Journal of Business Ecosystems
Volume 4 • Issue 1

Organizational Environmental Sustainability Business Model in Green Technology Innovation

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ABSTRACT

This study aims to analyze the implications of the organizational environmental sustainability business model in green technology innovation. It departs assuming that the implementation of green technology innovation in organizations must be supported by an environmentally sustainable business model. The method employed is the analytical reflection based on the conceptual, theoretical, and empirical literature. It is concluded that the implementation of a green business model of technology innovation, simultaneously with an internal structure of environmental sustainability regulations, is required for organizations to improve the organic integration to achieve sustainable competitive advantage and improve the development of the green technology innovation capabilities of firms.

KEYWORDS

Business innovation model, green technology innovation, organizational environmental sustainability

INTRODUCTION

Organizational environmental sustainability is critical in its practice in the ecology of the organizational population (Salimath & Jones, 2011). Innovation as organizational change is a learning process through organization to develop innovation capabilities aimed to enhance the organizational performance (Chin & Chuang, 2015; Shahadan & Oliver, 2016). When green environmental performance support is high, technological innovation adapts to improve the sustainable competitive advantage. Green technology innovation increases environmental performance. Green technology innovation support shows moderate organizational innovation and environmental performance (Xing, Wang, & Tou, 2019; Porter & van der Linde, 1995). That is, when global environmental solutions are at a higher level, innovation is more willingly adapted to the improvement of sustainable competitive advantage.

DOI: 10.4018/JBE.320483 *Corresponding Author

The growing interest for sustainable environmental socio-ecosystem services is a result of the social dimension that reinforces the socio-ecosystem management legitimation and contributes to enhance constructive conflict resolution. Organizations can manage their capabilities and processes to be able to innovate and compete in the global landscape (Barney, 1991; Teece et al. 1997; and Santos et al. 2009). In theory, every organization implement programs of innovation in organizational models of corporate social responsibility and customer relationship managements as the result of organizational transformations and restructuration.

Economic growth and efficiency contribute to sustainable environmental governance and affecting green sustainable development. Environmental regulations have an impact on the innovative behaviors and is not a perfect theoretical system. Environmental regulation theory linkage international environmental governance. The appropriate regulatory intensity, firms control the opportunistic behaviors to achieve environmental governance. The technology governance capabilities should be improved through environmental regulations.

Technological innovation is a factor affecting green development efficiency. The stronger the technological innovation capability is, it is more conducive to enhance green sustainable development (Chen & Golley, 2014; Guo et al., 2017; Chen et al., 2020; Wang et al., 2021). Technological innovation features and characteristics are perceived as causes of green technology innovation for sustainable competitive advantage. Green environmentally sustainable support moderates' green technology innovation and sustainable competitive advantage relationship.

Green technology innovation is a complex technological behavior and the effects of environmental sustainability regulations on green behavior are still not well known (Huang et al., 2022). Green technology innovation is a strategic contributor to advance organizational knowledge capacities and gaining a sustainable competitive advantage (Alavi & Leidner, 2001). Green technology innovation is related positively to environmental sustainability performance leading to sustainable competitive advantage in environmental sustainability (Seebode, Jeanrenaud, & Bessant, 2012; Zhang, Sun, Yang, & Li, 2018; Huang & Li, 2017; Ge et al., 2018; Chiou, Chan, Lettice, & Chung, 2011; Chang, 2011).

Organizational green technology innovation approach has the potential to protect the environment, develop competitive market leadership, become more efficient, etc. Technological innovation characteristics may lead to organizational sustainable competitive advantage.

To analyze the implications of the organizational environmental sustainability business model in green technology innovation, first it is analyzed the organizational environmental sustainability continuing with the organizational business model innovation leading to the analysis of green technology innovation, Finally, some conclusions are presented suggesting future research.

THEORETICAL BACKGROUND

Environmental Sustainability

In the organizational and environmental sustainability fit the organization performs better routines more valued by the environment. Theories on the effects of organizational aging on organizational process are competing to contrast claiming on the effects on the fit between the environment and organizations, growth, and survival and do not provide evidence of the different mechanisms (Ranger-Moore,1997). The environmental sustainability effects have some negative effects. Enhancing and sustaining ecosystem resilience is a function of ecosystem management and social capacity responding to environmental sustainability feedback over time as well as space (Berkes & Folke, 1998).

Environmental protection is a path to sustainable development. Technical and environmental sustainability protection and emissions standards are naturally different for various firms. This deterioration is expected to be transitory by reducing the CO2 emissions and requiring more environmental protection measures to achieve environmental sustainability. The environmental sustainability regulations are divided in the elements of command-based, incentive-based, and

voluntary environmental sustainability regulations. Command-based regulations, incentive-based, and voluntary environmental sustainability regulations can be implemented (Shi, 2019).

Incentive-based environmental sustainability regulations improve efficiency and policy flexibility. Voluntary environmental sustainability regulation motivates firms. Incentive-based environmental sustainability regulations and voluntary environmental sustainability regulations do not promote technology governance capabilities. Voluntary environmental sustainability regulations have an active participation on meeting the environmental sustainability goals. In other hand the implementation of voluntary environmental sustainability regulations is weaker than command-based and incentive-based environmental sustainability regulations and must be improved. Finally, the improvement of voluntary environmental sustainability regulations needs the supportive participation of government.

According to the Porter Hypothesis, environmental regulations induce firms to make up for compliance costs to promote the competitiveness (Porter & Van der Linde, 1995), confirmed by (Dechezlepretre et al., 2015; Wang et al., 2019; Weiss & Anisimova, 2019). Access to resources within the communities for socio-ecosystem management projects fulfilling nonmonetary goals of education, socio-economic development, and environmental sustainability protection. An adaptive socio-ecosystem approach is advocated by governance processes and activities of tradeoffs and a sustainability vision and direction operationalized by management and monitoring (Boyle et al., 2001).

Organization-level and firms at the same industry-level facing the same external environmental sustainability context have different responses as a function of differences in ages. Industry in developing countries can maintain an environmental sustainability sustainable socio-ecosystem and overcome dependence on commoditized products. Manufacturing may overcome their dependence on commoditized products and maintain an environmental sustainability sustainable socio-ecosystem.

Management in moderating the relationship between innovation and age, is related to inertia as a powerful force in high-technology firms. Some relevant elements for innovation development in high-technology oriented firms have not relevant relationship. The impact of external factors on capital price mechanisms may hinder the improvement of energy-saving technology and affects the efficiency of environmentally sustainable development (Sun et al. 2020).

Technological advance in organizations force them to change their business models and become more responsive to the dynamics of the environment (Chesbrough, 2010). Stakeholders ensure the adoption of voluntary environmental sustainability regulations beyond the mandatory regulations to generate benefits while incentive-based environmental sustainability regulations bridge the loss caused by mandatory regulation

Developing countries need achieving sustainable development to alleviate the environmental sustainability crisis. Environmental sustainability regulations make use of credibility of government to ensure implementation. International communities are more concerned with an environmental sustainability governance model to control environmental sustainability pollution and improve its environmental sustainability regulation system.

Formulation and implementation of strategies to optimize environmental sustainability regulation are required. Environmental sustainability regulations should be straightened in the face of uncertain economic and environmental sustainability to ensure the implementation of government policies (Işık et al., 2019b). Environmental sustainability regulations based on the force of government damage the market development. Promotion of environmental sustainability regulation strategies according to the characteristics and interest of firms in local conditions of the different industries aimed to achieve the environmental sustainability governance. Normative and coercive pressures from external constituencies prompt the commitment of firms to environmental protection policies (Hyatt & Berente, 2017; Truong et al., 2021).

Organizational Business Model Innovation

Innovation as the new processing technology, new product, or service new management system and structure or a new plan (Patel et al. 2015). Organizational innovation is the creation of new business

process, products, and services (Chen et al. 2015). New technology, management, and strategy in organizational innovation (Marwan et al. 2016) stresses in new products and services, new markets and promotes customer satisfaction. Innovation in organizations has elements of vision, innovation intention, leadership organizational structure, efficient teamwork, multidimensional communication, continuous devotion, creative culture, involvement, and support, etc. (Titrek, 2015).

Innovation has the learning organization as a primary task (Chen et al. 2017). Organizational innovation is the learning process to cope with environmental changes (Alanoğlu and Demirtaş, 2016). Organizational innovation is an outcome of organizational learning that facilitates the sources of competitive advantage and organizational performance. The Knowledge-based view is a management concept of organizational learning that refers to knowledge as a resource, cause and antecedent for strategic sustainable competitive advantage firm innovativeness, and performance (Kogut & Zander, 1992; Darroch, 2005). Organizational learning enhances innovation capabilities to being able to do new things (Daft, 2016). A learning organization stresses on organizational innovative learning to strengthen the organizational capabilities (Schuurman et al. 2016).

Learning organization has positive effects on organizational innovation. The learning organization is positively related to organizational innovation with both positive effects on organizational performance (Chen, Wang, Lin, & Chang, 2018). Continuous organizational innovation leads to organizational learning and performance. Innovation differentiates the value between competitors striving in a homogeneous market and enhancement of organizational performance (Chen et al. 2015). Organizational innovation has positive effects on organizational performance.

Organizational learning and organizational change are core concepts encourage the organizations and individuals to combine development objectives for a learning culture, creating thinking abilities, create a common vision through team learning, systemic thinking and innovation (Ahmad & Zabri, 2016; Wales, 2016; Daft, 2016). Organizational learning and work are continuous processes that combined result in changes of knowledge, beliefs, behaviors, enhance innovation and growth capabilities.

Propensity, posture, and performance are elements of an organizational framework to become competitive by changing positions within the organizational socio-ecosystem, adopting and adapting innovation culture and routines for the improvement of innovation development, performance and environmental sustainability impact, enhanced by cross-functional and cross-organizational collaborations (Carayannis & Provance, 2008; De Waal, 2006). Organizational structure, culture and strategy are factors influencing innovation to improve synergetic performance (Xu et al. 2007).

Innovation proceeds from organizational posture and position within the business ecosystem, propensity of processes and routines, capabilities in organizational culture and financial, products, patents, and environmental sustainability performance. The framework of sustainability innovations increase the economic, social and environmental sustainability capital stock of organizations with ethics and culture (Hansen et al. 2009).

Organizational management innovation refers to education, training and forming new ideas, processes, systems, etc. The development of organizational management innovation requires flexible organizational design, innovation and ambidexterity to enable sustainability (O'Reilly & Tushman, 2004). Organizational management innovation applies governance and organizational design competencies to incorporate resources and capabilities aimed to develop competitive advantages and entrepreneurship to exploit new opportunities and achieve organizational sustainability.

Organizations are forced to innovate its organizational model due to changing environmental sustainability and market conditions. Organizational model innovation aligns to economic, financial, social, and environmental sustainability goals. The concept of business model innovation has foundations in corporate strategic management and practices, industrial economics and across its business ecosystem. The concept of business model innovation is based on the principle that organizations innovate by leveraging their use of resources and capabilities (Zott & Amit, 2010a) leading to the formulation and implementation of innovation strategies (Reinmoeller & van Baardwijk, 2005) such as in knowledge management, entrepreneurship, exploration, and cooperation.

The conceptualization of business innovation model and value proposition provides benefits to the organizations in terms of flexibility and opportunity to remain innovative. Business model innovation in the organization is a method of lean innovation with resources and capabilities inherent and minimum investments. The business model framework change development and innovation driven by transformations related to interactions. A framework for innovation based on sustainable development provides business expansion through regulatory push and vision pull model leading to business growth (Day, 1998; Hockerts, 2007; Preuss, 2007).

Business model innovation embedded in the core business with capitalization of capabilities or dealing with disruptive innovation with the integration into a new organization (Lindgardt et al. 2009; Christensen, (1997). Organizations that have more than one business model innovation have greater chances of being successful (Clausen & Rasmussen, 2012).

The innovation of a business model cannot be predicted by examining the current organization business model. According to George & Bock (2011) business models reflect upon the organizational design, resources-based view of the firm, narrative and sense making, nature of innovation and opportunity, and transactive structures. Business model innovation leads to disruptions that needs redesign of the organization while established firms tend to be successful with sustainable innovations and less successful in business model innovation.

Ambidexterity is required by the organizational model of innovation positioned at the core of organizational strategy, information and communication technology and organization, illustrating the influence of organizational design. Organizational design is critical for the emergence of an ambidextrous organizational form with the capability to optimize explorative and exploitative innovation aimed to enhance sustainability and performance (He and Wong, 2004). Organizational design and business model innovation support organizational sustainability. Organizational design and governance have influence on business model innovation. American and European schools of business models distinguish and designing and modelling approaches, classifications and use of open innovation (De Reuver et al. 2013).

Most of the business models reinforce innovation, but not all of them, leading to higher level of innovativeness. The doubt of Porter (2000) about the business model concept who provide a concise framework that explains how the organizations create and capture value, and the means to monetize their innovations (De Reuver et al. 2013). Stakeholders of large organizations are potentially responsible for the business model innovation, although the responsibility is assigned to mid-level management with leadership gaps (Chesbrough, 2007; Santos et al. 2009).

The implementation process of an innovative business model is driven by actions on the external and internal threats and opportunities (Bucherer et al. 2012). Organizations adopting business models to combine and distribute research-based innovations to other different market segments have impacts on technology transfer agents (Clausen & Rasmussen, 2012). Technology transfer agents transform scientific and technological knowledge into marketable innovative products. Organizational technology innovation increases the functions of products and services to enhance the attraction. The business model innovation has effects on organizational sustainability, design, governance and the role of the different stakeholders, partners, and customers in innovation process towards organizational sustainability.

An institutional environment encourage innovation and experimentation, facilitates individuals and organizations to improve the solution of complex problems (Imperial, 1999). Government environmental sustainability regulations are forcibly implemented; organizations must allocate innovation funds to meet the environmental sustainability regulations. When the coercive force is weak, the speculation hinders the implementation of green technology innovation. The effectiveness of government environmental sustainability regulations is a means to achieve sustainable development.

Government formulates technical specifications and standards for environmental sustainability protection for green production performance. Government environmental sustainability regulations promote the development of green technology innovation and the ecological protection aimed to transform firms and reduce environmental sustainability pollution. Pollution discharge permit

system must meet the environmental sustainability protection standards. Government environmental sustainability regulations have abnormal characteristics and command-based environmental sustainability regulations stands out to promote green technological innovation. Strong government environmental sustainability regulations stimulate firms to engage in green technology innovation (Cainelli et al., 2020; Chen et al., 2021; Nie et al., 2021).

The indicators of command-based environmental sustainability regulation are the technical regulation, clean technology standards, requirements for wastewater and gas discharge, and standards for waste residue discharge. Command-based environmental sustainability regulations inhibit green economic and industrial growth, (Liu et al. 2021). Command-based government environmental sustainability regulations set technical specifications and standards for pollutant emissions of firms.

Command-based environmental sustainability regulation has effects on green technology innovation of the firm through formulation and implementation of green technology standards and emissions, as the strict mandates from the government that firms must comply to avoid penalizations. Command-based environmental sustainability regulation enhances manufacturing green product innovation capabilities, green process innovation capabilities and technology governance capabilities. Command-based environmental sustainability regulations give support to the green product innovation capability, green process innovation capability, and governance technology capabilities of firms.

The indicators of incentive-based environmental sustainability regulation are the appropriate allocation of clean production support funds, the appropriate allocation of technological special funds, the standards collection of environmental sustainability protection taxes, and the appropriate transaction permit. Incentive-based environmental sustainability regulations have not a remarkable role in green technology requirements leading to reducing polluted firms (Zhang, 2022).

Incentive-based environmental sustainability regulations leading to the implementation of green technology innovation are realized through green taxes, green emission permit trading, government green subsidies, etc. Firms improve green production processes, environmental sustainability protection, and reduce emissions to meet the government environmental sustainability protection (Deng and Chen, 2020). Incentive-based environmental sustainability regulations have effects on green product innovation capability and green process innovation capabilities.

Voluntary environmental sustainability regulations are motivated restrictions to uncontrolled environmental sustainability behaviors by actions such as disclosing environmental sustainability information, certification on competitive environment of the firm (Li et al., 2018). Voluntary environmental sustainability regulation promotes the green product innovation capabilities of firms.

Environmental sustainability regulations have an impact on innovation intensity, although the impact of innovation quality with different motivations (Hu et al., 2020; Chen et al., 2021; Ma & Li, 2021). The firm must examine perceived quality and efficiency of command-based regulations, incentive-based, and voluntary environmental sustainability regulations.

Environmental sustainability regulations have a decreasing impact on technological innovation affected by the incentives and government subsidies. Research has shown that incentive-based environmental sustainability regulation has not significant impact on technology governance capability. Voluntary environmental sustainability regulation has not significant impact on green process innovation capability.

Green Technology Innovation

Firm innovation is a strategic behavior aimed to technological progress and competitive advantage, catering stakeholders and government regulation with quality of innovation (Tong et al., 2014; Truong et al., 2021). The government is the initiator of environmental sustainability regulations and is responsible of supervision and taking measures to control external effects, reduce the risks and uncertainties inherent on innovation (Wu, 2017).

Firms take the opportunity to adjust their technical structure, cultivate green technology innovation competitiveness and achieve the goal of environmental sustainability protection. Green technology

innovation cannot be separated from technological innovation, although it is unknown if the Porter hypothesis of green technology innovation is still valid. Some studies could not verify the Porter hypothesis and cannot distinguish green and non-green technology innovation. Data on environmental sustainability regulation must be separated from data on green technology innovation to analyze the positive impact on the green technology innovation of firms.

The green technology innovation of firms can be divided into substantive green technology innovation and symbolic green technology innovation caused by the differences in regulatory captures, environmental sustainability regulations, and government subsidies from motivation to analyze the impact of environmental sustainability regulations. Government subsidies constrained by environmental sustainability regulations promote green technology innovation of firms although policymaking support with different intensity levels with different impacts on firms depending on the motivations for green technology innovation (Klette et al., 2000; Hud & Hussinger, 2015). Driving effects and results orientation government provides subsidies to firms engaged in green technology innovation activities.

In the context of strict environmental sustainability regulation to achieve green sustainability development and reduce carbon emissions, government must allocate subsidies to encourage the introduction of green technologies, environmental sustainability-friendly equipment, encourage and have an impact on green technology innovation. Environmental sustainability subsidies signal to investors that government legitimizes firms, according to the signal theory (Wei & Zuo, 2018; Ren et al., 2021). Robust environmental sustainability regulations with more strict enforcement but rising costs, firms gain competitive advantage through independent innovation (Xu et al., 2019; Jiang et al., 2020).

The dimensions of green technology innovation from the motivation perspective have different objectives leading to different levels of investments and energy constraints, improvements of green technology innovation of the firms and enhancing environmental sustainability and social responsibility performance. One of two dimensions may require more resources and organizational changes to improve the environmental sustainability performance at the cost of disrupting the internal flexibility (Hawn, 2012). Based on the perspective of motivation, green technology innovation is divided in green technology innovation behavior aimed to the advancement of corporate green technology and innovation strategy catering to environmental sustainability regulations ensuring that the firms meet social expectations of green technology innovation.

Green technology innovation behavior can be substantive and symbolic which varies with motivations and the perspective of innovation effects (Bronzini & Piselli, 2016; Li & Zheng, 2016; Hu et al., 2020). A behavior model created with characteristics of green technology innovation and government-enterprise, the government subsidies and regulatory capture lead to transmission mechanisms. Green technology innovation and green utility model patents are applied by firms (Huang, 2016).

Green technology innovation and environmental sustainability regulation in firms have an impact on technological innovation depending on the balance between compliance costs and innovation compensation (Ma & Li, 2021). Low-level and minor innovation is a low innovation cost, with less time, and a likelihood of obtaining government subsidies where regulatory capture outweighs the loss. Firms explore and develop new knowledge and technology out of the existing technology innovation paradigms, although some experience longer period without technological innovation results. Selected participants have a deep knowledge on organizational innovation and entrepreneurial activities. Innovation and growth processes are conditioned by entrepreneurship and systematic accumulation of knowledge and manpower skills.

Organizational ambidexterity in exploratory innovation generates and develops new knowledge and promotes radical innovation while exploitative innovation while exploitative innovation is based on current knowledge aimed at incremental innovation to achieve competitive advantage and enhance performance (Atuahene-Gima 2005; Benner & Tushman, 2003; Gibson & Birkinshaw,

2004). Ambidextrous organizations are sustainable and achieve high performance by implementing explorative innovation strategies and exploitative innovation strategies.

The market power supports firms to allocate ecological resources conducive to technological innovation. Environmental sustainability regulation has different types to cultivate micro mechanisms of green technology innovation in the of manufacturing industry. Laying a theoretical framework for policy proposal. The micro level structure of mechanism on environmental sustainability regulation of the elements of green technology innovation of manufacturing firms.

Environmental sustainability regulations have different effects on green technology innovation of firms. The relationship between technology innovation and environmental sustainability regulation is uncertain with and may be not a linear relationship or a threshold effect (Yang & Zeng, 2018; Cao et al., 2019). Government environmental sustainability regulations in technological innovation of firms is being clarified involving measures to ensure sustainable economic development in symbiosis with ecological economy (Du et al., 2021). Responding to environmental sustainability regulations, some firms are more inclined toward green technology innovation than to carry out non-green technology innovation (Nesta et al., 2014; Feng et al., 2017).

A research focusing on the adoption of characteristics of innovative technological characteristics using a model developed by Issa & Jabbouri, (2022) on the knowledge-based theoretical perspective for the adoption of green technological innovation in the health care industry in the region of MENA consisting of technological innovation characteristics such as the relative advantage, complexity, compatibility, observability, triability as antecedents, green technology innovation as a mediator, and sustainable competitive advantage as an outcome with government environmental support as a moderator. Trialability is a characteristic determinant of the adoption of green technology innovation (Le, Hollenhorst, Harris, McLaughlin, & Shook, 2006). Trialability is perceived positively related to green technology innovation.

Green technology innovation can be separated from technological innovation to evaluate the impact of environmental sustainability behavior on green firms. Environmental sustainability regulations have behavioral constraints driving firms to provide benefits to regulators seeking to soften the regulatory requirements leading to destroy the potential incentives for green technology innovation activities. Green technology innovation has attracted the attention (Kunapatarawong & Martínez-Ros, 2016; Sun et al., 2017; Ilg, 2019; Xie et al., 2022) to promote a low-carbon economy and neutrality (Popp, 2019; Zhang et al., 2021). The impact of green policy on green technology innovation attracts widespread attention, among the carbon emitters (Qi et al., 2021). The mechanism of environmental sustainability regulation policies influences the promotion of green low-carbon transformation and the green technology innovation of firms.

Green technology innovation is characterized by double externalities (Bi et al., 2016; Bai et al., 2019). A positive externality of green technology innovation without the support of government lead to market invalidation and poor motivation for the firm. Green technology innovation in firms is a quasi-public good with a positive externality. The quantity and speed of green technology innovation pursued by firms signals the environmental sustainability compliance to the stakeholders without compromising economic interests. Governments and stakeholders pressure organizations to achieve sustainable competitive advantage by adopting organizational green technologies innovations to remain competitive in the market (Brooks, Hedman, Henningsson, Sarker, & Wang, 2018).

Firms that have invested in green technology innovation resources, the benefits are not always exclusive leading to the free-riding in competition (Malen & Marcus, 2019; Xiang et al., 2022). A negative externality is the pollutant emissions. The pollution characteristics is used in research of environmental sustainability economics to build a model of environmental sustainability research policy on firm green technology innovation. High-quality green technology innovations are preferred by governments to increase financial support because can reduce adverse effects and maximize eco-environmental sustainability dividends (Lin et al., 2021).

The moderating effect of government subsidies and regulatory capture most be tested on the relationship between environmental sustainability regulation and the firm' green technology innovation.

The model to be tested must include the fixed effects of the firm, industry, and time. Government subsidies and regulatory capture subject to environmental sustainability regulatory constraints have moderating effects with motivations on firms' green technology innovation. The regulatory capture as a supply of financial resources is linked to environmental sustainability regulations with effects on the support of green technology innovation resources (Murphy et al., 1993; Xue et al., 2021). Regulatory capture has a negative effect on environmental sustainability regulations process to promote the green technology innovation of firms.

The regulatory capture may negatively moderate the promotion of environmental sustainability regulations which may be the reason for differences between green technology innovation behaviors. Lack of resources for high-quality independent innovation ability, firms cannot respond to environmental sustainability regulations and laws only by imitating and low quality innovation. Firms that imitate lacks independent high quality innovation capabilities which requires capital investment in long-term technology innovation accumulation.

Green process innovation capability directs to process design meeting the requirements for environmental sustainability protection. Organizational design for innovation aligned to the organizational business model creates an environment for organizational performance. Environmental sustainability regulations are a policy variable to investigate the impact on improving the green technology innovation capabilities of firms (Liu et al., 2021; Cui et al., 2022).

The green product innovation capability is related to the healthy products that are beneficial to consumers and environmental sustainability protection.

Green terminal technology innovation governance capability is related firms meeting the environmental sustainability protection through the waste's treatment (Song et al., 2020). Funds for environmentally sustainable governance led to efficient supply of environmental services and public services (Bai et al., 2019). Regional sustainable environmental quality caused by environmental governance improves development efficiency.

Firm green technology innovation is top management strategy. Measurement of corporate green technology innovation with patent is strategic behavior (Hall & Harhoff, 2012; Tong et al., 2014). The firm green technology innovation methods are not unified and standardized, they belong to different perspectives. A research method developed by (Wurlod and Noailly, 2018) identifies green invention patent applications as the measure of green technology innovation ability.

Organizations coping with environmental sustainability changes, must adopt new ideas, behaviors, and forms, including incremental and radical innovation activities, management systems innovation, new culture, equipment and techniques, services, and ideas, etc. (Demirtaş, 2016). The innovation compensation effect exceeding the compliance cost effect, using green factor productivity, indicates that environmental sustainability regulation leads to green technological innovation (Xie et al., 2017; Wang et al., 2019).

Challenges and threats of a changing environment of organizations in global competition require constantly to learn, innovate, and reengineer. Some of the challenges that corporations meet are the cost-pressures, differentiation, and threats of substitution in environments where the culture and imitation are over innovation and sustainable development.

Research Methodology

To carry out this bibliometric review, electronic literary, and scientific sources were used as the basis for on ecological innovation, organizational aging, organizational ecology, patents, and its impact on the organizational ecology innovation. The study was conducted in the main scientific search engines. The research has been in English and are related to the publications and consulting reports.

RESULTS AND DISCUSSION

An environmental sustainability positive attitude and organizational members must innovate the environmental sustainability concept, formulate, and implement green strategies to improve the green

technology innovation capabilities. Environmental sustainability regulation is correlated to green technology innovation and is positively related to sustainable competitive advantage. Environmental sustainability regulations have a direct impact on green technology innovation ability of firms despite the differences on the implementation effect caused by different variables. Environmental sustainability regulations improve the green technology innovation capabilities of firms.

The structure of environmental sustainability regulations must be simultaneously implemented. The internal structure of environmental sustainability regulations improves the organic integration of internal elements crucial for the development. The environmental sustainability regulations need to cultivate technology governance capabilities to improve incentive-based environmental sustainability regulations and voluntary environmental sustainability regulations. Environmental sustainability regulations must mobilize the green technology innovation capabilities of firms. Incentive-based environmental sustainability regulations support green technological innovation capabilities. Voluntary environmental sustainability regulations accommodate green economic development.

Policymaking must focus on reducing environmental pollution, encourage environmental technological innovations, and raise awareness of environmental culture to achieve sustainable development goals. Organizations must pursue innovation and changes to maintain flexible responses to customer needs and continuous product and service innovation. Organizational management must implement an innovation capability for research and development of technology to create organizational competitiveness and sustainable management. Stakeholders, policymakers, government officials, and organizations must be aware of the environmental impact on enhancing the development of green technological innovations aimed to promote clean and sustainable environment.

CONCLUSION

Local governments may improve the environmentally sustainable governance systems. Local governments are active in introducing technological innovation to build a resource-saving and sustainable environmental production and protection system. Local governments must increase the resources establishing a dynamic environmental monitoring system, disclose the environmental information, have strict environmental sustainability supervision and enforcement mechanisms to urge firms to abide by the environmental regulations and promote the environmental performance evaluation.

The adoption of green technology innovations supports the transition to a sustainable environment easing the consequences of climate change. Increase of energy consumption leads to strain on the environment. Green technological innovation tends to reduce carbon emissions in the long run. Transitions from fossil fuels to sustainable development shifting to renewable energies enhances environmental quality. Green technological innovation shifting to sustainable energy sources for example, reduce environmental pollution.

Future research is needed in the analysis of the environmental sustainability regulations. Future research must focus on the involvement of government and the dual effects and consider the effect intermediary.

Further research must be conducted to explore, define, and analyze the contributions to organizational transformation and the applicability of technology transfer to the organizational management innovation aimed to the innovativeness, competitiveness, and sustainability of organizations.

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