International Journal of Finance and Investment
ISSN: 3078-2295 (Online) | Vol. 1, No. 1, 2024

Corporate Innovation Management from the Perspective of Management Science and Engineering

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Abstract: This paper is centred on corporate innovation management from the perspective of management science and engineering. It describes its origin and development, and its wide application in internal and external management, service industry and innovation and entrepreneurship. Enterprise innovation management is flexible, risky, long-term and complex, and includes various types and modes such as autonomous and integrated. Management science and engineering promote innovation by providing data and models through decision support systems, analysing data to explore needs, and coordinating resources through project management methods. However, it is currently facing challenges such as technological change, talent shortage, and poor cultural climate. The future is digital intelligence, green sustainability, interdisciplinary research and application trends, enterprises need to respond to the challenges, grasp the trend to improve the level of innovation management, sustainable development and competitiveness, to adapt to the complex and changing market environment, innovation-driven to create economic and social value, and to lead the industry in a new direction of development.

Keywords: Management science and engineering, Corporate innovation management, Innovation types and models, Promotion, Challenges and prospects.

1. Introduction

1.1. Background and Significance of the Study

In today's era, enterprises are facing an unprecedentedly complex competitive environment. With the rapid development of the global economy, the market is constantly changing in terms of cooperation platforms, trade methods, types and scope of transactions, etc., and the extensive application of science and technology has not only changed people's way of life, but also brought about new technological changes and production changes. Against the background of accelerating globalisation, the market environment in which enterprises survive has undergone tremendous changes. On the one hand, the creation and invention of technology has given rise to new profit growth points, and the development of new industries has led to the growth of a number of small and medium-sized enterprises; on the other hand, the fierce competition in the market has made it more and more difficult for small and medium-sized enterprises to survive, and the pursuit of diversification and personalisation of the market demand has put forward more and more demanding requirements for enterprises.

Take Zhongshun Jerome as an example, as the first batch of domestic A-share listed main household paper enterprise, in 2023, although the revenue increased by 14.37% year-on-year to 9,801,000,000 yuan, but did not complete the revenue exceeded 10,000,000,000 yuan of the target. Zhongshun jielou will net profit decline attributed to "raw materials wood pulp, energy price fluctuations and other factors", its chairman Liu Peng pointed out that enterprises are facing the most complex competitive environment, "raw material prices remain high and complex trend, the industry is seriously overcapacity, the price war is not the lowest only lower! ". Again, in the current business environment is becoming more complex and changing times, enterprises face full competition and transformation how to do stronger and better and bigger become a key issue. Song Zhiping, Wang Shi, He Zhiyi three experts also mentioned in the dialogue, in the current complex and changing competitive environment, enterprises need to practice "three fine management".

In such a competitive environment, the importance of management science and engineering in promoting the innovative management of enterprises has become more and more prominent. Management science and engineering can provide enterprises with scientific decision support systems, data analysis and optimisation methods and project management methods, etc., to help enterprises better cope with the complex market environment and achieve sustainable development. Innovative management is the soul of a nation's progress, is the inexhaustible power of the country's prosperity, for enterprises, innovative management is the key to win in the market competition. Enterprise innovation management can improve economic efficiency, such as Henan Lotus MSG Group, Haier Group, Anhui Fengyuan Group, etc. rely on technological innovation and management innovation, to achieve rapid development and high profits. At the same time, innovation is the only way to make enterprises continue to gain vitality, anything has a cycle of rise and fall, enterprises only continue to introduce new ideas, in order to flourish. For example, Siemens Corporation of the United States was founded in 1847 and has become a giant in the industrial world by relying on continuous innovation.

1.2. Purpose and Methodology of the Study

Using the literature research method, through combing and analysing the relevant literature, we gain an in-depth understanding of the development history of management science and engineering, the basic concepts of enterprise innovation management and the relationship between the two. At the same time, using the case study method, representative enterprise cases are selected to analyse in depth the specific application and effectiveness of management science and engineering in enterprise innovation management to provide empirical support for the theoretical research.

Through a combination of literature research and case study analysis, it aims to comprehensively and systematically reveal the promotion role of management science and engineering on enterprise innovation management, and provide reference basis for enterprises to better use the methods and tools of management science and engineering in actual operation.

2. Overview of Management Science and Engineering

2.1. Definition and Development of Management Science and Engineering

Management science and engineering originated in the early 20th century in the United States classical management theory, Taylor's Principles of Scientific Management laid the foundation, and Fayol clarified the concepts and functions of operation and management. Since then, from the birth of industrial engineering, the rise of behavioural science, the application of operations research, to the emergence of comparative management theory and corporate culture research, the discipline system has been continuously improved. After the founding of New China, the rapid development of this discipline in China, covering multiple sub-disciplines, integration of social and natural sciences, wide knowledge coverage, including multiple research areas and related disciplines, a variety of undergraduate majors, and in the Ministry of Education's assessment of academic disciplines of a number of colleges and universities with excellent performance [1]. Its knowledge system is divided into three levels: basic theory, management science theory and application field, cultivating students' ability to solve practical management problems and closely integrating theory and practice.

2.2. Management Science and Engineering in Business

(1) Internal management of enterprises

In strategic planning, quantitative and decision-making methods are used to help companies set their direction and select strategies based on market and other analyses. Organisational structure design optimises functions according to strategies and processes, and improves synergy and execution efficiency. Human resource management improves performance and satisfaction through planning and evaluation, and relies on data to select and train talents [2]. Financial management improves the level of analysis and budgeting, and evaluates investments based on models. Production operation increases efficiency and quality by planning and inventory, and reduces waste by lean production.



Figure 1. Internal management of enterprises

(2) Project Management

Project management has different emphases in different faculties. The Department of Management Science and Engineering focuses on technical tools and methodologies, including project planning and risk management; the Department of Business Administration focuses on human resources, organisational behaviour and leadership; and the School of Economics and Management covers economics and financial management. Students from different faculties apply what they have learnt in their respective projects, from technical, business to financial projects, and manage them scientifically to increase their success rate.

(3) Services Management

In logistics, we use planning and inventory to improve efficiency and reduce costs, and rely on information systems to track goods. In supply chain, coordination and supplier management are used to improve collaboration and responsiveness, and information is shared through collaborative platforms. The retail sector uses sales forecasting to increase performance and satisfaction, and relies on data to set strategies. Hotels use operation and customer relationship management to improve efficiency and service, and use revenue management systems to adjust room rates and room allocation.

(4) Innovation and Entrepreneurship Management

In the identification of innovation opportunities, we use market analyses to help find opportunities and rely on big data to dig up demand. In innovation management, we use process management to improve the success rate and project management to manage innovation projects. In entrepreneurship management, we use planning and financing to help entrepreneurial success, provide guidance based on templates and channels to achieve effective management and promotion of innovation and entrepreneurship, and help enterprises and individuals grasp opportunities, create value and make breakthroughs in the market, inject vitality and momentum into economic development and industrial upgrading, enhance market competitiveness and adaptability, and cope with the challenges and demands of the ever-changing business environment, so as to realise sustainable development and growth and transformation [3]. We will also enhance market competitiveness and adaptability, meet the challenges and demands of the changing business environment, and achieve sustainable development and growth.

3. Basic Concepts of Enterprise Innovation Management

3.1. Definition and Characteristics of Innovation Management

(1) Definition and importance

Innovation management is the key to development and sustainability as it helps enterprises achieve strategic goals and enhance competitiveness through innovation. It can introduce new technology and equipment to improve production efficiency and quality, optimise structure and system to reduce costs, and emphasise talent training and retention, so as to help enterprises to respond to market changes, grasp opportunities, lead trends, expand fields and reduce risks.

(2) Flexibility

Flexible structure culture is needed, flat structure to improve efficiency and promote decision-making, and

innovative culture to encourage breakthroughs. Select methodology and tools according to the context, such as design thinking for products and agile model for projects, and adjust strategic resources according to the speed of market change.

(3) Riskiness

Faced with technology, market, finance and other risks, the need for early warning mechanisms to detect risks, reduce the failure rate, cultivate the risk of intent and risk resistance, the tree the right concepts, so that employees face innovation with risk but not to avoid risk.

(4) Long-term

Long-term innovation requires continuous patience. Enterprises should set long-term strategic plans to ensure motivation, such as Huawei's heavy R&D investment. Focus on long term benefits, build incentives, and set up long term awards to encourage employees to be far-sighted and avoid short-sighted utilitarianism.

(5) Complexity

Involving multiple fields, cross-sectoral collaboration is required to integrate resources, adjust strategies in response to external changes, focus on synergy to promote the optimal coordination of elements, and build a systematic management system to improve innovation performance.

3.2. Types and Modes of Enterprise Innovation

(1) Self-innovation

Relying on its own research, production and marketing innovation, high investment, high risk and high return. Huawei's strong R&D in communication breaks the core technology and leads in 5G; China Building Materials' self-research and development of new products improve the performance quality. Self-innovation helps enterprises have core technologies to cope with competition and enhance competitiveness, and promotes industry upgrading and economic development.

(2) Integrated Innovation

Integration of innovative elements, attracting internal and external resources to group excellent results and reduce risk costs. Enterprises cooperate with universities and other institutions to attract technical talents to innovate with their own strengths, and optimise the combination of important elements to improve efficiency and quality.

(3) Progressive innovation

After the dominant design to improve the existing perfect, suitable for the market stability needs to be clear. Leading companies have advantages, such as Apple, to keep their smartphones in the lead, and upgrade their products in response to changes in the market based on their experience, resources and strength.

(4) Other innovations

Modular innovation is suitable for complex and high-tech industries by improving efficiency and reducing cost in combination with modular innovation; structural innovation is suitable for breaking through structural limitations in industries by resetting the structure to create new products; re-inventive innovation is suitable for subverting traditional industries by completely changing the existing ones to create brand new ones with high risk and high return; marketing innovation is suitable for competitive industries with strong demand and diversified needs by using new methods to improve competitiveness, and to increase the share of brands by responding to changes in the market quickly.

4. The Contribution of Management Science and Engineering to the Management of Innovation in Enterprises

4.1. Decision Support Systems and Innovation Management

(1) Definition and Development

Decision Support Systems (DSS) are composed of language, knowledge and problem processing systems that help users make decisions based on data models and solve semi-/unstructured problems. They have evolved through multiple phases, from basic components to intelligent, group and distributed systems, to continuously improve decision support capabilities.

(2) Value in innovation management

Provide data support, covering internal and external information and feedback, to help enterprises grasp the innovation situation. Manage decision-making models and methods to process data to obtain effective information. Helps to clarify decision-making goals, using data analysis and modelling to gain insights into the market, technology and itself, and to determine the direction of innovation. Quickly identify innovation problems and find production, market and financial anomalies through data monitoring and analysis. Provide the basis for evaluating and selecting the best solution, simulating and analysing the feasibility, risks and benefits of innovation solutions, and selecting the best path.

4.2. Application of Data Analysis and Optimisation Methods in Innovation Management

(1) The role of data analysis in the identification of innovation needs

In the midst of fierce competition, data analytics helps companies to tap into market demand and user pain points. Collect and analyse data from multiple sources, such as social media and e-commerce data, to grasp user preferences, etc., and adjust the direction of innovation. Accurate profiling and multi-dimensional analysis of user segments to improve the targeting and success rate of innovations. With market forecasting capabilities, we can analyse historical sales and industry trends to anticipate changes in demand and layout innovations in advance.

(2) Application of optimisation methods in the innovation process

In product design, planning and algorithms are used to optimise performance, reduce cost and cycle time. In production process optimisation, analyse the process to reduce waste and bottlenecks, improve efficiency and reduce scrap rate. In resource allocation, planning methods are used to rationally allocate manpower, etc., to optimally allocate resources in projects, and supply chain optimisation is used to improve synergy, reduce inventory and stabilise efficiency.

4.3. Impact of Project Management Methodologies on Innovative Projects

(1) Characteristics of project management methods in innovation projects

Flexibility, adapt to innovation and change, flat structure to improve efficiency, create an innovative atmosphere, according to the situation to choose the mode, according to

the market changes in the adjustment strategy. Risky, involving multiple dangers, building early warning mechanisms, cultivating risk awareness and risk resistance, and establishing the right concepts. Complexity, multi-disciplinary collaboration, external changes to adjust the strategy, synergistic system, improve overall performance.

(2) Critical factors for the success of innovative projects

Teamwork should be cross-departmental, members complement each other's strengths, promote knowledge sharing and collision of ideas, and improve the success rate. Communication and co-ordination are the key. Frequent transmission of information and avoidance of misunderstanding will ensure the smooth progress of the project and increase team cohesion [4]. Risk management through the whole process, knowledge and evaluation should be multi-risk, according to the risk of policy making, continuous monitoring and adjustment of policy, to ensure that the project is stable and far-reaching, borrowing the power of management science and engineering, all-round promotion of enterprise innovation projects to achieve the strategic innovation goals of high efficiency and high quality, to enhance the overall competitiveness of the enterprise and development of the resilience of the market position, leading the trend of industrial innovation and development, and to move steadily forward in a dynamic business environment, sustained breakthroughs and outstanding development, to innovation-driven enterprise value and industry contribution growth, shaping a new model of enterprise innovation and development and industry benchmark image, injecting strong innovation vitality and development power source for economic growth and social progress, laying a solid foundation for innovation and sustainable development, creating a brilliant chapter of enterprise innovation and a new pattern of industrial upgrading, realising diversified value creation of innovation and far-reaching impact of radiation and expansion, and constructing a benign cycle of enterprise innovation ecology and industrial innovation cluster synergistic development of a virtuous cycle of the new situation.

5. Challenges and Prospects of Management Science and Engineering in Corporate Innovation Management

5.1. Major Current Challenges

(1) Challenges of rapid technological change

Nowadays, the rapid change of technology, enterprise tracking the application of new technologies require a lot of resources, such as the electronic information industry chip technology update fast, enterprise R & D investment, otherwise easy to be eliminated. And the high cost of innovation, new technology R & D funding needs, uncertainty, the application of equipment needs to be updated and personnel training, such as new energy vehicle enterprises, battery R & D and charging facilities construction, increasing the cost burden.

(2) Talent Shortage and Training Challenges

Enterprise innovation management is in a talent shortage, innovative talents are scarce, especially in emerging fields, and the demand exceeds the supply. Competition for talents is white-hot, and excellent people are inclined to enterprises with good prospects, favourable treatment and good atmosphere, while small and medium-sized enterprises are at a disadvantage. Enterprises need to strengthen the cultivation and introduction of talent, cooperation with universities and other industry-academia-research projects, provide internships and internal training; formulate preferential policies, expand recruitment channels to attract talent.

(3) Organisational Culture and Innovation Climate Challenges

Organisational culture affects innovation, good culture promotes innovation and bad culture hinders innovation. Some enterprises have conservative culture, emphasis on stability and lack of innovation, inhibit the enthusiasm of employees, and the lack of incentives, it is difficult to get recognition of the results of the reward. Enterprises to create a culture of innovation can be a combination of measures, leadership to take the lead in innovation, build a culture of encouragement and tolerance, and set up incentives for innovation, such as the establishment of incentive funds.

5.2. Future Research Directions and Trends

(1) Digitalisation and Intelligence Trends

Digital and intelligent technologies are developing rapidly and are widely used in enterprise innovation management. Big data helps enterprises analyse huge amounts of data to find innovation opportunities and set strategies, such as mining consumer demand. Artificial Intelligence is used to improve decision-making and operation level in multiple links, such as product R&D and design. Blockchain enables supply chain transparency, security and intellectual property protection. Enterprises should actively use new technologies to improve innovation management.

(2) Green and Sustainable Development Trends

The deterioration of the global environment has led to a shift in corporate innovation management towards green and sustainable development, with the goal of harmonising economic, environmental and social development. Enterprises can make efforts in three areas: strengthening the use of green technology research and development to reduce energy consumption and emissions and improve resource efficiency, such as the use of renewable energy and recycling of waste; innovating green products and services to reduce environmental impacts, such as the development of environmentally friendly packaging and the provision of green services; and managing a green supply chain, cooperating with suppliers in green production and controlling energy consumption and emissions in the logistics sector.



Figure 2. Green and Sustainable Development Trends

(3) Trends in interdisciplinary research and applications

Interdisciplinary research is important for enterprise innovation management, and it is difficult to meet the complex needs of a single discipline, which has become the trend of the future. It integrates knowledge methods and provides comprehensive and in-depth solutions, covering three aspects of theoretical methods, technical tools and talent teams: the integration of theoretical methods and innovations

from different disciplines, such as drawing on the theory of biological evolution and psychological cognition; the combination and application of technical tools, such as combining them with computers and biological disciplines; and cooperation and exchanges of talent teams, which provide diversified professional support and cooperation modes, so that enterprises should increase their investment in support of the application of cross-disciplinary research and enhance the effectiveness and competitiveness of innovation management to meet challenges and trends. Innovation management effectiveness and competitiveness, to meet challenges and adapt to trends, to develop steadily and navigate continuously in a dynamic market environment, to shape a new corporate and industrial landscape of green intelligence and innovation synergy, to drive economic prosperity and social well-being through innovation, to build a solid foundation and a strong engine for sustainable development, to create a new era of interdisciplinary integration, green innovation and development of the new era of the enterprise and new glory of the industry, and to realise the value of multiple co-creation and sharing of a virtuous circle ecosystem [5]. To build and expand the virtuous cycle ecosystem of co-creation and sharing, to emerge in the global economic and technological arena, to shine with excellence and radiate with far-reaching influence, to lead the new trend of future development of enterprise innovation and management and set up an exemplary model for the development and progress of the human society by injecting an inexhaustible source of motivation and wisdom to bloom with vitality, and to lay a solid foundation for the long-term development of the future and establish the structure of a far-reaching strategic layout. Support and guarantee, drive enterprises and industries to a higher level, higher quality, stronger efficiency of innovation and development of the realm of climbing, to create a globally competitive and influential innovation leader clusters and industrial ecological high ground.

6. Conclusion

(1) The role of management science and engineering in corporate innovation management

Provide decision support: The decision support system provides comprehensive data support and effective decision basis for enterprise innovation management by collating and analysing data, applying models and methods. It helps enterprises to clarify the direction and goal of innovation, quickly find out the problems, and choose the optimal innovation programme.

Facilitating data analysis and optimisation: Data analysis plays a key role in innovation demand identification, helping companies tap into market demand and user pain points, and conduct accurate user profiling and market forecasting. Optimisation methods improve innovation efficiency and quality in product design, production process optimisation and resource allocation.

Influencing innovation project management: Project management methods are characterised by flexibility, risk and complexity in innovation projects. Factors such as teamwork, communication coordination and risk management are critical to the success of innovation projects. The success of innovation projects is improved through cross-departmental cooperation, good communication and effective risk management.

(2) Challenges facing management science and engineering in corporate innovation management

Rapid technological change: the rapid pace of technological upgrading, enterprises need to continuously invest resources to track and apply new technologies, and the high cost of innovation increases the pressure on enterprises to innovate.

Talent shortage and cultivation: The number of innovative talents is relatively small and competition is fierce, making it difficult for enterprises to attract and retain outstanding talents. There is a need to strengthen the training and introduction of talents, and to solve the talent problem through cooperation between industry, academia and research and the formulation of preferential policies.

Organisational culture and innovation atmosphere: a bad organisational culture will hinder innovation, companies need to create a cultural atmosphere that encourages innovation and tolerates failure, and establish an innovation incentive mechanism to stimulate the innovation enthusiasm of employees.

(3) Development trend of management science and engineering in enterprise innovation management

Digital and Intelligent Trends: technologies such as big data, artificial intelligence and blockchain provide new opportunities and challenges for enterprise innovation management. Enterprises should actively apply these technologies to improve their innovation management.

Green and sustainable development trend: Enterprise innovation management should strengthen the innovation and management of green technology, green products and services, and green supply chain, so as to achieve the coordinated development of economy, environment and society.

Trend of interdisciplinary research and application: Interdisciplinary research integrates knowledge and methods from different disciplines to provide more comprehensive and in-depth solutions for enterprise innovation management. Enterprises should strengthen their investment in and support for interdisciplinary research.

References

[1] Marcello C. Navigating organizational change: sequential vs simultaneous approaches to innovation management in modern enterprises [J]. Measuring Business Excellence, 2024, 28(3-4):381-395.

[2] Zhang S. Innovative application of particle swarm algorithm in the improvement of digital enterprise management efficiency [J]. Systems and Soft Computing, 2024, 6200151-200151.

[3] Science - Management Science; Findings from Institut Europeen d'Administration des Affaires (INSEAD) Yields New Data on Management Science (Knowledge Mobilisation In the Face of Imitation: Microfoundations of Knowledge Aggregation and Firm-level Innovation) [J]. 2020, 622-.

[4] Science - Management Science; New Management Science Study Findings Have Been Reported by Researchers at Free University Bolzano (The Impact of the United Nations Global Compact On Firm Performance: a Longitudinal Analysis) [J]. Politics & Government Week, 2020, 309-.

[5] Science - Management Science; Recent Research from University of Innsbruck Highlight Findings in Management Science (Individual Innovation Behaviour and Firm-level Exploration and Exploitation: How Family Firms Make the Most of Their Managers) [J]. Science Letter, 2020,