International Journal of Research Studies in Management
2024 Volume 12 Number 5, 129-134

Impact of innovation investment on business growth of environmental protection companies in China

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Received: 1 April 2024
Revised: 15 May 2024
Accepted: 30 May 2024
Available Online: 15 June 2024
DOI: 10.5861/ijrsm.2024.1070

ISSN: 2243-7770
Online ISSN: 2243-7789

OPEN ACCESS

Abstract

This study aimed to determine the impact of innovation investment on business growth of environmental protection companies in China to increase its core competitiveness. Specifically, it aimed to determine the impact of innovation investment in environmental protection companies in terms of human resource, technology, and capital investment; assess the environmental protection companies' business growth in terms of customer growth, operational and financial growth; test the significant relationship between innovation investment and business growth; come up with Action Plan for environmental protection companies in China to increase its core competitiveness. This study used the descriptive type of research and there were 200 respondents who answered the survey represented by officers from environmental protection industry of different companies and scales. The study showed that the innovation investment in environmental protection companies have high impact to human resource and technology investment and only moderate impact in capital investment. The environmental protection companies' business growth is high in customer and operational and moderate in financial growth. Also, there is highly significant relationship between innovation investment and environmental protection companies' business growth. A plan of action to improve the core competencies of environmental protection companies was proposed towards the end of the study.

Keywords: innovation investment, business growth, environmental protection, companies in China

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1. Introduction

China's economic development has achieved remarkable results, and the living standards and quality of life of the people have also rapidly improved. However, with the rapid development, problems such as unreasonable economic and industrial structure, outdated technology, and low resource utilization efficiency have always existed. The extensive development model of high energy consumption, high pollution, and high emissions in the past has caused excessive exploitation and damage to resources and the environment (Xue et al., 2020). Especially with the continuous advancement of industrialization and urbanization, environmental pollution and other issues have seriously affected the normal life, work, and even health of the people (Wang, et. al., 2022), and have caused incalculable losses to the country's economy (Liu, et. al., 2019).

It can be said that the contradiction between environmental issues and sustainable economic development, as well as the people's need for a better life, has become an irreconcilable contradiction. To solve these contradictions is testing the governing level of the Party and the country. Whether it is environmental protection or technological innovation, enterprises are the most important entities, facing unprecedented opportunities and challenges. Under the existing environmental regulations and economic development models, environmental risks have become the main risks that cannot be ignored in the business process of enterprises. Especially for enterprises in heavily polluting industries, even a slight mistake may result in penalties such as suspension of operations and fines from the environmental protection department due to environmental issues. Enterprises investing in ecological and environmental protection to avoid environmental risks may consume a large amount of funds and resources in the short term, but the good reputation and support from stakeholders may help improve market competitiveness and performance in the future.

Technological innovation in enterprises can enable them to better optimize the allocation of production factors, improve operational production efficiency, and obtain sustained competitive advantages that are different from other competitors. However, technological innovation itself has high risks, and a successful technological innovation is a long process from its launch to market acceptance, resulting in extremely high research and development costs. China's environmental protection sector is vital. China's remarkable economic expansion has undeniably strained its environment, leading to pollution and resource depletion concerns (Moore, et. al., 2021). In response, the government has enforced stricter environmental regulations and prioritized "green development" initiatives, creating a significant market opportunity for environmental protection companies (Zhang et al., 2023) China's environmental challenges demand innovative solutions from its environmental protection companies. Studying the link between their innovation investment and business growth is crucial. This research can inform policy, identify best practices for the sector, and ultimately contribute to a sustainable future for China and beyond.

Objectives of the Study - This study aimed to determine the impact of innovation investment on business growth of environmental protection companies in China to increase its core competitiveness. Specifically, it aimed to determine the impact of innovation investment in environmental protection companies in terms of human resource, technology, and capital investment; assess the environmental protection companies' business growth in terms of customer growth, operational and financial growth; test the significant relationship between innovation investment and business growth; come up with Action Plan for environmental protection companies in China to increase its core competitiveness.

2. Methods

Research Design - This study will use descriptive type of research. Using descriptive research allows

researchers to explore the potential relationship between innovation investment and business growth in environmental protection companies in China. Creswell (2014).

Participants of the Study - A total of 200 questionnaires were collected in this survey, answered by officer's respondents from environmental protection industry of different companies and scales. Among them, 30% of the respondents came from the environmental technology, 25% came from the environmental service, 20% came from the environmental manufacturing, 15% came from the environmental consulting, and 10% came from other environmental related companies. In terms of the size of the enterprises in which the respondents are located, 15% are small enterprises, 30% are medium-sized enterprises, 45% are large enterprises, and 10% are super large enterprises.

Instruments of the Study - This study used the self-structured questionnaire. This was validated and undergo reliability testing. This consists of two parts. Part1 describes the innovation investment in view of human resources, technology and capital investments. Part 2 is composed of business growth and its domains particularly customer growth, operational growth and financial growth.

Data Gathering Procedure - Processing is a crucial part of research, including the process of organizing, classifying, and processing the data obtained from questionnaire surveys. In this study, it used statistical analysis methods to process the data from the questionnaire survey results. On the one hand, the researcher organized and classified the collected questionnaire data. Based on the types of questions designed in the questionnaire, we classify the data into different variables, including gender, age, occupation, etc. Then, encoded the data of different variables for subsequent statistical analysis. In the process of data processing, it also cleaned and filtered the data. We have excluded some invalid or missing data to ensure the accuracy and reliability of the analysis results. In addition, we also conducted some simple descriptive statistics, such as calculating the mean, standard deviation, and median, to understand the distribution of the data. On the basis of data processing, it conducted interpretation and analysis of the results. By analyzing the statistical results, it can draw some conclusions about the marketing situation of China Petroleum and Chemical Corporation. For example, if understand the evaluations of different groups of people on the company's marketing philosophy and product sales situation, thereby providing corresponding improvement suggestions and marketing strategies for the company. Overall, data processing is a crucial step in this study. Through the organization, statistics, and analysis of the survey results, we can obtain valuable information about the marketing situation of China Petroleum and Chemical Corporation, providing a scientific basis for the company's marketing decisions.

Ethical Considerations - Ethical considerations were practiced in the conduct of the research work to warrant that every information that was gathered are used for research purposes only to maintain the quality and integrity of the research. The researcher also sought the consent of the respondents through letter and communication to make sure that the target respondents will be prepared to answer necessary questions involved in the research. It also ensured the confidentiality and anonymity of the respondents by not seeking their names as they were answering the questionnaires. The researcher also ensured that the respondents voluntarily answer the questionnaires according to their will. Lastly, it ensured that none of the respondents of the study will be hurt or harmed, and their safety and security is of top priority.

Data Analysis - Weighted mean and rank were used to determine the impact of innovation investment in environmental protection companies in terms of human resources, technology, and capital investment; and to assess the environmental protection companies' business growth in terms of customer growth, operational and financial growth. The result of Shapiro-Wilk Test showed that p-values of all variables were less than 0.05 which means that the data set was not normally distributed. Therefore, Spearman rho was used as part of the non-parametric tests to determine the significant relationship. All analyses were performed using SPSS version 28.

3. Results and discussions

Table 1 summarizes the impact of innovation investment on environmental protection companies. It analyzes

investments in three key areas: Human Resources (HR), Technology, and Capital. The Grand Composite Mean (3.50, Strongly Agree): This headline value represents the overall average across all three key investment areas. The "Strongly Agree" rating suggests a generally positive perception of the impact of innovation investment on environmental protection companies.

Table 1
Summary Table on Impact of Innovation Investment in Environmental Protection Companies

Key Result Areas	Composite Mean	VI	Rank
Human Resources Investment	3.52	Strongly Agree	1
Technology Investment	3.50	Strongly Agree	2
Capital Investment	3.49	Agree	3
Grand Composite Mean	3.50	Strongly Agree	

Legend:3.50-4.00=Strongly Agree;2.50-3.49=Agree;1.50-2.49=Disagree;1.00-1.49=Strongly Disagree

Human Resources (HR) Investment (3.52, Strongly Agree). Ranked first with the highest score, indicating the strongest positive perception of HR innovation's impact on environmental protection efforts. This could be due to factors like improved talent acquisition for relevant roles or better employee engagement in sustainability initiatives. Technology Investment (3.50, Strongly Agree): Ranked second, closely following HR investment. This suggests a strong positive perception of technology innovation's contribution to environmental protection. This could be due to factors like increased efficiency in environmental processes or the development of new technologies for pollution control or environmental monitoring. Capital Investment (3.49, Agree): Ranked third with the lowest score, indicating a positive but slightly less strong perception compared to HR and Technology investments. This suggests that capital investments, while beneficial, might have some trade-offs to consider.

Overall, the table showed that environmental protection companies view innovation investment across all three areas (HR, Technology, and Capital) as beneficial for achieving their environmental goals. However, HR and Technology investments seem to be perceived as having a slightly stronger positive impact compared to Capital investment.

Table 2
Summary Table on Environmental Protection Companies' Business Growth

Key Result Areas	Composite Mean	VI	Rank
Customer Growth	3.52	Strongly Agree	1
Operational Growth	3.51	Strongly Agree	2
Financial Growth	3.48	Agree	3
Grand Composite Mean	3.50	Strongly Agree	

Legend:3.50-4.00=Strongly Agree;2.50-3.49=Agree;1.50-2.49=Disagree;1.00-1.49=Strongly Disagree

Table 2 presents the summary regarding the overall business growth of environmental protection companies. It analyzes growth across three key result areas: Customer Growth, Operational Growth, and Financial Growth. The grand composite mean (3.50, Strongly Agree) represents the average score across all three key growth areas. The "Strongly Agree" rating implies a generally positive perception of the impact of various practices on the business growth of environmental protection companies. Customer Growth (3.52, Strongly Agree) ranked first with the highest score, indicating the strongest positive impact on customer growth. This aligns with the findings in Table 5, which highlighted factors like a commitment to sustainability, competitive offerings, and satisfied customers leading to referrals and repeat business. As to Operational Growth (3.51, Strongly Agree), it ranked second, closely following Customer Growth. This means that environmental protection practices contribute significantly to operational efficiency. Table 6 supported this notion by indicating that sustainable practices can optimize resource use, reduce costs, and potentially minimize downtime from environmental issues. Finally, the Financial Growth (3.48, Agree) ranked third with the lowest score, but still achieving an "Agree" rating. This gives a positive but potentially less pronounced impact on financial growth compared to the other areas.

Table 3
Relationship Between Investment Innovation and Business Growth

Variables	rho	p-value	Interpretation
Human Resources Investment			
Customer Growth	0.791**	< .001	Highly Significant
Operational Growth	0.799**	< .001	Highly Significant
Financial Growth	0.810**	< .001	Highly Significant
Technology Investment			
Customer Growth	0.834**	< .001	Highly Significant
Operational Growth	0.857**	< .001	Highly Significant
Financial Growth	0.854**	< .001	Highly Significant
Capital Investment			
Customer Growth	0.895**	< .001	Highly Significant
Operational Growth	0.880**	< .001	Highly Significant
Financial Growth	0.871**	< .001	Highly Significant

***. Correlation is significant at the 0.01 level*

Table 3 explores the relationship between investment in three areas (Human Resources, Technology, and Capital) and business growth for environmental protection companies. It uses correlation coefficients (rho) and p-values to assess the strength and significance of these relationships. Here's a breakdown: As seen indicated in the table, the computed rho-values ranging from 0.791 to 0.895 indicate a strong to very strong direct relationship among the sub variables of investment innovation and business growth. There was a statistically significant relationship between investment innovation and business growth because the obtained p-values were less than 0.01.

All investment types (Human Resources, Technology, and Capital) show statistically significant positive correlations with Customer Growth, Operational Growth, and Financial Growth (all rho values above 0.791, p-values < 0.001). This suggests that increased investment in these areas tends to coincide with improvements in all three-growth metrics. As to Capital Investment, it exhibits the strongest correlations with all three growth metrics (Customer Growth: 0.895, Operational Growth: 0.880, Financial Growth: 0.871). This implies that capital investments in environmental protection companies might have a particularly strong association with overall business growth. Under technology Investment, it shows very strong positive correlations across all growth areas (Customer Growth: 0.834, Operational Growth: 0.857, Financial Growth: 0.854).

This indicates that investments in technological innovation are likely to benefit customer acquisition, operational efficiency, and financial performance. In terms of Human Resources Investment, while still positive and significant, has slightly lower correlation values compared to Capital and Technology investments (Customer Growth: 0.791, Operational Growth: 0.799, Financial Growth: 0.810). This suggests that HR investments also contribute to growth, but their impact might be less pronounced than the other two areas in this specific data set. Overall, it showed that investment in innovation across all three areas (Human Resources, Technology, and Capital) is positively associated with business growth for environmental protection companies. Capital investment seems to have the strongest correlations, followed by Technology investment. Human Resources investment also shows a positive impact, but the data suggests its effect on growth might be slightly less prominent.

Table 4
Action Plan for Environmental Protection Companies in China to Increase its Core Competitiveness

Key Results Area	Strategies	Objectives based on Strategies	Expected Outcome	Persons Involved
Capital Investment Low increase in capacity to address environmental challenges.	Employee engagement and education in the company Collaboration and partnerships among companies in the industry. Continuous measurement and monitoring in	To empower employees to contribute to environmental challenges solutions. To allow knowledge sharing and resource pooling for industry-wide collaborations to tackle large-scale environmental issues. To allow adjustments and showcase the effectiveness of implemented strategies.	Increased environmental awareness, productivity and enhanced problem solving and innovation among employees. Access to shared knowledge and resources and increased efficiency and cost savings. Reveal unexpected areas for further improvement and opportunities for	Company Owners Managers Supervisors Employees Industry

	addressing environmental challenges.		innovation.	
Financial Growth Slow improvement in ROI	Re-evaluate the sustainability strategy. Explore alternative revenue streams. Invest in emerging sustainable technologies.	To have focus on clearest cost savings and revenue generation. To capture the added value for environmentally conscious consumers. To improve efficiency and potentially lead to cost savings or new revenue streams.	Improved cost effectiveness and stronger ROI potential Increased creased revenue. Un-locking new business opportunities.	Company Owners Managers

4. Conclusion and recommendations

The innovation investment in environmental protection companies have high impact to human resource and technology investment and only moderate impact in capital investment. The environmental protection companies' business growth is high in customer and operational and moderate in financial growth. There is highly significant relationship between innovation investment and environmental protection companies' business growth. A plan of action to improve the core competencies of environmental protection companies. The environmental companies may communicate the finding to stakeholders, such as investors and employees, to show that innovation is essential for their success. The environmental companies may evaluate the action plan to help improve their business operations. For future researchers, an industry-specific research can be done like investigating the dynamics within specific sub-sectors of environmental protection (e.g., renewable energy, waste management) that might reveal unique opportunities.

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