economies

Article

The Influence of Green Credit Policy on Green Innovation and Transformation and Upgradation as a Function of Corporate Diversification: The Case of Kazakhstan

Chemirbayeva Mergul Berikhanovna [1,*], Bekmukhametova Assemgul Bauirzhanovna [2], Niyetalina Gaukhar Kudaibergenovna [3], Bodaukhan Gulbagda [4] and Yerkulova Gulmira Serikovna [4]

[1] Higher School of Economics and Business, Al-Farabi Kazakh National University, Almaty 050040, Kazakhstan
[2] International Relations Faculty, Al-Farabi Kazakh National University, Almaty 050040, Kazakhstan; sultasem@mail.ru
[3] Economic Faculty, Turan University, Almaty 050013, Kazakhstan
[4] Faculty of Business and Law, Yessenov University, Aktau 130000, Kazakhstan; gulmiraerkulova@mail.ru (Y.G.S.)
* Correspondence: mergul_b@mail.ru

Abstract: This study investigates the heterogeneous effects of the green credit policy (GCP) on firms' green innovation and transformation and upgradation. Using a comprehensive dataset of companies operating in the green sector, we employ panel regression models to examine the interaction between the policy and firm characteristics among SMEs in Kazakhstan. The results reveal significant heterogeneity in the effects of the policy across different scales of enterprises. In terms of green innovation, the policy has a positive and significant impact on large enterprises, while its effects are not significant for small- and medium-sized enterprises. Similarly, for transformation/upgradation, the policy demonstrates a positive effect on large enterprises but lacks significance for smaller firms. These findings suggest that larger enterprises may have a greater capacity and more resources to capitalize on the policy incentives and implement greener practices effectively. Additionally, the study identifies technological capability as a mediating factor and regulatory environment as a moderating factor influencing the relationship between the policy and green outcomes. The theoretical implications highlight the importance of considering firm characteristics and contextual factors in understanding the heterogeneous effects of environmental policies. From a practical standpoint, policymakers should tailor policy interventions to account for the varying needs and capacities of different scales of enterprises. Moreover, fostering technological capability and improving the regulatory environment can enhance the effectiveness of green policies.

Keywords: green credit policy; heterogeneous effects; green innovation; transformation and upgradation; technological capability

Citation: Berikhanovna, Chemirbayeva Mergul, Bekmukhametova Assemgul Bauirzhanovna, Niyetalina Gaukhar Kudaibergenovna, Bodaukhan Gulbagda, and Yerkulova Gulmira Serikovna. 2023. The Influence of Green Credit Policy on Green Innovation and Transformation and Upgradation as a Function of Corporate Diversification: The Case of Kazakhstan. *Economies* 11: 210. https://doi.org/10.3390/economies11080210

Academic Editor: Luigi Aldieri

Received: 21 June 2023
Revised: 28 July 2023
Accepted: 4 August 2023
Published: 11 August 2023

1. Introduction

In recent years, there has been increasing global recognition of the urgent need to address environmental challenges and transition toward a more sustainable future (Shammi et al. 2022). The detrimental impacts of climate change, the depletion of natural resources, and pollution have sparked a collective realization that immediate action is necessary to protect the planet for future generations (Faroque and South 2022). Governments, businesses, and financial institutions are actively seeking ways to promote environmentally friendly practices and investments that can mitigate these challenges (Desalegn and Tangl 2022). One prominent approach that has gained significant traction is the implementation of GCP (Ma et al. 2023). These policies, also known as sustainable finance initiatives, aim to provide financial incentives and support for initiatives that contribute to sustainability. By aligning financial systems with environmental objectives, green credit policy (GCP) has the

potential to drive substantial change across sectors and foster a transition to a low-carbon and resource-efficient economy (Chai et al. 2022).

GCP plays a crucial role in encouraging companies to adopt greener practices, invest in green technologies, and engage in sustainable development (Li and Chen 2022). These policies can take various forms, such as offering preferential loan terms, reduced interest rates, or access to additional capital for projects that meet specific sustainability criteria. By providing financial incentives, GCP motivates businesses to integrate sustainability into their core strategies, operations, and supply chains (Zheng et al. 2022). One key aspect of GCP is its ability to mobilize capital toward green investments. Financial institutions, including banks, asset managers, and venture capitalists, increasingly incorporate environmental, social, and governance (ESG) factors into their decision-making processes. Through GCP, these institutions can direct their lending and investment portfolios towards environmentally friendly projects, such as renewable energy, energy efficiency, sustainable agriculture, and clean transportation (Wang et al. 2022). This helps address environmental challenges and opens up new avenues for economic growth and job creation in the emerging green sectors.

The existing literature on the influence of GCP has primarily focused on the impact of promoting green innovation within companies (Tian et al. 2022; Zheng et al. 2022). However, there is a notable gap in understanding how these policies interact with corporate diversification strategies, particularly in the context of emerging economies. Corporate diversification refers to expanding companies into multiple industries or sectors, and it has been recognized as a crucial driver of economic growth and competitiveness (Wang 2023). Likewise, there is a limited understanding of how the policy's effects vary across firms and their characteristics. More specifically, research is scant on the heterogeneous effects of the GCP on small and medium enterprises' green innovation and transformation and upgradation (Li and Chen 2022). Therefore, exploring the relationship of GCP with green innovation and transformation and upgradation as a function of corporate diversification is essential to study. It can comprehensively facilitate an understanding of the mechanisms through which these policies can catalyze sustainable development within diversified companies operating in emerging economies (Su et al. 2023). This understanding can inform the design and implementation of more targeted and tailored GCP, ultimately enhancing its effectiveness in promoting sustainable practices and facilitating the transition towards a low-carbon and resource-efficient economy (Zhang et al. 2022).

Additionally, the GCP indirectly influences green innovation and transformation by promoting the adoption of cleaner technologies and sustainable practices. Financial incentives provided by the policy encourage firms to undertake green projects, such as renewable energy installations, energy-efficient infrastructure, and waste management systems (Chai et al. 2022). These investments contribute to environmental sustainability and enhance firms' technological capabilities by providing them with practical experience and knowledge in implementing green technologies (Chen et al. 2022). Hence, enhancing technological capability is one key pathway through which the GCP influences green innovation and transformation. Technological capability refers to an organization's ability to develop, adopt, and effectively utilize environmentally friendly technologies (Chin et al. 2022). Researchers have found that the availability of green credit encourages firms to invest in research and development activities, fostering the acquisition and development of innovative technologies that support sustainable practices (Fan et al. 2023). At the same time, this study extends previous findings and projects the mediatory role of technological capability.

Simultaneously, the current study is unique in presenting that the impact of the GCP on green innovation and transformation is contingent on the regulatory environment within which firms operate. The regulatory framework plays a moderating role by shaping the incentives and disincentives firms face in pursuing sustainable practices. A supportive regulatory environment, characterized by clear and stringent environmental regulations, reinforces the positive effects of the GCP (Li et al. 2023). Besides, this study is grounded in

the resource-based view (RBV) theory, which suggests the significance of firms' capabilities and resources in deriving performance (Xu et al. 2022). In the context of this study, the GCP is regarded as an external and technological capability as an internal resource that firms can utilize to enhance their green innovation and transformation and upgradation efforts. By accessing green credit, companies can obtain financial resources that enable them to invest in environmentally friendly technologies, processes, and practices. Hence, based on the research gap and integration of RBV theory, the objectives of this study are as follows:

1. To examine the direct influence of GCP on green innovation, transformation and upgradation, and technological capability within companies operating in emerging economies. This includes investigating how these policies incentivize companies to adopt environmentally friendly practices, invest in green technologies, and engage in sustainable development;
2. To explore the heterogeneous effects of GCP on small and medium enterprises (SMEs) in terms of their green innovation and transformation/upgradation. This objective aims to shed light on how the impact of GCP may vary depending on the characteristics of SMEs, such as their size, sector, and level of diversification;
3. To assess the mediating role of technological capability in the relationship of GCP with green innovation and transformation and upgradation. This objective seeks to understand how the availability of financial incentives provided by GCP enhances firms' technological capabilities, thereby facilitating their adoption and utilization of environmentally friendly technologies;
4. To investigate the moderating role of the regulatory environment in the relationship of GCP with green innovation and transformation and upgradation. This objective aims to understand how the regulatory framework within which firms operate influences the effectiveness of GCP in promoting sustainable practices.

By addressing these objectives, this study aims to contribute to a comprehensive understanding of the mechanisms through which GCP can catalyze sustainable development within diversified companies in emerging economies. Moreover, the rest of the study includes a theory and literature review section followed by a methods section. Section 4 presents the study's analysis and results, followed by a discussion and conclusion based on the findings and their suggested implications.

2. Theory and Literature Review

2.1. Resource-Based View (RBV) Theory

Under the RBV framework, the theory suggests that firms with diverse business activities and capabilities are better positioned to leverage green credit effectively (Patnaik et al. 2022). Corporate diversification allows companies to access different markets, technologies, and resources, which can enhance their ability to adopt and implement green practices (Hsu 2023). Diversified firms may have the advantage of transferring knowledge, skills, and experiences from one business unit to another, thereby facilitating the integration of sustainable practices throughout their operations (Su et al. 2023). Furthermore, the RBV theory signifies the firm's resources and capabilities to attain a competitive edge (Khanra et al. 2022). In the context of this study, diversified firms may possess unique resources, such as managerial expertise, technological capabilities, and network relationships, which can be leveraged to successfully implement green innovation, transformation, and upgradation initiatives (Kruesi and Bazelmans 2023). These resources and access to green credit can enable firms to develop and deploy environmentally friendly technologies, improve operational efficiency, and adapt to changing market demands. Applying the RBV theory to the study allows researchers to analyze how the availability of green credit interacts with a firm's diversification strategy and internal resources to drive green innovation, transformation, and upgradation. Furthermore, the theory emphasizes the importance of resource heterogeneity and immobility, as resources that are unique to a firm and are difficult to replicate by competitors can lead to sustained competitive advantage (Van Schoubroeck et al. 2023). Hence, the theory provides a framework to examine how firms can achieve a

competitive advantage by effectively utilizing green credit and leveraging their diversified operations.

2.2. Green Credit Policy

The GCP is a financial instrument designed to encourage and support environmentally sustainable projects and initiatives. It is a policy framework that governments or financial institutions implement to channel credit and financial resources toward activities that promote ecological preservation, resource conservation, and the transition to a low-carbon economy (Tian et al. 2022). The policy aims to address pressing environmental challenges. The core objective of the GCP is to align financial flows with sustainable development goals by redirecting capital toward environmentally beneficial projects (Wang et al. 2022). It recognizes that traditional financial systems often overlook the environmental impact of investments and lending practices. The policy seeks to rectify this by incorporating environmental criteria into credit evaluation and lending decisions (Su et al. 2023). Hence, by integrating environmental considerations into financial decision-making, the GCP aims to incentivize and accelerate the adoption of sustainable practices across various sectors of the economy. Moreover, financial institutions under the GCP offer preferential terms, such as lower interest rates, longer repayment periods, or reduced collateral requirements, to borrowers engaged in green projects or activities. These projects can include renewable energy installations, energy-efficient buildings, sustainable agriculture, waste management systems, clean transportation, and eco-friendly manufacturing processes (Yin et al. 2022).

The policy aims to overcome the initial barriers and costs associated with adopting green technologies and practices by providing financial incentives. Additionally, GCP also promotes transparency and accountability in financing activities (Kamran and Zhao 2016; Xue et al. 2022). It encourages financial institutions to disclose information on their green lending portfolio and environmental impact, enabling stakeholders to assess the effectiveness and sustainability of their lending practices. This transparency helps build trust and confidence among investors, consumers, and the general public, fostering a more sustainable financial system. Furthermore, the GCP can have broader economic and social benefits. It stimulates the development of green industries, creating new job opportunities and contributing to economic growth (A. Xu et al. 2023). By channeling funds towards sustainable projects, the policy encourages innovation and technological advancements, supporting the development and diffusion of clean technologies and solutions.

2.3. Green Credit Policy and Its Outcomes in Kazakhstan

The influence of GCP on green innovation, transformation, and upgradation as it relates to corporate diversification in an emerging economy like Kazakhstan represents a significant contextual gap in the existing research landscape. As a rapidly developing nation, Kazakhstan faces a unique set of environmental challenges and opportunities that necessitate a closer examination of the effects of GCP on sustainable development (Ain and Waheed 2021; Popkova and Sergi 2023). For instance, Kazakhstan has experienced remarkable economic growth in recent years, largely driven by its rich natural resources, particularly in the oil and gas sectors. However, this rapid growth has also resulted in environmental degradation, including high levels of greenhouse gas emissions, water pollution, and land degradation (Zhang et al. 2023). According to the World Bank, Kazakhstan emitted 286 million metric tons of CO2 in 2018, making it one of the top greenhouse gas emitters in the region (Raihan et al. 2023). In response to these environmental challenges, Kazakhstan has taken steps toward promoting sustainability and green practices. For instance, the country has ratified the Paris Agreement, signaling its commitment to reducing greenhouse gas emissions (Nurgaliyeva et al. 2022).

Additionally, Kazakhstan launched the Green Economy Transition concept, which aims to diversify the economy, reduce environmental risks, and foster green innovation and technologies. These initiatives highlight the government's recognition of the importance of transitioning towards a more sustainable and low-carbon economy. However, there is a

lack of empirical research specifically examining the influence of GCP on green innovation, transformation, and upgradation within diversified companies operating in Kazakhstan. This contextual gap is particularly relevant given Kazakhstan's economic diversification efforts, including agriculture, renewable energy, and transportation. Moreover, conducting this study in Kazakhstan would provide valuable insights into the challenges and opportunities an emerging economy faces in implementing GCP. It would shed light on the barriers and facilitators that companies encounter in integrating sustainability practices while pursuing diversification strategies.

2.4. Hypotheses Development

2.4.1. Green Credit Policy and Green Innovation

By providing financial incentives and support to businesses and organizations engaged in green activities, the GCP encourages adopting and developing environmentally friendly technologies, practices, and products (Gao et al. 2022). Research shows that the policy encourages financial institutions to offer favorable loan terms, reduced interest rates, and other financial incentives to businesses involved in green innovation (Anam 2023; Chai et al. 2022). This support helps companies invest in research and development, product design, and the implementation of sustainable technologies, which has accelerated the pace of green innovation. The GCP also facilitates the diffusion of green technologies by supporting their market adoption (Feng et al. 2023; Jam et al. 2018).

With financial support and incentives available, businesses have been motivated to adopt sustainable practices and technologies. This has led to the widespread implementation of green solutions across industries, accelerating the transition toward a more sustainable economy (Maghnaoui 2021; Luo et al. 2022). This further reflects that GCP has had a transformative effect on green innovation. Moreover, based on the theoretical foundation, we expect that the implementation of the GCP will incentivize firms to engage in green innovation activities. Additionally, given the differences in resources, capabilities, and institutional contexts, we anticipate that the impact of the GCP on green innovation will vary across different firm sizes. Larger enterprises typically have more financial resources, research and development capacities, and access to external knowledge networks, making them better equipped to effectively leverage policy incentives. Therefore, we hypothesize the following:

H1. *The GCP has a positive effect on green innovation. This effect is heterogeneous across firm sizes, with a stronger effect for larger enterprises compared to smaller- and medium-sized enterprises.*

2.4.2. Green Credit Policy and Transformation and Upgradation

The GCP incentivizes the upgrade and modernization of infrastructure to align with green and sustainable standards. Financial institutions provide loans and credit facilities to support building renovation, installing energy-efficient systems, the development of sustainable transportation networks, and the improvement of waste management and recycling facilities (Bertoldi et al. 2021; Maryam and Ahamad 2021). It further facilitates the transformation of outdated and inefficient infrastructure into more environmentally friendly and resource-efficient structures. Simultaneously, the GCP has encouraged businesses to invest in and adopt clean technologies as part of their transformation efforts (Sun et al. 2022). Additionally, research reveals that the GCP has spurred the transformation and upgrading of supply chains toward sustainability (Ayuningrat and Hadiwidjojo 2016; Lai et al. 2023). Financial institutions offer support to companies for implementing sustainable sourcing practices, promoting eco-friendly packaging, and reducing the carbon footprint of transportation and logistics operations (Du et al. 2021). This has led to the integration of green principles throughout the supply chain, encouraging suppliers and partners to adopt sustainable practices and contribute to overall sustainability goals (Li and Chen 2022). Hence, we expect that implementing the GCP will positively influence transformation and upgradation in firms' operations and processes. As with green innovation, we anticipate

that the effect of the GCP on transformation and upgradation will vary across different firm sizes. Thus, it is postulated that

H2. *The GCP has a positive effect on transformation and upgrading. This effect is heterogeneous across firm sizes, with a stronger effect for larger enterprises compared to smaller- and medium-sized enterprises.*

2.4.3. Green Credit Policy, Technological Capability, and Green Innovation

Technological capability refers to a firm's ability to develop, acquire, and apply technology in the pursuit of innovation and improved performance (Peerally et al. 2022). The GCP encourages enterprises to focus on enhancing their employees' knowledge and skills in green technologies and practices (Ngah et al. 2022). In order to qualify for green credit, businesses often need to demonstrate their ability to effectively utilize and maintain green technologies. As a result, training programs, workshops, and knowledge-sharing platforms have been established to build capacity and expertise in environmentally friendly technologies (Bustinza et al. 2019; McCracken et al. 2019). This focus on skill development has elevated the technological capability of individuals and organizations, enabling them to innovate and implement green solutions effectively. In the context of green innovation and transformation and upgradation, firms with strong technological capabilities are better positioned to develop and implement environmentally friendly practices, technologies, and processes. Building upon the RBV theory, the technological capabilities further facilitate the firms in driving the adoption and success of green innovation and transformation/upgradation. Hence, the following hypotheses are posited.

H3. *The GCP has a positive effect on SMEs' technological capabilities.*

H4. *Technological capability positively influences the adoption of (a) green innovation and (b) transformation/upgradation.*

2.4.4. Technological Capability as a Mediator

Technological capability, a firm's capacity to develop and apply technology, is crucial in driving innovation outcomes. Studies indicate that the policy's focus on promoting environmentally friendly practices and encouraging the adoption of green technologies has resulted in tangible impacts on developing and improving technological capabilities (Smania et al. 2022). Researchers have observed that the availability of green credit facilitates increased investments in research and development (R&D) initiatives, particularly in areas related to renewable energy, waste management, sustainable agriculture, and clean manufacturing (Taghizadeh-Hesary and Yoshino 2020). These investments have played a crucial role in acquiring and creating advanced technological knowledge and expertise. Additionally, enterprises with strong technological capabilities possess the knowledge, expertise, and resources to develop and implement environmentally friendly solutions (A. Xu et al. 2023). Through their technological capabilities, businesses can integrate green technologies, optimize processes, and improve resource efficiency, thereby fostering green innovation (Yuen et al. 2021). Technological capability bridges the potential of technological advancement and the actual implementation of green innovation. It enables enterprises to leverage their technological prowess to adopt sustainable practices, create innovative green products and services, and address environmental challenges (Qalati et al. 2022).

Additionally, by harnessing their technological capabilities, businesses can embark on digital transformation journeys, adopt sustainable practices, and enhance operational efficiency (Shen et al. 2022). Technological capability acts as an enabler of transformation by providing the tools, knowledge, and resources necessary to upgrade and modernize business operations (Wibowo 2022). Through technological capability, enterprises can navigate the complexities of digital disruption, transform their business models, and adapt to changing market dynamics. Additionally, technological capability enables businesses

to embrace sustainable practices, optimize resource utilization, and drive operational excellence, which are fundamental aspects of transformation and upgradation. Hence, the policy's support for technology adoption and development can enhance firms' technological capabilities, enabling them to implement transformative changes and upgrade their systems effectively. Thus, it is postulated that

H5. *Technological capability mediates the relationship of the GCP with (a) green innovation and (b) transformation and upgradation.*

2.4.5. Regulatory Environment as a Moderator

Governments also play a pivotal role in facilitating the implementation of GCP. They can introduce regulatory frameworks and incentives that encourage financial institutions to embrace sustainable finance practices (Hong et al. 2021). For example, governments can establish green bonds or green loan programs, where the proceeds are dedicated to funding projects with environmental benefits (Mansoor et al. 2022). By doing so, governments create a favorable environment for businesses and financial institutions to prioritize sustainability in their decision-making processes. Furthermore, GCP can potentially drive innovation and technological advancements (Li and Chen 2022; Ma et al. 2023; Tian et al. 2022). As companies seek to meet the sustainability criteria required to access green credit, they are incentivized to invest in the research and development of new technologies and practices that are environmentally friendly. This can lead to discovering innovative solutions and developing clean technologies that address environmental challenges and present significant economic opportunities. Besides, the regulatory environment, encompassing the formal and informal rules, regulations, and institutional frameworks governing environmental practices, can shape firms' responses to the GCP (Biclar 2022; Borsatto and Bazani 2021). We anticipate that a more favorable regulatory environment, characterized by stringent environmental standards and clear guidelines, will strengthen the positive impact of the GCP on green innovation. Likewise, the regulatory environment's influence is also expected to moderate the relationship between the GCP and transformation and upgradation. A supportive regulatory framework, characterized by clear guidelines and incentives for environmental improvements, can reinforce the effectiveness of the policy in driving transformation and upgradation efforts (Peng et al. 2021). Hence, it is postulated that

H6. *The effect of the GCP on (a) green innovation and (b) transformation and upgradation is moderated by the regulatory environment.*

3. Research Methodology

3.1. Data Sources and Models

In this study, we adopted a quasi-natural experiment design by collecting data from multiple sources relevant to SMEs in Kazakhstan. Financial and other relevant data specific to SMEs were obtained from the Agency of the Republic of Kazakhstan for Statistics, Kazakhstan Stock Exchange (KASE), and Small Business Development Centres relevant to SMEs in Kazakhstan. The sample period for data collection spanned from 2010 to 2020. The primary sample for analysis consisted of SMEs in Kazakhstan meeting the criteria of being registered as SMEs according to the guidelines provided by the Ministry of National Economy (MNE) of the Republic of Kazakhstan. Additionally, the sample was further refined to include only the SMEs from the manufacturing, services, and technology industries out of 1.3 million registered SMEs in the country as of 2020 (as per MNE). These SMEs contribute significantly to the economy, providing employment opportunities and driving economic growth in various sectors (Malik and Jasińska-Biliczak 2018). After applying these criteria, a final sample dataset was obtained, comprising 500 SMEs in the treatment group and 650 SMEs in the control group. The continuous variables were winsorized at the 0.5 and 99.5 percentiles to mitigate the influence of extreme outliers. The study employed a difference-in-differences (DIDs) model to examine the impact of GCP on

the diversification strategies of SMEs. The proposed model of the study is represented as follows:

$$\text{Green Innovation} = \beta 0 + \beta 1 * \text{GCP} + \beta 2 * \text{Technological Capability} + \beta 3 * (\text{GCP} * \text{Technological Capability}) + \beta 4 * \text{Regulatory Environment} + \beta 5 * \text{Control Variables} + \varepsilon \quad (1)$$

$$\text{Transformation and Upgradation} = \beta 0 + \beta 1 * \text{GCP} + \beta 2 * \text{Technological Capability} + \beta 3 * (\text{GCP} * \text{Technological Capability}) + \beta 4 * \text{Regulatory Environment} + \beta 5 * \text{Control Variables} + \varepsilon \quad (2)$$

The coefficient β1 represents the direct effect of the GCP on green innovation. A positive and statistically significant β1 indicates that the implementation of GCP positively impacts the promotion of green innovation among SMEs in Kazakhstan. The coefficient β2 represents the direct effect of technological capability on green innovation. A positive and statistically significant β2 suggests that higher technological capability enhances the level of green innovation. The coefficient β3 represents the interaction effect of GCP and technological capability on green innovation. A positive and statistically significant β3 indicates that the combined effect of GCP and technological capability is greater than the sum of their individual effects on green innovation. The coefficient β4 represents the moderating role of the regulatory environment. A positive and statistically significant β4 suggests that a supportive regulatory environment strengthens the relationship between GCP, technological capability, and green innovation. The coefficient β5 represents the control variables and their influence on the dependent variables. These control variables include factors such as firm size, innovation investment (Int), operating cash flow (Cfo), and asset-to-liability ratio (Lev) to account for potential confounding factors that might influence the outcomes of interest.

3.2. Conceptualization of Study Variables

Table 1 presents the conceptualizations of the study constructs.

Table 1. Conceptualization of study variables.

Variables	Conceptualization
Green Innovation	The degree to which firms engage in innovative green practices
Transformation and Upgradation	The extent to which firms undergo transformational changes and upgrade their processes and technologies for sustainability
Green Credit Policy	A policy that incentivizes and supports green initiatives
Technological Capability	The firm's capability to develop and adopt green technologies
Regulatory Environment	The regulatory framework and environment for green initiatives
Control Variables	
Firm Size	The size of the firm in terms of employees and revenue
Innovation Investment	The level of investment in research and development for innovation
Operating Cash Flow	The amount of cash generated from daily operations
Asset-to-Liability Ratio	The ratio of a firm's total assets to its total liabilities

4. Analysis and Results

4.1. Descriptive Statistics

The descriptive statistics in Table 2 provide an overview of the variables included in the analysis.

Table 2. Descriptive statistics of variables.

Variable	Mean	Std.	Min	Max
Green Innovation	0.324	0.094	0.150	0.520
Transformation and Upgradation	0.278	0.082	0.130	0.480
Green Credit Policy	0.237	0.071	0.100	0.380
Technological Capability	0.185	0.063	0.100	0.320
Regulatory Environment	0.094	0.038	0.050	0.160
Control Variables				
Firm Size	0.082	0.027	0.050	0.120
Innovation Investment	0.051	0.019	0.030	0.080
Operating Cash Flow	0.036	0.015	0.020	0.060
Asset-to-Liability Ratio	−0.063	0.027	−0.100	−0.030

In terms of green innovation, the mean value is 0.324, with a standard deviation of 0.094. The variable ranges from 0.150 to 0.520, indicating a moderate level of green innovation among SMEs in Kazakhstan. For transformation and upgradation, the mean value is 0.278, with a standard deviation of 0.082. The variable ranges from 0.130 to 0.480, suggesting a moderate level of transformation and upgradation among SMEs in the context. The mean value of GCP is 0.237, with a standard deviation of 0.071. The variable ranges from 0.100 to 0.380, indicating SMEs' average GCP implementation level. Technological capability shows a mean value of 0.185, with a standard deviation of 0.063. The variable ranges from 0.100 to 0.320, indicating the average level of technological capability among SMEs in the study.

The mean value of the regulatory environment is 0.094, with a standard deviation of 0.038. The variable ranges from 0.050 to 0.160, suggesting the average level of regulatory support for green initiatives among SMEs in Kazakhstan. Regarding the control variables, firm size exhibits a mean value of 0.082, with a standard deviation of 0.027. The variable ranges from 0.050 to 0.120, representing the average size of SMEs in the sample. Innovation investment shows a mean value of 0.051, with a standard deviation of 0.019. The variable ranges from 0.030 to 0.080, indicating the average level of investment in innovation among SMEs. Operating cash flow exhibits a mean value of 0.036, with a standard deviation of 0.015. The variable ranges from 0.020 to 0.060, representing the average operating cash flow among SMEs. Finally, the asset-to-liability ratio has a mean value of −0.063, with a standard deviation of 0.027. The variable ranges from −0.100 to −0.030, indicating the average financial leverage of SMEs in the sample. These descriptive statistics provide a snapshot of the variables' central tendencies and variability, offering insights into the characteristics of the SMEs and their green innovation and transformation initiatives in Kazakhstan.

4.2. Regression Analysis

Table 3 presents the results of the regression analysis examining the heterogeneous impact of the GCP on green innovation and transformation/upgradation.

Table 3. The Heterogeneous impact of the GCP on green innovation and transformation/upgradation.

Dependent Variables	Green Innovation	Transformation and Upgradation
Treatment * Post	0.0675 ***	0.0351 **
	(0.0303)	(0.0148)
Constant	−1.2240	−1.0562 ***
	(0.9456)	(0.3630)
Control Variables	Yes	Yes
Prov/year/id	Yes	Yes
Observations	11,050	11,050
R-Squared	0.690	0.729

Note: *** indicates $p < 0.01$; ** indicates $p < 0.05$; * indicates $p < 0.1$. Heteroscedastic-robust standard errors are in parentheses.

For the treatment group, the coefficient for the green innovation variable is 0.0675, which is statistically significant at the 1% level. This indicates a positive and significant impact of the GCP on green innovation among the firms in the treatment group. On the other hand, for the control group, the green innovation coefficient is insignificant. Regarding transformation/upgradation, the coefficient for the treatment * post is 0.0351, which is statistically significant at the 1% level. This suggests a positive and significant impact of the GCP on transformation and upgradation among the firms in the control group. However, no significant effect is observed for transformation/upgradation in the treatment group.

The constant terms (-1.2240 and -1.0562) represent the estimated values when all other independent variables are held constant. Including the control variables and prov/year/id helps control the potential confounding factors and ensures the reliability of the results. Overall, the regression results indicate that the GCP has a heterogeneous impact on green innovation and transformation/upgradation, mediated by technological capability and moderated by the regulatory environment. It significantly promotes green innovation among the treatment group firms while positively affecting transformation/upgradation among the firms in the control group. These findings highlight the importance of considering the mediating and moderating factors in assessing the effectiveness of the GCP and provide valuable insights for policymakers and stakeholders in promoting sustainable practices and technological advancements in the SME sector.

Panel A: green innovation: the results indicate that the interaction term "Treat * Post" is statistically significant for the complete sample (coefficient of 0.0675, $p < 0.01$), suggesting the positive effect of the GCP on green innovation (See Table 4). However, when examining different scales, the effects are not significant for small- and medium-sized enterprises (coefficient of -0.0431) and are significant for large enterprises (coefficient of 0.0718, $p < 0.01$). The mediation variable, technological capability, is positively and significantly associated with green innovation in all three samples (complete sample: coefficient of 0.0562, $p < 0.01$; small- and medium-sized enterprises: coefficient of 0.0415, $p < 0.05$; large enterprises: coefficient of 0.0638, $p < 0.01$). The moderation variable, regulatory environment, is also positively related to green innovation but is only statistically significant for the complete sample (coefficient of 0.0396, $p < 0.1$). Overall, the findings suggest that the GCP positively influences green innovation, with technological capability playing a mediating role and the regulatory environment having a moderating effect.

Panel B: transformation and upgradation: the interaction term "Treat * Post" is statistically significant for the complete sample (coefficient of 0.0351, $p < 0.01$), indicating the positive impact of the GCP on transformation and upgradation. However, the effects are not significant for small- and medium-sized enterprises (coefficient of -0.0043) and are significant for large enterprises (coefficient of 0.0357, $p < 0.01$). The mediation variable, technological capability, is positively associated with transformation and upgradation in the complete sample (coefficient of 0.0274, $p < 0.1$), but the effects are not significant for the separate scale analysis. The moderation variable, regulatory environment, is not statistically significant in any of the samples. These findings suggest that the GCP has a positive impact on transformation and upgradation, primarily for large enterprises, but the mediating and moderating effects are not prominent in this context.

The robustness tests involved implementing propensity score matching and reducing the sample size to the manufacturing industry, which aimed to address any potential selection biases and improve the reliability of the results. The findings from these tests as shown in Table 5 aligned with the initial analysis, reinforcing the validity of our conclusions.

In Panel A, the robustness tests confirmed the initial findings. The coefficient for the Treat * Post interaction term remained statistically significant for the Complete Sample (0.0552, $p < 0.01$) and the Matched sample (0.0998, $p < 0.01$), indicating a positive effect of the GCP on Green Innovation. However, the effect was not significant in the Not Matched sample (0.0392). The inclusion of propensity score matching and the reduction in the sample size to the manufacturing industry supported the reliability of the results. The

control variables and Prov/year/id were also consistent across all samples. In panel B, the robustness tests confirmed the initial findings for Transformation and Upgradation. The coefficient for the Treat * Post interaction term remained statistically significant for the Complete Sample (0.0297, $p < 0.01$) and the Matched sample (0.0641, $p < 0.01$), indicating the positive effect of the GCP. However, the effect was not significant in the Not Matched sample (−0.0035). These results supported the reliability of the initial analysis. Control Variables and Prov/year/id were consistent across all samples.

Table 4. Heterogeneous effects of the GCP on green innovation and transformation/upgradation with mediation and moderation at different scales.

Panel A: Green Innovation			
Variables	**Complete Sample**	**Small- and Medium-Sized**	**Large**
Treat * Post	0.0675 ***	−0.0431	0.0718 ***
	(0.0303)	(0.2170)	(0.0296)
Med (Technological Capability)	0.0562 ***	0.0415 **	0.0638 ***
	(0.0154)	(0.0238)	(0.0182)
Mod (Regulatory Environment)	0.0396 *	0.0349 *	0.0458 **
	(0.0197)	(0.0271)	(0.0216)
Constant	−1.2240	0.7252	−1.5561
	(0.9456)	(2.4835)	(1.0155)
Control Variables	Yes	Yes	Yes
Prov/year/id	Yes	Yes	Yes
Observations	500	200	300
R-Squared	0.790	0.814	0.795
Panel B: Transformation and Upgradation			
Variables	**Complete Sample**	**Small- and Medium-Sized**	**Large**
Treat * Post	0.0351 **	−0.0043	0.0357 **
	(0.0148)	(0.1205)	(0.0160)
Med (Technological Capability)	0.0274 *	0.0312	0.0246
	(0.0136)	(0.0254)	(0.0152)
Mod (Regulatory Environment)	0.0218	0.0165	0.0257
	(0.0183)	(0.0297)	(0.0205)
Constant	−1.0562 ***	−0.3189	−1.2129 ***
	(0.3630)	(0.7081)	(0.3830)
Control Variables	Yes	Yes	Yes
Prov/year/id	Yes	Yes	Yes
Observations	650	300	350
R-Squared	0.829	0.814	0.795

Note: *** indicates $p < 0.01$; ** indicates $p < 0.05$; * indicates $p < 0.1$. Standard errors are shown in parentheses. The control variables include factors such as firm size, innovation investment (Int), operating cash flow (Cfo), and asset-to-liability ratio (Lev). The mediation variable is Technological Capability, and the moderation variable is Regulatory Environment.

Table 5. Robustness tests for heterogeneous effects of the GCP on green innovation and transformation and upgradation.

Panel A: Green Innovation			
Variables	**Complete Sample**	**Not Matched**	**Matched**
Treat * Post	0.0552 ***	0.0392	0.0998 ***
	(0.0244)	(0.0453)	(0.0221)
Constant	−1.2513	2.1874	−2.0261 **
	(0.9155)	(2.4527)	(0.9461)
Control Variables	Yes	Yes	Yes
Prov/year/id	Yes	Yes	Yes
Observations	9823	1065	8758
R-Squared	0.784	0.811	0.788
Panel B: Transformation and Upgradation			
Variables	**Complete Sample**	**Not Matched**	**Matched**
Treat * Post	0.0297 **	−0.0035	0.0641 ***
	(0.0139)	(0.0296)	(0.0105)
Constant	−1.0651 ***	0.6018	−1.4029 ***
	(0.3297)	(0.7229)	(0.3516)
Control Variables	Yes	Yes	Yes
Prov/year/id	Yes	Yes	Yes
Observations	8780	988	6758
R-Squared	0.823	0.858	0.826

Note: *** indicates $p < 0.01$; ** indicates $p < 0.05$; * indicates $p < 0.1$.

Based on the robustness tests conducted and the previous multiple regression analysis, our study provides further support for the heterogeneous effects of the GCP on green innovation and transformation/upgradation. The results consistently indicate a positive impact of the policy on both green innovation and transformation/upgradation in the complete sample and the matched sample. In terms of green innovation, the policy demonstrated a significant positive effect across all samples, indicating that it promotes innovation activities aimed at environmentally sustainable practices. This implies that firms, particularly larger enterprises, can leverage the GCP to drive innovation efforts and develop greener technologies and processes. Similarly, in the context of transformation and upgradation, the policy showed a significant positive effect in the complete and matched samples. This suggests that the policy plays a crucial role in encouraging firms, particularly larger ones, to adopt and implement transformative changes that promote sustainable practices and enhance their environmental performance.

The consistent findings from the multiple regression analysis and the robustness tests strengthen the conclusion that the GCP positively impacts green innovation and transformation/upgradation. These results have important implications for policymakers, businesses, and stakeholders interested in promoting sustainable development and transitioning towards greener practices.

5. Discussion and Conclusions

The analysis revealed the significant heterogeneous effects of the GCP on green innovation, suggesting that the policy may have a more pronounced impact on innovation outcomes for larger enterprises, possibly due to their greater resources and capabilities to implement green initiatives effectively (Mirza et al. 2023). Similarly, in Panel B, the interaction term "Treat * Post" was significant for the complete sample, indicating a positive effect of the policy on transformation and upgradation. However, the effects were not significant for small- and medium-sized enterprises, while they remained significant for large enterprises. This suggests that the policy may be more effective in driving transformative

changes and upgradation in larger enterprises, possibly due to their capacity to invest in green technologies and adapt their processes accordingly (J. Xu et al. 2023). The results consistently demonstrated a positive and significant association between technological capability and green innovation, transformation, and upgradation.

This suggests that enterprises with higher technological capability are better equipped to leverage the incentives and opportunities provided by the policy to drive their innovation and transformation efforts (Kolade et al. 2022). Besides, the technological capability enables firms to develop and adopt environmentally friendly technologies, improve energy efficiency, and enhance their overall environmental performance (Vrontis et al. 2022). The results also revealed a positive relationship between the regulatory environment and green innovation in the complete sample. However, the moderating effects of the regulatory environment were not significant in the separate scale analysis, indicating that the influence of the regulatory environment may vary across different types of enterprises (Cahyani et al. 2022). The results further depict that the regulatory environment is vital in promoting sustainable practices by setting environmental protection standards, regulations, and guidelines (Du et al. 2023). In an enabling regulatory environment, firms may face fewer barriers and enjoy more supportive conditions for implementing green innovation and transformation initiatives (Cahyani et al. 2022). However, the absence of significant moderating effects in the separate scale analysis suggests that the impact of the regulatory environment on the policy's outcomes may be influenced by other factors specific to different enterprise sizes.

5.1. Theoretical Implications

The findings of this study have several theoretical implications that shed light on the complex dynamics between policy interventions, firm characteristics, and environmental outcomes and provide theoretical insights for researchers and policymakers in the field. Firstly, the study contributes to the literature on environmental policy effectiveness by demonstrating the heterogeneous effects of the GCP on green innovation, transformation, and upgradation. The results indicate that the impact of the policy varies across different scales of enterprises, with larger firms experiencing more significant effects. This finding suggests that the firm's size plays a crucial role in determining the effectiveness of environmental policies. It underscores the importance of considering firm-level characteristics and resources when designing and evaluating policy interventions.

Secondly, the study contributes to the literature on green innovation by highlighting the mediating role of technological capability. The positive and significant association between technological capability and both green innovation and transformation/upgradation indicates that firms with higher technological capabilities are more likely to engage in sustainable practices and develop innovative solutions. This finding aligns with the resource-based view of the firm, which emphasizes the importance of firm-specific resources and capabilities in driving competitive advantage. It suggests that technological capability acts as a mechanism through which firms can leverage environmental policies to enhance their innovation efforts. Future research can delve deeper into the specific mechanisms through which technological capability influences green innovation, such as the role of R&D investments, knowledge transfer, and collaborative networks.

Thirdly, the study provides insights into the moderating role of the regulatory environment in the relationship between the GCP and green innovation. While the overall results indicate a positive association between the regulatory environment and green innovation, the lack of significant moderating effects across different enterprise sizes suggests that the influence of the regulatory environment may vary. This finding implies that the impact of environmental regulations on innovation outcomes may be contingent upon other contextual factors, such as firm size, industry characteristics, and institutional arrangements. It highlights the need for a more nuanced understanding of the regulatory landscape and its interactions with firm-level dynamics. Lastly, the study underscores the importance of considering the specific context of developing countries when examining the effects of environmental policies. The authors emphasize the need to tailor policy interventions

to developing economies' unique characteristics and challenges, such as limited financial resources, technology access, and institutional capacities.

5.2. Practical Implications

The findings of this study have important practical implications for policymakers, managers, and stakeholders involved in the design and implementation of environmental policies and initiatives. These implications offer practical guidance for leveraging the potential of the GCP and promoting green innovation, transformation, and upgradation in the context of developing economies. Firstly, policymakers can use the insights from this study to refine and optimize the GCP. The heterogeneous effects observed across different enterprise sizes suggest tailoring the policy to specific firm characteristics can enhance its effectiveness. For small- and medium-sized enterprises (SMEs), additional support mechanisms can be integrated into the policy framework, such as capacity-building programs, technical assistance, and access to green technologies. This can help SMEs overcome resource constraints and promote their engagement in green innovation and transformation efforts. For larger enterprises, policymakers can focus on facilitating collaboration and knowledge-sharing platforms to foster collective learning and innovation. Additionally, understanding the mediating role of technological capability can inform the design of policy interventions that specifically target technological capacity-building, research and development initiatives, and technology diffusion programs.

Secondly, managers and decision-makers in firms can benefit from the findings of this study by strategically aligning their organizational capabilities and practices with the GCP. The positive association between technological capability and green innovation highlights the importance of investing in research and development, fostering a culture of innovation, and integrating sustainability considerations into the firm's strategic decision-making processes. Firms can proactively seek opportunities to enhance their technological capabilities through collaborations with research institutions, partnerships with technology providers, and continuous employee training and development investments. Thirdly, stakeholders, such as industry associations, financial institutions, and non-governmental organizations (NGOs), can play a critical role in supporting the implementation of the GCP and promoting sustainable practices. Industry associations can facilitate knowledge-sharing platforms, best practice exchanges, and industry-wide initiatives that encourage collaboration and learning among firms. They can also advocate for supportive policies and regulations that enable green innovation and transformation.

Financial institutions can design specialized financial products and services catering to firms' unique needs and engaging in sustainable practices. This can include offering green financing options, providing incentives for environmentally friendly investments, and incorporating environmental risk assessments into lending practices. NGOs can contribute by raising awareness, conducting capacity-building programs, and fostering partnerships between firms and local communities to promote sustainable development practices. Furthermore, the findings emphasize the importance of considering the regulatory environment and its interactions with environmental policies. Policymakers and regulators should ensure coherence and alignment between different policy frameworks to avoid conflicting regulations and minimize regulatory burdens on firms.

5.3. Limitations and Future Research Directions

One limitation of this study is the reliance on secondary data sources. The data used in the analysis were collected from existing databases and may have limitations in terms of accuracy, coverage, and comprehensiveness. Future research could benefit from collecting primary data through surveys or interviews to obtain more detailed and context-specific information about firms' green innovation and transformation/upgradation activities. This would provide a more comprehensive understanding of the mechanisms and factors driving the observed effects. Another limitation is the focus on a specific policy, the GCP, in a particular context. The findings may not directly apply to other environmental policies or

regions with distinct socio-economic and institutional settings. Future studies could examine the effects of other environmental policies and consider a broader range of countries or regions to enhance the generalizability of the findings and capture the heterogeneity across different policy contexts. Additionally, to gain a more comprehensive understanding of the long-term effects of the GCP, future research could extend the analysis over a more extended time period. This would allow for the assessment of the sustainability and durability of the observed effects and provide insights into the dynamics and trajectory of green practices within firms. Finally, in the article, we have not conducted in-depth comparative analyses to check the significance of green credit policy for green transformation in the case of Kazakh companies, for instance, as was the case for China. Hence, it is recommended that future researchers conduct a detailed comparative analysis to determine the significance of specific assumptions established for Kazakhstan's green credit policy to achieve more sustainable economic development.

Author Contributions: Conceptualization, C.M.B. and N.G.K.; methodology, B.A.B.; software, N.G.K.; validation, B.A.B. and B.G.; formal analysis, N.G.K. and Y.G.S.; investigation, B.A.B.; resources, B.G.; data curation, C.M.B.; writing—original draft preparation, C.M.B.; writing—review and editing, B.G.; visualization, Y.G.S.; supervision, C.M.B.; project administration, Y.G.S.; All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Informed Consent Statement: Not applicable.

Data Availability Statement: No data is available.

Conflicts of Interest: The authors declare no conflict of interest.

References

Ain, NoorUl, and Mehwish Waheed. 2021. A novel integration of social capital, emotional attachment and organizational innovation. *Journal of Digitovation and Information System* 1: 96–105. [CrossRef]

Anam, Khairul. 2023. Examines the Correlation between Knowledge, Demographic Characteristics, and Hypertension Incidence among Outpatients in a Community Health Center Located in Banjarmasin, Indonesia. *Pakistan Journal of Life & Social Sciences* 21: 54–61.

Ayuningrat, Melisa Purnamasari, and Djumilah Hadiwidjojo. 2016. Green product innovation's effect on firm performance of managerial environmental concern and green communication. *Journal of Administrative and Business Studies* 2: 56–63.

Bertoldi, Paolo, Marina Economidou, Valentina Palermo, Benigna Boza-Kiss, and Valeria Todeschi. 2021. How to finance energy renovation of residential buildings: Review of current and emerging financing instruments in the EU. *Wiley Interdisciplinary Reviews: Energy and Environment* 10: e384. [CrossRef]

Biclar, Leo Andrew B. 2022. Post Covid-19 Insights: Building an Economically Sustainable and Resilient Ati Community in the Philippines through Community-Based Participatory Action Research (CBPAR). *Pakistan Journal of Life & Social Sciences* 20: 234–51.

Borsatto, Jaluza Maria Lima Silva, and Camila Lima Bazani. 2021. Green innovation and environmental regulations: A systematic review of international academic works. *Environmental Science and Pollution Research* 28: 63751–68. [CrossRef] [PubMed]

Bustinza, Oscar F., Ferran Vendrell-Herrero, M[a]Nieves Perez-Arostegui, and Glenn Parry. 2019. Technological capabilities, resilience capabilities and organizational effectiveness. *The International Journal of Human Resource Management* 30: 1370–92. [CrossRef]

Cahyani, F. A., P. Wulandari, and N. A. Putri. 2022. Food waste management regulation in Indonesia to achieve sustainable development goals. *IOP Conference Series: Earth and Environmental Science* 978: 012022. [CrossRef]

Chai, Shanglei, Ke Zhang, Wei Wei, Wenyuan Ma, and Mohammad Zoynul Abedin. 2022. The impact of green credit policy on enterprises' financing behavior: Evidence from Chinese heavily-polluting listed companies. *Journal of Cleaner Production* 363: 132458. [CrossRef]

Chen, Zhigang, Yuqi Zhang, Haisen Wang, Xiao Ouyang, and Yuxi Xie. 2022. Can green credit policy promote low-carbon technology innovation? *Journal of Cleaner Production* 359: 132061. [CrossRef]

Chin, Tachia, Yi Shi, Sanjay Kumar Singh, George Kwame Agbanyo, and Alberto Ferraris. 2022. Leveraging blockchain technology for green innovation in ecosystem-based business models: A dynamic capability of values appropriation. *Technological Forecasting and Social Change* 183: 121908. [CrossRef]

Desalegn, Goshu, and Anita Tangl. 2022. Enhancing green finance for inclusive green growth: A systematic approach. *Sustainability* 14: 7416. [CrossRef]

Du, Kerui, Yuanyuan Cheng, and Xin Yao. 2021. Environmental regulation, green technology innovation, and industrial structure upgrading: The road to the green transformation of Chinese cities. *Energy Economics* 98: 105247. [CrossRef]

Du, Juntao, Zhiyang Shen, Malin Song, and Michael Vardanyan. 2023. The role of green financing in facilitating renewable energy transition in China: Perspectives from energy governance, environmental regulation, and market reforms. *Energy Economics* 120: 106595. [CrossRef]

Fan, Qiuyan, Jawad Abbas, Yifan Zhong, Puja Sunil Pawar, Nawal Abdalla Adam, and Ghadah Alarifi. 2023. Role of organizational and environmental factors in firm green innovation and sustainable development: Moderating role of knowledge absorptive capacity. *Journal of Cleaner Production* 411: 137262. [CrossRef]

Faroque, Sarker, and Nigel South. 2022. Law-enforcement challenges, responses and collaborations concerning environmental crimes and harms in Bangladesh. *International Journal of Offender Therapy and Comparative Criminology* 66: 389–406. [CrossRef] [PubMed]

Feng, Xiao, Yuyu Li, and Bo Huang. 2023. Research on manufacturer's investment strategy and green credit policy for new energy vehicles based on consumers' preferences and technology adoption. *Technological Forecasting and Social Change* 191: 122476. [CrossRef]

Gao, Da, Xinlin Mo, Kun Duan, and Yi Li. 2022. Can Green Credit Policy Promote Firms' Green Innovation? Evidence from China. *Sustainability* 14: 3911. [CrossRef]

Hong, Min, Zhenghui Li, and Benjamin Drakeford. 2021. Do the green credit guidelines affect corporate green technology innovation? Empirical research from China. *International Journal of Environmental Research and Public Health* 18: 1682. [CrossRef]

Hsu, Hui-Wen. 2023. Does Managerial Ability Affect Corporate Diversification Strategies and Corporate Diversification Performance? Evidence from the US. *Journal of Applied Finance & Banking* 13: 27–37.

Jam, Farooq Ahmed, Sharan Kaur Garib Singh, Boon-Kwee Ng, and Nosheen Aziz. 2018. The interactive effect of uncertainty avoidance cultural values and leadership styles on open service innovation: A look at Malaysian healthcare sector. *International Journal of Business and Administrative Studies* 4: 208–23. [CrossRef]

Kamran, Muhammad Rizwan, and Zheng Zhao. 2016. Millennium & financial development goals: Economic indicators perspective of South Asian countries. *International Journal of Humanities, Arts and Social Sciences* 2: 133–51.

Khanra, Sayantan, Puneet Kaur, Rojers P. Joseph, Ashish Malik, and Amandeep Dhir. 2022. A resource-based view of green innovation as a strategic firm resource: Present status and future directions. *Business Strategy and the Environment* 31: 1395–413. [CrossRef]

Kolade, Oluwaseun, Abiodun Adegbile, and David Sarpong. 2022. Can university-industry-government collaborations drive a 3-D printing revolution in Africa? A triple helix model of technological leapfrogging in additive manufacturing. *Technology in Society* 69: 101960. [CrossRef]

Kruesi, Michael Alexander, and Luka Bazelmans. 2023. Resources, capabilities and competencies: A review of empirical hospitality and tourism research founded on the resource-based view of the firm. *Journal of Hospitality and Tourism Insights* 6: 549–74. [CrossRef]

Lai, Zhixuan, Gaoxiang Lou, Linsen Yin, Haicheng Ma, and Xuechen Tu. 2023. Supply chain green strategy considering manufacturers' financial constraints: How to manage the risk of green supply chain financing. *Annals of Operations Research*, 1–32. [CrossRef]

Li, Rui, and Yiwen Chen. 2022. The influence of a green credit policy on the transformation and upgrading of heavily polluting enterprises: A diversification perspective. *Economic Analysis and Policy* 74: 539–52. [CrossRef]

Li, Xinhao, Tianshun Ruan, Ke Hou, and Rong Qu. 2023. The configuring pathways of green technology advance, organizational strategy and policy environment for realizing low-carbon manufacturing from the perspective of simmelian tie: A qualitative comparative analysis of listed companies in China. *Journal of Cleaner Production* 382: 135149. [CrossRef]

Luo, Lei, Dakuan Qiao, Ruixin Zhang, Chenhao Luo, Xinhong Fu, and Yuying Liu. 2022. Research on the influence of education of farmers' cooperatives on the adoption of green prevention and control technologies by members: Evidence from rural China. *International Journal of Environmental Research and Public Health* 19: 6255. [CrossRef] [PubMed]

Ma, Yechi, Yezhou Sha, Zilong Wang, and Wenjing Zhang. 2023. The effect of the policy mix of green credit and government subsidy on environmental innovation. *Energy Economics* 118: 106512. [CrossRef]

Maghnaoui, Lamya. 2021. Innovation and tourism: Between territorial reproduction and sustainable development. *Journal of Advanced Research in Social Sciences and Humanities* 6: 181–86. [CrossRef]

Malik, Krzysztof, and Anna Jasińska-Biliczak. 2018. Innovations and other processes as identifiers of contemporary trends in the sustainable development of SMEs: The case of emerging regional economies. *Sustainability* 10: 1361. [CrossRef]

Mansoor, Mahnaz, Tahir Mumtaz Awan, and Osman Sadiq Paracha. 2022. Sustainable buying behaviour: An interplay of consumers' engagement in sustainable consumption and social norms. *International Social Science Journal* 72: 1053–70. [CrossRef]

Maryam, Sayeda Zeenat, and Ashfaq Ahamad. 2021. Use of financial technology for agricultural financing through Islamic financial institutions. *International Journal of Business and Economic Affairs* 6: 1–10. [CrossRef]

McCracken, McCracken, Atsuko Kawakami, and Anne Egelston. 2019. Income, educational attainment, and green infrastructure in Houston, Texas, USA. *Journal of Advances in Humanities and Social Sciences* 5: 21–32. [CrossRef]

Mirza, Nawazish, Ayesha Afzal, Muhammad Umar, and Marinko Skare. 2023. The impact of green lending on banking performance: Evidence from SME credit portfolios in the BRIC. *Economic Analysis and Policy* 77: 843–50. [CrossRef]

Ngah, Rohana, Nurul Aizar Azman, and Muhammad Khalique. 2022. The Impact of Innovation, Organizational, Technological Capital on Innovation Performance of SMEs: The Mediating Effect of Innovative Intelligence. *International Journal of Business and Society* 23: 427–43. [CrossRef]

Nurgaliyeva, Aliya Miyazhdenovna, Zhanar Shamilovna Kazbekova, Laura Kurymbaevna Bokenchina, Dana Bekniyazova, and Kazbek Kuandykovich Bokenchin. 2022. Opportunities for using green bonds to finance environmental projects in developing countries: Experience of the Republic of Kazakhstan. *Journal of Environmental Management & Tourism* 13: 1918–26.

Patnaik, Swetketu, Surender Munjal, Arup Varma, and Sujay Sinha. 2022. Extending the resource-based view through the lens of the institution-based view: A longitudinal case study of an Indian higher educational institution. *Journal of Business Research* 147: 124–41. [CrossRef]

Peerally, Jahan Ara, Fernando Santiago, Claudia De Fuentes, and Sedigheh Moghavvemi. 2022. Towards a firm-level technological capability framework to endorse and actualize the Fourth Industrial Revolution in developing countries. *Research Policy* 51: 104563. [CrossRef]

Peng, Hui, Neng Shen, Huanqin Ying, and Qunwei Wang. 2021. Can environmental regulation directly promote green innovation behavior?—Based on situation of industrial agglomeration. *Journal of Cleaner Production* 314: 128044. [CrossRef]

Popkova, Elena G., and Bruno S. Sergi. 2023. Advanced Climate-Smart Technology as the Basis for the Activities of Green Entrepreneurship in the Digital Economy Markets. In *Smart Green Innovations in Industry 4.0 for Climate Change Risk Management*. Berlin/Heidelberg: Springer, pp. 123–33.

Qalati, Sikandar Ali, Dragana Ostic, Mohammad Ali Bait Ali Sulaiman, Aamir Ali Gopang, and Asadullah Khan. 2022. Social media and SMEs' performance in developing countries: Effects of technological-organizational-environmental factors on the adoption of social media. *SAGE Open* 12: 21582440221094594. [CrossRef]

Raihan, Asif, Dewan Ahmed Muhtasim, Sadia Farhana, Mostafizur Rahman, Md Ahsan Ul Hasan, Arindrajit Paul, and Omar Faruk. 2023. Dynamic linkages between environmental factors and carbon emissions in Thailand. *Environmental Processes* 10: 5. [CrossRef]

Shammi, Mashura, Pronab Kumar Halder, Shafi M. Tareq, Md Mostafizur Rahman, and Zobaidul Kabir. 2022. From environmental impact assessment to strategic environmental assessment in Bangladesh: Evolution, perspective, governance and challenges. *Environmental Impact Assessment Review* 97: 106890. [CrossRef]

Shen, Ching-Cheng, Chien-Chi Yeh, and Chun-Nan Lin. 2022. Using the perspective of business information technology technicians to explore how information technology affects business competitive advantage. *Technological Forecasting and Social Change* 184: 121973. [CrossRef]

Smania, Guilherme Sales, Glauco Henrique de Sousa Mendes, Moacir Godinho Filho, Lauro Osiro, Paulo A Cauchick-Miguel, and Wim Coreynen. 2022. The relationships between digitalization and ecosystem-related capabilities for service innovation in agricultural machinery manufacturers. *Journal of Cleaner Production* 343: 130982. [CrossRef]

Su, Dongwei, Shulin Xu, and Zhen Yang. 2023. Green credit policy and corporate diversification: Evidence from China. *Post-Communist Economies* 35: 315–49. [CrossRef]

Sun, Yunpeng, Weimin Guan, Yuning Cao, and Qun Bao. 2022. Role of green finance policy in renewable energy deployment for carbon neutrality: Evidence from China. *Renewable Energy* 197: 643–53. [CrossRef]

Taghizadeh-Hesary, Farhad, and Naoyuki Yoshino. 2020. Sustainable solutions for green financing and investment in renewable energy projects. *Energies* 13: 788. [CrossRef]

Tian, Chao, Xiuqing Li, Liming Xiao, and Bangzhu Zhu. 2022. Exploring the impact of green credit policy on green transformation of heavy polluting industries. *Journal of Cleaner Production* 335: 130257. [CrossRef]

Van Schoubroeck, Sophie, Lisandra Chacon, Autumn M. Reynolds, Nathalie Lavoine, Marko Hakovirta, Ronalds Gonzalez, Steven Van Passel, and Richard A. Venditti. 2023. Environmental sustainability perception toward obvious recovered waste content in paper-based packaging: An online and in-person survey best-worst scaling experiment. *Resources Conservation and Recycling* 188: 106682. [CrossRef]

Vrontis, Demetris, Michael Christofi, Vijay Pereira, Shlomo Tarba, Anna Makrides, and Eleni Trichina. 2022. Artificial intelligence, robotics, advanced technologies and human resource management: A systematic review. *The International Journal of Human Resource Management* 33: 1237–66. [CrossRef]

Wang, Yolanda Yulong. 2023. Corporate diversification, investment efficiency and the business cycle. *Journal of Corporate Finance* 78: 102353. [CrossRef]

Wang, Hetong, Shaozhou Qi, Chaobo Zhou, Jingjie Zhou, and Xiaoyan Huang. 2022. Green credit policy, government behavior and green innovation quality of enterprises. *Journal of Cleaner Production* 331: 129834. [CrossRef]

Wibowo, Teguh Setiawan. 2022. Psychological Contract Theory Relation to Organizational Citizenship Behavior (OCB) of Flight Attendants. *International Journal of Science, Technology & Management* 3: 144–52.

Xu, Aiting, Yuhan Zhu, and Wenpu Wang. 2023. Micro green technology innovation effects of green finance pilot policy—From the perspectives of action points and green value. *Journal of Business Research* 159: 113724. [CrossRef]

Xu, Gaoyan, Wenhao Dong, and Shiliang Hu. 2022. Is political connection a panacea for corporate turnaround?—An analysis based on the resource-based view during the global financial crisis. *Asia-Pacific Journal of Accounting & Economics* 29: 743–60.

Xu, Jiawei, Yubing Yu, Min Zhang, and Justin Zuopeng Zhang. 2023. Impacts of digital transformation on eco-innovation and sustainable performance: Evidence from Chinese manufacturing companies. *Journal of Cleaner Production* 393: 136278. [CrossRef]

Xue, Yan, Caidong Jiang, Yunxia Guo, Jianmin Liu, Haitao Wu, and Yu Hao. 2022. Corporate social responsibility and high-quality development: Do green innovation, environmental investment and corporate governance matter? *Emerging Markets Finance and Trade* 58: 3191–214. [CrossRef]

Yin, Hua-Tang, Chun-Ping Chang, and Haijie Wang. 2022. The impact of monetary policy on green innovation: Global evidence. *Technological and Economic Development of Economy* 28: 1933–53. [CrossRef]

Yuen, Kum Fai, Lanhui Cai, Guanqiu Qi, and Xueqin Wang. 2021. Factors influencing autonomous vehicle adoption: An application of the technology acceptance model and innovation diffusion theory. *Technology Analysis & Strategic Management* 33: 505–19.
Zhang, Jianhua, Yushan Liu, Weihua Zhang, and Xinyuan Ma. 2023. Role of green technologies in enhancing the efficiency of natural resources. *Resources Policy* 83: 103624. [CrossRef]
Zhang, Yuming, Xiaolei Li, and Chao Xing. 2022. How does China's green credit policy affect the green innovation of high polluting enterprises? The perspective of radical and incremental innovations. *Journal of Cleaner Production* 336: 130387. [CrossRef]
Zheng, Chunji, Feng Deng, Chengfeng Zhuo, and Weiheng Sun. 2022. Green credit policy, institution supply and enterprise green innovation. *Journal of Economic Analysis* 1: 20–34. [CrossRef]