

Research on the Influencing Factors of Green Quality Management in Manufacturing Enterprises

Shuaikang Wu*, Hui Sun, Ming Liu

School of Economics and Management, Liaoning University of Technology, Jinzhou, Liaoning, 121001, China

**corresponding author*

Keywords: Quality management, Green manufacturing technology, Green quality chain, Green Operation Management, Green quality management

Abstract: Under the background of intelligent manufacturing power, quality power strategy and innovation leading development, improving enterprise green quality management ability is the only way for enterprises to realize green development. On the basis of summarizing and drawing lessons from scholars' research on the influencing factors of green quality management in manufacturing enterprises, this study explores the influencing factors of green quality management practice in manufacturing enterprises. This study explores the influencing factors of green quality management in manufacturing enterprises from the perspective of green manufacturing process of products, internal and external quality environment of enterprises and collaborative agglomeration of green quality management. It puts forward internal situational factors : Green manufacturing technology, green quality chain, green operation management and external situational factors : Green collaborative agglomeration and green consumption environment are the key factors affecting the green quality management of enterprises, and puts forward corresponding suggestions from three aspects of enterprises, governments and consumers, so as to put forward theoretical guidance and practical enlightenment for the green quality management practice of Chinese manufacturing enterprises.

1. Introduction

Under the background of the new stage of national economic development and the new corona epidemic, only enterprises that adhere to green high-quality development and innovation-driven development can achieve core competitiveness of enterprises and achieve green and healthy development in the dual-cycle world green new economic development pattern at home and abroad [1]. In the 14th Five-Year Plan, the Chinese government stressed that the manufacturing industry should develop steadily under the guidance of the concepts of "intelligent manufacturing power", "quality power strategy" and "innovation is the first driving force for development". Chinese economy and society has entered the "quality era", leading by quality and winning by new is the core competitiveness of modern enterprises. Under the background of ecological civilization construction and "double carbon", the green development of industry is urgent. The state and the public require green production and green consumption. Green production transforms the supply

side of products, and green consumption digests the green products of the market. Green quality management is the quality management between production, manufacturing and consumption, and is the quality management advocating the green concept [2]. Therefore, green quality management innovation in the new era is endowed with more new significance.

2. Overview of research on green quality management

As for green quality management, scholars mainly integrate total quality management and green concept, improve and upgrade total quality management on this basis, and then discuss green quality management from multiple angles.

2.1. Total Quality Management and Green Concept

2.1.1. Summary of research on total quality management

International Organization for Standardization (ISO) on the definition of total quality management refers to the organization around the quality and continuous improvement of product and production process, adhere to the participation of all members of the organization, so that customers are satisfied with the final product and service, and make all relevant parties benefit from the enterprise total quality management system. Total quality management adheres to meet customer needs as the management orientation, adheres to the continuous improvement of production management technology and adheres to the mutual cooperation of team members [3].

Some scholars explored the influencing factors of total quality management from a qualitative perspective. He et al. (2008) studied the current situation of quality management in Chinese manufacturing industry, and believes that total quality management is mainly affected by enterprise quality design and employee participation [4]. Li et al. (2011) through the exploration of manufacturing quality management present situation, that the quality management practice is mainly affected by the enterprise management support, employee participation management, green product design and production process management in six aspects [5]. Xiong et al. (2012) identified the constituent elements of quality management practice, and believed that the main influencing factors of quality management practice can be divided into social and managerial soft elements and technical and procedural hard elements [6]. Barouch et al. (2016) explored the theory and practice of total quality management, and believes that the unsatisfactory effect of TQM practice may be the lack of understanding of key concepts of quality management [7]. Song et al. (2019) believed that government quality management department, social quality management and certification department and consumers were the main members of quality governance structure [8].

Some scholars study the influencing factors of total quality management from the perspective of empirical analysis. On the basis of Li, Shi et al. (2014) added statistical control and feedback to the hard elements, and uses intermediary adjustment to empirically analyse the influence path of the elements of total quality management practice on organizational learning [9]. Shi et al. (2015) constructed a total quality management evaluation index system to evaluate the maturity of enterprise quality management, and believed that the key factors affecting quality management should include quality strategy, quality information and human resource management [10]. Zhang et al. (2017) analysed the mediating effect of innovation ability in the promotion of total quality management on competitive advantage from the perspective of resources [11]. Liu et al. (2019) systematically analysed the quality management practice of manufacturing enterprises based on grounded theory. The study found that the construction of green quality culture, the development of industrial chain, innovative management mode and lean management are very important for manufacturing enterprises to implement total quality management [12]. Based on the new quality

management paradigm, Yang et al. (2021) constructed a moderated mediation effect model under the innovation dominant logic to explore the relationship between product innovation and product quality [13].

2.1.2. Green development concept

Since the advent of the concept of sustainable development in 1987, the harmonious coexistence of manufacturing enterprises, consumers and the ecological environment has been paid more and more attention. In order to protect the ecology and environment and realize the harmonious coexistence of man and nature, the Chinese government has issued 'industrial green development' and other documents to guide the development of green production in enterprises. For manufacturing enterprises, green means that production activities need to shoulder the responsibility of protecting the ecological environment. Green design, green manufacturing, green production, green governance and other green behaviours emerge in endlessly. Green governance includes enterprises improving the quality of products or processes, using more effective raw materials, improving design, and the public actively conducting green consumption under the government's advocacy or enterprises actively launching green products. Li et al. (2017) expounded the definition of the main responsibility of green governance and the guidance of green governance behaviour from the government, enterprises, social organizations and the public [14].

2.2. Summary of connotation research of green quality management

After manufacturing enterprise quality management enters the stage of total quality management, the driving force and strategic decision of enterprise management still lack the integration of green concept and environmental protection. The goal of quality management is still based on economic benefits, ignoring the quality management based on green concept.

The research on green quality management is mostly based on ecological quality management and environmental quality management, which marks the initial integration of green concept and quality management. Han (2000) defined the concept of enterprise ecological quality management based on green concept and cleaner production and puts forward practical suggestions [15]. Based on the green consumption concept and environmental management practice, Liu (2001) proposed that green quality management is the result of the coupling development of green concept and manufacturing quality management [16]. Luo et al. (2003) first integrated the important theory of total quality management with green management theory and proposed total green management (TGM) [17]. Li et al. (2004) from the enterprise economy, ecological environment, social influence three aspects of comprehensive evaluation of enterprise ecological management level [18]. Sui et al. (2006) carried out innovative research on enterprise green quality management model based on process method and sustainable development concept [19]. Chen (2010) analysed analysis of the similarities and differences between green quality management and total quality management, that enterprises to carry out green quality management is imminent [20]. Pu et al. (2016) constructed an early warning mechanism for the green quality management system of equipment manufacturing industry, and started a detailed study on the green quality management system [21]. Lu et al. (2016) evaluated the green quality management system based on AHP [22]. Wen-Hsien (2018) used activity-based costing based on green quality management to study the capacity expansion of manufacturing enterprises [23]. Sirish et al. (2019) first explored and identified the dimensions of product green quality, and proposed a new dimension based on the analysis and expansion of the eight dimensions of green quality: Traceability and standardization [24].

Sui (2007) first defined the green quality management as: The green quality management of enterprises is that enterprises integrate the concept of green development into the practice of

enterprise total quality management, pay attention to the management of energy and ecological environment, undertake the quality responsibility of products or services, and pursue the balance and sustainable development of economy, society and ecological environment [25]. After that, scholars have extended their concepts and expanded their application fields on the basis of them. This study defines green quality management: Green quality management is a quality management that integrates the green concept into the practice of total quality management, balances the economic development of enterprises and the ecological and environmental protection, and ensures that the implementation of green concept is the guiding principle in the process of product quality and does not cause harm to stakeholders.

2.3. Review of Influencing Factors of Green Quality Management

The essence of green quality management is to promote the effectiveness of its factors, promote the green transformation of enterprises and have a significant improvement effect on enterprise performance in a certain period of time. The key point is to explore the factors affecting the practice of green quality management in a certain field and region.

Han (2010) examines the maturity of green supply chain management in manufacturing enterprises from the perspective of enterprise management level. Based on the established green supply chain management evaluation system, the green supply chain management of enterprises is evaluated from six dimensions: Design, procurement, manufacturing capacity, marketing and recycling [26]. Sui (2012) established the green quality management index system from the perspective of product quality life cycle, including five aspects: Product realization process, management process, support process, pollution prevention and control, and energy resource utilization [27]. Based on self-determination theory and social cognition theory, Peng et al. (2019) explains the influencing factors of employees' green behaviours from two aspects of personal factors and emotional factors, and believes that the influencing factors of employees' green behaviours can be divided into single-dimensional and two-dimensional, task-based and active [28]. Cai et al. (2018) studied the influencing factors of green consumption willingness based on the background of green consumption [29]. Chen (2019) empirically studied the coupling effect of internal and external factors on enterprises' green competitive advantage and green product innovation. The internal factors include organizational green innovation willingness and green innovation behaviours, and the external factors include the dynamic nature of green innovation environment [30]. Zhao et al. (2019) studied green quality management from the perspectives of system balance, economic development and livelihood orientation [31]. In order to promote the transformation of industrial traditional assembly quality to green industrial quality, Yu et al. (2019) investigated green quality management from six factors: Green culture, green strategy, green innovation, green investment, green production and green emission [32].

3. Factors affecting green quality management

Throughout the scholars' research on manufacturing green quality management and its influencing factors, green concept and quality management have been deeply combined. In the era of industrial interconnection, manufacturing power and quality power rely on regional green industrial agglomeration and collaborative innovation of quality management. At present, the research on the key influencing factors of green quality management in high-tech enterprises and intelligent manufacturing industry is not comprehensive, and the research on the key influencing factors of integrating green collaborative agglomeration into green quality management is still lacking. On the basis of scholars' exploration on the influencing factors of green quality management, this study explores the practice of green quality management in high-tech and intelligent manufacturing

industries, and explores the influencing factors of green quality management from the perspective of product green manufacturing process, internal and external quality environment of enterprises and collaborative agglomeration of green quality management.

3.1. Enterprise internal situational factors

3.1.1. Green manufacturing technology

Product quality is the attribute given to the product in the manufacturing process. The shaping of green quality depends on green technology innovation. Green technology innovation controls the green quality of products from two aspects of manufacturing process and manufacturing method to realize green production. Green R&D and design work can promote product differentiation competition and homogenization competition. The use of new energy and new materials is conducive to breaking high-tech barriers between enterprises and international, making 'green' and 'economic' compatible growth.

Quality cost control is a key link in the process of green quality control, which is a key factor to consider product economic benefits and product ecological and environmental benefits. Green quality cost control should consider green raw material cost, green manufacturing cost, green supply chain cost and product recycling cost. Most enterprises' green growth plans are stagnant due to the difficulty in controlling green management costs. Cost control is cost management under the premise of ensuring quality unchanged or improved. Enterprises should actively explore green cost management methods to break green cost management barriers. Green cost control ability can measure the enterprise green quality management ability, also is the enterprise quality performance competitiveness.

In the era of intelligent manufacturing, the informatization management of manufacturing industry can observe the management dead angle that cannot be observed by traditional management methods, and realize the green quality control of the whole life cycle of products. Lean technology of lean manufacturing method and industrial engineering method can make the green production mode and green transformation of products effective, and make the allocation of human resources and energy resources more reasonable and the utilization efficiency greatly improved.

3.1.2. Green quality chain

Enterprise green quality management is also affected by the green supply chain. The manufacturing process is only a part of the product from design to recycling. The green quality management of the product is also supervised by the suppliers, sellers, partners, customers and even the government in the supply chain. As the main body of the green supply chain, manufacturing enterprises should focus on establishing the cooperative restriction mechanism of the green supply chain, and actively carry out the design, production and circulation of the green supply chain. Under the background of energy shortage, waste recycling management can promote green consumption, green production, green quality competition and ecological responsibility of enterprises.

3.1.3. Green Operation Management

Enterprises to implement green quality management, the first is the integration of green concept in corporate culture. The traditional quality culture with the pursuit of quality and profit as the benchmark is no longer applicable to the green era and the era of quality innovation. The green management practice of intelligent manufacturing enterprises and high-tech enterprises should establish green quality objectives and principles, carry out the certification of enterprise green quality control system, adhere to the introduction of green human resources and green technology,

and strive to meet the green consumption needs of consumers and the green environmental protection willingness of society, so as to further deepen and improve the comprehensive green quality management.

3.2. External situational factors

3.2.1. Green collaborative agglomeration

Manufacturing enterprise green quality management is limited by industry level and regional policy environment. Green quality management practice requires collaborative agglomeration of other enterprises, establishing quality collaborative innovation network in the industry, strengthening the exchange of green management practice and experience sharing among enterprises, realizing the spillover effect and agglomeration effect of different industries, different regions, different scales and different green quality management technology knowledge, improving the transformation of enterprise quality chain to high level, accelerating the realization of green production and green manufacturing in manufacturing industry, promoting the high-end quality and product intelligence of manufacturing industry, giving full play to the advantages of industrial coordination and linkage, and constructing green industry system. Green collaborative agglomeration will consolidate the pattern of green development and optimize the theory of green quality management, and then feedback on enterprise quality management.

3.2.2. Green consumption environment

In the context of 'carbon peak' and smart manufacturing power, residents' living standards, residents' green consumption willingness and green consumption policies affect green quality management. Quality is good or not, is the consumer. This requires enterprises to actively carry out green quality management certification and green design, and integrate green concept into product quality management from the perspective of environmental protection. The government popularizes green knowledge to enterprises and the public, conducts green certification to enterprises, and popularizes science to consumers. Consumers' supervision of green products promotes green quality improvement and competition. The public's green consumption willingness is driven by personal safety and health, the guidance of the government's environmental protection concept, and the supply of green high-quality products in enterprises. The improvement and implementation of the green quality management system of enterprises are urged and selected by the residents' green consumption willingness.

4. Conclusions and prospects

4.1. Conclusions and suggestions

This study analyses the influencing factors of green quality management from the perspectives of green production process, internal and external quality environment of manufacturing enterprises, and collaborative quality management of manufacturing enterprises, and divides it into internal and external situational factors from the perspective of green behaviours subjects. Corresponding suggestions are put forward from the three aspects of enterprises, government and consumers, and theoretical guidance and practical enlightenment are put forward for the green quality management practice of Chinese manufacturing enterprises.

4.1.1. Insisting on green technology innovation and deepening green manufacturing engineering

Enterprises should actively promote green supply chain, green production and green marketing. Enterprises take the initiative to shoulder corporate social responsibility, achieve the choice of green suppliers, green logistics services, encourage or help partners and suppliers to achieve green supply chain. Enterprises actively adhere to green technology innovation and manage quality from the technical side. Green design of products, lean management of production and manufacturing process, improve or transform the performance of production equipment, realize cleaner production, ensure the development and use of new materials, new energy and green materials that have both economic benefits and do not harm the ecological environment. The whole process of production should try to achieve environmentally friendly, build green factories, promote the digital, intelligent and green transformation of enterprise production and manufacturing, and improve the green quality management system of enterprises.

4.1.2. Implementing green operation management and promoting residents' green consumption

Manufacturing enterprises should also shape a quality-oriented and green-oriented enterprise quality culture. The leadership should attach great importance to green quality management and formulate the green quality management strategy and management system applicable to the enterprise. At the same time also pay attention to green human resource management, green quality culture of human resources more sustainable. High-tech enterprises and intelligent manufacturing enterprises should get rid of the quality culture under traditional mechanical manufacturing and develop more green and dynamic quality culture. Employees in the quality line, to allow employees to participate in the construction of green quality management system. Enterprises show the green highlights of products to consumers and advocate consumers for green consumption, so as to gain competitiveness and green quality management motivation. Enterprises take the initiative to adopt green marketing model to provide channels for the public willing to participate in green quality management and assist enterprises in green quality management. Consumers should actively participate in green quality management and make plans for the green development of enterprise products.

4.1.3. Strengthening the coordination of green industries and the coordinated green development of fields

The government helps enterprises to achieve green development, build a green governance platform, establish a reward and punishment mechanism for green responsibility, and calls on enterprises in various industries to participate in green technology exchanges and technical cooperation, promote the knowledge spillover of green quality management in intelligent manufacturing enterprises, and create a pattern of co-construction and sharing of green quality management system. To educate the public about green knowledge and advocate green consumption, encourage the public to choose green and high-quality products actively, urge the public to supervise the transformation of green governance of enterprises and governments, and cultivate green technical talents. Building green industrial parks in the region, strengthening the exchange and learning of green talents among enterprises, strengthening the knowledge flow and knowledge spillover of green quality management among enterprises, actively promoting the mode innovation of green quality management among enterprises, strengthening the coordination of green industries, realizing the coordinated green development of fields, and improving the green quality management system.

4.2. Deficiency and prospects

Based on the summary of scholars' discussion on green quality management, this study only explores the influencing factors of green quality management of enterprises from a qualitative perspective, and does not analyse them from the empirical perspective based on the micro data of green quality management of enterprises. In the future research, we will focus on the research from the perspective of empirical analysis, and explore the impact of green quality management on enterprise technology development and economic benefits.

Acknowledgements

This work is supported by Social Science Planning Fund Project of Liaoning Province (L21AGL014).

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