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Reflections on the Application of FinTech in ESG Risk Management under the Background of Sustainable Finance

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Abstract: As China's green financial system continues to improve and sustainable finance steadily expands, it has effectively promoted the green and low-carbon transformation and upgrading of the domestic capital market. Against the backdrop of the routine development of green investment and financing activities, environmental, social, and governance (ESG) risk management has become a core tool for financial institutions to ensure compliance and control green credit risks, directly determining the quality of risk management across various green financial services. Traditional ESG assessment systems primarily rely on static corporate disclosures and manual expertise for risk evaluation, resulting in a relatively coarse overall approach that strugg les to adapt to the new industry landscape following the full implementation of low-carbon policies. These systems commonly suffer from inherent shortcomings such as delayed data updates, strong subjectivity in human judgment, reactive risk mitigation, and insufficient coverage of risk dimensions, making them inadequate to meet today's demand for refined, high-quality green finance development. Leveraging cutting-edge fintech technologies—including big data, blockchain, and artificial intelligence—financial institutions can achieve quantitative risk assessment, dynamic monitoring, and end-to-end closed-loop management of ESG risks, significantly enhancing the intelligence and precision of green risk governance. However, in practice, multiple re al-world barriers still hinder the effective application of fintech in ESG risk management. Issues such as significant disparities in data quality, structural biases in algorithms, lack of standardization in industry-wide ESG evaluation frameworks, and lagging regulatory evolution substantially diminish the enabling power of digital technologies. Based on current industry practices, this paper systematically identifies key application scenarios of fintech in ESG risk management, deeply analyzes critical implementation bottlenecks, and proposes targeted optimization pathways to provide practical guidance for Chinese financial institutions in building standardized, digitalized ESG risk control systems.

Keywords: Sustainable finance, Financial technology(Fin Tech), ESG Risk Management, Green finance, Digital empowerment.

1. Introduction

In the context of the in-depth implementation of the national carbon neutrality strategy, various industries in China are accelerating the transformation and upgrading towards green and low-carbon development, gradually abandoningthe traditional, energy-intensive and emission-intensive development model. Various market entities are gradually building a modern green and low-carbon development pattem through optimizing production processes, iterating industrial structures, and strictly controlling energy consumption and emissions. The systematic green upgrading of the real economy has raised new requirements for the financial service system, forcing the financial industry to innovate traditional business models and continuously expand the application scenarios and service boundaries of sustainable finance. Currently, sustainable finance has become the core financial carrier for optimizing green capital allocation, guiding social capital to flow into low-carbon industries, and empowering the green transformation of the real economy [1]. The three ESG evaluation dimensions run through the entire business chain of financial institutions' green investment, risk pricing, and compliance management, serving as the core basis for financial institutions to accurately identify business risks and scientifically assess the quality of green business. Embedding ESG governance concepts deeply into the financial business system can standardize the production and operation behaviors of enterprises through market-oriented capital guidance mechanisms, avoiding ecological risks caused by industrial development at the source, and effectively reducing the compliance risks and reputation risks faced by financial institutions.

To regulate the operation order of the green financial market and the main responsibilities of various market entities for compliant operation, domestic regulatory authorities have continuously issued ESG information disclosure norms and industry regulatory rules, promoting the continuous refinement of industry standards and the improvement of the regulatory system. Under the constraints of the system, China's green finance has officially bid farewell to the stage of the extensive development and entered a high-quality stage of standardization, specialization, and refinement [2]. Driven by market demand and policy and institutional constraints, the domestic financial industry has gradually reversed the traditional business thinking of "emphasizing returns, neglecting risk control", and the initial ESG risk control system adapted to the laws of green economic development has taken shape, and has been continuously optimized in industry practice. Before the implementation of digital transformation in the financial industry, domestic financial institutions mainly relied on enterprises' annual public disclosure reports and offline on-site investigations for ESG risk assessment. The structural defects of the traditional information collection and risk assessment model were relatively prominent. The update cycle of enterprise annual disclosed data was long and its timeliness was weak, unable

to capture sudden environmental violations and internal governance deviations during the enterprise's operation. At the same time, the lack of unified quantitative standards in manual risk assessment led to assessment results being susceptible to the interference of professional qualities and subjective cognition of assessors, making it difficult to avoid assessment deviations, resulting in the industry's risk control remaining in a passive state of post-event handling.

The rapid iteration and large-scale implementation of digital technology have promoted the deep integration of financial technology and sustainable finance, effectively breaking through the technical barriers of traditional ESG risk control. The static risk assessment model based on manual experience has gradually evolved into an all-day, quantifiable, and traceable intelligent dynamic monitoring model, significantly improving the operational efficiency and assessment accuracy of green risk control. However, the rapid digital transformation of the industry has also led to structural development imbalances. Some financial institutions pursue the rate of digital transformation one-sidedly, blindly implement intelligent risk control systems, and neglect the foundational construction of data governance, algorithm compliance, and model verification, resulting in polarization of the industry's technological empowerment effects and an imbalance in the market development pattern. Based on the current industry situation and practical pain points, this paper, relying on first-line business practice, systematically sorts out the application value and existing shortcomings of financial technology in ESG risk control, builds an optimized system that conforms to market laws and regulatory requirements, and helps the sustainable finance industry achieve long-term and stable development [3].

2. The Practical Scenarios of Fintech Enabling ESG Risk Management

The core value of sustainable finance lies in enhancing the efficiency of green capital allocation, regulating the order of market investment and financing, and guiding social capital to converge towards the green and low-carbon sectors. Compared to traditional financial business, the risk control logic of green finance has significant particularities. The core focuses on climate risks, compliance risks, and reputation risks derived from green business. A well-developed ESG management system is an important foundation for resolving various green financial risks and ensuring the stable operation of the business. The traditional ESG assessment work heavily relies on the annual report data voluntarily disclosed by enterprises. Such data has a low update frequency and insufficient continuity, and cannot reflect the dynamic operating status and risk fluctuation trends of enterprises in real time, resulting in significant lag in risk assessment results [4]. From the perspective of the market structure, listed enterprises have a well-developed information disclosure mechanism and rich data dimensions, but a large number of small and micro enterprises in China have not established a standardized ESG disclosure system. The willingness of enterprises to disclose information is weak, and the reserve of effective public data is insufficient, leading to a large number of blind spots in the risk screening of financial institutions for small and micro market entities, and making it difficult to achieve comprehensive risk management.

The large-scale implementation and regular application of fintech technology have effectively expanded the information collection channels of financial institutions, truly moving the risk control forward. This technology system can implement full-process dynamic control of core green financial businesses such as credit lending and equity investment, effectively compensating for various shortcomings of the traditional manual risk control model. Among them, big data and natural language processing technologies have wide application scenarios and outstanding operational stability, and are the most mature digital tools in the field of ESG intelligent risk control [5]. Financial institutions can rely on the collaborative advantages of these two technologies to integrate multi-dimensional unstructured data such as enterprise environmental protection public information, online public opinion dynamics, labor disputes records, and internal governance announcements. Through cross-verification and complementary verification of multiple sources of data, it effectively solves the industry pain points of lagging, and inaccurate information disclosure by enterprises, and helps institutions build a three-dimensional and all-round ESG risk profile of enterprises.

For hard green assessment indicators such as project construction scale, total energy consumption, and pollutant emission intensity, satellite remote sensing and Internet of Things technology can achieve 24-hour continuous dynamic monitoring. These technologies completely break the time and space limitations of traditional manual sampling, completely eliminating the irregular reporting and fraud of enterprises' data, and ensuring the authenticity, objectivity, and validity of monitoring data. On this basis, machine learning technology can screen, sort, and deeply analyze massive raw data, converting fragmented qualitative descriptions into standardized and horizontally comparable quantitative scoring systems [6]. This system can be directly applied to pre-project loan screening, accurately identifying high-pollution, high-consumption, and high-risk projects, and building a green financial risk defense line at the business front end. At the same time, blockchain technology, with its core characteristics of data immutability, full traceability, and openness and transparency, effectively solves the practical problems long existing in the green finance industry, such as ESG information distortion, difficulty in risk traceability, and low data credibility.

Based on the blockchain evidence and traceability mechanism, core business data such as enterprise compliance operation records, project fund flow trajectory, energy conservation and emission reduction effectiveness, etc. can be fully recorded and permanently stored. This mechanism can effectively restrain enterprises from beautifying their green operation image through false information disclosure and curb the frequent "greenwashing" speculation and arbitrage behavior in the capital market. Financial institutions can build an intelligent risk early warning platform based on blockchain, real-time monitoring of negative business events such as environmental violations, safety accidents, and labor disputes of enterprises, quickly capturing risk signals and automatically triggering the early warning mechanism, significantly improving the efficiency of post-loan risk control and the ability to handle sudden risks. From the overall development trend of the industry, fintech has completely revolutionized the traditional static annual assessment's extensive risk control model. A smart ESG risk control system that operates 24/7, is data-driven, and can be dynamically iterated has been fully implemented and regularly applied in the domestic financial industry, becoming

an important technical support for green finance risk management [7].

3. The Practical Challenges of Applying Fintech to ESG Risk Management

3.1. The Quality of Underlying Data Varies Greatly, And the Phenomenon of Isolated Industry Data Is Prominent

At present, the ESG data in China mainly comes from three channels: enterprises' self-publication, government public disclosure, and special collection by third-party institutions. The statistical standards, review norms and quality standards of these different channels have not yet been unified, resulting in relatively scattered and uneven quality of industry-wide data. Currently, the mandatory ESG disclosure system in China has not yet achieved full coverage of the market. Most small and micro enterprises, in order to reduce operational costs and maintain brand reputation, generally simplify the disclosure content and deliberately hide core business data and environmental protection compliance information. This leads to a lack of effective data resources for financial institutions to make risk control judgments. At the same time, government data such as environmental protection, human resources, judiciary and natural resources are independently managed by different departments, and their business systems are independent of each other, with significant data barriers [8]. The absence of a regular cross-departmental data sharing mechanism directly restricts the intelligent upgrade process of the ESG risk control system. In addition, some enterprises have selective disclosure behavior, actively disclosing positive business results while deliberately concealing negative information such as environmental violations and non-compliance with labor regulations. This further causes the underlying risk control data to be and inaccurate. Due to the high reliance of the judgment accuracy of intelligent risk control models on the quality of raw data, incomplete and inaccurate basic data will directly lead to deviations in enterprise risk assessment results from the actual business situation, affecting the scientificity and accuracy of financial institutions' business decisions.

3.2. The Algorithm Has Black Box Bias and The Model Lacks Sufficient Interpretability

At present, the mainstream ESG intelligent scoring models of domestic financial institutions are mostly built based on deep machine learning algorithms. The operation logic of such algorithms is relatively closed, and the rules for weight allocation of indicators are not made public, resulting in the widespread "algorithm black box" problem in the industry [9]. The model training is carried out based on historical sample data of the industry, and the existing samples have inherent defects such as uneven disclosure and imbalanced structural allocation, which makes the algorithm evaluation logic inherently biased and has significant differences in adaptability for different types of market entities. The information disclosure system of listed enterprises is complete and the data dimensions are rich, and the model scoring results are relatively objective and fair; while the public data volume of small and micro enterprises is small and the dimensions are single, the model is difficult to comprehensively identify their potential operational risks, and the overall scoring is generally low, which is prone to triggering operational problems such as risk misjudgment and evaluation imbalance. At the same time, the model derivation process cannot be traced, and staff members cannot clearly determine the specific scoring basis and weight configuration standards. Once credit default, investment loss and other risk events occur, the subsequent risk definition, responsibility division and rectification implementation work are difficult to be advanced in an orderly manner. In addition, the problem of model homogeneity in the industry is relatively prominent. Most financial institutions, in order to save operating costs and improve operational efficiency, directly purchase commercial standardized third-party models for business application, resulting in highly similar risk assessment logic across the industry, amplifying the market resonance effect, and continuously accumulating regional financial risks [10].

3.3. The Evaluation Criteria Are Fragmented, And the Regulatory Supporting System Urgently Needs to Be Improved

The theoretical research and market implementation of the ESG evaluation system in our country have occurred relatively late. Currently, the industry has not yet formed a unified national evaluation index and statistical norms with official authority. The mainstream third-party rating agencies have all established their own evaluation systems, independently setting indicator weights, statistical standards, and scoring rules. The evaluation logic of different institutions varies significantly, and the rating results for the same market entity often show significant deviations [11]. The fragmented evaluation standards not only restrict the standardized and normalized development of the green finance industry but also make the assessment results of intelligent risk control models lose their horizontal comparison value, reducing the professionalism and standardization of ESG risk control work. At the same time, the special regulatory rules adapted to the digital ESG risk control model are still in the process of continuous improvement. Core contents such as data collection boundaries, privacy protection norms, and algorithm compliance review standards have not been clarified [12]. The industry generally has compliance risks such as data abuse and excessive information collection. It is necessary to clarify that digital technology can only play a supporting role in risk control and cannot completely eliminate the "greenwashing" chaos in the capital market. If financial institutions overly rely on intelligent quantitative scoring and neglect the core value of manual on-site investigation and special verification, it will not only weaken the effectiveness of risk control implementation but also continuously accumulate hidden financial risks, which is not conducive to the long-term stable development of the industry.

4. Thoughts on the Path for Optimizing ESG Risk Control in Financial Technology under Sustainable Finance

Data governance is the core foundation of the digital ESG risk control system construction. The quality of underlying data directly determines the accuracy and reliability of risk assessment results, and it is the core prerequisite for the implementation of technology-enabled risk control [13].

Therefore, relevant authorities need to further refine unified ESG information disclosure rules and gradually expand the coverage of mandatory disclosure for market entities to ensure the standardized behavior of small and medium-sized enterprises in information disclosure and fill the data gaps in the industry. On this basis, a data sharing platform involving government, financial institutions, and market enterprises should be established to integrate public data resources from multiple fields such as ecological protection, taxation, justice, and emergency management, and break down barriers to data circulation across departments and industries. At the same time, the industry needs to establish a regular data operation and verification mechanism, uniformly standardize basic processes such as data cleaning, verification, update, and annotation, select effective risk control data, and eliminate redundant and invalid information, to comprehensively ensure the authenticity, completeness, and timeliness of underlying data, and lay a solid data foundation for the stable operation of intelligent risk control models [14].

A well-implemented data governance system can provide solid support for the iterative optimization of algorithm models, solve algorithm application problems, and improve model adaptability, which is a key link in optimizing the intelligent risk control system. When financial institutions upgrade ESG risk control models, they can prioritize the use of open algorithm frameworks with transparent logic, traceability, and dynamic optimization capabilities, clearly define the risk impact mechanisms and weight ratio standards of various ESG indicators, and solve the problem of algorithm black boxes from the root. At the same time, institutions need to establish regular algorithm auditing and dynamic verification mechanisms, regularly check model deviations, operational loopholes, and security risks, and update model parameters in real time based on industry development characteristics, market dynamics, and enterprise operating conditions to ensure that the model meets the needs of industry risk control and market development rhythms. In actual business operations, it is necessary to strictly implement the modern risk control model of human-machine collaboration, use intelligent tools as auxiliary assessment carriers, and avoid solely relying on machine scoring to make business decisions [15]. For major investment and financing projects and high-risk industry businesses, core steps such as manual review and on-site verification must be retained to ensure the scientific and reliable results of risk control assessment.

A sound regulatory system is the bottom-line guarantee for the compliant and stable development of green finance, capable of effectively balancing the dual demands of financial innovation iteration and financial risk prevention, and regulating the industry's development order [16]. Regulatory authorities need to further clarify the business boundaries and compliance standards of ESG fintech products, refine the regulatory rules for the entire process of data collection, storage, transmission, and application, and the main responsibility of financial institutions for compliance operations. In response to the prominent problems of chaotic industry evaluation standards and fragmented systems, the regulatory level should take the lead in unifying the statistical standards and evaluation systems for core ESG indicators, improving the standardization and normalization level of industry risk control [17]. During the process of promoting the implementation of digital risk control innovation pilots, regulatory authorities need to urge financial institutions to disclose the operation principles, applicable scenarios, and inherent defects of the models, avoid centralized market risks caused by algorithm homogeneity, effectively prevent regional and systemic green finance risks, and ensure the long-term compliant and stable development of the industry.

5. Conclusion

The regular implementation and large-scale application of fintech have effectively improved the numerous drawbacks of the traditional ESG risk control, which is characterized by being extensive, passive and lagging. It has significantly enhanced the risk identification, quantitative analysis and precise prevention capabilities of financial institutions, providing a solid digital support for the high-quality development of sustainable finance. It is necessary to clarify that there are clear boundaries for technology empowerment. Digital tools are merely auxiliary carriers for risk control and cannot replace the core value of system construction and professional manual analysis. Currently, problems such as an imperfect data governance system, inherent flaws in algorithms, inconsistent industry evaluation standards, and lagging regulatory mechanisms are continuously restricting the effectiveness of fintech's risk control empowerment. In response to this, financial institutions need to rationally recognize the application value of digital technology, abandon the one-sided thinking of relying solely on technology, and base themselves on the overall situation of green finance development, to build an intelligent ESG risk control system that is compliant with data, transparent in algorithms, compatible with regulation, and human-machine collaborative. Through the empowerment of fintech to the real economy's green and low-carbon transformation, it helps to implement the dual carbon strategy, strictly adheres to the bottom line of financial security development, and ultimately achieves the coordinated improvement of economic benefits, social benefits and ecological benefits, promoting the high-quality and sustainable development of the domestic sustainable finance industry.

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