatory frameworks. The European Green Deal encourages green finance, including developing the EU Green Bond standard to ensure high-quality green bonds. The Sustainable Finance Disclosure Regulation (SFDR) promotes sustainability risks and impacts disclosure. Such disclosures encourage transparency and responsible green bond issuances [7]. The Securities and Exchanges Board of India (SEBI) has been issuing guidelines for the issue and listing of green bonds [8].

CHAPTER 6

Implications of Computational Modelling Approaches and Predictive Analytics in Insurance Companies: Case-Based Evidence

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Abstract: Effective risk assessment and management have become paramount for financial service companies' sustainable growth and profitability in today's digital world. Predictive analytics is a valuable technique in the risk evaluation process of insurance companies. This chapter explores how predictive analytics revolutionizes risk assessment and management with insurance companies. Predictive analytics enables insurance companies to analyze historical data to forecast future events, identify claim patterns, and assess potential risks. With advanced techniques such as artificial intelligence and machine learning, insurers can mitigate potential financial losses by analyzing demographic trends and customer behavior in insurance claims. Predictive analytics is also helpful in detecting fraud and prevents insurance companies and insurance policyholders from fraudulent activities. This facilitates the insurers' adoption of risk management strategies to enhance operational efficiency with the minimum possible losses. Hence, predictive analytics helps foster the sustainable growth of insurers by managing the vast data of policyholders. In this chapter, we apply the Resource View (RBV) theory and draw findings from a qualitative case-based approach to present the implications of predictive analytics in the insurance industry.

Keywords: Artificial intelligence, Customer behavior, Financial sector, Machine learning, Innovative technology, Insurance companies, Operational efficiency, Policyholder, Predictive analytics, Resource Based View (RBV), Risk assessment, Sustainable growth.

INTRODUCTION

Insurance is essential for protection against unanticipated risks in a society where uncertainty is increasing. People and businesses have looked up to the insurance

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industry for millennia as a pillar to shield them from the financial fallout from unanticipated events. Nevertheless, insurers' risk assessment and management techniques must adapt to the changing global landscape. Predictive analytics is one innovative technology that is revolutionizing the core principles of insurance. The era of static risk assessments based on broad demographics and rates that apply to everyone has long since passed. In this age of data-driven decision-making, predictive analytics is ushering in a new era for the insurance industry. Early fraud detection, customized pricing, and a thorough comprehension of each individual's risk profile will define this new era. Insurance businesses use analytics [1] to sort through IoT-enabled data and understand customers' needs, preferences, and suggestions. Predictive analytics is a data-driven methodology that evaluates historical data using statistical and machine learning techniques to provide well-informed projections regarding risk, pricing, underwriting, claims, and consumer behavior [2, 3]. The goal is to improve insurance operations and decision-making.

Predictive analytics models are designed to analyze historical data, spot patterns, and trends, and use that information to anticipate future trends. Standard predictive analytics models include time series, clustering, and classification methods. By using predictive analytics models, businesses may more accurately identify and assess potential risks, develop and implement effective risk-reduction strategies, and ultimately make better decisions overall [4]. Insurers may build machine learning models that analyze customer behavior and anticipate the likelihood of future churn by utilizing predictive analytics [5]. Using this information, retention teams can reach out to these clients and offer them enticing renewal incentives. Today's organizations store most of their data in several data repositories located throughout the company. This data mainly consists of log files, photos, and video. Data scientists employ machine learning and deep learning algorithms to identify patterns in the data and forecast future occurrences to derive valuable insights from the data [6, 7]. Therefore, predictive analytics have significant implications for the insurance sector. However, the impact of predictive analytics on insurance has yet to be summarized in the literature. In this chapter, we use a qualitative case-based approach to address the applications of predictive analytics in the insurance industry to address this gap. Through the lens of a rigorous literature review and insights from the Resource Based View (RBV) theory [8], we analyze the case studies to present findings that explain the applications of a predictive analytics model in insurance. Our findings can guide scholars in detailing the predictive models in the insurance industry. The insights from HDFC Agro and Reliance General Insurance case studies offer practical implications.

PREDICTIVE MODELS USED IN INSURANCE

Predictive analytics models are designed to analyze historical data, spot patterns, and trends, and use that information to anticipate future trends. Predictive analytics models include time series, clustering, and classification [9 - 11]. The classification models describe relationships within a given dataset by classifying data based on historical data. A study suggests that this model can be employed for consumer or prospect segmentation purposes [12]. Alternatively, it can also be used to answer queries with binary values, like true or false or yes or no. Two typical use cases for this are credit risk assessment and fraud detection. Clustering models are yet another well-liked model [13, 14]. When a large amount of data is sorted based on similar characteristics, it is employed [15, 16]. For example, an e-commerce website can use the model to develop marketing strategies for each client group, which separates it into groups based on comparable characteristics [17 - 19]. Insurance companies also employ time series models for predictive analytics. Time series models employ a range of data inputs at a given time interval, such as weekly, monthly, and so on [20 - 22]. These predictive analytics models empower insurers to apply the best-suited model to increase their insurance business [23, 24]. They gain more clients due to the process and increase insurer satisfaction and trust. Insurers can utilize data and predictive analytics to identify events, information, and other factors that may impact a claim's result [25 - 27]. This can reduce risks for the claims department and expedite the procedure [28, 29], which is used to take weeks or even months. Based on this discussion, the key uses of predictive models in insurance companies are presented in Fig. (**1**).

RISK ASSESSMENT AND MANAGEMENT IN INSURANCE

Every industry has become part of digitalization and faces customer risk issues in banking transactions, insurance, and other financial services [30, 31]. Therefore, companies must apply techniques for assessing risk. The future expected risk can be evaluated with the help of historical data based on demographic data [32] and insurance claims. This historical data can be extracted from social media and sensor networks. Insurance companies use predictive analytics to evaluate risk in insurance services. This approach uses artificial intelligence, machine learning, and advanced statistical techniques to estimate future events by analyzing data from the past and present; for example, financial institutions utilize predictive analytics to assess market trends and investment risks. Machine learning algorithms are increasingly used in risk assessment because they can identify complex patterns and relationships in data [33, 34]. As a result, risk assessment in

CHAPTER 7

Role of AI in Computational Risk Modeling of Financial Stability and Portfolio Risk: A New Perspective

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Abstract: The need to assess climate change-related risks and their impact on the financial stability of banks is imperative. Innovations in technology, especially AI and ML algorithms, have improved the efficiency and accuracy of risk analysis models. The obstacle for banks is assessing the climate risk exposure due to their lending portfolio. The climate data are uncertain and unavailable, and the granularity of the data is questionable. To overcome these issues, in this chapter, a hybrid risk predictive model is proposed. It uses a combination of ResNet-50 (to analyze and quantify spatial image data) and CoViaR (risk prediction) models. Using the ResNet-50 model, a climate change risk score is developed from images and feature extraction, which is correlated with the emission volume of the borrower firms. Then, using the proposed model, the impact of climate change-related risk on the lending portfolio is evaluated to understand the financial stability of banks through capital.

Keywords: AI predictive risk modeling, Artificial intelligence, Capital reserves, Climate data, Climate change risk score, CoViaR, Hybrid model, Lending portfolio, Portfolio risk, Risk analysis model, Spatial image data, Temperature maps, VaR.

INTRODUCTION

"Risk is the unknown change of the future value" - (Wu & Olson) [1]. The need to identify and analyze risk, and its types for mitigating the impact of these identified risks on a firm, has taken a substantial role in the investment decision-making process [1]. A firm is exposed to different types of risk that impact its market, credit, reputation, and operational and legal risk. In the present-day situation, firms and economies are faced with climate change-imposed risks,

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which are considered the second riskiest threats [2]. Risk analysis and management help in assessing and mitigating these risks. They also help in evaluating performance, managing portfolios, and eventually helping with decision-making. It is a multistage process that helps minimize the vulnerability of a firm to risk exposure. The earlier risk analysis models included a risk matrix, which dealt primarily with the operational hazards and their intensity, and the other important matrix was Value at Risk (VaR). It is a statistical tool that helps in assessing potential financial loss at any level for a specific time. It is also used for risk exposure assessment.

To assess risk VaR, historical simulation and agent-based models have been extensively used. However, these models falter when assessing tail risks or event risks [3]. The historical simulation method of evaluating the VaR proposed by Boudoukh *et al.* [4] seems irrelevant when assessing climate risk, as it depends on historical data [5]. Climate risk relies on the impact of climate change, and the current data have limited access and are uncertain. Risk analysis and management are herculean tasks for firms. The identification of climate risk from this analysis and management perspective is even more difficult and imperative for firm survival.

The risk analysis models are dependent on numerical methods and modeling techniques. They need to process large amounts of data and assess the probability of potential financial loss. Hence, they play a pivotal role in firms' decision-making. The need for risk modeling to mitigate the impact of these risks was identified by the Basel Committee on Banking Supervision & Joint Forum [6]. The use of the Markov chain Monte Carlo method for risk measurement and allocation was a part of the numerical experiments, which proved the innate role that numerical models play in risk analysis [7]. Thus, the use of the latest technologies such as artificial intelligence (AI) and its subsidiaries, such as machine learning (ML) and deep learning, has taken precedence, making the entire process more accurate and easier. Computational modeling with the use of DL has been used for credit risk modeling by identifying the loan default probability *via* binary classifiers [8]. The need to assess portfolio risk and stress testing *via* a computational model is evident, as they impact the financial stability of a firm (Vovchenka *et al*.) [9].

Owing to the lack of access, unavailability, and granularity of climate data, researchers have struggled to develop a model to mitigate and predict climate change risk. The proposed predictive model presented in the chapter is intended to develop the climate change-related risk of loan portfolios to understand the status of the financial stability of banks. Hence, predicting the loan portfolio risk of

financial institutions (banks) is useful in predicting and assessing the probability of expected loss.

Impact of External Factors on Firm Performance

A firm or industry plays a pivotal role in economic development by providing employment and infrastructure. This provides an opportunity for fair distribution of national resources, income, knowledge, and power [10]. However, a firm does not operate alone. It exists in an ecosystem with a host of other factors that influence the firm in every possible way. The impetus of a firm according to stakeholder theory is value creation for all profits [11]. The definition of value is broad and discrete. The performance of a firm directly or indirectly implies production and sales and is measured *via* both financial and nonfinancial factors [12].

The key factors impacting business performance are as follows:

- Economic
- Political
- Technological
- Social
- Environmental
- Global policies, Competition

Macroeconomic factors tend to have an impact on firm performance and require policy measures to reduce the effect in India [13]. Considering the relationship between institutional theories and relational governance, it has been proven that business ties, rather than political ties, have a prominent impact on a firm's performance in China [14]. Technological innovation has shifted the entire paradigm. The use of big data and artificial intelligence (AI) has eased the gathering and processing of large chunks of unstructured and structured data. The computation models increase the speed and accuracy of the whole process. Social and global policies have eased global interactions and trade. The most important factor influencing a firm’s performance is the environment, as radical changes rapidly occur in this space. Environmental factors influence energy consumption and GHG emissions. They directly influence the social responsibility and reputation of the firm, which influences asset returns.

Role of UN and Government Policy Changes in Risk

The UN’s Sustainable Development Goals (SDGs), Kyoto Protocol, and Paris Agreement highlight the need to incorporate sustainable practices into business operations. The focus has shifted toward reducing carbon emissions from business

CHAPTER 8

Computational Approaches to the Digital Transformation in Banking and the Role of Fintech in Women's Empowerment

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Abstract: This study utilizes computational approaches to evaluate how fintech solutions influence women's financial autonomy in banking. The study analyses demographic characteristics and perceptions of digital banking for 386 women, revealing the ability of fintech to transform access to financial services, income generation opportunities, and participation in economic life more broadly. Descriptive statistical analysis using SPSS and computational methods used in the study helped to recognize patterns as well as discover important insights about women's demographic background and beliefs toward digital banking. This process allows a detailed view of how fintech solutions are adopted and used, with an assessment of their potential impact on financial inclusion. The results show that women from a variety of demographic backgrounds have a broad interest in and a good impression of digital banking, highlighting the potential of fintech solutions to increase access to financial services and streamline revenue generation. The study makes practical policy recommendations that can be implemented to advance financial inclusion laws, improve financial literacy programs, eliminate barriers to access based on gender, assist female entrepreneurs, create a strong regulatory framework for the fintech industry, and encourage collaborations between the public and private sectors.

Keywords: Banking, Computational approaches, Customer experience, Digital banking, Digital payment,, Financial inclusion, Financial literacy, Financial services, Fintech, Public sector, Private sector, Regulatory framework, SPSS.

INTRODUCTION

Banks play a crucial role in the economy by providing credit to vast sectors, running payment systems, and serving as a haven for depositors' money [1]. They

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also offer a wide range of financial products and services to individuals and small enterprises, primarily relying on interest rates, fees, and proprietary products to generate revenue [2]. This period is particularly significant for employees in the financial services sector due to rapid technological advancements [3]. Decision-makers heavily support the financial technology sector, which has revolutionized how people conduct business, transfer money, and complete everyday transactions, globally.

Given the sector's potential for technological transformation, investments are projected to reach $15 billion by 2022, driven by increased innovation and efficiency aimed at promoting prosperity and growth [4]. Banks traditionally act as intermediaries, but the Internet is reshaping how financial service providers operate [5]. As a result, both the nature of banking services and their delivery mechanisms are evolving. To remain competitive in this dynamic digital landscape, banks must continuously adapt [6]. Established banks are focusing on redefining their roles, while challenger banks are essentially building from the ground up [7, 8]. In this context, banks face challenges related to data management, trust, competition, and the integration of computational approaches in financial services, in addition to their core function of liquidity transformation [9].

The traditional analytical framework used to examine these dynamics requires revision to accommodate the new challenges presented by the digital transformation of banking [10]. Today, banks manage transactions and payments, but the Internet now facilitates and executes these tasks as well [11]. This shift is driving the rise of both public and private digital currencies, altering how transactions are recorded in ledgers [11]. Furthermore, the information asymmetry that once existed between banks and their borrowers or clients is gradually diminishing [12].

Concept of Financial Technology (Fintech)

“Fintech” refers to businesses or representatives of businesses that integrate financial services with cutting-edge, modern technologies [13]. It is a field closely linked to information and communication technology as well as financial innovation [14]. Any organization entering this space to offer innovative technological solutions to its clients is categorized as a fintech company. These businesses, often new entrants in the financial services industry, aim to challenge and disrupt traditional players by capturing market share through innovation [15]. The term “fintech” encompasses a wide range of technologies and innovations that are transforming traditional banking and finance, reshaping how individuals access, manage, and interact with their financial assets [16]. Fintech companies

typically leverage advanced technologies such as blockchain, big data analytics, cloud computing, artificial intelligence, and mobile applications to offer inventive solutions across various financial sectors [17].

Key Aspects of the Concept

The key aspects of the concept include:

- ***Disruption of traditional banking:*** It is expanding the customers' range of choices regarding what basic banking ought to provide using efficiency and convenience, frequently substituting it with better options [18]. Newly emerged fintech firms offer clients services in payments, financing, investments, insurance, and saving and spending management, among others, by the use of the internet and mobile apps. Such services are often more convenient and have better disclosure than the ones offered by traditional banks [18].

- ***Financial inclusion:*** Fintech can extend financial services, especially for untapped consumers: individuals and businesses residing in remote or rural areas, as well as those who have limited access to banking facilities [19]. Fintech companies can avail the opportunity to customers who were without any affiliation to the formal financial sector with technology and non-traditional data [20].

- ***Innovation & agility:*** Fintech organizations are innovative and flexible because they always develop and incorporate new solutions and technologies or experiment with new work approaches to meet demand from the clients or fulfill industry expectations [21]. Thus, fintech companies can quickly respond to changes that take place in the competitive environment and look for new opportunities in the sphere of finance by implementing a fast-paced experimentation and learning process.

- ***Enhanced customer experience:*** Fintech is unique in that the customer experience is a key focus in offering personalized services, user interfaces, and transactions [21]. Fintech wants to deliver on the expectations of today's consumers, who have been shaped by the continuous usage of technology and social media, by designing and delivering valuable and meaningful interactions from the big data generated by its clients [22].

- ***Regulatory challenges:*** Fintech is very promising, but it is not devoid of certain regulations and compliance when it comes to the synergy between conventional financial service providers and regulators [23]. Around the globe, regulators are battling concerns like cybersecurity. Policies such as consumer protection, data privacy and protection, and anti-money laundering are used to enhance financial

CHAPTER 9

Computational Models for Sustainable or Green Finance

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Abstract: To access and manage risk associated with green finance and other sustainability-focused financial instruments, various computational modeling approaches have been designed by various researchers and intellects. Some of them are blockchain technology, machine learning, agent-based modeling for sustainable corporate social responsibility activities, and many others. ESG [environment, social, and governance] considerations present both possibilities and problems for businesses looking to make meaningful contributions to society and long-term financial success. This is especially true as the movement toward sustainability picks up steam. Owing to the current environment, which focuses on short-term advantages and allows for limited and frequently voluntary disclosures on environmental, social, and governance [ESG] concerns, management is hesitant to allocate resources toward sustainable goals. Consequently, investors find it challenging to gauge the extent to which ESG affects performance. The creation and execution of long-term plans that clearly define the importance of ESG considerations in corporate operations are mostly the responsibility of boards of directors. Management may now pursue project goals as present performance is in line with sustainable financial objectives in line with the strategy guidelines, giving analysts and investors more information when assessing the impact of ESG variables on the bottom line. What does sustainable financing entail? Sustainable development targets are still not being met by the current global trajectory, despite the celebration of success by sustainability experts. At a minimum, these factors should give financial institutions special concern. First of all, there may be a lot of danger involved. Second, they continue to be involved in several activities that are detrimental to sustainability. Particularly, banks and insurers assist and encourage these kinds of operations, putting them in danger. Thirdly, there is a significant amount of untapped revenue.

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Keywords: Agent-based modeling, Banks, Blockchain technology, Challenges, Corporate social responsibility, Computational approaches, ESG analysis, ESG factors, Financial institutions, Green portfolio, Insurance, Investors, Machine learning, Objectives, Portfolio diversification, Renewable energy, Sustainable CSR, Sustainable development, Sustainable finance, Sustainable revenue.

INTRODUCTION

Sustainable finance is a financial service that deals with ESG factors (environmental, social, and governance) to provide business and investment-related benefits to both clients and society [1].” Sustainable finance refers to any financial service that takes into account ESG factors when making decisions related to business or investment to provide benefit to clients as well as society as a whole.” [2]

For the elimination of poverty and environmental preservation, the United Nations adopted the agenda of Sustainable Development 2030, which has around 17 SGDs (Sustainable Development Goals) to enhance the lives and well-being of people worldwide. The SDGs are expected to be achieved by 2030 [3]. On the other hand, the term “sustainable finance” refers to a wide range of sustainable approaches to achieving financial and investment objectives. Sustainable finance is described by the European Commission [2021] as a vibrant process that takes ESG considerations while making decisions related to finance and investment [4]. Nonetheless, this definition, which is restricted to ESG factors, is quite limited. This necessitates a broader and more inclusive definition that encompasses sustainability as a whole.

To complement the many objectives set forth by various stakeholders, including the UN Sustainable Development Goals and the European Commission's ESG, we suggest that sustainable finance should include all actions and elements that would make finance sustainable and contribute to sustainability. A range of strategies, such as climate finance, carbon and ESG disclosure, green bonds, and socially responsible investment, can be utilized to achieve sustainable policy goals across various jurisdictions [5 - 8]. All these strategies can be covered under our broad definition of sustainable finance.

LITERATURE REVIEW

Our research draws on surveys and scholarly literature to close the divide between theoretical sustainability concepts and their practical implementation in finance.

- Amidst growing societal pressure, companies are increasingly incorporating sustainability into their mission statements and objectives. Business managers are changing their emphasis from merely maximizing shareholder wealth to providing innovative solutions for pressing human challenges. However, navigating this complex landscape—where financial and societal pressures sometimes diverge—poses a significant challenge for managers [9].
- Companies need to be accountable for their effects on stakeholders and society in addition to focusing on financial success. Sustainability involves a commitment to economic, social, and environmental well-being, balancing present needs with future demands. It encompasses behaviors, processes, and technologies that yield benefits across these dimensions [10].
- Numerous studies have shown that when businesses use both financial and socially profitable strategies, they are performing best for their shareholders and stakeholders. These studies found that the two performance measures were correlated, and the relationship between them appears to be bidirectional and simultaneous. Additionally, reputation seems to play an important role as a mediator in this relationship [11].
- In recent times, there has been a strong argument that it is beneficial for investors and corporate managers to consider sustainability factors when making decisions, as highlighted by Clark *et al.* [12]. Research indicates that integrating ESG issues into fundamental investment analysis can enhance financial performance. Correlation studies have shown a positive relation between sustainability and financial success. For instance, by utilizing the industry-specific materiality guidance provided by the SASB (United States Sustainability Accounting Standards Board) in the United States, research has demonstrated significant risk-adjusted returns for portfolios that include companies excelling in ESG performance on relevant sustainability issues [13].
- Executive management firmly believes that embracing a longer time horizon for business decisions will significantly boost corporate performance. This strategic shift is likely to enhance financial returns while simultaneously driving greater innovation across the organization.
- However, there seems to be increased pressure at the executive management level. Many companies strive to show strong financial performance within a short time frame often in just two years or less, or using strategies within a three years duration. In response to executive management's claims that these pressures come from their boards, Boards argue that they are merely reflecting the amplified temporary pressures from investors and institutional stakeholders [14].
- With the population now exceeding seven billion people, managers are finding it increasingly difficult to distinguish between 'us' and 'them' in typical business transactions. They face a challenging reality when making decisions on behalf of

CHAPTER 10

Advancements in Computational Modeling for Enhancing Financial Risk Management: Applications, Challenges, and Future Directions

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Abstract: The advancement in risk management with deeper insights and more accurate predictions amidst complex data landscapes is attributed to computational modeling. It offers sophisticated tools to analyze, forecast, and mitigate risks in the dynamic financial market. This research article discusses integrating machine learning, network analysis, and other techniques to enhance risk identification, scenario analysis, and decision support in financial institutions. This article also addresses the importance of data quality, model validation, and transparency in ensuring the reliability and effectiveness of computational models. The application of machine learning techniques in credit risk assessment, market risk analysis, stress testing, scenario analysis, sensitivity analysis, portfolio management, and optimization is discussed. The study has demonstrated the conceptual model where identifying the type of risks is the first step, followed by sourcing the data internally and externally, considering the accuracy and reflection of current market conditions. Choosing the right computational techniques occupies an important stage due to the availability of both traditional and modern techniques. Traditional techniques are equally important to modern techniques, but this comes with challenges. Further risk management processes can be initiated to address the identified risks proactively and reduce potential financial losses. Finally, the study outlines future trends and technological advancements that promise to shape the future of computational modeling in financial risk management.

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Keywords: Agent-based modelling, Anomaly detection, Computational modelling, Credit risk assessment, Credit risk, Ensemble methods, Ethical issues, Financial system, Fraud detection, Liquidity risk, Machine learning, Market risk, Monte carlo simulation, Natural language processing, Operational risk, Optimization, Risk control, Risk management process, Risk management, Stochastic modelling, Stochastic modelling and supervised learning.

INTRODUCTION

Risk management methods followed traditionally are outdated and struggling to match the rapid changes that are happening in the financial markets both at the domestic and global levels. Improvements in computational modeling, particularly with Artificial Intelligence (AI) and Machine Learning (ML), have enhanced financial risk management. Computational modeling is a flexible method applied in multiple fields for examining complex processes. It acts as a practical resource for professionals to address current issues using numerical techniques, emphasizing various equations and algorithms [1]. Computational modeling has revolutionized the way financial institutions analyze complex financial systems, particularly in predicting market trends, mitigating risks, and making strategic decisions. Artificial intelligence and machine learning employ mathematical techniques, statistical methods, and computational processes to develop innovative solutions. These models allow for the immediate analysis of Big financial data, revealing patterns, trends, and relationships that might be overlooked using traditional analysis techniques [2]. Moreover, they enhance the ability to perform stress testing and scenario analysis, understanding the crucial potential outcomes and various economic scenarios. Furthermore, numerical methods are essential when analytical solutions are not available, such as in the contexts of portfolio selection and pricing derivatives [3]. These tools improve risk assessment and decision-making processes by being utilized in evaluating credit risk, identifying fraud, and handling market risks. They outperform traditional statistical methods in accuracy and efficiency [4, 5]. However, challenges remain high, including risks with models, data quality issues, and the need for skilled personnel to manage these complex systems [6]. Future studies highlight the importance of robust data governance frameworks and regulatory guidelines to guarantee ethical behavior in AI and ML applications [7]. Additionally, it is crucial to employ advanced statistical algorithms and big data analytics to navigate the complexities of modern financial markets.

The advancement of computational modeling methods has enhanced financial risk management. Conventional risk management techniques struggle to adapt to rapid market changes, rising complexity, global reach, and big data volumes in financial

markets. Utilizing computational modeling enhances financial risk management by offering more accurate, scalable, and dynamic strategies for assessing and mitigating risks.

The way financial institutions assess and manage risks has been transformed by using computational models such as machine learning, big data analytics, and Monte Carlo simulations. These models enable companies to analyze large data, disclose hidden trends, and predict potential risks more accurately. The adoption of machine learning algorithms to improve credit risk assessment by analyzing customer behavior and market conditions, leading to more informed decisions, is one of the best examples [8].

However, multiple challenges are involved in adopting and implementing the computational modeling technique in financial risk management. Data accuracy, transparency in models, and regulatory compliance are the major barriers. Moreover, complexities involved in these models could create difficulties in their interpretation and lead to over-dependence on automated systems without a complete understanding of their limitations [9]. In these challenges, regarding the future of computational modeling, quantum computing and blockchain are new avenues of innovation and a source of optimism. This study is aimed at examining the advancement of computational modeling and its role in enhancing the financial risk management process by addressing the challenges and providing suggestions for future development.

METHODOLOGY

The primary objective of this research work is to identify different tools and techniques of computational modeling and their potential for enhancing financial risk management processes. Previous studies are reviewed to form a theoretical foundation and bring out the research gaps in this area. Additionally, this research work proposes a conceptual model that the companies can adopt for their effective implementation of risk management systems in finance. Further, the study has captured the challenges and issues in adopting computational modeling techniques by comparing traditional and contemporary approaches along with the future and emerging trends associated with computational modeling.

CONCEPTUAL FRAMEWORK

Computational modeling can contribute to better decision-making and risk management by offering solutions to complex financial problems [10]. Fig. (**1**) demonstrates an advanced risk management model that combines key components of financial risk management and computational modeling techniques. In the current market, companies encounter various forms of financial risk, which can be

CHAPTER 11

A Computational Data-Granular Model Highlighting the Evolving Fintech Landscape in India

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Abstract: The Fintech sector in India has undergone remarkable development, complementing the significant progress in financial technology designed to simplify financial services and provide innovative solutions. This study aims to discover and analyze two significant knowledge gaps in the Indian Fintech sector. It seeks to identify and examine the evolving patterns in web searches for potential career opportunities in the Fintech sector, providing perspectives into the trendline data from the country. Secondly, the study will assess employment in the Fintech Sector in India, emphasizing Position Titles, the geographical distribution of opportunities, and market trends from 2015 to 2023. Furthermore, it will examine the motivation and strategies essential for supporting and developing the Fintech sector in India. It performs a trend analysis on Fintech, Finance, and Accountancy searches and how they have changed over the years. By addressing these gaps, the research aims to provide valuable insights into the Fintech industry's dynamics and development in the Fintech job market over the years in the Indian context. To complement the trend analysis conducted in the paper, a computational modeling approach is used to predict future job trends in the Indian Fintech sector. The model relies on data from the years 2015 to 2023 on job openings, web searches, and geographical distribution. Therefore, the Autoregressive Integrated Moving Average (ARIMA) model has been used to understand the future patterns of job opportunities and skill requirements accordingly. This research will be helpful for companies and business owners to improve their financial operations in the long run.

Keywords: Accountancy, Computational approaches, Consumer behavior, Data granular approach, Digital transformation, Employment, Innovation, Finance, Fintech, Financial operations, Financial services, Financial technology, Job portals, Job trend, Job opportunity, Policy, Transformational technology, Technological advancement, ARIMA model, Trend analysis, Trendline.

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INTRODUCTION

Digital transformation underscored by the fourth industrial revolution has led to the emergence of sophisticated technology-enabled financial services, Fintech, swiftly altering traditional financial services [1]. Financial Technology, or Fintech, represents a dynamic and cross-disciplinary field amalgamating principles from finance, technology management, and innovation management. The convergence of these domains in Fintech often catalyzes the emergence of novel business models and, in some instances, entirely new businesses [2]. Innovative solutions for finance-related services have transformed the financial industry. Fintech has evolved and provided everyone with more straightforward, faster, convenient, and cheaper financial services, leading to financial inclusion. The prospective Indian Fintech market is projected to generate $200 billion in revenue by 2030. Fintech companies in India are acquiring greater visibility due to the government's initiatives to expand financial services to the under-banked sector of the economy. India must prioritize the improvement of financial inclusion in order to effectively reach these underserved segments and create a stable environment for Fintech operations [3].

As the sector evolves, its expertise is also increasing, thus demanding a workforce skilled with the knowledge necessary to help the industry grow. The global landscape of Fintech is witnessing unprecedented growth and transformation. In India, the Fintech landscape is evolving rapidly, with notable impacts on traditional financial services and user behaviors. The infusion of investment into the Fintech sector has substantially mirrored global trends. As reported by a study [4], Fintech companies all across the globe generally received an average investment of £15 million or £2.9 billion in aggregate up to 2017, stating the significant confidence of investors in the sector. The FinTech market sector is expected to offer a market opportunity of around $2.1 trillion by the end of 2030.

The Fintech sector has experienced a rapid transformation in recent years, with the development of startups and new business players coming with novel solutions; this has changed the complete scenario of the conventional financial services industry in the country. This development has significantly improved the job seekers' interest in the sector by providing them numerous opportunities to explore multiple potential roles in the Financial Technology Sector. Experience in this rapidly changing domain, irrespective of success, has become an attractive way of demonstrating a diverse career profile. Considering these aspects, this study seeks to discover and assess the diverse pattern in web searches related to potential job opportunities in the Fintech sector and educational information within the Indian context. Secondly, the study aims to assess the present state of the job market in the Fintech industry. This analysis is supposed to look into

crucial aspects such as job titles, the location of job opportunities, and the overall condition of the job market within the Fintech sector. By analyzing these factors, the study offers critical insights into the challenges related to employment trends within the Fintech industry. Also, the study extends its scope by examining the components and strategies essential for supporting the development of the Fintech sector in India. This study will provide an extensive view of the challenges and prospects supporting the sector's development.

The present study will delve into the comprehensive analysis of the crucial aspects that influence the financial services landscape in India, like policy change, consumer behavior, and technological advancement. The study will discuss the need for a crucial relationship between educational institutions and Fintech companies to nurture and cultivate a competent workforce that can work proficiently per the industry's diverse and critical needs. India can produce a talented, proficient, and, most importantly, skilled workforce who can survive and excel as per the requirements of the financial sector. Digital literacy is the area where significant investments in training and education are required.

The study highlights the importance of regular investments in developing the country's digital infrastructure. It shows that the country's financial industry can only improve significantly regarding digital innovation. The country's resilient infrastructure is present, boosting operational efficiency and supporting additional investments, strengthening the idea of making India a prominent Fintech center.

LITERATURE REVIEW

It has been explained that the concept of “connectivity inclusion” focuses on the interconnectedness of technology to create a more convenient and secure financial experience [5]. The literature review explains that the financial service industry is adapting quickly to meet all the emerging demands of consumers through integrating technology, leading to social and economic inclusion. Businesses prioritizing these principles are better positioned for success in this changing landscape. As per a study [6], the fourth industrial revolution has duly created an emerging environment providing disruptive and digital transformational technology, for example, the Internet of Things, extended reality, artificial intelligence, *etc.*, changing the way of life. The emergence of the Fourth Industrial Revolution has created a context in which disruptive and digitally significant technologies, such as the Internet of Things (IoT), extended reality, and artificial intelligence (AI), have entirely changed the way of living. These advancements have significantly impacted working in different sectors, rethinking the nature of employment and revolutionizing ordinary experiences, leading to unprecedented transformation in all areas of society.

CHAPTER 12

Behavioural Finance Factors and Investment Decisions: Risk Perception of Gender as a Mediating Factor

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Abstract: This research explores the link between behavioural finance characteristics and investing choices, explicitly examining the gender-specific role. This link is mediated by the perception of risk, which plays a role in the interaction. The gap between conventional finance theories, which presume logical decision-making, and behavioural finance theories, which acknowledge the influence of biases and emotions, has been brought to light by research over the last thirty years. This research aims to look at the impact of variables like risk perception, herd behaviour, financial literacy, and avoidance of regret in making choices about investments. Additionally, it seeks to investigate how risk perception is influenced by gender in these dynamics. Three hundred individuals who were actively interested in investing and were at least 18 years old were given questionnaires as part of a quantitative approach. The data was analysed using AMOS to examine the mediating influence of gender-specific risk perception and SPSS for regression analysis and mediation analysis. Results show that although herd behaviour, risk perception, and regret aversion play essential roles, financial literacy favours investing choices. Notably, gender variations in risk perception impact how effective financial literacy is in guiding investment behaviour. This is because gender-specific links involve an essential amount of mediation carried out by risk perception between knowledge of finances and investing choices. With this, the importance of integrating behavioural finance components into financial counselling and decision-making approaches is highlighted.

Keywords: AMOS, ANOVA, Behavioural finance, Computational approaches, Decision making, Financial counselling, Financial knowledge, Financial Literacy, Financial theory, Gender bias, Gender specific, Herd behaviour, Investment, Investment behaviour, Investment decision, Investor choice, Natural language processing, Regret aversion, Risk perception, SPSS.

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INTRODUCTION

A significant number of studies conducted throughout behavioural finance for the last thirty years have explored people's investment decisions in relation to the impact of risks [1]. Following a rational approach while making investment judgments is not always essential. According to research, the method individuals choose to invest their money has been linked to behavioural biases [2]. The field of behavioural finance challenges conventional finance theory, which maintains that investors are impacted by their emotions, beliefs, and cognitive limits; one might argue that they should always make rational decisions based on trustworthy information [3]. There is an ongoing disagreement between current financial theory and the impact of non-financial variables on stock value, as explained by the behavioural theory of finance. Even now, finance theory claims that the stock market is efficient and that stock prices fairly represent all available information. In contrast, behavioural finance theory argues that emotional and emotional elements may have an impact on stock prices [4]. Several studies have shown that the particular features and attributes of a person and their perceptions about the role that investing plays in providing a buffer against inflation participate meaningfully throughout the decision-making process [5].

A big part of managing one's money is choosing investments since they allow one to balance existing requirements and future ambitions. Regarding people and families, financial planning may be a lengthy and resource-intensive process that needs thorough evaluation and research of numerous investment possibilities [6]. In addition, it is essential to protect oneself in opposition to inflation and unstable circumstances [7]. Academics researching behavioural finance and economics have found a substantial amount of opportunities. People face challenges while attempting to make prudent financial choices [8]. Much research has been done in scientific circles on how behavioural finance issues affect investing choices. A wide variety of behavioural finance elements, including prejudices, emotional biases, social effects, perceptions of risk, and personality characteristics, have been shown by researchers to have an impact on investing choices. Investors have a risk-averse mindset when it comes to investment; risk perception is preferable since it favours a better and more consistent degree of risk inclination [9]and inclination for danger [10].

Gender is seen as a significant element in influencing one's attitude toward risk. Based on the available empirical information, males, on average, are more risk-taking and aggressive than women [11]. It also unequivocally demonstrates the presence of a stereotype about investment risk-taking, according to which males would typically take more aggressive risks. At the same time, women are automatically seen as being more cautious [12]. For example [13], a study uses

experimental data to demonstrate that women are much more likely than males to be thought of as having a risk-averse attitude when asked to identify people's risk attitudes during a gambling assignment [12]. Another study attests that this stereotyped conduct is relevant while incurring financial risks. Furthermore, new research indicates that gender norms influence family members' allocations to investing activities, suggesting that the male member is in control. In contrast, gender conventions place women in charge of managing home finances and neglect their financial investment opinions. In this literature, the idea of gender threat (*i.e.*, masculinity or femininity threat) refers to circumstances when one may be compelled to behave like the other Gender.

An investor's perception of risk is dynamic and subject to varying depending on the circumstances, while their attitude towards risk stays constant. A greater sense of risk results in more frequent transactions and lower stock market investment [14]. Market participants often exhibit herding behaviour because they have a sense of minimal risk, which has a detrimental effect on the investments they choose to make. Investor decision-making is significantly impacted by herding tendency [15]. Establishing the connection using the risk perceptions component as a mediator, the link between financial behaviour, risk perception, and investing must be established [14]. Individuals' emotional reactions and cognitive biases may affect their financial decisions, as behavioural finance acknowledges. This is where risk perception comes in handy as an intermediate variable to help explain how people see and understand hazards influencing their investments. Understanding the impact of gender on risk perception while making investing decisions helps us better understand the psychological processes that underlie financial behaviour.

Behavioural finance is a field that combines insights from psychology and economics to explore how cognitive biases and emotional factors influence financial decision-making. Computational approaches in behavioural finance have become increasingly prominent, offering sophisticated tools and methods to analyze complex financial behaviours and market dynamics. These approaches often employ machine learning algorithms, agent-based modelling, and neural networks to simulate and predict investor behaviour, asset pricing, and market trends. For instance, machine learning techniques can identify patterns and anomalies in trading data, shedding light on herd behaviour, overconfidence, and loss aversion. Agent-based models, on the other hand, simulate interactions among heterogeneous agents, capturing the emergent properties of financial markets influenced by individual and collective behaviours. Additionally, sentiment analysis, leveraging natural language processing (NLP) tools, can assess the impact of news and social media on investor sentiment and market movements. By integrating these computational tools with behavioural finance

CHAPTER 13

Navigating the Green Frontier: Unveiling Investor Strategies in Green Bond Market *vs.* Traditional Markets

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Abstract: Green bonds have emerged as a key instrument in sustainable finance, but their risk-return profile remains poorly understood. This study examines the risk-return profile of green bonds compared to traditional markets over a midterm investment horizon. Daily closing prices of five indices (S&P Green Bond Index, S&P 500 Index, S&P GSCI Gold Index, S&P Global Clean Energy Index, and S&P 500 Carbon Efficient Index) from August 2021 to August 2024 were analysed using descriptive statistics and GARCH (1, 1) models. Green bonds exhibit higher volatility persistence and leverage effects compared to traditional markets. There is a significant positive correlation between the S&P Green Bond Index and the S&P Global Clean Energy Index. The S&P GSCI Gold Index exhibits low volatility and no significant leverage effects. Investors should consider the unique risk-return profile of green bonds when constructing portfolios. Portfolio managers should employ sector-specific risk management strategies. Policymakers should consider the potential benefits of green bonds in promoting sustainable finance and mitigating climate risk. This study contributes to the growing body of research on green finance and sustainable investing, providing valuable insights into the midterm risk-return dynamics of green bonds.

Keywords: Bonds, Climate risk, GARCH models, Green bond, Index, Investment, Investor strategies, Leverage, Portfolio, Risk, Return, S&P 500, Sustainable development, Sustainable finance, Traditional markets, Volatility.

INTRODUCTION

Green bonds are generally an instrument that is used to fund projects that are environmentally friendly. Sustainable development is the focus in today's world with countries striving to achieve sustainable development goals (SDP). It is estimated that 55 trillion dollars is needed by 2035 to finance projects that are

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climate-friendly [1]. Green bonds can be defined as any bond instrument whose proceeds will be used exclusively for green projects, whether for finance or re-finance, and whether in part or full.

The eligible green projects are those in the areas of renewable energy, energy efficiency, clean transportation, climate change adaptation, green buildings, pollution prevention and control, *etc.* [2]. According to Sachs *et al.* [3], green bonds are invested in green projects that are in the starting stage and not commercially viable. On the other hand, traditional bonds are invested in projects with high commercial viability where returns are assured.

Taghizadeh-Hesary and Yoshino [4] observed that investments made in green projects are risky. In the case of traditional bonds, the chances of the investments doing well are high because of the commercial viability. In green projects, the lack of commercial viability brings in an element of risk. This is why there is a gap between the availability of financing and the need for green projects. Green bonds help in bridging this gap. Fransman and Hall [5] looked at how the low returns impacted the green bonds market in Sweden. The premium of green bonds was due to the additional administrative reporting cost for the issuers. The study stated that the main motive for investors to buy green bonds was to get a financial return and a sustainable return. The premium price was acceptable to many investors because of the utility return of the bonds. The study highlighted that social norms did not have much of an impact on green bond investments.

Fung and Klement [6] showed that green bonds trade at a premium when compared to traditional bonds. There was an eight bps yield premium for green bonds. This is as per a study of U.S. corporate and municipal bonds. Ma *et al.* [7] hinted that some green bonds have less volatility than their non-green equivalents. The authors state that there is a delayed relationship between financial market stress and greenium. They conclude that green bonds and other sustainable investments may be more resilient to systemic disasters. On the other, low-risk investors prefer long-term bonds and would want to hold them until they mature. The study concluded that liquidity issues and the related risks can affect its growth. It is important to understand liquidity risks for better investor behaviour [8].

Deschryver and de Mariz [9] looked at the challenges that the green bond market faced. Most investors are not clear about the financial benefits of green bonds. This is a barrier against investments in green bonds. Liquidity is another major issue acting as a barrier. The study offers a few recommendations that can be helpful in expanding the green bond market:

- Greater transparency and disclosure through knowledge sharing, impact measurement, and reporting systems.
- Using sustainability-linked instruments and transition bonds to reduce the risk of green washing and thus distinguish green bonds from traditional bonds.
- Mechanisms to encourage investments in emerging economies.

Although the green bond market has witnessed rapid growth, there still remains a huge gap in comprehending the risk-return characteristics, particularly the green bond market with other traditional markets such as equity, gold, energy, and carbon markets. Even though it is considered to be a low-risk security, its association with quality issuers of the instrument over various investment time frames is poorly understood.

Fewer studies have explored the risk-return characteristics of the green bond market with equity, gold, energy, and carbon markets. In order to address this research gap, the present study examines the risk-return characteristics of green bonds compared to traditional markets such as the S&P 500 Index, the S&P GSCI Gold Index, the S&P Global Clean Energy Index, and the S&P 500 Carbon Efficient Index. Using both systematic and unsystematic GARCH models, the study investigated the correlation, volatility persistence, risk premium, and leverage effect of green bonds with other indices. Thus, the outcome of the study would provide greater insights into green finance for investors and regulatory bodies.

REVIEW OF LITERATURE

Green bonds are gaining significant popularity as financial investments that are designed to fund environmental-related projects. Despite the fact green bonds have appeared as a key investment tool in sustainable finance, their risk-return profile remains poorly understood. This existing literature discusses the role of green bonds and their performances when compared to other asset categories.

Chousa *et al.* [10] studied the impact of investor sentiment on the green bond market. The study used social networks as its information source to understand the sentiments of investors. The study found that positive investor sentiment increases the price of green bonds, while negative sentiment has a negative effect. Thus, it is very sensitive to investor sentiment changes, and it is more volatile. Behavioural factors like reactions to news and herd behaviour have an impact on the green bond market. The study concludes that transparency can help reduce the volatility due to investor sentiments. In a study, Maltais and Nykvist [11] found that incentives could help the green bond market to improve. Their study in Sweden found that business case incentives got better results than financial incen-

CHAPTER 14

Green by Design: How Fintech's Human Touch is Revolutionizing Sustainable Finance

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Abstract: Using an empirical approach complemented by agent-based modeling, this research examines the linkages between RPA usage, sustainability, and innovation in the fintech industry. Consequently, 168 online questionnaires were completed by fintech employees, and several semi-structured interviews were conducted with HR leaders and sustainability managers. Studies show that RPA maturity positively impacts sustainable innovation performance as controlled by pro-environmental self-identity. In the case of ESG integration and psychological empowerment, the results showed a moderate positive correlation with the pro-environmental self-identification of the subjects. However, the results for gamification are lesser. Employing agent-based simulations, these findings are confirmed, and moreover, the critical mass at the level of 30% is established as the Rate of Diffusion increases steeply thereafter. This makes it possible to show that in case of a simulated increase in ESG regulations, adoption rates increase by 25%. To this end, this research can be said to have contributed to sustainable HR by establishing that sustainability can be driven by technology, values, and engagement of the employees. It underlines the utilization of RPA in achieving operational efficiency and environmental responsibility, as well as presenting information on system-level factors of sustainable practice diffusion. It stresses the importance of the integration of sustainability objectives into HR practices. It makes a methodological contribution in integrating qualitative and quantitative analysis for studying the socio-technical systems of sustainable finance.

Keywords: Corporate sustainability, Digital transformation, Employee engagement, Environmental performance, Environmental Social Governance (ESG), Financial technology, Fintech, Gamification, Green innovation, Human-centered design, Mixed-methods research, Organizational culture, Pro-environmental self-identity, Psychological empowerment, Robotic Process Automation (RPA), Sustainable banking, Sustainable finance, Sustainable innovation, Sustainability metrics, Technological adoption.

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INTRODUCTION

Background of the Study

Fintech is simply a union of the two important components- the financial sector and innovation technology, and it will remain a platform that will explore the deepest frontiers of what is possible in digital finance [1]. Specifically, within the last decade, the sector has come under pressure to consider sustainability more and more as people from all around the world become more environmentally conscious and it is imperative for companies to adopt sustainable business practices [2]. This change has resulted in the creation of what is referred to as green fintech to use financial technology to support sustainable finance projects [3]. At the same time, the use of robotic process automation (RPA) has increased in many contexts and fields, including fintech [4]. As identified, the opportunity with RPA is that it can help reduce the amount of time and effort required for low-value-added and repetitive tasks and improve the quality of the process, meaning that resources can be shifted from low-value to high-added activities [5]. Nevertheless, the role and impact of RPA adoption on sustainable practices in the fintech area are still investigated insufficiently.

PROBLEM STATEMENT

Consequently, focusing on the RPA and sustainability concerns, it is possible to state that, although both the concepts belong to the concerned fintech sector, there is very limited understanding of how both trends are interrelated and interact [6]. Furthermore, it is stated that, despite the growing importance of technology, there has been a lot of emphasis on the more humanistic aspects of the operation, such as employee engagement and pro-environmental self-identity in the process of sustainable innovation [7]. The problem is determining how organizations can utilize RPA and support sustainability practices and employee engagement to increase innovation and contribute to environmental objectives [8].

To fill this gap, this study shall examine RPA maturity, ESG integration, psychological empowerment, and gamification of sustainability goals as factors influencing the fintech sector's pro-environmental self-identity and sustainable innovation performance.

RESEARCH OBJECTIVES

The primary objectives of this study are:

- To assert the necessary hypotheses to identify the correlation between RPA maturity and sustainable innovation performance in fintech organizations.

- To examine the moderating role of pro-environmental self-identity in the relationship between the maturity of the RPA and sustainable innovation performance.
- To evaluate whether incorporating ESG factors into performance indicators has changed the aspects of fintech employees' self-identity concerning their environmental responsibility.
- To test the impact of psychological empowerment and gamification of functionality in sustainability goals on self-identification as a pro-ecological person.
- To identify HR practices that can support sustainability goals and thus create a culture of sustainable innovation.

SIGNIFICANCE OF THE STUDY

This research also benefits the young and rapidly expanding fields of sustainable HR and green fintech by examining RPA implementation from the standpoint of its impact on sustainable innovation; this is an essential research void observed in the current literature [9]. In bridging the gap of what this study calls pro-environmental self-identity, the study reveals the psychological process behind sustainable behavior and innovation amongst employees at the workplace [10]. Therefore, it provides managerial implications regarding its research objectives about ESG integration, psychological empowerment, and gamification for organizations that intend to improve their sustainability efforts [11]. The mixed-methods approach allows for gaining an extensive picture of the technological, organizational, and human factors at the root of sustainable innovation [12]. Such insights are valuable for both the HR community and fintech organizations to understand the direction for positioning HR practices in pursuing sustainable goals and promoting environmental responsibility among employees and organizations [13].

COMPUTATIONAL MODELLING IN SUSTAINABLE FINANCE

In recent years, various methods for developing computational models have been identified as promising for analyzing complex systems in the context of sustainable finance [84]. Among the discussed approaches, agent-based modeling, system dynamics, and machine learning provide rewarding tools for exploring the relationships between the adoption of technologies, organizational practices, and people's behaviors in the context of the fintech environment [85]. As such, it is possible to use these computational methods to develop arguments, envision possibilities and features, or pose questions that cannot be examined solely relying on empirical findings [86].

CHAPTER 15

Growth and Challenges Faced by Fintech Revolution in Achieving Sustainable Banking Goals

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Abstract: Sustainable financing has become the most crucial goal after the G20 meeting, which examines environmental, social, and governance impact while making an investment decision. The present study contributes to sustainable financing by examining the effect of the fintech revolution on sustainable banking. The latest buzzword in the banking and financial sector is financial technology, abbreviated as Fintech, which describes the technological innovations in the industry. Due to the increase in digital transactions, Fintech has become essential for all stakeholders in the Indian financial sector, such as regulators, banks, intermediaries, NBFCs, investors, payment service providers, brokers, *etc.* Fintech has also evolved into a new financial service industry in India, which consists of companies that use technologies to provide financial services such as the payment sector, insurance, wealth management, *etc.* India, the largest emerging market economy in the world with a strong banking system and intention to adopt technology, has great potential to benefit from fintech resolution to achieve sustainable banking. The present study examines the growth of the fintech industry along with the challenges it faces. The study critically analyzed the latest literature and reports of banking institutions to examine Fintech's impact on sustainable banking—the advantages of green bonds as key development drivers. Financial backer techniques uncover a pattern toward the thorough expected level of effort, an inclination for straightforwardness, and confirmed green qualifications. The discoveries highlight the significance of hearty norms and administrative structures to keep up with market believability and advance certified ecological effects through green securities.

Keywords: Banks, Brokers, Computational modeling, Challenges, Digital transaction, Financial sector, Financial services, Fintech revolution, G20, Green bonds, Green securities, Insurance, Intermediaries, Investors, NBFCs, Payment service providers, Regulators, Sustainable banking, Sustainable financing, Wealth management.

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INTRODUCTION

Fintech, being a relatively new industry, has been rapidly growing over the years, with the market size expected to grow from $340.10 billion in 2024 to $1152.06 billion by 2032. The journey of Fintech can be described in three phases. Fintech 1 began in 1866-1967, with significant developments such as telegraph, railroads, and steamships. Because of such developments, information could be transmitted across borders. Fintech 2 was created between 1967 and 2008 when finances were digitalized and completed. Online banking and e-commerce business models were significant developments during this period. Fintech 3 began in 2008 and is still prevalent; due to the global financial crisis, there was a tremendous shift in customers' preferences towards the banking system. Some evolutions, such as smartphones, digital wallets, *etc.*, have contributed a lot to the growth of Fintech [1, [2].

Many factors have contributed to the growth of Fintech in India, such as government policies for promoting ease of doing business, availability of mobiles, and internet penetration [3]. People nowadays use online mode more than physical buying due to the problems faced during COVID. Due to this, India has become the third largest market and is the fastest growing in the world. It is expected to grow at a CAGR of 31% till 2025.

The present chapter aims to examine the key trends contributing to the growth of Fintech and understand how Fintech companies design the computational model. The research questions for the chapter are stated below:

RQ1: What are the trends contributing to the growth of Fintech in India?

RQ2: How do fintech companies create a computational model ?

The chapter has two sections to examine the present research questions. Section A includes the reviewed literature to understand the gap between present and future Research. Section B contains further discussion and findings.

Research Methodology

The chapter is based on secondary data collected from various authenticated sources to understand Fintech growth in India and how Fintech companies create computational models.

LITERATURE REVIEWS

Introduction

What is Fintech? Fintech, an acronym for financial technology, refers to innovative technology designed to boost and modernize the provision and utilization of financial services [4]. Fintech is primarily used to assist organizations, entrepreneurs, and customers in managing their financial operations, procedures, and lives more effectively and efficiently [5]. It is made up of algorithms and specialized software that are utilized by computers and cell phones [6]. FinTech is defined as a set of new services enabled by developments in information systems and communication technologies [7]. The FinTech industry is defined as innovative enterprises that deliver financial services primarily *via* the use of technology, and the phrase "FinTech" is derived from the combination of the words "finance" and "technology." FinTech refers to the financial services industry's adaption to technology [8]. FinTech refers to using the Internet and digital technologies in financial services. FinTech is predicted to generate fresh ideas of action, outcomes, apps, and phases in the financial markets [9]. Additionally, it includes computer programs and other technologies that facilitate financial and banking services, resulting in numerous financial transactions such as credit cards, cash transfers, ATM/debit cards, e-money, and other payment processors [10]. The financial industry's innovation has resulted in lower costs, more efficiency, speed, flexibility, creativity, and better business procedures [11, 12]. Since most services are automated, business models have now changed to offer consumers personalized services without regard to time or location. Furthermore, as noted by Thakor [12], FinTech has facilitated disintermediation and offered online platforms for lending (including peer-to-peer and crowdfunding) and asset management, including robo-advising [13].

Fintech Revolution

As the Fintech movement gains momentum, there is potential to improve financial services' accessibility, efficiency, and safety to meet sustainable banking goals [14]. However, this quick development also presents risks, like data privacy issues, cyber security threats, lax regulatory enforcement, and the potential to worsen inequality [15].

The inability of regulatory frameworks to keep up with the rapid technological advancements poses a challenge to the efficient supervision of Fintech innovations [16].

Fintech's growth necessitates a careful balance between innovation and risk management [17], notwithstanding the industry's potential for beneficial social

SUBJECT INDEX

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Sonal Trivedi

Dr. Sonal Trivedi is an Associate Professor at Manav Rachna University. She has more than 12 years of teaching experience. She has published two books with national publishers and two edited books indexed in Scopus. She has 28 research papers in Scopus-indexed journals and six granted patents. She has received two Best Paper Awards. She has 22 research papers in UGC-approved journals and has presented 15 papers at international and national conferences. She has served as a conference chair at five international conferences and is a reviewer for four reputed journals. She completed her Ph.D. in Management (Finance) on the topic "A Study on Risk Management Tools and Techniques in the Life Insurance Industry in India" from the University of Kota (Rajasthan) in 2017. She has also worked as a Teaching Assistant at S.V. National Institute of Technology (NIT), Surat, an Institute of National Importance under the Ministry of Human Resource Development (MHRD), Government of India.

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Balamurugan Balusamy is currently serving as the Associate Dean (Student) at Shiv Nadar University, Delhi-NCR. His contributions focus on Engineering Education, Blockchain, and Data Sciences. He has published over 200 high-impact papers in Springer, Elsevier, and IEEE, along with more than 80 edited and authored books. He collaborates with eminent professors from top QS-ranked universities around the world. Passionate about teaching, he applies design thinking principles in his lectures. Dr. Balusamy has visited over 15 countries for technical courses and participated in numerous high-level conferences. He has published over 200 quality journal articles, conference papers, and book chapters combined. He serves on advisory boards of several startups and forums and consults on Industrial IoT. He has delivered more than 195 talks at various events and symposiums.

Prasad Begde

Dr. Prasad Begde holds a Ph.D., MBA, and BBA in Business Administration with over 17 years of teaching and research experience. He is currently the Dean of VITBS, VIT University, and has taught in India, Fiji, and Oman, gaining exposure to UK, Australian, and Indian curricula. He has worked with Fiji National University, Sur University (Oman), and MITS Deemed University (India).

His interests include Strategy, Marketing, Leadership, Consumer Behavior, Retail, and International Marketing. He has presented at numerous conferences and published extensively in SCOPUS and ABDC-listed journals. He authored "Emerging Trends in Retail Management", available on Amazon, and holds patents like "DSS in Retail" under Australian rights. A member of IMRTC (USA) and Harvard Business Education, he has mentored students at UG, PG, and Ph.D. levels.