Quarterly Journal of Environmental Education and Sustainable Development
Vol. 10, No. 4, Summer 2022 (17-33)
Article type: Research
Original Article; DOI: 10.30473/EE.2022.64523.2542

فصلنامه علمی، آموزش محیط‌زیست و توسعه پایدار
سال دهم، شماره چهارم، تابستان ۱۴۰۱ (۳۳-۱۷)
نوع مقاله: پژوهشی

The Impact of Establishing a Green Supply Chain on Environmental and Economic Performance with the Supporting Role of the Government, Private Sector Participation and Green Innovation

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(Received: 03.04.2022 **Accepted:** 22.06.2022**)**

اثر استقرار زنجیره تامین سبز بر عملکرد محیط‌زیستی و اقتصادی با نقش حمایتی دولت، مشارکت بخش خصوصی و نوآوری سبز

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(دریافت: ۱۴۰۱/۰۱/۱۴ پذیرش: ۱۴۰۱/۰۴/۰۱)

Abstract
The aim of this research is to verify the effect of environmental regulations on environmental and economic performance through the establishment of a green supply chain with the mediating role of government support and private sector participation with a green innovation approach. The research is practical and descriptive in terms of objective and data selection. The statistical population of the study is experts and pundits available in the field of the supply chain in the industrial park of greater Tehran. 136 people were selected by the non-probabilistic sampling method. Research data are collected according to a standard questionnaire. All extracted data are analyzed using SmartPls statistical software with a variance-based structural equation approach. Statistical indicators such as Cronbach's alpha Composite Reliability, criterion validity and convergence validity of mean-variance, and Fornell and Larker divergence validity have been used to explain the validity of the published questionnaire. The results of the study show that environmental regulations affected the establishment of a green supply chain with the mediating role of government support and private and public partnerships 0.228 and 0.627, respectively, affecting environmental performance. The direct effect of establishing a green supply chain on economic performance in short-term and medium-long term performance were 0.769 and 0.653 respectively. The result of the study can be deployed in green supply chain management (GSCM) at manufacturing companies, especially are located in Tehran. Through the approach of environmental regulations, government support, and the participation of companies in the profitability of themselves, the growth rate can be observed in the economic performance of the country.

Keywords: Green Supply Chain Management, Government Support, Green Innovation, Environmental Education.

چکیده
هدف این تحقیق بررسی تأثیر مقررات زیست‌محیطی بر عملکرد زیست‌محیطی و اقتصادی از طریق ایجاد زنجیره تأمین سبز با نقش میانجی حمایت دولت و مشارکت بخش خصوصی با رویکرد نوآوری سبز است. این تحقیق از نظر هدف و از نظر انتخاب داده‌ها کاربردی و توصیفی است. جامعه آماری پژوهش را کارشناسان و صاحب نظران حوزه زنجیره تأمین شهرک صنعتی تهران بزرگ تشکیل می‌دهند. ۱۳۶ نفر به روش نمونه‌گیری غیراحتمالی انتخاب شدند. داده‌های تحقیق بر اساس پرسشنامه استاندارد جمع‌آوری شده است .تمامی داده های استخراج شده با استفاده از نرم‌افزار آماری SmartPlsبا رویکرد معادلات ساختاری مبتنی بر واریانس تجزیه و تحلیل شده است. برای تبیین روایی پرسشنامه منتشر شده از شاخص‌های آماری مانند پایایی ترکیبی آلفای کرونباخ، روایی معیار و روایی همگرایی میانگین واریانس و روایی واگرایی فورنل و لارکر استفاده شده است. نتایج تحقیق نشان می‌دهد که مقررات زیست‌محیطی از طریق ایجاد زنجیره تأمین سبز با نقش میانجی حمایت دولت و مشارکت خصوصی و دولتی به ترتیب ۰/۲۲۸ و ۰/۶۲۷ بر عملکرد زیست‌محیطی تأثیر می‌گذارد. اثر مستقیم ایجاد زنجیره تأمین سبز بر عملکرد اقتصادی در عملکرد کوتاه مدت و میان مدت به ترتیب ۰/۷۶۹ و ۰/۶۵۳ است. نتیجه مطالعه را می‌توان در GSCM در شرکت‌های تولیدی به ویژه در تهران مستقر کرد. با رویکرد مقررات زیست‌محیطی، حمایت دولت و مشارکت شرکت‌ها در سودآوری خود، نرخ رشد در عملکرد اقتصادی کشور مشاهده می‌شود .

واژه‌های کلیدی: مدیریت زنجیره تأمین سبز، حمایت دولت، نوآوری سبز، آموزش محیط زیست

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Introduction

Supply chain has detrimental effects on the environment (Kurinjimalar Ramu al., 2022). The regulations, laws, and lifestyles of people in the societies have changed a lot, in line with which organizations have tried to base their supply chain management system on that basis. Air pollution in urban areas is considered one of the most important concerns in the environment and has led to the creation of some important agreements such as Kyoto and Paris (Xie., et al., 2022), which focus on desertification, drought reduction, and similar factors. Iran is also one of the following members and according to Shojaei et al., in 2020, air pollution in urban areas will cause the emission of greenhouse gases and similar issues and will turn it into one of the environmental concerns. The answer to environmental issues must be approved by the traditional SCM system. It is important because of the possibility of great competition among companies in order to achieve their creative goals. GSCM has various affairs for different industries. These include reducing waste production and increasing the level of biological yield; it also leads to improve environmental skills of companies. According to the help of GSCM, companies would develop and maintain their environmental and economic processes (Ren et al., 2020). The incentives which are considered to improve the inappropriate effects on the environment; especially in the issue of GSCM in the field of construction, are expressed as a strategic solution. Surveys conducted by (Bhatia & Gangwani, 2021) around 2020 showed that less than 2% of GSCM studies are related to the construction industry, which indicates a lack of work in this field and requires more investment. GSCM may be introduced as one of the effective methods for creating appropriate economic-environmental functions in the business process of green supply chain management (T. Sang et al., 2019). Due to the lack of sufficient knowledge about the output of the GSCM process, companies will have difficulty with the components and implementation of this design in their systems. Factors such as social pressures, and customer demand can lead to better implementation of GSCM (Leal Filho et al., 2020). Ecological Modernization Theory (EMT) is committed to sustainable industrial development with no trace of environmental degradation. (Alkhuzaim et al., 2021). According to this theory, GSCM has emerged as environmental technology innovation and helps organizations to move beyond control technologies. The main difference between traditional GSCM and SCM is the environmentally friendly applications that are based on the three principles of society, economy, and environment. Traditional SCM focuses mainly on the final delivery of the finalized form to the customer, while environmental issues will be jeopardized during the related process. GSCM is a new approach to reducing environmental risk. The EMT justifies the promotion of technological and scientific developments, stating that it will be driven by government interposition through policy-making and ultimately lead to greater competitiveness in the industry (Rosyidah et al., 2022). EMT is used in constructing models, developing analytical models, and analyzing experimental data in line with the implementation and development of studies related to GSCM. Sheng et al (2022) showed, that green supply chain management studies were limited using EMT, and they suggested extending EMT to studies in the case of GSCM to examine how the two dimensions of ecological modernization theory; government intervention and technological innovation, affect green supply chain management research.

In recent years, strict laws have been applied by governments due to the pollution created especially in the air, soil, etc., which has caused the expansion and application of a green supply chain in many industries. Concerns created in the mentioned field in producers, consumers, and governments have made them seek environmental developments including environmental education. The scope of this attention is from the beginning of the production process or providing services to the end product or product stage. One of the factors affecting the efficiency of the green supply chain is the integration of environmental education and the company's supply chain, which should be considered in all stages. Due to the growing environmental concerns lack of

related research in this field is felt. The economic performance of companies, which has changed in recent years, is slightly linked to environmental issues. Company managers should seek to create competitive advantages and innovation to attain profit from their activities with their partners, especially with foreign companies. Some companies, considering the environmental performance in the green supply chain, increase the knowledge of their customers in the same field, which in general causes awareness of the consequences or harmful effects of environmental pollution, and the final customers' demand for the company's product will follow.

The market share of environmentally friendly goods, services, and products is increasing worldwide due to significant changes and developments in the supply chain. For example, several companies are currently producing cars that use hybrid fuel and lithium batteries, and some other leaders of the same industry have envisioned visions until 2035 for an entire change in this direction. These actions can be included in climate change, which will affect Western and East Asian countries as well as the whole world. These goods and services can also be called environmentally friendly or green (Bhatia & Gangwani, 2021) and also argued that it is important to expand the scope of green supply chain management and identify how its practices differ in the industry. Gradually, companies imposed GSCM practices on their business models due to increased demand for environmentally friendly goods or due to pressure from shareholders such as NGOs and governments. Past studies have shown the basic need to know protocols to eliminate interference among supply chain actors such as transition management to GSCM (Bag et al., 2022). Public and private partnerships (Lu et al., 2022) are recognized as a method to close the infrastructure investment gap, enable multi-stakeholder cooperation, and promote broader economic growth and political reform. Research has also shown that corporate environmental change is governed by government regulation and is made possible by government incentives and support (Maaz et al., 2021). Due to climate changes and the need for more protection of the environment and its resources, sensitivities related to this area have grown, which has led many industrial owners to implement GSCM policies. Governments are also making more laws related to environmental issues than in the past, which should be considered an influential factor in the survival of companies. Considering the profitability nature of companies, as well as the intervention of the government and other factors such as customer demand, private-public partnerships, etc., the effect of the factors affecting the company's process should be investigated to provide the basis for the growth of the company's profitability, the life and retention of customers. It must be clear whether incentives and empowerment may strengthen cooperation or partnership between the actors by resolving contradictions among them.

Literature review

Internal and external factors

Many studies have pointed out the impact of deploying GSCM in different fields. Some researchers have described it as internal and external factors and others as stimuli and obstacles. According to some researches, environmental management and green design were among the most important measures. He also mentioned three factors, lack of participation in world competitions, lack of sufficient knowledge and lack of sufficient legal leverage as the main obstacles (Mubarik et al., 2021). Tseng et al. (2022) examined the factors that compel or motivate organizations to green supply chain management operations. The results of their research showed that stimuli affect green supply chain management more than barriers; they also found that companies or organizations are influenced by external factors to implement supply chain management. In this study, external factors, "rules" were studied.

Green innovation

Due to the improvement of environmental awareness of stakeholders such as consumers and environmental organizations, more attention is paid to pollution, which indicates lack of proper use resources by companies From resources perspective, companies are able to form vital and valuable resources in such a way that they can improve their products and thus minimize their economic performance and environmental impact. In a study by Amjad et al. (2022) it was discussed how the

implementation of GSCM had affected the financial performance of companies that support the environment. The data of this research was collected from about 400 employees working in leading companies in the same field in Pakistan. The results indicated the positive impact of green innovation on GSCM practices.

Economic and environmental performance

The financial performance of companies is also discussed and green supply chain management is described as an effective and efficient strategy to reduce environmental impact and take advantage of long-term financial benefits. Paying attention to the economic aspect of GSCM is of great aid to companies in order to compete better than similar ones and increase their market value. (Goodstein & Polasky, 2017). Ren et al (2020) proposed a model for maximizing post-tax profit. Business organizations are naturally profit-oriented, and if they are constrained by laws, they will find a way to counterbalance the effects of laws and thus profiteering. The environmental performance will lead to cost reduction, which will bring economic performance for that company in the short term. In order for a company to have a better economic performance, research in this field was conducted by (Claver et al., 2007), and they stated that the various activities related to GSCM must be in full harmony with each other. Some other researchers extended their research to stock and economic companies and their results indicated the impact of social functions and correct planning. Some other researchers developed mathematical models in this direction.

Government support

Governments play a key role in disseminating environmental policies and seek to create a sustainable society while protecting the development of the economy (Goodstein & Polasky, 2017). Different governments around the world are the largest and most influential institutions in various issues, including the supply chain. Governments are powerful institutions that can promote green culture and products by implementing legal policies and legislation and putting companies on the path of optimal GSCM. For example, they can use subsidy tools (overt and hidden) and encourage them in this direction due to the effect on the finished cost of the company's products, or by using the national media of each country, they can influence the public's mind towards a particular company to follow the desired policies and encourage them to improve profitability due to GSCM. Some researchers (e.g. Valenciano, 2020 and Baranikumar et al., 2021) have an opinion similar to the abovementioned contents, while others have confirmed an opinion contrary to the above statements. However, governments can be considered as powerful institutions that can have a great impact on the performance of companies according to their policies. Centralized implementation of environmental laws relies on local governments to strengthen environmental oversight, the provision of public goods, and infrastructure (Alnahhal et al., 2021).

Public and private partnerships

The partnership has been used as a criterion for resolving conflicts, eliminating hostile relationships, and increasing efficiency in construction projects (Amade et al., 2020). GSCM expansion among economic entities can be achieved through two paths as supply chain and public-private partnerships, also known as vertical diffusion. In vertical diffusion, GSCM expands through the supply chain, which is influenced by upstream and downstream participants. Partnerships were effective in protecting social problems through flexible, creative and innovative production (McQuaid, 2010), generating and disseminating knowledge, building capacity, and encouraging public participation. Public and private partnerships are also found in construction, which is an agreement between two private and public entities that will lead to the sharing of various issues between them (Otairu et al., 2014). PPP is introduced as an important tool that will lead to sustainable development. These tools include both environmental and economic issues, and members are involved in decision-making networks.

Green Supply Chain Management

Green supply chain management is an evolution

in SCM that includes various measures including product design, product preparation and delivery to the client. Mehr Menesh and Ghasemi (2018) have examined 2 structural relevances. They described quality management and the dimensions of the supply chain, which include the selection of supplier, supplier participant and developer, as influencing customer participation. The primary purpose of GSCM is to minimize adverse operational consequences such as atmospheric emissions, wasteful use of resources, improper disposal of the product, etc. (de Sousa Jabbour et al., 2015). As a broad-based innovation, GSCM addresses environmental issues in the supply chain and companies use it to modify their stability. (Sifolo, 2020). Farbod and Hamidieh (2022) investigated the effect of green supply chain on the performance of companies admitted to the Tehran Stock Exchange by taking advantage of artificial neural network and structural equations. The results of their research indicated the effect of GSCM on economic performance and they stated that it can improve quality. The excellent figure of this study and the reference to collaborative roles in environmental issues, there is a research gap in this field, and it shows that it has not been paid enough attention. (Otairu et al., 2014).

Short, medium and long-term economic performance

Past studies have taken various measures to evolve economic performance (Almajal, 2021). Economic performance refers to the factory's ability to reduce costs related to the purchase of raw materials, energy consumption, waste measures and fines for environmental accidents, and so on. (Ramezanian et al., 2010) Stated that there was no consensus on the direct impact of GSCM applications on an organization's economic performance, while some people reported positive effects and others negative effects. Most studies have reported that due to high costs, the negative effects may be apparent at first, but in the long run, green applications will bring economic benefits. Regarding long-term economic performance and GSCM applications, Amjad et al. (2022), investigated the effect of GSCM methods on the operational performance of Pakistani companies. They used the PLS method and collected data from 223 companies that were engaged in production. Their research had acceptable statistical results and the positive effect of GSCM on long-term operational and economic performance was confirmed. Zhang et al. (2020) have studied economic factors such as ROA[1], cost management, etc. Economic performance can be examined through several factors at the level of companies, which short, medium- and long-term performance will be examined in this article. The short term also leads to optimal performance in terms of environmental effects. (Murphy & Gouldson, 2020).

Environmental proceeds

Ecological Modernization Theory (EMT) sustains coordination between performance in the economy and the environment by improving resource productivity (Joo & Min., 2022). The modernization aspect of this theory requires the utilization of new technologies and the environmental reform (Lu et al., 2022). Mohtasham & Sarollahi (2016) have examined the relevance between the components of the green supply chain and productivity in organizations. Roh et al. (2022) organized a study in order to investigate the effect of greenhouse gas emissions on the company's performance from an economic point of view. The results of their research, unlike the results of some other researchers, including Amjad, et al. (2022), indicated the existence of a significant and effective relationship. Also, EMT is an influential and important framework on air pollution. The research was done in 2022 with the approach of integrating GSCM and EMT by Huang & Huang. They collected 300 questionnaires related to electrical and electronic companies in Taiwan. Finally, they confirmed that public awareness for public participation in EMT can significantly affect sustainable GSCM (including economic and social performance).

According to the literature, the research hypotheses can be proposed in the form of the initial research model as shown in Figure 1.

- Hypothesis 1: Environmental regulation has a positive effect on the implementation of green supply chain management
- Hypothesis 2: Environmental regulation has a positive effect on public-private

1. Return on Asset

partnerships.

- Hypothesis 3: Government support positively balances the relationship between environmental regulation and GSCM.
- Hypothesis 4: Government support positively balances the relationship between environmental regulation and PPPs.
- Hypothesis 5: Government support and public-private partnerships consistently balance the relationship between environmental regulation and GSCM.
- Hypothesis 6: Implementing green supply chain management is positively related to environmental performance.
- Hypothesis 7: Implementing green supply chain management is positively related to short-term economic performance.
- Hypothesis 8: Implementation of GSCM is positively related to medium-long term economic performance.
- Hypothesis 9: Internal and external factors have a positive effect on the implementation of supply chain management.
- Hypothesis 10: Green innovation has a positive effect on environmental performance.
- Hypothesis 11: Green innovation has a positive effect on the implementation of green supply chain management.
- Hypothesis 12: Green innovation has a positive effect on economic performance

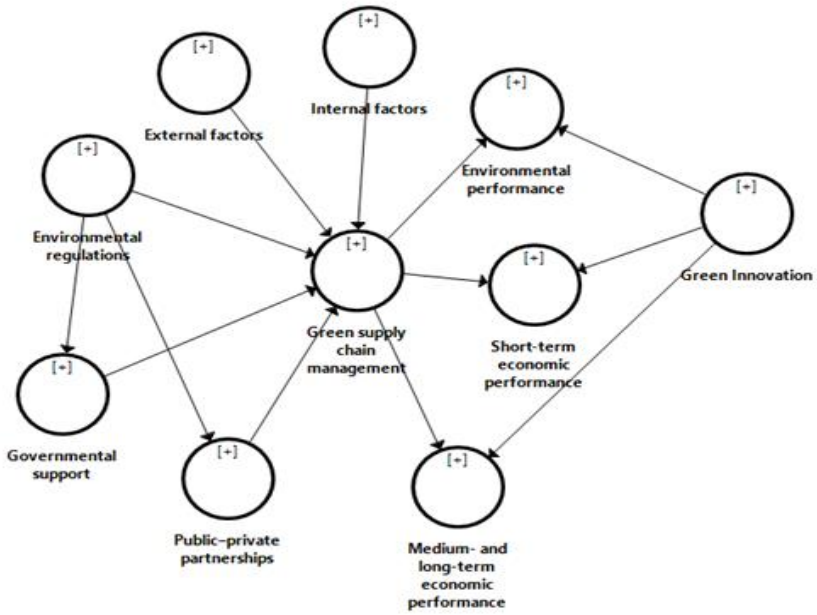

Figure 1. Conceptual Framework of the Research

Research Methodology

This research is a quantitative study, in terms of descriptive-correlational nature and in terms of practical purpose. Research data were collected according to the standard questionnaire in Table 1. The COVID-19 conditions have had an effect on the selection of the statistical sample, which was the reason why non-probability sampling was used from 136 experts in Tehran's industrial park. In this study, the method of variance-based structural equations in SmartPls3.3.9 software has been used to test the hypotheses considering the mediating effect of public support and public-private partnerships. This method is used when the amount of data is less than 200. In other words, the fitting of the model was done in the structural equation method with the PLS technique of the bootstrap method without considering the sample size and the distribution of the research variables. This method is more of a modeler and is even used for forecasting (Farbod, 2018). In the following, we discuss the indicators that confirm the PLS model:

- Cronbach's Alpha: the value of this index must be greater than 0.7 for the

questionnaire to be a reliable asset.

- Validity of the questionnaire with composite reliability index: this index must have a value greater than 0.5 for the questionnaire to be valid.
- The validity of the questionnaire with the AVE index of the square root of the average variance: this index must have a value greater than 0.7 for the questionnaire to be valid.
- Divergent validity: the elements on the main diagonal of the correlation matrix are the square root of the mean variance, the value of which must be larger for each column of numbers below it.

Figure 1 shows the conceptual model of the research after fitting. Also, before examining the hypotheses, we examined the validity and reliability. To determine the reliability and validity of the questionnaire, Cronbach's alpha index, combined reliability, criterion validity and convergence validity of mean extraction variance and Fornell and Larker divergence validity were used (Farbod, 2018).

Table 1. The Research Variables

Measure	Structures
(Rombe & hadi, 2022)- 5 items	Internal Factors
(Rombe & hadi, 2022)- 5 items	External Factors
(Farbod and Hamidieh, 2022) - 7 items	Green Innovation
(Zhao et al., 2022)- 3 items	Environmental Regulations
(Zhao et al., 2022)- 4 items	Governmental Support
(Zhao et al., 2022)- 3 items	Public–private Partnerships
(Zhao et al., 2022)- 6 items	GSCM
(Zhao et al., 2022)-3 items	Economic Performance in short mode.
(Zhao et al., 2022)-7 items	Medium-long-term Performance
(Zhao et al., 2022)- 4 items	Environmental Performance

Research Findings

A structural equation model which is solved by the partial least squares (PLS) method should be analyzed and interpreted in two stages. First, the measurement model and then the structural model should be analyzed and interpreted. The purpose of the measurement model is to investigate the weights and loads of the underlying variables, and the structural model is to investigate the path coefficients between the underlying variables or structures. In the measurement model stage, it is determined whether the theoretical concepts were correctly measured by the observed variables or not. For this purpose, the construct validity. Two criteria of convergent validity and discriminant validity were also used to assess the measurement.

The research findings were expressed in the fit section of the model with the approach of variance-based structural equations. Fitting of variance-based structural model was done in three stages of measurement model fitting, structural model fitting and general model fitting.

Fitting the measurement model

In this step, it was determined whether the theoretical concepts were properly measured by the observed variables. For this purpose, the construct validity of the model was examined, which was measured by using two criteria of convergence validity and divergence validity. As it can be seen in Table 2, the factor loads of all dimensions of the variables are higher than 0.4, which shows that the instrument of the present research method of confirmatory factor analysis has a good validity and all dimensions have well explained their structures.

Table 2. The Research Credit Convergence

Items / Structures	Original Sample (O)	Statistics T (|O/STDEV|)	Result
E1 <- External factors	0.845	30.821	accept
E2 <- External factors	0.852	41.74	accept
E3 <- External factors	0.841	32.242	accept

Items / Structures	Original Sample (O)	Statistics T (|O/STDEV|)	Result
E4 <- External factors	0.85	33.836	accept
E5 <- External factors	0.57	8.318	accept
EP1 <- Environmental performance	0.863	44.178	accept
EP2 <- Environmental performance	0.864	41.262	accept
EP3 <- Environmental performance	0.864	46.925	accept
EP4 <- Environmental performance	0.858	38.375	accept
ER1 <- Environmental regulations	0.839	22.005	accept
ER2 <- Environmental regulations	0.784	14.413	accept
ER3 <- Environmental regulations	0.815	18.481	accept
GI1 <- Green Innovation	0.74	13.951	accept
GI2 <- Green Innovation	0.844	25.635	accept
GI3 <- Green Innovation	0.851	25.076	accept
GI4 <- Green Innovation	0.845	20.972	accept
GI5 <- Green Innovation	0.437	3.623	accept
GI6 <- Green Innovation	0.289	2.186	accept
GI7 <- Green Innovation	0.472	4.122	accept
GS1 <- Governmental support	0.677	7.777	accept
GS2 <- Governmental support	0.634	6.284	accept
GS3 <- Governmental support	0.572	4.459	accept
GS4 <- Governmental support	0.808	15.849	accept
GSCM1 <- Green supply chain management	0.807	29.139	accept
GSCM2 <- Green supply chain management	0.778	21.385	accept
GSCM3 <- Green supply chain management	0.822	36.434	accept
GSCM4 <- Green supply chain management	0.831	33.665	accept
GSCM5 <- Green supply chain management	0.607	9.99	accept
GSCM6 <- Green supply chain management	0.711	17.488	accept
I1 <- Internal factors	0.832	21.751	accept
I2 <- Internal factors	0.771	19.043	accept
I3 <- Internal factors	0.776	16.936	accept
I4 <- Internal factors	0.837	27.312	accept
I5 <- Internal factors	0.598	8.234	accept
MLTEP1 <- Medium- and long-term economic performance	0.694	12.258	accept
MLTEP2 <- Medium- and long-term economic performance	0.698	12.906	accept
MLTEP3 <- Medium- and long-term economic performance	0.833	31.408	accept
MLTEP4 <- Medium- and long-term economic performance	0.727	14.216	accept
MLTEP5 <- Medium- and long-term economic performance	0.707	14.113	accept
MLTEP6 <- Medium- and long-term economic performance	0.727	15.689	accept
MLTEP7 <- Medium- and long-term	0.725	15.283	accept

Items / Structures	Original Sample (O)	Statistics T (|O/STDEV|)	Result
economic performance			
PPP1 <- Public–private partnerships	0.88	48.063	accept
PPP2 <- Public–private partnerships	0.866	45.414	accept
PPP3 <- Public–private partnerships	0.879	52.472	accept
STEP1 <- Short-term economic performance	0.846	28.44	accept
STEP2 <- Short-term economic performance	0.887	42.922	accept
STEP3 <- Short-term economic performance	0.912	88.269	accept

As it can be seen in Tables 2 and 3, the mean of extractive variance and Cronbach's alpha for the research variables were higher than 0.5 and 0.7, respectively, thus it can be said that the research tool had acceptable convergent validity. All items were significant at the confidence level of 0.95. The significance of the items was higher than the significance number of 1.96. Therefore, according to the obtained values, it can be said that the convergence validity of the measurement tool was confirmed.

Table 3. Construct Reliability and Validity

Structure	Cronbach's Alpha	Composite Reliability	Average Variance Extracted
Environmental performance	0.885	0.921	0.744
Environmental regulations	0.744	0.854	0.661
External factors	0.852	0.897	0.639
Governmental support	0.704	0.77	0.66
Green Innovation	0.78	0.84	0.656
Green supply chain management	0.853	0.892	0.583
Internal factors	0.821	0.876	0.589
Medium- and long-term economic performance	0.857	0.889	0.535
Public–private partnerships	0.847	0.907	0.765
Short-term economic performance	0.859	0.913	0.778

To evaluate the divergent validity, Fornell and Lanker's criteria were used. This criterion was obtained by placing the root of the mean of extracted variance instead of 1 in the principal diameter of the correlation coefficient matrix. According to Figure 2, it was inferred that this value for each of the variables was more than the correlation of one structure with other structures, so the research tool had a good divergent validity.

Structure	Environmental performance	Environmental regulations	External factors	Governmental support	Green Innovation	Green supply chain management	Internal factors	Medium- and long-term economic performance	Public–private partnerships	Short-term economic performance
Environmental performance	0.862									
Environmental regulations	0.304	0.813								
External factors	0.537	0.293	0.799							
Governmental support	0.435	0.342	0.453	0.678						
Green Innovation	0.543	0.224	0.516	0.347	0.676					
Green supply chain management	0.532	0.366	0.501	0.702	0.425	0.763				
Internal factors	0.538	0.301	0.603	0.413	0.367	0.489	0.768			
Medium- and long-term economic performance	0.825	0.388	0.61	0.535	0.466	0.733	0.589	0.731		
Public–private partnerships	0.425	0.315	0.501	0.656	0.415	0.841	0.455	0.56	0.875	
Short-term economic performance	0.465	0.348	0.492	0.547	0.307	0.761	0.468	0.728	0.536	0.882

Figure 2. Fornell-Larcker Criterion in the Correlation Matrix

Considering the desirability of the values of factor loads, convergence validity, differential validity and composite reliability, the fit of the research measurement model was approved**.**

Structural model fit

After analyzing and examining the fit of the measurement model, in this section, the fit of the structural model was examined. In fact, the second step in the procedures was to use the path analysis, coefficient of determination and model fit index. In the path analysis, relationships among variables flow in one direction and were considered as distinct paths. Figures 3 and 4 have shown the structural equation model and the path diagram of the research model along with the significant numbers and the path coefficients.

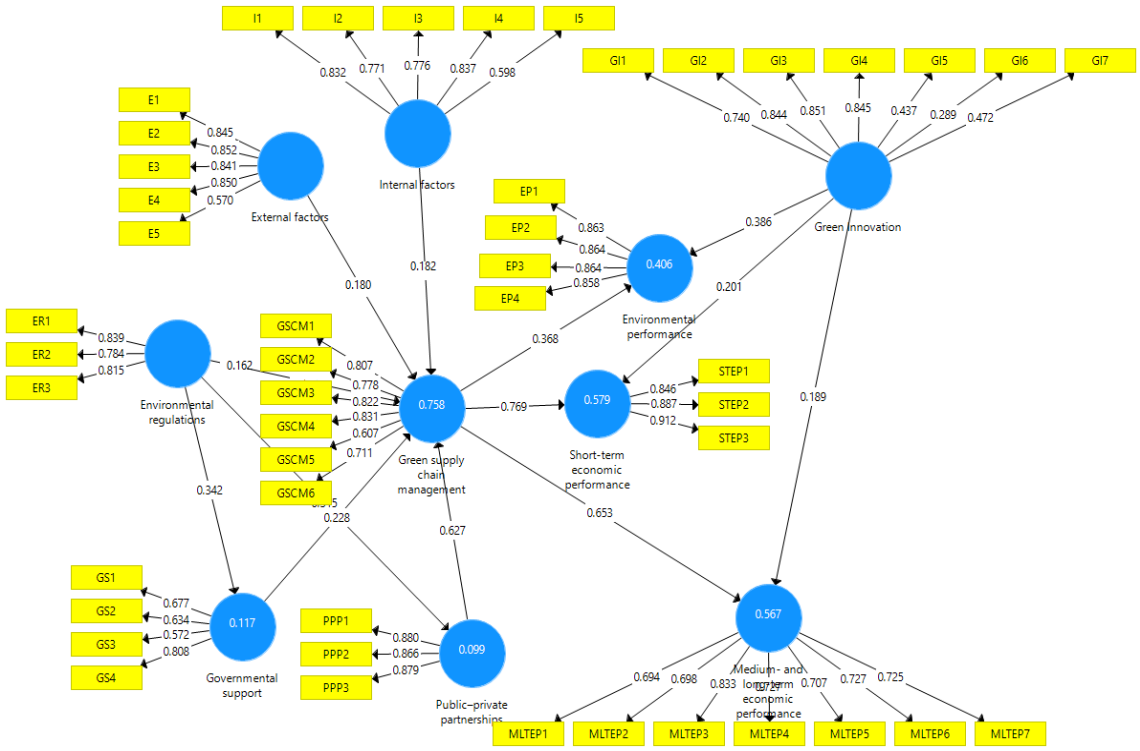

Figure 3. The Conceptual Framework of the Research

The specified numbers on the coefficients are explained in Table 3. In other words, the numbers on the path in Figure 2 are convergent validity and the influence degree of the research structures on each other. Figure 3 shows the significance of the paths and the confirmation or rejection of the hypotheses.

Table 4 shows the coefficient of determination and the Stone-Geiser coefficient for the variables of environmental performance, green innovation, reactive dimensions and persistent resilience.

Table 4. The Determination Coefficient and Predictive Power of Model Structures

Construct	R Square	Q^2
Environmental Performance	0.406	0.293
Governmental Support	0.117	0.039
Green Supply Chain Management	0.758	0.437
Medium- and Long-term Economic Performance	0.567	0.279
Public–private Partnerships	0.099	0.07
Short-term Economic Performance	0.579	0.428

According to Table 4, about 75% of the changes in the implementation of green supply management were directly and indirectly affected by green innovation, environmental regulations, government support, public and private partnerships, internal and external factors and green innovation. Also, according to the obtained values for the coefficient of determination and predictive power of the model, it can be said that the structural part of the model has a good fit. Also, 41% of environmental performance changes directly by green innovation and 57% of short-term economic performance changes directly. This could be explained by green innovation,environmental performance and green supply chain implementation.

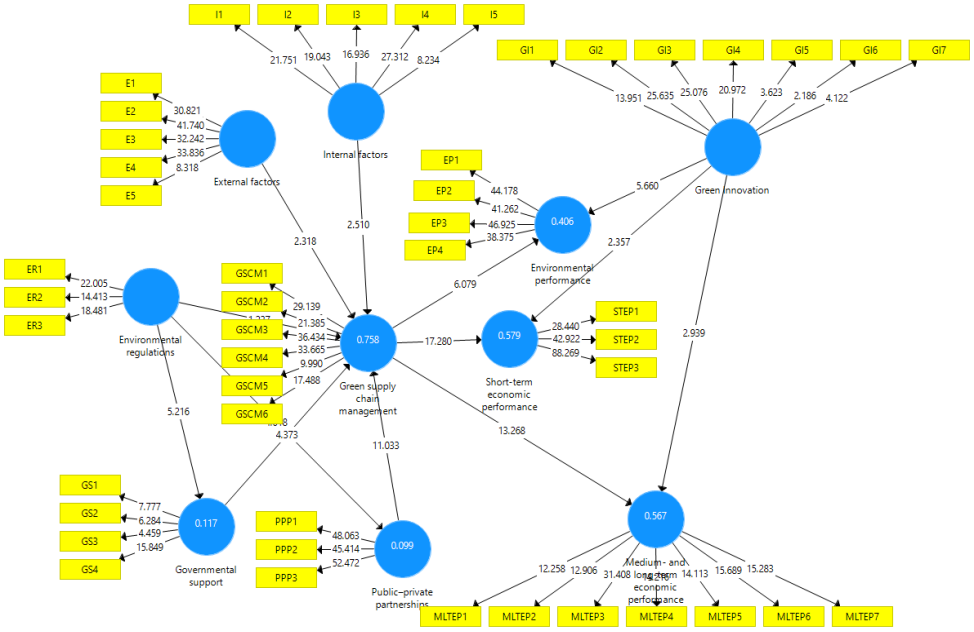

Figure 4. The Conceptual Framework of the Research

Overall model fit

The fit of the model was obtained from the geometric mean of the coefficient of determination and the common mean, which is called the goodness index of the fit of the model. The value of the goodness index of the model should be above 0.36 so that the model was a *good* model. According to the calculation of the model fit goodness index based on the outputs of SmartPls software, the model had a good fit (See, Weinzi et al., 2010).

Table 5. The CR-Communality and CR-Redundancy Indices

Construct	Construct Crossvalidated Redundancy	Construct Crossvalidated Communality
Environmental Performance	0.293	0.557
Environmental Regulations		0.321
External Factors		0.462
Governmental Support	0.039	0.124
Green Innovation		0.305
Green Supply Chain Management	0.437	0.414
Internal Factors		0.384
Medium- and Long-term Economic Performance	0.279	0.375
Public–private Partnerships	0.07	0.504
Short-term Economic Performance	0.428	0.533

In formula $GOF = \sqrt{AverageR^2 \times AveregeCommunality}$. AverageR^2 is the average of the model determination coefficient and Average Communality is the average of the index of validity of $GOF = \sqrt{0.421 \times 0.398} = 0.409$ validity of the subscription or cross-validity, which was used to calculate the goodness-of-fit index of the model.

Considering the three values of 0.01, 0.25 and 0.36 which have been introduced as weak, medium and strong values for the goodness of fit model of the model (Wetzels et al., 2009), based on formula (1) the value of 0.409 for the model fit goodness index, the very good fit of the overall model is confirmed. In Table 6, the numbers in the CR-Red column indicate the validity or redundancy check indicator, which refers to the quality of the structural model, and the CR-Com column numbers that indicate the cross-validity or cross-validity check indicator (Farbod, 2018).

Examining the hypotheses

The research hypotheses test includes direct effects test (effect of independent variables on dependent), mediator effects test (indirect effects) and total effects test (effect of independent variables on dependent in the presence of mediator variables).

Table 6. Testing Hypotheses (Path Coefficients)

Path Diagram with Mediating Variables	Original Sample (O)	T Statistics (|O/STDEV|)	P Values
Environmental regulations -> Governmental support	0.342	5.216	0
Environmental regulations -> Green supply chain management	0.162	2.237	0.109
Environmental regulations -> Public–private partnerships	0.315	4.018	0
External factors -> Green supply chain management	0.176	2.318	0
Governmental support -> Green supply chain management	0.228	4.373	0
Green Innovation -> Environmental performance	0.386	5.66	0
Green Innovation -> Medium- and long-term economic performance	0.189	2.939	0.002
Green Innovation -> Short-term economic performance	0.201	2.357	0
Green supply chain management -> Environmental performance	0.368	6.079	0
GSCM-> Medium- and long-term economic performance	0.653	13.268	0
GSCM-> Short-term economic performance	0.769	17.28	0
Internal factors -> Green supply chain management	0.182	2.51	0
Public–private partnerships -> Green supply chain management	0.627	11.033	0

It should be noted that if the significant numbers are higher than 1.96, the significance of the path between the two variables can be confirmed and the existence of this relationship can be confirmed. Therefore, according to Table 6, the first, third, sixth, seventh, eighth, ninth, tenth, eleventh and twelfth hypotheses were accepted.

Table 7 shows the test of mediator variables. It can be concluded that the variable of government support has a mediating role between environmental regulations and the implementation of the GSCM. Since the significance number was 3.298 (higher than 1.96) variables and public-private partnerships played a mediating role between the GSC implementation and the environmental regulations. As the significance number was 2.950 (higher than 1.96) thus the variable of the preventive resilience played a mediating role between the environmental performance and the green supplier integrity. Moreover, the next significance number was 3.990 (much higher than 1.96) therefore, it can be inferred that the approved mediator variables were complete mediators since according to Table 7, direct paths are meaningful.

Table 7. The Effects of Mediating Variables

Path Diagram with Mediating Variables	Original Sample (O)	T Statistics (|O/STDEV|)	P Values
Environmental regulations -> Governmental support -> Green supply chain management	0.078	3.298	0.001
Environmental regulations -> Public–private partnerships -> Green supply chain management	0.197	3.99	0

Table 8 shows the effects of independent on the dependent variables in the presence of the mediator and the moderator variables. It can be concluded that since the significant numbers were higher than 1.96, the significance of the path between the two variables can be confirmed and thus this relationship was confirmed.The effects of independent variables affecting the dependent variables were expressed in Table 8.

Table 8. Total Effect of Independent Variables on the Dependent Variables.

Path Diagram	Original Sample (O)	T Statistics (|O/STDEV|)	P Values
Environmental regulations -> Environmental performance	0.124	3.638	0
Environmental regulations -> Governmental support	0.342	5.216	0
Environmental regulations ->GSCM	0.337	4.942	0
Environmental regulations -> Medium- long-term economic performance	0.22	4.687	0
Environmental regulations -> Public–private partnerships	0.315	4.018	0
Environmental regulations -> Short-term economic performance	0.259	4.615	0
Governmental support -> Environmental performance	0.084	3.676	0
Governmental support -> GSCM	0.228	4.373	0
Governmental support -> Medium- long-term economic performance	0.149	4.261	0
Governmental support -> Short-term economic performance	0.175	4.271	0
Green Innovation -> Environmental performance	0.386	5.66	0
Green Innovation -> Medium- and long-term economic performance	0.189	2.939	0.002
Green supply chain management -> Environmental performance	0.368	6.079	0
GSCM -> Medium- long-term economic performance	0.653	13.268	0
GSCM -> Short-term economic performance	0.769	17.28	0
Public–private partnerships -> Environmental performance	0.231	5.423	0
Public–private partnerships -> Green supply chain management	0.627	11.033	0
Public–private partnerships -> Medium- and long-term economic performance	0.41	8.248	0
Public–private partnerships -> Short-term economic performance			

Based on Table 8 and Figure 5, it was concluded that among the independent variables affecting the implementation of the green supply chain, the variable of public and private partnerships with a total impact factor of 0.627 acquired the first place, the environmental regulations with a total impact factor of 0.337 acquired the second place and the government support with a total impact factor of 0.228 placed in the third rank.

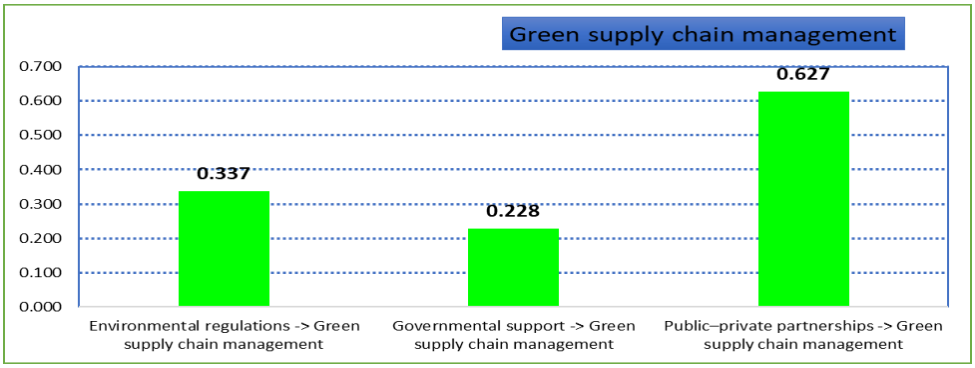

Figure 5. Prioritized Factors Affecting the Implementation of Green Supply Chain Management by Considering the Mediating Role

Evaluation of variance-based structural equation model

The main basis of variance-based structural equations is the creation of explanatory models with acceptable predictive power. The variance-based structural equations, by maximizing the amount of variance described by the endogenous structures embedded in a hypothetical path model, produce the mechanisms by which predictions are generated. This feature distinguishes variance-based structural equations from various machine learning tools designed for predictive purposes. Assessing the predictive power of a statistical model is an important element in any study. The focus of management and marketing researchers is more on whether model coefficients are significant, meaningful, and hypothetical than on whether a model can predict new ones. Analysis of variance-based structural equations is a "predictive-causal" method (Jöreskog and Wold, 1982). To evaluate the predictive power of variance-based structural equation models, the root mean square error index proposed by Shmouli et al. (2019) in SmartPls software was used. The results of the predictive power of the fitted model in Figure 3 are as shown in Table 9:

Table 9. Evaluation of Predictive Power of SEM-PLS Model

PLS Predictions (Descriptives)	Mean	Min	Max	RMSE
Green Supply Chain Management	3.049	2.274	3.698	0.905

Conclusion

The study purpose was to verify the effect of environmental regulations on environmental and economic performance through the establishment of a green supply chain with the mediating role of government support and private sector participation with a green innovation approach. The results showed, firstly, due to the support of the public sector and the participation of the private and public sectors, the management of the green supply chain can be implemented by observing the country's models, so that internal and external factors affect the implementation of the supply chain by 0.80 and 0.182 respectively. Internal factors including eco-design, corporate management commitment, logistics, organizational participation and stakeholder pressure, as well as external factors including collaborating with suppliers, government and public facilitators, awareness and cultivation of the effects of green supply chain management and economic benefits which the results of this study confirmed the research conducted by Taghavi et al. (2021). On the other hand, environmental regulation has been effective on environmental performance by establishing a green supply chain with the mediating role of government support and private and public partnerships of 0.228 and 0.627, respectively. The direct effect of establishing a green supply chain on short-term economic performance was 0.769 and on medium-term and long-term economic performance was 0.653 which was consistent with the results of previous research (e.g. Wu et al., 2020 and Farbod and Hamidieh,

2022) and confirmed them. Implementation of green supply chain affected environmental and economic performance in the medium, long term and short term, respectively 0.368, 0.653 and 0.769, which the results of research confirmed Jabbour, et al (2015). Finally, green innovation impact on environmental performance is observed as 0.386 according to the path coefficient results, the same effect on long-term and short-term economic performance are 0.189 and 0.201 respectively. Which was consistent with and confirmed the research Ulfat et al (1390) carried out previously. The result of the study can be deployed in GSCM at manufacturing companies, especially which are located in Tehran. Through the approach of environmental regulations, government support and the participation of companies in the profitability of themselves, growth rate can be observed in the economic performance of the country.

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