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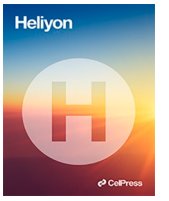

Determinants of eco-innovation initiatives toward sustainability in manufacturing SMEs: Evidence from Bangladesh

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ABSTRACT

This study identifies the key factors accelerating the eco-innovation initiatives of manufacturing Small & Medium Enterprises (SMEs) in Bangladesh. The study further attempted to measure the impact of eco-innovation on a firm's economic, environmental, and societal performance, broadly called sustainability. Following the convenience sampling technique, data was collected from 876 respondents through a structured questionnaire considering the 7-point Likert scale. The Structural Equation Model (PLS-SEM) has been employed using Smart PLS v3.3 software to simultaneously show the constructs' relationships. Moreover, the study incorporated several tests to check the reliability and validity of the data. Furthermore, the degree to which data collected for this study fits well with the model has been tested by calculating model fit indices- NFI and SRMR. The findings reveal that all other factors Technological Capabilities (TC), Environmental Regulations (ER), Green products (GP), Competitive Pressure (CP), and Energy Price (EP) has a significant positive association with the firm's Eco-innovation initiatives except FR. Moreover, Eco-innovation (EI) greatly enhances the two domains of Sustainability- Environmental Performance (EnP) and Societal Performance (SoP) in manufacturing SMEs in Bangladesh. However, the relationship between EI and EcP was found to be insignificant. Apart from Economic Performance (EcP) andEnvironmental Performance(EnP), Societal Performance (SoP) as a sustainability domain remains unattended in the prior study, which has been incorporated in this research. Thus, the findings of this study will provide some unique implications for business managers and policymakers.

1. Introduction

The exponential population growth, intricate manufacturing environment, and harmonization of industrial development have led to ecological imbalance, which concerns global politics and the business community. Thus, international platforms have focused on the trade-off between ecological balance and economic growth through sustainable manufacturing. Furthermore, due to the post covid −19 crisis, environmental uncertainty and risk, including shortage of resources, the intensity of pollution, and climate change, have pushed countries across the globe to pay greater attention to sustainability. Growing environmental awareness among the consumers and a variety of stakeholders, advancement of corporate social responsibilities, including the diversification and nature of pressure groups expectations, and transformation of local business to the global trade create pressure on the corporate house to change the

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drivers of eco-innovation. As a result, eco-innovation is the cross-cutting issue. Therefore, it has become the ultimate option for firms to gain a competitive advantage that enhances financial, environmental, and societal performance. Eco-innovation works as a glue that upholds the components of sustainable performance by maximizing the ecological balance and reducing the externalities impact on the environment. Proponents have agreed that a firm's innovative activities enhance competitive advantage [1], but in the case of eco-innovation, competitive advantage is linked with environmental benefits [2].

Compared to eco-innovation, so-called traditional innovation fails to uphold the cross-cutting relationship that leads to vulnerable the results of innovation drivers [1]. Numerous academics in the fields of innovation, management, environmental economics, stakeholder theory, and institutional theory have explored the primary drivers of eco-innovation [3,4]. Insights from the field of eco-innovation indicate that factors of eco-innovation and its impact on sustainability are the most important and debatable topic because the findings differ from firm to firm, country to country, and culture to culture [5,6]. Thus, there is a need for justification and policy specification that identifies the key factors accelerating the eco-innovation initiatives of manufacturing Small & Medium Enterprises (SMEs).

It is widely discussed that all businesses must use green practices due to global sustainability concerns. Particularly, Small and Medium Enterprises (SMEs) constitute the backbone of the business arena in developing economies like Bangladesh. In the economy, particularly those at the developing stage, Small and Medium Enterprises (SMEs) account for a significant role in the form of absorbing any labor surplus by generating employment, accelerating the development of a diversified economic structure, contributing to the trade balance through export earnings or import substitution, and providing desirable innovation and sustainability in the economy as a whole [7]. SMEs signify about 90% of businesses and higher than 50% of total employment worldwide. SMEs account for 60% of the entire workforce worldwide[8]. This is critical for poverty alleviation, social stability, and equitable growth and forms the backbone of the working middle class in most countries [9]. Moreover, up to 40% of national income (GDP) comes from formal SMEs in emerging economies, while the percentage is significantly higher when informal firms are included [10].

The prior studies show that firms' eco-innovation initiatives substantially affect SMEs' economic performance [1,11]. Thus, the other two domains of sustainability, namely Societal performance and Environmental performance, remain unattended [12]. However, there appears to be an absence of inclusive research incorporating all the possible actors and factors underpinning the firm's attitude toward the eco-innovation initiative and its impact on sustainability [13]. In nominal terms, Bangladesh is the 39th largest country globally and 29th largest in terms of PPP; more importantly, it is the 3rd fastest growing country worldwide [14]. SMEs' contribution to this journey is undeniable. There are 15,666 small and 6,103 medium-scale enterprises in Bangladesh, which account for 35.49% of total employment in the country [15]. Around 65% of all SMEs are located outside the areas of Dhaka and Chottogram [16]. Thus, the total number of SMEs located within Dhaka and Chottogram is approximately 7620. Sustainability in this particular sector through eco-innovation will foster the sustainable development of Bangladesh [17]. From this perspective, the present study is very rational in unfolding the factors behind SMEs' eco-innovation initiatives. Moreover, the quantity of research conducted on this massive business arena is not proportionate to the entire industry's size. Furthermore, those studies existing in the literature are nothing but a simple overview of SMEs in Bangladesh [18]. Therefore, this underlying gap in the literature is the appropriate justification for this research.

The sector is yet to be fully utilized in Bangladesh, although it can create numerous jobs and escalate its contribution to the GDP. However, economic performance is no longer the last word in the business world. In achieving sustainable performance in SMEs, environmental performance and societal performance are equally important as economic performance. While environmental performance is to conserve nature and not harm the environment in all respect, societal performance includes stable and equitable social growth [19], both are essential in SME sectors. Previous scholars examined the nature and drivers of eco-innovation and performance in different industrial sectors [20,21]. Still, only a few studies examined the relationship between eco-innovation and sustainability in SME firms [22,11]. In addition, the findings of these studies mainly focused on European countries and other developed economies [11]. Thus, researchers suggest new studies to understand eco-innovation development and drivers that help sustainable performance in SMEs in emerging economies [23,22].

In Bangladesh, the situation is extremely critical due to the vulnerability of climate change. There are no established environmental policies while carbon emission is increasing, threatening achieving Sustainable Development Goals (SDG). Slowly but surely, government and responsible parties are working hard to lower carbon emissions with eco-innovation help [24]. So, this research established a comprehensive link between factors of eco-innovation and its impact on a firm's economic, environmental, and societal performance, broadly called sustainability. Although multiple studies have examined the association between eco-innovation and financial performance [25,26,27], these mainly focus on established and developed cultures [23,11]. Only a few studies conducted and addressed these cross-cutting issues for emerging economies which consider SMEs [28].

In addition, new and emerging researchers suggest that these issues need to examine the emerging economics to enhance the applicability of eco-innovation factors [4]. Besides, the post-crisis of covid −19 and slowing down economic activity negatively impact consumption patterns. So, this study can be seen as an attempt to enhance eco-innovation factors toward sustainability in SME sectors. Eco-innovation is becoming a prominent field that generates financial returns and contributes to the other components of sustainability, like environmental and societal performance. Thus, different pressure groups, including the government and other national and international bodies, have surely accepted eco-innovation prospects that also uphold environmental and social performance [29]. Consequentially, these parties are promoting eco-innovation to gain environmental and social performance in line with financial performance. Although previous researchers mentioned that financial success is the main goal of SMEs [28,25,27], there is no way to ignore environmental and societal performance, which are critical components of sustainability [4]. Considering this debate, the authors develop the factors of eco-innovation and its impact on a firm's "economic", "environmental," and "societal performance."

The study explores the factors of eco-innovation initiatives toward sustainability in manufacturing SMEs in Bangladesh.

Specifically, this study aimed to achieve two objectives. Firstly, to investigate the effects of Technological capabilities, Environmental regulations, Demand for green products, Competitive pressure, High energy price, and Expected future regulations on Eco-innovation initiatives of manufacturing SMEs. Secondly, to examine the impact of Eco-innovation initiatives on the sustainability of manufacturing SMEs in Bangladesh. To serve the purpose of this study, following questions were developed:

Q1 Do technological capabilities, environmental regulations, Demand for green products, competitive pressure, high energy price, and expected future regulations significantly influence eco-innovation initiatives of manufacturing SMEs?
Q2 Does eco-innovation substantially affect the Economic, Environmental, and Societal performance of manufacturing SMEs?

There is a gap in the existing literature on the factors of eco-innovation toward sustainability in SME sectors, specifically in Bangladesh. Furthermore, factors of eco-innovation like Technological Capabilities (TC), Environmental Regulations (ER), Market Demand for Green Products (GP), Competitive Pressure (CP), High Energy Price (EP), Expected Future Regulations(FR) have not been linked in the previous literature in south Asia. Earlier researchers found links between EI and EcP [30,21], but these studies mainly focused on developed economics [30], where there are no fluctuations in economics [31]. Hence, the results of these studies are strongly criticized by modern proponents of eco-innovation due to their limited applicability [28], not fit for emerging economies like Bangladesh. In addition, there is not a single study found that links a firm's eco-innovation initiatives and sustainability, stressing all three domains, namely- Economic Performance (EcP), Environmental Performance (EnP), and Societal Performance (SoP) [1,30]. Although eco-innovation has a substantial impact on the environment and society in the SME industry, there is no single study that considers both impacts along with economic performance whether developed or emerging economics [27,11]. Moreover, the association between EI and EcP, EnP, and SoP has not been established in SMEs in Bangladesh. These gaps in the existing literature suggest three directions for future research.

Firstly, researchers call for careful examination to recognize that factors like TC, ER, GP, CP, EP, and FR, truly work as a factor of eco-innovation. Secondly, existing prominent researchers call for further investigation to identify holistic nexus between EI with EcP, EnP, and SoP. Thirdly, they emphasize the importance of considering other aspects of eco-innovation in the SMEs to have a complete picture of the eco-innovation implementation. As a result, to fill these gaps, the authors examine the association of eco-innovation with TC suggested by Refs. [32,33]; ER suggested by Refs. [34,35]; GP suggested by Refs. [36,37]; CP suggested by Refs. [1,5]; EP suggested by Refs. [38,39] and FR suggested by Ref. [3]. Finally, to recommend SMEs in Bangladesh, the authors establish a framework incorporating the firms' Eco-Innovation undertakings and their effects on EcP, EnP, and SoP.

This study contributes to the theoretical development and practical implication in the field of eco-innovation and sustainability in the SME industry in Bangladesh. This study explored the drivers of eco-innovation and examined its impact on the sustainable performance of SMEs in Bangladesh. This paper will be the policy guideline and offers valuable insights for policymakers, managerial personnel, and regulatory bodies. As a methodological contribution, applying PLS-SEM generates a robustness between eco innovation and sustainability in the current study, which enriches the existing literature. Resource-based view also emphasizes the range of a company's resources and competencies that provide a long-term competitive advantage instead of implementing programs to enhance ecological technology that secures competitive advantages and long-term economic growth. Business should put their attention on minimizing technological dependencies. Thus, the outcome of the study strengthened the established philosophy of resource-based view theoretically. However, the study offers at least three specific contributions. First, this research extends the debate on the association among EI and EcP and EnP, by integrating SoP into existing studies [40,4]. Second, the study explores how EI is positively correlated with TC, ER, GP and CP. Therefore, SMEs may critically consider these factors while deciding how to implement EI. Third, most prior research has focused on developed economics [34,1,38,6,30,31,4] and only a limited few on the developing world [28]; while ignoring growing economies in South Asia like Bangladesh, this study incorporates evidence from emerging economies.

The subsequent sections of the research provide the theoretical framework and hypothesis development, material and methods, analysis, test of hypothesis & discussion, and Conclusion.

2. Theoretical background and hypotheses development

Small and Medium Enterprises (SMEs) comprise one of the significant segments of an economy, and their role in generating employment opportunities, resource utilization, and income generation is undeniable. In Bangladesh, the enterprise comprises fixed assets, excluding land and building between Tk. 7.5 million and Tk. 150 million, or having a number of workers ranging from 31 to 120 deemed as small enterprises. When a firm's fixed assets, apart from land and building, lie within the range from Tk. 150 million to Tk. 500 million, or having workers between 121 and 300, is called a medium enterprise. These two forms of industry, coupled with macro firms, account for 25% of GDP and employ 87% of Bangladesh's civilian population [41]. Therefore, the performance of SMEs as a particular industry is critical for the economic development of Bangladesh. The world in this 21st century is not happy only with economic growth. Doing business while doing no harm to the environment and nature's conservative motive to achieve social equity has become a growing concern across the globe. Therefore, social and environmental performance has become equally crucial as economic performance [42]. All these three performances constitute sustainability, a mandatory module for businesses regardless of their nature, location, and size nowadays.

Sustainable development comes from sustainable performance, which means the degree to which firms manage to achieve their economic, environmental, and social goals in the systematic coordination of key inter-organizational business processes to improve long-term financial performance [43]. The traditional approach may enable a firm to achieve its expected economic performance in a specific period of time, but environmental and social performance requires concern for something else. The level of eco-innovation

initiative determines how well the firm's functions are aligned with the go-green philosophy[44]. Moreover, eco-innovation paved the way for achieving social goals through societal performance. Therefore, the question is-what drives firms to take eco-innovation initiatives? Become the center of interest to the researchers and policymakers. This study identifies all the significant forces shaping SMEs' eco-innovation initiatives for achieving sustainability in the form of economic, environmental, and societal performance.

2.1. Technological capabilities and eco-innovation

Many scholars have recognized the application and significance of Resource Based View (RBV) in explaining firms' eco-innovation behavior. Resource Based View concentrates on managerial attention & actions of a firm regarding its assets, capabilities, and competencies. It argues that to enjoy a competitive advantage, firms' resources need to be unique, non-imitable, and valuable [45]. Proponents of RBV have developed a causal link between competitive advantage and eco-innovation activities of firms. Researchers argued that RBV supports firms to respond to external change based on their internal resources and capabilities [46]. The authors used three approaches to establish the relationship between RBV and eco-innovation. Firstly, resources are firm-specific tangible assets such as financial and physical resources, or intangible includes firm's reputation, culture, technology, and customer relationship. Secondly, competencies or capabilities are resources generated from firm's activities performed repeatedly in a firm.

Organizational competencies are generated from the organizational routine work process. Thirdly, dynamic capabilities are those abilities that an organization purposefully generates, extends, and changes its resources and competency base to respond to a rapidly changing environment [47]. It is evident that RBV is a useful theory for analyzing eco-innovation determinants. A solid resource base, particularly in technological capabilities and environmental and organizational capabilities, is critical for SMEs' eco-innovation [48]. Based on RBV, this study upholds the discussion about the determinants of eco-innovation in the context of technological capabilities, which is a firm-specific resource. Technological capabilities combine all tangible technical infrastructure and intangible knowledge and experience in the firm's possession to produce eco-friendly products and design green manufacturing processes [49]. Eco-innovation is basically the accumulation and application of environmental knowledge in every work process. Technology enables the firm to abandon conventional manufacturing and embrace eco-friendly production [32]. An organization having an eco-innovation motive keeps itself open to learning from other organizations and incorporating it to achieve further success [50]. Desire and practice of innovation is something that comes from generational history and intensifies as it goes on [51]. If innovation existed in the past, the firm is more likely to be innovative now, and the degree will be intensified in the future [52]. On the contrary, other studies argued that advancement in a firm's technology made it blind and prevented our minds from thinking of the environment [53]. From this confusing situation, the following hypothesis has been developed:

H1. *Technological Capabilities positively affect the Eco-innovation of manufacturing SMEs in Bangladesh.*

2.2. Environmental regulations and eco-innovation

Historically, it is evident that organizations are sensitive to responding to control and command instruments from the government side [54]. In the case of eco-innovation, the situation reveals the same sensitivity of companies toward environmental regulations [55]. However, to enhance financial performance complying with environmental regulations, firms must innovate eco-friendly processes that can yield lower-cost production [56]. The institutional theory explains the way organizations behave and act in all aspects. Specifically, it includes actions regarding the consumption of resources& energy, ecological practice, conservation of nature and environment, etc. [57]. This theory claims that an organization's actions are greatly influenced by external pressure, which can be coercive, normative, and mimetic in nature [58]. Coercive pressure comes in the form of environmental regulations, particularly from the government. However, firms feel pressure to achieve capabilities to meet and, if possible, to exceed the satisfaction level of their customers, clients, partners, and suppliers. This is normative pressure. The mimetic pressure is derived from the need to follow and imitate the market leader [1]. The appropriate authority forces the organizations to undertake eco-friendly functions putting coercive pressure on them in the name of environmental regulations [59]. It is a general tendency of most firms to perform minimum to comply with environmental regulations. Legal bindings to act in the way of doing no harm to the environment is a powerful control and command instrument [60]. Rightly crafted regulations relating to the environment may inspire firms to produce green products using green technology and process, improve management techniques, and offset the costs of compliance with the law [61]. Author [62] argued that the firm's attempt at eco-innovation is not because of its concern for the environment but rather to achieve reward in the form of incentives that authorities offer for compliance with regulations. On the contrary [63],recognized that market-based instruments more effectively foster eco-innovation than environmental regulations in their study. However, command instruments stimulate SME's eco-innovation initiatives; the degree of stimulation varies in the context of the regulations [64]. In many researches, it is revealed that firm's main intention towards environmental regulations is to attain compliance by obeying regulations at a minimum level to get certified as a compliance venture [65]. On the other hand, many studies also found that companies that actually believe and desire to follow the environment-friendly way in all their operations and are willing to exceed the minimum requirement set by legislation are pioneering in eco-innovation and enjoy the first mover advantages [65]. This situation motivates to develop the following hypothesis:

H2. *Environmental Regulations positively affect the Eco-innovation of manufacturing SMEs in Bangladesh.*

2.3. Demand for green products and eco-innovation

Meeting customers' demands is the prime reason for any business's existence, and thus, the organization's strategy revolves around the customer's expectations [66]. The customer's Demand for green products works as a normative pressure and a key motivator to take eco-innovation initiatives [67]. A consumer attitude called environmentalism has captured sheer interest worldwide; consequently, customers are commonly willing to pay more for green products [68]. Companies are no longer in doubt understand that Demand for environmentally friendly products constantly increases and can generate more profit [65]. The additional revenue from selling green products comparatively at a higher price enables the organization to bear the cost of eco-friendly production [69]. Moreover, in this era of sustainability, consumers are very much conscious of preserving the green and hold themselves accountable for the environmental impacts of their purchasing choices, which indirectly pressure the companies to limit the adverse impact of their production and other operation [70]. More Demand from the customer for green products stimulates firms to behave in an environmentally sensitive way and foster eco-innovation [67]. Moreover, higher Demand for green products makes the firm busy with green production, limiting technology use to reduce its adverse effects. Thus, the following hypothesis has been developed:

H3. *There is a positive association between the Demand for green products and Eco-innovation.*

2.4. Competitive pressure and eco-innovation

The institutional theory claims that mimetic pressure influences the firms' strategies to compete in the market. The pressure it feels is moderated by the degree to which competitors are successful in their actions [71]. Marketplace competition somewhat determines the strategies to be followed, products to produce, and customers to serve [72]. To survive and win, the customer organization needs to analyze its competitors [1]. Competitive pressure lets the firm set a higher price; in the same way, sometimes it forces to cut the price to be competitive [73]. Likewise, the organization's eco-innovation initiatives are determined mainly by how its competitors embrace the green challenge [69]. Thus, when an organization captures the customer's attention and gains a relative competitive advantage through eco-innovation, other firms will go the same way to maintain market share. Moreover, to take first-mover advantage, firms keep on any new development in other industries that can be applied here too. So, competition can be considered as one of the key drivers of eco-innovation initiatives for firms dealing with environmentally sensitive customers [74]. From this point of view, firms' eco-innovation initiatives from unrelated industries could work as competitive pressure and determine their attitude towards green. Thus, the following postulate has been made:

H4. *Competitive pressure positively triggers the Eco-innovation initiative.*

2.5. Rise in energy price and eco-innovation

According to the energy consumption theory, the high cost of energy used in production and business operation can be compensated significantly by creating a positive economic impact on overall operations [75]. This positive economic impact results from recycling, effective use of residuals, continuous innovation, and efficient energy consumption [76]. However, adjusting the high price of energy used in the production process has become a business concern worldwide. One of the primary reasons behind the firm's initiative for eco-innovation is to reduce energy consumption [65]. The eco-friendly production process discourages the use of energy-driven technologies [77]. Thus, the firm can save the price it is supposed to spend on energy. Moreover, eco-innovation can release the company from its concern for the ever-increasing energy cost. Clean technologies reduce materials and energy consumption and improve productivity, efficiency, and competitiveness [78]. Eco-innovation allows the firm to keep energy consumption a minimum since it encourages limited fuel-run machinery and other related technologies. Thus, a surge in energy prices fosters the firm's eco-innovation initiatives. The following hypothesis has been developed based on this situation:

H5. R*ise in Energy prices positively triggers the Eco-innovation initiative.*

2.6. Expected future regulations and eco-innovation

The firms have a clearer vision and are able to accurately articulate the future, and prepare themselves with rightly crafted strategies, products, and services to come to a market for the first time, called first mover [46]. According to the first mover advantage theory, being first in the market with a new product or service allows the firm to gain the upper hand over its competitors. In contrast, the theory further argued that this advantage could be drained to the grip of the late mover if the first mover fails to address and adjust to challenges in the new market or with the new product [79]. The business environment is very dynamic in all aspects like-regulations, tastes, preferences of customers, innovation, way of operations, etc. [80]. The ever-growing concern to conserve nature gradually comes with tighter regulations regarding the firm's behavior towards the environment[81]. It is easy to anticipate that the environmental concern will sharpen over time. To comply with the expected future regulations and take the first-mover advantages, visionary firms could choose eco-innovation in all aspects of their business [82]. This proactive step will take the firm to a unique height. An anticipated future legal environment fosters a firm's today's environment-friendly initiative [83]. From this discussion following hypothesis has been developed:

H6. *Expected future regulations positively affect the firm's Eco-innovation initiative.*

2.7. Eco-innovation and sustainability

The stakeholder theory of organizational management and business ethics states that business operations have an impact on multiple constituencies like employees, investors, suppliers, communities, and others [84]. It addresses morals and values in managing an organization. The theory claims that a business should create value for all its stakeholders, not just for the shareholders who invested their money [85]. Thus, the aim of business must be committed to protecting the interest of the entities connected with the environment and society. In general, sustainability, when achieved, no one will stay behind, and the world will be a better livable place for us now and for the future generation [86]. From a business perspective, sustainability refers to doing business to achieve economic gain, social stability, and growth and remaining conservative to the environment [87]. Prior studies reveal that eco-innovation considerably affects a firm's economic and environmental performance [88]. Eco-innovation initiatives are the firm's strategies for providing value to the customer and business that result in sustainable development and minimize the negative environmental impact [89]. Eco-innovation helps the firm to achieve all three broader goals of sustainability. Firstly, it enhances the firm's resource efficiency, saves energy costs and raw materials, and reduces the cost of pollution penalties when it complies with environmental regulations [2]. Besides, eco-innovation initiatives lead to extra profits by establishing a green image, inspiring customer loyalty, and increasing market share [66]. Secondly, eco-innovation replaces machine-driven standardized factory goods with greener products, thereby reducing adverse environmental impacts [90]. Thirdly, eco-innovation does not allow establishing its factory anywhere as the firm wishes. Thus, firms need to establish their factory in rural sites to uphold the environment-friendly nature [28]. Therefore, the scope for rural development broadens through greater employment opportunities, the scope for utilization of indigenous resources, and societal development as a whole [91]. Eco-innovation harnesses the rural economy, which leads to social equality. The following hypotheses have been developed based on this situation:

H7a. *Eco-innovation initiative is positively associated with the Economic performance of manufacturing SMEs in Bangladesh.*

H7b. *Eco-innovation initiative is positively associated with Environmental performance of manufacturing SMEs in Bangladesh.*

H7c. *Eco-innovation initiative is positively associated with Societal performance of manufacturing SMEs in Bangladesh.*

The conceptual model (Fig. 1) represents what the study denotes to identify as the critical factor that accelerates the eco-innovation initiatives of SMEs in Bangladesh and its impact on a firm's economic, environmental, and societal performance. The conceptual model in Fig. 1 has been developed from a systematic and careful examination of literature to visualize the relationships among forces driving eco-innovation and sustainability of manufacturing SMEs in Bangladesh. Prior to the development of the conceptual model, authors also consulted with subject experts, researchers, and policymakers before the conceptualization and idea generation. So, the conceptual model in Fig. 1 is based on the abovementioned literature review, theoretical background, and expert opinion.

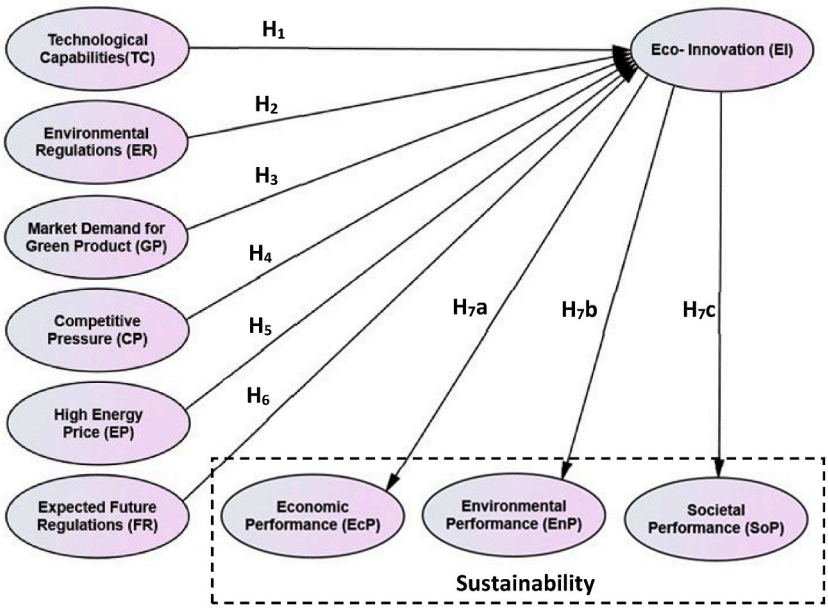

Fig. 1. Conceptual model.
Source: Self developed

3. Materials and methods

3.1. Research type

The present study is empirical in nature and is mostly primary data-based. Structural Equation Modeling (SEM) has been employed to measure the association between endogenous and exogenous constructs since it is prevalent to the researcher and is a widely used multivariate regression analysis technique that includes factor analysis, correlation analysis, causal modeling, path analysis, etc. [92]. SEM is more appropriate as the present research model, which is found quite complex, having many constructs, dealing with comparatively small sample size, and predicting the key construct is the research goal [93,94].

3.2. Sampling

The total SME in Bangladesh is 21,769, which is the total population; among them, 7620 are located in Dhaka and Chottogram division which is 35% of total SMEs [15]. There are eight divisions in Bangladesh, among which major economic establishments are located in Dhaka and Chottogram division. To ensure the validity of data, the determination of an appropriate sample size is necessary. Thus, the following formula was adopted [95]to determine the appropriate sample size from these two most industrialized divisions:

Table 1
Measurement items.

Constructs/Items	Code	sources
Technological Capabilities	**TC**	
The ecological production technology of your firm is not very complex.	TC1	[68]
Your firm has had some successful eco-innovation experience previously.	TC2	
You have adequate resources for the design of green products.	TC3	
R&D is capable of designing eco-friendly production processes.	TC4	
Environmental Regulations	**ER**	
Your firm regards environmental audits as mandatory.	ER1	[5]
There is a policy in your enterprise to guide ecological management.	ER2	
Your firm is responsive to any new provision to environmental regulations.	ER3	
Market Demand for Green Products	**GP**	
Your firm routinely measures the market demand for green products.	GP1	[54]
You produce green products because it has demand in the market.	GP2	
To the valued customer environment is an issue of great interest.	GP3	
Market demand is the main reason you produce the green product.	GP4	
Competitive Pressure	**CP**	
Competitive pressure intensifies the eco-innovation initiatives of your firm.	CP1	[96]
You increase market share through environmental concepts.	CP2	
Competitive advantage can be acquired through environmental policy.	CP3	
High Energy Price	**EP**	
You follow a green policy due to the high price of energy.	EP1	[67]
The high price made the green policy a necessary module.	EP2	
High energy fosters eco- innovation in manufacturing.	EP3	
High energy price motivates to go for green production.	EP4	
Expected Future Regulations	**FR**	
The state will be stricter in conserving the environment in the future.	FR1	[67]
Anticipated future regulations motivate eco- innovation initiatives.	FR2	
Accurately predicting future regulations enables a firm to keep ahead.	FR3	
Eco-Innovation	**EI**	
Use of cleaner technology to create savings and prevent pollution.	EI1	[69]
Your manufacturing process effectively reduces hazardous emissions.	EI2	
Low energy consumption, like electricity, gas, etc., in production and disposal.	EI3	
The manufacturing process reduces the use of raw materials.	EI4	
Reproduce, reuse, and recycle material.	EI5	
Economic Performance	**EcP**	
Improved capacity utilization.	EcP1	[96]
Decrease in loss from environmental accidents.	EcP2	
Decrease in waste management cost.	EcP3	
Increase in revenue by selling scrap materials and equipment.	EcP4	
Environmental Performance	**EnP**	
Reduction of exhaust gas, wastewater, and solid waste.	EnP1	[96]
Decrease in frequency of environmental accidents.	EnP2	
Decrease in the use of toxic material harmful to nature.	EnP3	
Reduction of exhaust gas, wastewater, and solid waste.	EnP4	
Societal Performance (SoP)	**SoP**	
The use of indigenous resources helps balanced development.	Sop1	[97]
Eco-innovation initiatives foster social equity.	SoP2	
Eco-innovation initiative accelerates social awareness for green.	SoP3	
Increase in investment for social development.	SoP4	

Table 2
Sample Characteristics.

	Characteristics	Type/Measure	No. of Firm	% of Firms
Firm's Profile (Total 876)	**Ownership Type**	Collective ownership	06	0.68%
		Private ownership	870	99.32%
	Type of Industry	Manufacturing	871	99.42%
		Not Specified	05	0.58%
	Year of Operation	01-05 years	423	48.26%
		05-10 Years	327	37.36%
		Above 10 Years	126	14.38%
	No. of Employees	10-50	378	43.10%
		50-100	227	25.86%
		100-150	136	15.52%
		150-200	75	8.56%
		200-250	60	6.90%
	Location	Dhaka	181	20.66%
		Chottogram	143	16.32%
		Khulna	92	10.50%
		Rangpur	93	10.62%
		Barishal	89	10.16%
		Mymensingh	91	10.39%
		Sylhet	91	10.39%
		Rajshahi	96	10.96%
Resondent's Profile (Total 876)	**Age**	Less than 30 Years	86	9.77%
		30-35 Years	128	14.66%
		36-40 Years	169	19.25%
		41-45 Years	148	16.95%
		46-50 Years	189	21.55%
		More than 50 Years	151	17.24%
	Gender	Female	133	15.23%
		Male	743	84.81%
	Education	Secondary	85	9.70%
		Higher Secondary	110	12.56%
		Graduation	363	41.44%
		Master degree	261	29.80%
		Others	57	6.51%
	Year of Experience	Less than 03 Years	81	9.20%
		03-05 Years	206	23.56%
		06-10 Years	269	30.75%
		11-15 Years	169	19.25%
		More than 15 Years	151	17.24%

$$Sample\ Size\ n = \frac{Z^2 \times p \times q}{E^2} - \frac{(1.96)^2 \times 0.35 \times 0.65}{(0.05)^2} = 349.58^{\sim}\ 350$$

Where n = Sample Size,

Z = Z value (1.96 at 95% confidence level).
P=Sample Proportion (35%, which is expressed as decimal 0.35).
q = 1-p
E = Acceptable Error(5%, which is expressed as decimal 0.35)

Moreover, from each of the other six divisions, namely- Khulna, Barishal, Rangpur, Mymensingh, Sylhet, and Rajshahi 100 samples from each have been taken to cover the whole country. Thus, the total number of samples is:

$$100 \times 6\ (from\ other\ six\ divisions) + 350\ (from\ Dhaka\ \&\ Chottogram) = 950$$

For data collection, a total of 950 Small and Medium scale firms came within reach of the survey. From each firm, one managerial level position, particularly managing director or general manager, was approached with the questionnaire for data collection. Among them, 876 responded. Thus, the size of the sample is n = 876 (Table 2). The 876 sample firms comprise181 firms from Dhaka (specifically located in Narayangonj, Gazipur, and Dhaka districts) division and 143 from Chottogram (particularly in Cumilla, Feni, and Chottogram districts) division in Bangladesh. Rests of the 552 responses came from the other six divisions. Non-probability convenience sampling technique has been considered for choosing a sample from the population because probability sampling or randomization is impractical for a large population. Most of the firms included in the sample are privately owned (870 firms).

3.3. Measurements

Literature survey and expert opinion are the basis of model development, selection of items, and constructs of this study. In this study total of ten latent variables were measured: Technological Capabilities (TC), Environmental Regulations (ER), Market Demand for Green Products(GP), Competitive Pressure (CP), High Energy Price (EP), Expected Future Regulations (FR), Eco-Innovation (EI), Economic Performance (EcP), Environmental Performance (EnP), and Societal Performance (SoP). Existing studies reveal that both seven and five-point scales are viable for surveys [91]. However, a 1–7 ranking is more preferable than a 1–5 scale to ensure the reliability, validity, and discriminating power of collected data [98]. And thus, a 7- point Likert scale has been used to measure the opinion of survey participants (from 01 "Strongly Disagree" to 07 "Strongly Agree") in the questionnaire. All the measurement items used are adopted from existing literature (Table 1). There were four items adopted from Ref. [68] to measure the technological capability of manufacturing SME. To measure environmental regulation, 03 items were adopted from Ref. [5]. According to Ref. [54], four items adopted in this research can measure market demand for green products. To measure Competitive pressure, 03 items were adopted from Ref. [96]. Four items for High energy prices and 03 items to measure Expected future regulation were adopted from Ref. [67]. However, five items were adopted to measure firms' Eco-innovation initiatives [69]. In the case of measuring economic performance and environmental performance, four items for each were adopted from Ref. [96]. Finally, to measure societal performance, four items were adopted from [97].

3.4. Data collection instrument

The analysis and findings of this research are principally based on primary data, while secondary data has been considered for making the conception, development of the questionnaire, selection of items and constructs, etc. Secondary data has been collected from journals, the periodicals published by national and international SME associations like SME Foundation, World SME Forum, Newspapers, etc. Data was collected by meeting the respondents both physically and online survey (google docs) from May 2022 to August 2022. For data collection, the respondents were approached with a structured questionnaire. For the online survey, first the email address of potential respondents were collected from websites, directories and others sources. The survey started in the middle of May 2022, sending emails to the respondents followed by gentle reminders. Respondents put their opinion on each item mentioned in the questionnaire. Informed consent had been obtained in the form of a written consent letter from each respondent before they participated in this study. The Business Ethics Review Committee, Cumilla, Bangladesh (Approval no: BERC-CU-0052) approved our interviews, collection, and analysis of data on September 20, 2022. A questionnaire pre-testing was carried out through a pilot survey of ten informants to measure accuracy and validity and identify any mistakes. Before the main survey, pre-testing the draft questionnaire with five to ten participants is pertinent [76]. Before finalizing the questionnaire, the draft was sent to some field-specific experts to collect their well-thought suggestions regarding the appropriateness of items selected under each construct. Expert propositions and feedback from the pilot survey were duly incorporated to rewrite the questionnaire and launch the final survey.

The survey instrument used in this research is divided into two broad parts. The first part included some questions regarding the firm's profile, including its year of operation, type of ownership etc. Apart from this, there were some questions regarding the respondent's demographics like age, gender, year of experience, level of education, etc. The second part of the questionnaire consisted of questions on each construct where respondents gave their opinion on a 7-point Likert scale.

3.5. Analysis techniques

This study employed both Statistical Package for Social Science (SPSS) and Partial Least Squares- Structural Equation Modeling (PLS-SEM) to examine and analyze the research hypothesis. For preliminary analysis, to check the missing values and data distribution, various statistical tests were employed using SPSS. PLS- SEM was also employed as the best method for multivariate analysis, especially in management and accounting literature [99]. PLS-SEM provides accurate estimation for reliability measures, including "Cronbach's Alpha" and "Composite Reliability (CR)" and validity measures convergent and discriminant validity. The two-stage model suggested by Ref. [94] was chosen in the analysis section. The first stage was analyzing and examining the measurement model to test the reliability and validity of different study variables. In the second stage, the structural model was examined to check the significance of relationships within the inner model, which prescribed variance of endogenous variables and test of hypothesis. The research summary is presented in Table 3.

4. Analysis

4.1. Common method variance

Since all the respondents were high officials, thus on all the items of a questionnaire, the data could be suffered from common method variance, which may result in measurement error. Herman's single factor test was employed to rectify the common method variance, which is the widely used tool given by Ref. [100]. Exploratory Factor Analysis (EFA) has been carried out for each item of all the 876 questionnaires. The un-rotated principal components analysis showed that the first factor accounted for 31.56% of the variance, and none of the factors accounted for a majority, which means that data is free from common method variance.

4.2. Reliability and validity

The data factor loadings (Table 4) of all the items have been measured to test the validity and reliability. Only items with a factor loading greater than 0.5 have been considered for further analysis, and other items from the data collection instruments with a factor loading less than 0.5 have been skipped. Moreover, Average Variance Extracted (AVE), Construct Reliability (CR), and Cronbach's Alpha have been carried out too. Since Cronbach's Alpha for all the latent constructs measured greater than 0.7 indicates higher reliability [101]. It is found that (Table 4) the Square Root of Average Variance Extracted (AVE) for each of the latent constructs is more than 0.50. High convergent validity was found since factor loadings for all the items measured greater than 0.6.

The validity data can be measured using the heterotrait–monotrait (HTMT) ratio of correlations criterion [94].all the values of HTMT ratio calculated satisfactorily as they are within the threshold (below 0.90). This denotes "discriminant validity." Additionally, the square root of respective AVE values of the correlation matrix shown in Table 5 reveals that all the diagonal values are higher than those shown below in the same column. Thus, discriminant validity is evident.

However, the content of the questionnaire seems valid as it is supported by literature and formulated considering the expert opinion

Table 3
Study Summary.

Idea generation and instrument development	1. Comprehensive, systematic, and careful examination of literature review; 2. Making a well-organized & structured questionnaire; 3. 7- point Likert scale; 4. Pre-testing.
Data and sample	1. Sample size: 950 participants; 2. Frame: Small and Medium Enterprises; 3. Approach: Convenience Sampling; 4. Data collection period: May 2022 to August 2022.
Data analysis	1. Measurement model: Reliability & Validity; 2. Structural model: Path analysis with PLS-SEM; 3. Software: Smart PLS version.
Results	1. Hypothesis testing; 2. Explanation of hypothesis results; 3. Theoretical Implication; 4. Practical Implications; 5. Future research direction.

Table 4
Measurement model.

Constructs/Items	Code	Mean	SD	FL
Technological Capabilities α: 0.823; AVE:0.853; CR: 0.877	**TC**			
The ecological production technology of your firm is not very complex.	TC1	6.12	1.238	.933
Your firm has had some successful eco-innovation experience previously.	TC2	6.56	1.895	.855
You have adequate resources for the design of green products.	TC3	6.22	1.465	.776
R&D is capable of designing eco-friendly production processes.	TC4	5.55	1.328	.790
Environmental Regulations α: 0.844; AVE: 0.987; CR: 0.976	**ER**			
Your firm regards environmental audits as mandatory.	ER1	5.75	1.432	.818
There is a policy in your enterprise to guide ecological management.	ER2	6.15	1.263	.551
Your firm is responsive to any new provision to environmental regulations.	ER3	5.89	1.413	.728
Market Demand for Green Products α: 0.841; AVE: 0.941; CR: 0.978	**GP**			
Your firm routinely measures the market demand for green products.	GP1	5.25	1.372	.641
You produce green products because it has demand in the market.	GP2	5.62	1.582	.823
To the valued customer environment is an issue of great interest.	GP3	6.12	1.363	.754
Market demand is the main reason you produce the green product.	GP4	6.03	1.496	.976
Competitive Pressure α: 0.981; AVE: 0.923; CR: 0.975	**CP**			
Competitive pressure intensifies the eco-innovation initiatives of your firm.	CP1	5.55	1.655	.652
You increase market share through environmental concepts.	CP2	5.84	1.470	.946
Competitive advantage can be acquired through environmental policy.	CP3	5.21	1.714	.587
High Energy Price α: 0.834; AVE: 0.967; CR: 0.887	**EP**			
You follow a green policy due to the high price of energy.	EP1	6.63	1.412	.778
The high price made the green policy a necessary module.	EP2	6.75	1.307	.845
High energy fosters eco- innovation in manufacturing.	EP3	5.58	1.443	.518
High energy price motivates to go for green production.	EP4	6.28	1.385	.785
Expected Future Regulations α: 0.954; AVE: 0.854; CR: 0.845	**FR**			
The state will be stricter in conserving the environment in the future.	FR1	6.28	1.386	.675
Anticipated future regulations motivate eco- innovation initiatives.	FR2	6.32	1.496	.845
Accurately predicting future regulations enables a firm to keep ahead.	FR3	6.81	1.328	.768
Eco-Innovation α: 0.725; AVE: 0.915; CR: 0.876	**EI**			
Use of cleaner technology to create savings and prevent pollution.	EI1	5.53	1.415	.987
Your manufacturing process effectively reduces hazardous emissions.	EI2	5.96	1.183	.548
Low energy consumption, like electricity, gas, etc., in production and disposal.	EI3	6.23	1.536	.758
The manufacturing process reduces the use of raw materials.	EI4	6.65	1.721	.678
Reproduce, reuse, and recycle material.	EI5	6.52	1.612	.745
Economic Performance α: 0.723 AVE: 0.856; CR: 0.865	**EcP**			
Improved capacity utilization.	EcP1	6.69	1.307	.978
Decrease in loss from environmental accidents.	EcP2	6.36	1.385	.812
Decrease in waste management cost.	EcP3	6.21	1.551	.865
Increase in revenue by selling scrap materials and equipment.	EcP4	6.87	1.258	.769
Environmental Performance α: 0.823 AVE: 0.928; CR: 0.842	**EnP**			
Reduction of exhaust gas, wastewater, and solid waste.	EnP1	6.52	1.205	.551
Decrease in frequency of environmental accidents.	EnP2	6.57	1.263	.679
Decrease in the use of toxic material harmful to nature.	EnP3	6.34	1.243	.715
Reduction of exhaust gas, wastewater, and solid waste.	EnP4	6.51	1.875	.778
Societal Performance (SoP) α: 0.721; AVE: 0.978; CR: 0.862	**SoP**			
The use of indigenous resources helps balanced development.	Sop1	6.53	1.655	.837
Eco-innovation initiatives foster social equity.	SoP2	6.55	1.470	.765
Eco-innovation initiative accelerates social awareness for green.	SoP3	6.66	1.692	.819
Increase in investment for social development.	SoP4	6.27	1.425	.817

SD: Standard Deviation; FL: Factor Loadings; α: Cronbach's Alpha.

Table 5
Discriminant validity.

	TC	ER	GP	CP	EP	FR	EI	EcP	EnP	SoP
TC	**0.949**	0.813	0.864	0.878	0.852	0.798	0.723	0.787	0.859	0.728
ER	0.765	**0.989**	0.745	0.789	0.881	0.777	0.798	0.774	0.747	0.756
GP	0.823	0.732	**0.982**	0.734	0.831	0.754	0.722	0.876	0.737	0.789
CP	0.778	0.741	0.878	**0.981**	0.845	0.885	0.834	0.859	0.739	0.756
EP	0.762	0.827	0.821	0.799	**0.991**	0.834	0.787	0.821	0.788	0.789
FR	0.787	0.819	0.832	0.814	0.895	**0.954**	0.734	0.776	0.828	0.849
EI	0.799	0.789	0.847	0.754	0.885	0.823	**0.956**	0.796	0.811	0.792
EcP	0.891	0.722	0.831	0.778	0.733	0.864	0.845	**0.924**	0.858	0.819
EnP	0.823	0.855	0.829	0.722	0.758	0.881	0.871	0.861	**0.979**	0.787
SoP	0.888	0.856	0.895	0.753	0.774	0.761	0.896	0.778	0.855	**0.982**

from an in-depth interview with managers. A Confirmatory Factor Analysis (CFA) has been carried out to test the construct validity. For all the four endogenous constructs- EI, EcP, EnP, and SoP the value of R^2 was calculated 0.682, 0.146, 0.692, and 0.683, respectively (Table 6). Except for the case of EcP, the value of r square was found between the acceptable range, indicating a strong association between exogenous and endogenous variables. When R square lies beween 0.67–0.75, the model is strong [102]. Thus, 68% Eco-Innovation (EI) initiatives of manufacturing SMEs are explained by the drivers altogether identified in this study. However, only 14% of SME's economic performance (EcP) is determined by Eco-innovation initiatives. In contrast, eco-innovation determines 69% and 68% of SMEs environmental performance (EnP) and societal performance (SoP), respectively (Table 6).

4.3. Test of hypothesis

SEM is the most appropriate method for the analysis of this study as it enables researchers to test relationships among various constructs simultaneously and able to test a theory with the goodness of fit [92]. Moreover, using SEM is appropriate to measure the mediating effect and testing a theory with the goodness of fit. Thus, partial least square (PLS-SEM) was used to analyze the collected data. Therefore, to test all the hypothesized relationships between constructs, SEM has been applied in this study.

The statistical results of the analysis revealed (Table 7) the goodness of fit indices accounted for $\chi 2 = 795.212$, $\chi 2/df = 1.352$, TLI $= 0.925$, and RMSEA $= 0.035$, indicating that the model has a good fit with the data (Table 5). Moreover, SRMR calculated $= 0.059$ and NFI $= 0.964$ (Table 7) which represents a good fit. The closer the value of NFI to 1, the better the model is fit. Usually, NFI> 0.9 represents an acceptable fit [103]. However, SRMR was found in between ($0<$SRMR<0.08), the acceptable range [104].

A total of ten latent constructs were measured in this study. The value of R square in the blue circle (Fig. 2) denotes the variance in the endogenous construct explained by the exogenous construct. Among the total nine hypotheses, only two (H_6 and H_{7a}) do not support as shown in Table 7, that the p-value is greater than 0.05. When the p-value is calculated less than 0.05 and less than 0.01 the result is statistically significant at 5% and 1% level of significance, respectively [105]. Thus, there is no significant relationship between Expected Future Regulation (FR) and Eco-Innovation (EI) initiatives of SMEs in Bangladesh. Similarly, Eco-innovation Initiatives (EI) on SMEs economic performance measured as insignificant($p > .05$). According to the statistical results (Table 7), all other hypotheses (H_1, H_2, H_3, H_4, H_5, H_{7b} & H_{7c}) supported.

5. Discussion

The worldwide concern for sustainability has made green practice a mandatory module for business in all respect. Unlike others, Small and Medium Enterprises (SMEs) constitute the backbone of the business arena in developing economies like Bangladesh. In the era of technology with greater concern for sustainability, SMEs seek technological competitiveness and improvement in their innovation initiatives. Technical and managerial excellency boosts SME's environmental process innovation [5]. It is predicted that it becomes innovative if a firm's technological capability is coupled with sophisticated knowledge. That means innovative firms are likely to be further innovative. This study found that technological capability had a ($p < .05$) positive impact on SME's Eco-Innovation initiatives. This finding is consistent with the previous study [5]. It means more eco-innovation will result when physical technology and specialized knowledge are amassed. This is because SMEs with better environmental expertise will maximize knowledge transfer in their cluster networks, and eco-innovation is likely.

This study reveals that, the impact of Environmental Regulations (ER) and Demand for Green Products (GP) on the Eco-Innovation behavior of manufacturing SMEs are significant at a 5% significance level. To comply with the environmental bindings and the extended demand for sustainable product SMEs in Bangladesh intensifies their eco-innovation initiatives. However, the existing literature claims environmental regulations are the critical eco-innovation driver [78]. These findings go in the same direction as prior research [34,36]. Thus, SMEs must comply with environmental regulations adopting eco-innovation to achieve sustainability in the form of financial, societal and environmental performance. At the same time firms, the worldwide concern for environmental conservation accelerates the demand for green products. Thus, eco-innovation could be the ideal tool to respond to this demand and attain sustainability. SMEs adopting eco-innovation having compliance with environmental regulations would be in an advantageous position to satisfy the customer producing and offering green products.

In the world of ever-increasing competition in all walks of business, SMEs in Bangladesh are more responsive to competitive pressure and extend the effort to make a difference to the fullest. However, In this study, it is found that Competitive Pressure (CP) and the rise in Energy Prices (EP) are positively significant with firms eco-innovation initiatives. That means Competitive Pressure (CP) and the rise in Energy Prices (EP) are the two primary drivers that push the firms to take further eco-innovation, as supported by earlier study [1,30]. The rise in energy prices surges in the price for almost all commodities. Consequently, manufacturing SMEs take this issue with greater importance in formulating their energy consumption policy. However, SMEs choose eco-innovation to keep the

Table 6
Results of structural model.

Constructs	R^2	SRMR	NFI
EI	.682	.059	.964
EcP	.146	.059	.964
EnP	.692	.059	.964
SoP	.683	.059	.964

Table 7
Estimated relationships.

Path		Path Coefficient	Standard Path Coefficient	C.R	P	Decision
EI ←	TC	.449	.127	1.867	.030*	H_1Supported
EI ←	ER	.357	.182	2.562	.017*	H_2Supported
EI ←	GP	.259	.156	1.378	.020*	H_3Supported
EI ←	CP	.619	.137	0.262	.000**	H_4Supported
EI ←	EP	.867	.241	3.457	.000**	H_5Supported
EI ←	FR	.527	.054	4.278	.423	H_6Not Supported
EcP ←	EI	.321	.279	7.681	.359	H_{7a}Not Supported
EnP ←	EI	.736	.129	2.991	.000**	H_{7b}Supported
SoP ←	EI	.149	.167	0.571	.006**	H_{7c}Supported
χ^2	*795.212*	*TLI*		*0.925*		
df	*593*	*CFI*		*0.971*		
χ^2/df	*1.352*	*RMSEA*		*0.035*		

**Significant at 1% level. *Significant at 5% level.

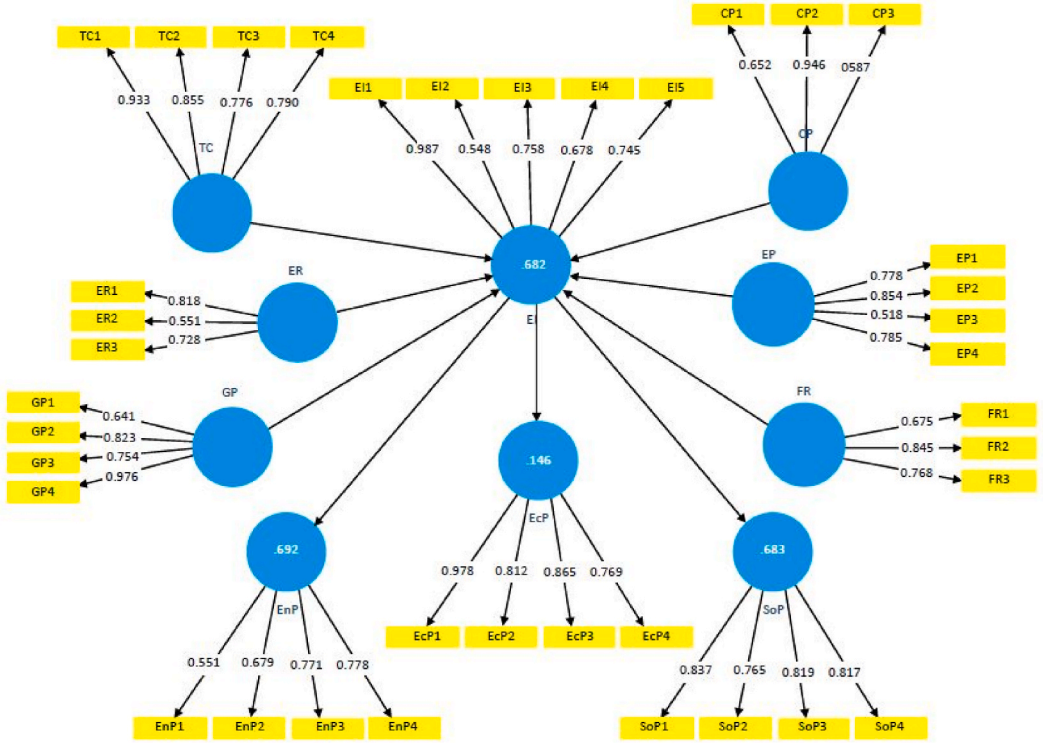

Fig. 2. Structural equation model.
Source: Generated from PLS output.

production cost less elastic with the increase in energy price. Thus, Competitive pressure (CP) and a rise in Energy Price (EP) significantly influence the firm's Eco-Innovation (EI) initiative as the p-value accounts for less than 0.01. Technological capabilities and producing green products obeying environmental regulations will give SME a competitive edge. Capitalizing these competitive advantages, firms could achieve sustainability in all three domains. Tailoring green technology and eco-friendly innovation in production will result in low energy consumption, providing financial and environmental benefits. Firstly, Low energy consumption enables a firm to leverage its financial assets to other priority investments and thus enhance returns. Secondly, lower carbon emissions

as a product of low energy consumption will reduce environmental pollution.

However, in the current study, the relationship between expected Future regulations (FR) and SMEs eco-innovation initiatives was found insignificant ($p > .05$). Conversely, in developed economies, FR significantly influences the eco-innovation because most of the firms are in the matured stage and economy is comparatively stable, which is why firms always try to predict the future regulations [3]. But in an emerging economy like Bangladesh, where most of the firms are in their growing stage, and the economy is unpredictable, firms are not concerned about the forthcoming regulations and other moves.

Moreover, the relationships between Eco-Innovation (EI) initiates and Economic Performance (EcP) of SMEs in Bangladesh were measured as insignificant ($p > .05$) (Table 7), and R square was found to be less than the acceptable range (Table 6). The result goes in the opposite direction to the existing literature [1,11]. In contrast, eco-innovation significantly influences SMEs' Environmental Performance (EnP) ($R^2 = 0.692$). Eco-innovation resulted in less harm to the environment through designing green products and developing eco-friendly production processes with the use of technology. Thus, environmental performance accelerated. However, the installation of green production process requires heavy investment in sophisticated technology and infrastructure like water and waste treatment. Therefore, eco-innovation could not improve a firm's economic performance in the short run. Finally, the relationship between Eco-Innovation and SMEs' Societal Performance (SoP) goes in the same direction as the existing study [97]. In general, there is a tendency of firms that pursue sustainability to build up their factory in locations far from urban areas. They try to live in green which is hardly found in the cities in Bangladesh. This tendency of the firms accelerates the rural economy in the form of employment creation, use of indigenous resources, and enhance the quality of life of rural people [105]. These all together contribute to making a society conscious, livable, and self-reliant. Thus, Eco-Innovation has a significant positive impact on societal performance ($p < .01$). However, though there is no direct relationship between eco-innovation and SMEs' economic performance, there is an indirect positive impact. To comply with environmental regulations, firms promote a cleaner production process using eco-friendly technologies and indigenous raw materials [106]. It enhances greater production efficiency, compensating the cost of compliance and innovation and resulting in higher growth and profitability in the long run. From the discussion, it is fair to conclude that eco-innovation positively influences SMEs' sustainability. Among the three domains of sustainability, eco-innovation has a significant direct impact on environmental performance and societal performance, while the impact is indirect on the economic performance of SMEs in Bangladesh.

6. Implications

6.1. Theoretical implication

Linking the relationship between resource-based view and Eco-innovation, the authors provide a comprehensive picture of the determinants of Eco-innovation initiatives towards sustainability in the light of manufacturing SMEs that previous scholars have failed to conclude a complete decision in emerging economies like Bangladesh, Bhutan, Pakistan, India, and Maldives. This study identifies the determinants of eco-innovation and its impact on economic, environmental, and social performance. The finding of the study reveals new interesting insights with several implications for the resource-based view.

Firstly, technological capabilities, environmental regulation, market demand for green products, competitive pressure, and high energy prices are determinants of eco-innovation. From a resource-based perspective, the result shows that institutional pressure is not only a single factor in shaping a firm's eco-innovation but also shaped by the firm's internal resources that are critical for both prospective, like government and business community. Secondly, Bangladesh, as one of the most environmentally vulnerable countries, works to accelerate eco-innovation further; it cannot depend only on institutional factors like environmental regulations, green products, and competitive pressure. Under the resource-based view, eco-innovation is the process that helps generate a firm's valuable resources for establishing a competitive advantage that leads to sustainable performance. This study contributes to the environmental policymakers implementing flexible initiatives to accelerate internal resources. The current initiative, like market demand for green products and high energy prices, aims to create and promote a culture of eco-innovation to capitalize technology of SMEs. Finally, RBV highlights the pool of a firm's resources and capabilities that offer a sustained competitive advantage. That is why policymakers and firms should focus on reducing technological dependency instead of adopting initiatives to improve ecological technological capabilities that ensure competitive advantage and sustained economic growth. SME firms should concentrate on attaining technology capabilities which are critical determinants of eco-innovation, only when firms become more competitive. Therefore, responsible parties must collaborate to enhance small and medium enterprise technology capabilities through eco-innovation with the help of established RBV.

6.2. Practical implications

The current findings provide some impactful implications for SME industries in Bangladesh and other potentially similar emerging economies. The result of this study suggests that eco-innovation is positively and significantly linked with three domains of sustainability. This result breaks the previous perception of business that Eco-innovation is considered a wasteful investment that leads to zero financial return and is treated as a sunk cost. Now, SME industries recognize that eco-innovation is considered a barometer of the economy, and its results are efficacious for sustainable business. This study comes out with a comprehensive model capable of producing directions in useful guidelines and explaining the associations among the pertinent actors and factors in this field. On top of that, this study incorporates societal performance as an important domain of sustainability. In contrast, most of the studies in the existing literature measured the relationship between eco-innovation and a firm's economic performance and hardly extended to environmental performance. Thus, it enables the policymaker to formulate appropriate policies and put the SME sector on track toward

sustainability through understanding the critical determinants of eco-innovation initiatives and their intensity. From a managerial perspective, the findings of this research facilitate SMEs' managerial levels to understand the association between sustainability and eco-innovation and help fine-tune their eco-friendly motive.

7. Conclusion, limitations, and future research direction

Eco-innovation has become unavoidable for firms to pursue sustainability and thus enjoy a competitive advantage under ever-increasing environmental pressure due to resource scarcity, ecological degradation, and increasing pollution worldwide. Considering institutional economics and the resource-based theory, this study provides an all-inclusive picture identifying the critical determinants of SMEs' eco-innovation initiatives and their impacts on sustainability in the form of economic performance, environmental performance, and societal performance. In general, this study contributes to enriching the existing literature. Realizing the Sustainable Development Goals are in tandem with Bangladesh's development agenda 'Vision 21′ and 'Vision 41'. To achieve sustainable development performance in all three domains, i.e., Financial, Environmental, and Societal performance, should be taken as equally important. One-fourth of our GDP comes from SMEs, along with 7.8 million employments which provide a livelihood to 31.2 million people. Thus, the study finding will facilitate the appropriate bodies to fine-tune the planning, decision, and strategies to flourish this important sector of the Bangladesh economy. Therefore, the run after the development agenda of Bangladesh will be smoother.

The limitations of the research need to be recognized when the outcome of the results is interpreted and to compare the generalizability to others. No study is free from limitations. Similarly, this research has some shortcomings. Firstly, the scope of the study is solely limited to the boundary of Bangladesh. So, the findings are not fair to generalize in other economies. Thus, future studies should emphasize more research on similar industries of other economies. Secondly, this study considered only the manufacturing SMEs as the sample, which restricts the transferability of the outcome to other industries. Therefore, future studies should encompass manufacturing and service-oriented SMEs to find robust results. Thirdly, this research is mostly based on primary data. A comprehensive study could be carried out incorporating both primary and secondary data. Finally, large and heavy industries contribute significantly to a country's economy, but this research is solely based on the data on small and medium enterprises. Therefore, further study must be carried out covering firms regardless of their size and nature.

Author contribution statement

MD JAHID HASAN; MUHAMMAD SHAJIB RAHMAN: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Data availability statement

Data will be made available on request.

Additional information

No additional information is available for this paper.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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