

Green Innovation Performance

Subjects: Management

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Keywords: green innovation strategy ; organizational green learning ; green technology turbulence

1. Introduction

The environmental issue is one of the major challenges of the time. From shifting weather patterns that threaten food production, to rising sea levels that increase the risk of catastrophic flooding, the impacts of climate change are global in scope and unprecedented in scale. Without drastic action today, adapting to these impacts in the future will be more difficult and costly ^[1]. It is clear that the role of human influence on the climate system is undisputed and human actions still have the potential to determine the future course of the climate. Strong and sustained reductions in emissions of carbon dioxide and other greenhouse gases should be taken into consideration to limit climate change ^[2]. As the dual subject of social life and commercial activities, enterprises are not only the “initiator” of environmental problems, but can also offer the “solution” of environmental improvement. The strategy adopted by the enterprise directly affects the change of environment; of course, its implementation is also restricted by the change of environment. Despite debate over whether to be green or non-green ^[3], enterprises have recognized the need to take measures to avert environmental degradation and balance their social responsibility with economic benefits ^[4]. Enterprises should choose a path of green, low-carbon and sustainable development. At present, enterprises have realized the importance of environmental problems within the context of the sustainable development of the enterprise. As a green innovation strategy requires greater costs and rich resources, and holds much uncertainty, many enterprises have not yet incorporated environmental issues into their strategic planning nor implemented green innovation strategies with sustainable development as the principle and goal. Although enterprises in different industries and different enterprises within the industry may differ in green innovation strategies due to various reasons, enterprises viewing green innovation strategies with complete disregard will find it difficult to survive ^[5].

Green innovation strategy considers both environmental and economic benefits. Similar concepts to green innovation strategy include sustainable innovation strategy, ecological innovation strategy, and environmental innovation strategy. Through comparison, researchers find that there are only slight differences in the definition and description of the four concepts, which belong to the same theme in their concerned content, so they can be used interchangeably to a large extent ^[6]. GIS means that enterprises take the initiative to reduce the negative impact on the environment in their business activities and incorporate environmental responsibility into their strategic planning ^[7]. Enterprises must design and develop more environmentally friendly processes and products to reduce the negative impact on the environment and maintain the sustainable operation of enterprises by incorporating environmental issues into the strategic level of enterprises ^[8]. Green innovation strategy has become the key way for enterprises to promote green transformation ^[9]. GIS includes enterprises' consideration of reducing the negative impact on the environment in the whole process of raw material procurement, raw material use and waste disposal ^[10]. The traditional logic holds that green innovation strategy requires special resource input, which will increase the cost of enterprises and is a kind of economic waste. However, the practice of some enterprises has proved that the green innovation strategy not only does not reduce its income but also improves corporate performance. Does green innovation strategy have to be at the expense of economic interests? The experiences of some enterprises show that profits can be improved through green marketing and sales of waste products and environmentally friendly technologies to other enterprises. Others can avoid environmental penalties, save on raw materials, and reduce waste disposal costs by improving their production processes ^[11]. In view of this, this entry tries to achieve environmental protection and corporate income simultaneously through green innovation strategy.

Green innovation performance refers to enterprise's improvement of their product design or production process in terms of environmental protection and environmental management. Green innovation performance includes green product innovation performance and green process innovation performance from the perspective of innovation objects. The improvement of pollution prevention, energy saving, non-toxic or green product design, waste recycling, and so on, in product innovation and manufacturing process innovation enable enterprises to gain first-mover advantage and differentiated competitive advantage in the market ^[12]. There has also been previous literature about the content of green innovation performance, including enterprise economic performance, enterprise environmental performance, and enterprise social performance; this view focuses more on developing or adopting new technologies to add economic and social value to an enterprise ^[13]. Some scholars believe that the evaluation of green innovation performance should also consider the utilization of talents, equipment, and asset circulation, in addition to economic and environmental benefits, so as to reflect the favorable impact of saving on production cost and improving utilization efficiency ^[14]. There are also views that environmental innovation performance can be divided into indirect performance, direct performance, and knowledge output level ^[15]. Considering that the green innovation performance brought by strategic influence may not be reflected in the financial performance in the short term, but may be reflected in the green product, green process, green knowledge accumulation, and other aspects, this entry adopts the viewpoints of Banerjee, et al. (2003) ^[16], Leonidou et al. (2017) ^[17], Zameer et al. (2020) ^[18], and Panet al. (2017) ^[12], and measures GIP in two aspects: green product innovation and green process innovation.

Different from general organizational learning, organizational green learning focuses on learning and applying environmental protection knowledge based on green concept. As an internal factor, organizational green learning occurs under pressure or incentive ^[19]. The government's environmental regulation forces enterprises to adopt environment-friendly green technology, and the market's green demand stimulates enterprises to develop green products, resulting in enterprises having to organize employees to learn green knowledge, technology, and skills. It can be seen that organizational green learning lays more emphasis on green awareness and environmental protection knowledge learning. Organizational green learning is a crucial approach for enterprises to conduct a green innovation strategy. Through organizational green learning, enterprises master the current advanced green ideas and methods, and then apply them to enterprise green innovation. Through continuous learning, the original thinking, views, and cognition of enterprises can be updated, so as to change the original ideas and promote green innovation. Through green learning, enterprises can master cutting-edge theories and knowledge, help them make quick decisions, deal with changes outside, and improve their competitiveness ^[20].

Green technology refers to production equipment, methods, processes, product design and product delivery mechanisms that can save energy and natural resources, so as to reduce the environmental load of human activities ^[21]. Technological turbulence reflects the constant change in technology in an industry, which makes existing technology obsolete ^[22]. Green technology turbulence is an important external environmental factor, which describes the uncertainty and unpredictability of the market or industry, and represents the fuzziness and risk of green technology in the market ^[23]. Technology is a key point of innovation. In industries where technological turbulence is on the higher side, enterprises often encounter strong uncertainty about the expected results of green innovation ^[24].

Enterprises implementing green innovation strategy may allocate more resources in environmental management, making it easier for enterprises to develop green innovation strategy to obtain green innovation performance ^[25]. Previous research has highlighted the substantial benefits of green innovation strategy to enhance performance. Enterprises may decrease production costs and increase economic efficiency by applying environment-related innovation, such as reduction of energy consumption, reuse of material, and redefinition of the production process. Enterprises can further create corporate reputation and image to achieve green innovation performance ^[26]. Green innovation technology is complex and costly, and requires more environmental knowledge than traditional innovation. In order to implement green innovation strategy quickly, enterprises must constantly learn green knowledge. Organizational green learning requires enterprises to pay attention to the trend of creating and using green knowledge. Influenced by green innovation strategy, enterprises will consciously adopt green learning to promote green innovation behavior and improve green innovation performance ^[27]. Although researchers have studied the antecedents of green innovation strategy, there are few studies on the relationship between organizational green learning and green innovation performance, and the impact of organizational green learning on green innovation performance in the context of green technology turbulence still needs to be investigated.

2. Green Innovation Strategy and Green Innovation Performance

The theory of Natural Resource-Based View explains the green innovation behavior of enterprises related to environmental protection ^[28]. The natural environment can severely limit an enterprise's attempts to create sustainable

advantages. An enterprise must be able to respond to changing environmental requirements by developing new resources; in other words, enterprises need nature environment-related resources and capabilities to build sustainable competitive advantage [29]. Pollution prevention, product management, and sustainable development are three important and interrelated strategic capacities [28]. As a strategy-driven orientation, green innovation strategy can guide enterprise behavior and achieve the goals of pollution prevention, product management, and sustainable development. Natural Resource-Based View theory emphasizes that by incorporating environmental considerations into strategy, enterprises can improve their ability to deal with the uncertainty of the connection between business operations and ecological issues, which is conducive to the development of competitive and scarce organizational capabilities [16][28][30].

Green innovation activities can enhance the profitability of enterprises by commercializing innovative products and processes [31]. Green innovation activities can not only minimize production pollution and increase productivity, but also gain competitive advantage by setting better prices for green products and improving corporate image [26]. Some scholars do not agree that green innovation strategy will inevitably lead to the improvement of enterprise performance; in particular, it is thought that it may damage the economic performance of enterprises in the short term. Enterprises' choice of green innovation strategy centered on the natural environment usually means higher initial cost and longer returns cycle [32]. However, in the long term, implementing green innovation strategies can help companies gain a reputation for environmentally based leadership and first-mover advantage. Considering that reputation itself is the source of market advantage, enterprises can take advantage of the first-mover advantage to occupy a long-term competitive advantage. Empirical research found that green innovation strategy can help enterprises win competitive advantage by gaining leadership reputation in environmental protection [33].

It is found that the green innovation strategy can lead to cost reduction, process improvement, and product innovation through a variety of green organization activities, and thus improve enterprise performance. Through strategic resource allocation, learning, and using new knowledge and ideas to creatively participate in green production, enterprises can improve the efficiency and effect of green product innovation or process innovation.

3. Green Innovation Performance: A Conditional Process Analysis

Green technology turbulence reflects the challenge and impact of the uncertainty of external green technology changes on the existing green innovation activities of enterprises [34]. It represents the innovation speed and frequency of key green technologies in an industry. In this entry, green technology turbulence plays a positive moderating role in the mediating relationship between organizational green learning and green innovation performance. Based on contingency theory, this moderated mediation model reveals how organizational green innovation strategy affects green innovation performance under the condition of green technology turbulence. The more intense the turbulence of green technology, the greater the promotion effect of organizational green learning on green innovation performance, just as Ogbeibu et al. (2020) [35] previously mentioned. When the industry technology environment is in a state of high-speed turbulence, the rapid change of technology will shorten the life cycle of existing products, quickly eliminate the current dominant products or services, and weaken the existing competitive advantage. Currently, the rapid update of industry technology also forces enterprises to break through technical difficulties quickly and invent new technologies with a higher success rate. If an enterprise can organize green learning to obtain more green-related new technologies, it will produce more green product, just as was previously proposed by Wang (2020) [34], Thornhill (2006) [36] and Yang (2018) [37]. Some scholars believe that in a relatively stable technological environment, enterprises tend to seek more profits from existing technologies and markets in order to reduce risks, so the innovative technological achievements of enterprises will also be reduced. This is consistent with the results of Yin (2014) [38].

However, the moderating effect of GTT on the direct effect between GIS and GIP is not supported. To gain insight into this counterintuitive result, researchers conducted further interviews with managers at some manufacturing enterprises. As for the non-significant moderating effect of GTT, respondents explained that when GTT is low, the external technical environment is relatively stable and the execution effect of the green innovation strategy is stable, and there is a steady consumer demand for green products in the market. In this case, enterprises can rationally allocate resources according to established strategies, conduct green development, implement green production, conduct green marketing, breed green corporate culture, and then achieve green performance. Although in the case of high GTT level, it is more difficult for enterprises to gain new green technology support, enterprises that have implemented green innovation strategy still achieve better performance based on existing green advantages than those that have not implemented green innovation strategy. Therefore, the moderating effect of green technology turbulence between green innovation strategy and green innovation performance is not significant. However, the impact of green innovation strategy on green innovation performance through organizational green learning can be significantly moderated by green technology turbulence. Another possible explanation is that despite the importance of GTT, enterprises implementing green innovation strategies

do not care much about external green technology turbulence due to their enthusiasm for pursuing green market premiums. Several scholars have also suggested that enterprises must organize their product development teams to be more agile and responsive to technological change ^[39]. Changing technologies may limit the performance of breakthrough innovations and fail to incorporate new technologies into products and provide new benefits to customers ^{[40][41]}. In the case of rapid technological environment turbulence, the weak technological advantage brought by some enterprises' green strategy can easily be offset by external technological changes. Therefore, it is possible that the moderating effect of green technology turbulence is different under different environmental backgrounds.

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