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Investigating the Impact of Business Analysis and Environmental Orientation with Regard to the Mediating Role of Green Innovation on the Green Competitive Advantage of Companies

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Abstract

The main goal of this research was to identify and determine the impact of business analysis and environmental orientation regarding the mediating role of green innovation on the competitive advantage of manufacturing companies in Sao Paulo city. This research is applied in terms of purpose and descriptive survey in terms of data collection method. The statistical population of the research includes the CEOs of manufacturing companies located in Sao Paulo's industrial towns, whose number was determined to be about 420 people. Based on Morgan's table, 201 CEOs of industrial production companies in Sao Paulo were selected as a statistical sample using a non-probability method. In order to collect data, the questionnaire of Zamir et al. (2020) was used. The results of Cronbach's alpha test showed that the research variables are of good quality in terms of reliability. Also, the Kolmogorov-Smirnov test was used to determine the normality of the population, which showed that all research variables have non-normal distribution. Therefore, partial least squares method and PLS software were used to test the research hypotheses. The results showed that business analysis and environmental orientation have a positive and significant effect on green innovation and green competitive advantage. Also, green innovation has a positive and significant effect on green competitive advantage, and green innovation can positively and significantly mediate the effect of business analysis and environmental orientation on green competitive advantage.

Keywords: Business analysis, Environmental orientation, Green innovation, Green competitive advantage

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Introduction

Organizations are an integral part of human life. In order to maintain their survival, humans must maintain organizations and develop them according to their growing needs. The activity environment of organizations is a very turbulent environment and they have to adapt themselves to these turbulent conditions in order to survive, and the only way to achieve it is to gain a

competitive advantage. In addition to gaining a competitive advantage, organizations must be able to maintain it. Maintaining a competitive advantage is the concept of sustainability. On the other hand, the increasing pressure of competition and the ever-increasing expansion of diverse human needs have created pressure on the natural environment, and this has caused the expectations of beneficiaries from organizations to change, and in addition to expecting their needs to be met, they also raise the expectation of preserving the natural environment. One of the most important concerns of the beneficiaries is the preservation of the natural environment and the health of society. Paying attention to these concerns is one of the topics known as green management or environmental management system. Problems such as global warming, reduction of rainfall, thinning and destruction of the ozone layer, air, water and soil pollution are among the issues that have been the attention of governments and organizations are expected to pay attention to it. (1). In today's highly competitive environment, institutions and organizations must strengthen their ability to respond to environmental changes and customer needs in order to guarantee their financial position and maintain their market share. And according to Sergio Ziman, provide more reasons to customers to encourage them to buy and create a long-term relationship with the company. Competitive advantage is one of the important issues that has been emphasized in the literature of strategic marketing and management in recent years, and it is among the components that guarantee organizational sustainability. Also, companies need to design and adopt strategies that can help them improve their performance; Because in such a competitive environment, companies are able to survive by synchronizing themselves with the changing dynamic competitive conditions; In other words, company managers will see the results of their decisions in the form of strategy selection in the mirror of performance criteria, and a company with distinct marketing capabilities has a higher probability of creating superior value for customers and achieving a competitive advantage. (2). In recent years, most manufacturing and industrial companies have focused on profitability and gaining more market share, and therefore have neglected the environment and the natural environment around them. However, nowadays there is increasing pressure from the society towards compliance and commitment to protect environmental rights by production companies. Therefore, if companies place environmental protection as one of their organizational strategic priorities and start production in accordance with environmental protection and green production, then they can enjoy a green competitive advantage compared to their other competitors. Based on this, it is very important to identify the factors that lead to the development of green competitive advantage for manufacturing and industrial companies.

As environmental pressures from various stakeholders increase, companies must maintain their products/services and operations in such a way that they are environmentally friendly. As a result, management's perception of environmental management has changed from a cost center to a profit center to meet environmental protection requirements. In addition, an increasing number of companies consider green innovation as a critical approach to reduce their negative impact on the natural environment. For example, research (3) suggested that green innovation is critical for a company to gain competitive advantage. Recently, other researchers (4) have shown that companies should improve green innovation performance when faced with various stakeholder pressures. Therefore, there is a need to examine how to promote green innovation. Also, environmental orientation is defined as the extent to which the company's managers recognize the importance of its environmental problems, and the company's mission is considered in two dimensions: internal environmental orientation and external environmental orientation. Internal environmental orientation is defined as aspects of the company's internal values, norms of ethical behavior and committed efforts to protect the environment. While external environmental orientation refers to the company's attitude towards environmental protection, which may affect its relations with external stakeholders such as suppliers, government and society, etc. Therefore, environmental orientation can be an important factor in improving organizational performance (5).

On the other hand, the global and rapid changes in the business environment, along with unprecedented developments in the technological fronts, force companies to be more innovative and agile in identifying and

responding to the evolving demands of customers. The success or survival of companies depends on the ability of these businesses to respond effectively/accurately and efficiently/quickly to complex dynamics in the market. Therefore, information systems (IS) and information technologies (IT) become metaphors that provide different tools and techniques to businesses that intend to overcome the challenges of these environments. Recently, companies have been able to access massive amounts of data generated by their operations on electronic platforms. The information system has many applications that include various tools and techniques to deal with the processing of large data sets. These tools and techniques statistically and quantitatively analyze a huge set of data sources to add value and support/decision making for businesses, and today it is collectively called business analysis (6). Business analytics (BA) is rethinking the way companies generate and use data. Due to its high operational and strategic potential in various industries, including financial services, insurance, retail, healthcare, and manufacturing, business analytics has attracted increasing attention from academics and professionals. Business analytics can be defined as a holistic approach to managing, processing and analyzing data to enable organizations to anticipate changes in the market and respond quickly to them. BA systems include the use of capabilities and technologies to collect, transform, analyze and interpret data to support managers' decision-making. Nowadays, business analysis is also mentioned as competitive differentiators (7).

Today, awareness about environmental and sustainable issues is increasing all over the world. The first step in compliance with environmental guidelines for each producer is green production. Competitive advantage is something that makes you look better than your competitors in the eyes of your customers. At first, this term was used for businesses, but now the term competitive advantage is used for everything, from employees of companies to countries. Usually, the best ones remain in the markets. In order to survive, every company must have at least one special market, that is, have a capability in which it is stronger than all its competitors. To protect the environment, manufacturers produce products that cause the least damage to the environment. On the other hand, the desire to buy these types of products by consumers has increased. This type of product is called green product. Green product is a type of product whose presence in today's societies is not only considered very important and vital for preserving the environment, but also pays attention to the health of consumers (8). The biggest problem that every organization faces today is the problem of change and transformation, and the acceptance of this change by organizations is definitely one of the biggest factors of the organization's durability and survival. In fact, in this dynamic market full of competition, innovation is the guarantee of the survival of any organization. Because nowadays the environmental performance of companies and following environmental laws is considered as a competitive advantage for companies. Therefore, compatibility of any innovation with environmental considerations is very important. Due to this necessity, a new concept called green innovation emerged, which means that any innovation should contribute to improving the environmental efficiency of the organization. Such as innovation in production processes that save energy and natural resources, improve the recycling process, or reduce environmental pollution (9).

Based on this, the main goal of the research is to identify and investigate the impact of business analysis and environmental orientation with regard to the mediating role of green innovation on the competitive advantage of manufacturing companies in Sao Paulo.

The conceptual model of the research is presented as follows:

Based on the conceptual model of the research, the hypotheses are proposed as follows:

1. Business analysis significantly affects green innovation.
2. Business analysis significantly affects green competitive advantage.
3. Environmental orientation has a significant effect on green competitive advantage.
4. Environmental orientation significantly affects green innovation.
5. Green innovation significantly affects green competitive advantage.
6. Green innovation has a significant mediating role in the impact of environmental orientation on green competitive advantage.

Green innovation has a significant mediating role in the impact of business analysis on green competitive advantage

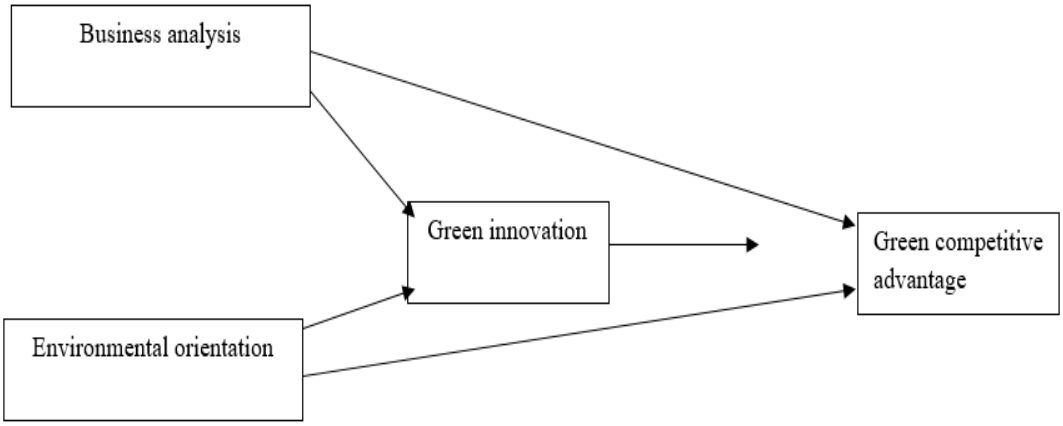

Figure 1: Conceptual model of the research

Research Methodology

The current research is descriptive and causal in terms of its practical purpose and in terms of the nature and method of analysis, which is carried out by a survey method. The statistical population of this research includes 420 CEOs of manufacturing companies located in Sao Paulo's industrial towns. In order to determine the statistical sample, the available non-probability method was used, and Morgan's table was used to determine the statistical sample size, based on which 201 CEOs of manufacturing companies were selected as a statistical sample. In order to measure the variables, the standard questionnaire of Zamir et al. (2020) was used, which was organized in two main parts. The first part of the questionnaire includes general information including the company's work history and the number of employees. The second part is dedicated to specialized questions about research variables. This section contains 16 questions that were presented in four parts. This questionnaire is completed by CEOs of companies in Sao Paulo Industrial City. Also, the scale used in the questions of the questionnaire is a five-point Likert spectrum including completely disagree, disagree, somewhat agree, agree and completely agree. Table (1) shows the specifications of the research questionnaire.

In order to check the validity of the questionnaire, the face validity method and the opinions of several expert university professors were used. Cronbach's alpha coefficient was also used to measure the reliability of the questionnaire. In this way, 30 questionnaires were distributed among the respondents in the first stage, and the value of Cronbach's alpha for the business analysis variable was 0.769. And for environmental orientation variable 0.834, green innovation variable 0.803 and green competitive advantage variable 0.766 were obtained. And since these values are more than the minimum standard of 0.7, it can be concluded that the research variables are reliable in the questionnaire tool.
Also, in order to analyze the data, in the first step, the normality of the data distribution was investigated by using the Kolmogorov-Smirnov test. The next step is to evaluate the construct validity and composite reliability of all the collected questionnaires. Construct, diagnostic and convergent validity criteria have been used to check the validity of the questionnaire. When one or more characteristics are measured, the correlation between these measurements provides two important indicators of validity. If the correlation between factor loadings is high, the questionnaire has convergent validity, and if the correlation between the tests that measure different characteristics is low, the tests have

divergent validity. In the divergent validity part, the amount of difference between the indices of one construct is compared with the indices of other constructs in the model. Finally, the reliability evaluation has been done based on indicators such as Cronbach's alpha coefficient. Cronbach's alpha coefficient is a classic criterion for measuring reliability and a suitable criterion for evaluating internal stability. Internal stability indicates the degree of correlation between a variable and its related indicators. The estimation of the research model and the testing of the hypotheses were also done based on the structural equation modeling method with the partial least squares approach. It is also worth mentioning that the implementation of the mentioned statistical methods was done using specialized software SPSS $_{23}$ and Smart PLS$_2$

Table 1: Research questionnaire information

Variables	Number of questions
Business analysis	1-5
Environmental orientation	6-9
Green innovation	10-13
Green competitive advantage	14-16
Total questions	16

Findings

The results of the analysis of demographic characteristics, which included questions in the first and general part of the questionnaire, are shown in Table 2.

Table 2: Description of demographic characteristics

Demographic characteristics	Categories	Frequency	Percentage
Job experience	Less than 10 years	38	19%
	11-20 years	116	58%
	More than 20 years	47	23%
Number of employees	Less than 20 people	13	7%
	21-50 people	169	84%
	More than 50 people	19	9%

As the results of Table 2 show, out of the total of 201 CEOs participating in this research, companies with 11 to 20 years of experience had the highest number of 116 and 58 percent. Also, 169 companies out of 201 companies, which constituted 84%, had between 21 and 50 employees.

Descriptive analysis of variables including centrality and dispersion indices such as mean, skewness, skewness, variance and standard deviation are shown in Table 3.

Table 3: Descriptive indices of the studied variables

Variable	Mean	SD	Variance	Skewness	Kurtosis
Business analysis	2.973	0.942	0.889	-0.589	-0.221
Environmental orientation	3.123	0.868	0754	-0.799	-0.671
Green innovation	3.041	0.824	0.679	-0.137	-0.387
Green competitive advantage	3.134	0.770	0.594	0.457	-0.132

According to Table 3, the green competitive advantage variable with a value of 3.134 had the highest average and the business analysis variable with a value of 2.973 had the lowest average. This shows that the dominant view of the respondents in the green competitive advantage variable is somewhat agreeable, but regarding business analysis, they are somewhat opposed to the items of this variable. Also, the business analysis variable has the highest standard deviation with a value of 0.942 and green competitive advantage has the lowest standard deviation with a value of 0.770.

Kolmogorov Smirnov test was used to investigate the claim made about the data distribution of a quantitative variable. In this test, the null hypothesis represents the claim made about the normality of data distribution. Table 4 shows the results of this test. The results of Table 4 show that the significance level of all variables is less than 0.05. Therefore, it can be concluded that the variables have a non-normal distribution. Therefore, in order to analyze the data, partial least squares method and Smart PLS software were used, which are suitable for non-normal distribution.

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Table 4: Kolmogorov-Smirnov test results

Variables	Sample size	Kolmogorov-Smirnov value	Sig.	Result
Business analysis	201	0.187	0.000	Abnormal
Environmental orientation	201	0.260	0.000	Abnormal
Green innovation	201	0.207	0.000	Abnormal
Green competitive advantage	201	0.143	0.000	Abnormal

In this section, the fitting of the measurement model is discussed using the criteria of diagnostic validity, convergent validity and reliability. The results of Table 5 show the values of indicators related to diagnostic validity, convergent validity and reliability. According to the considered limits for both criteria of Cronbach's alpha coefficient and composite reliability (above 0.7), it is concluded that the values of these indicators are acceptable for all research variables. Based on the convergent validity results, it can be seen that all the research constructs are in a suitable range and overall the desirability of the measurement models is confirmed.
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Table 5: The results of Cronbach's alpha coefficient and composite reliability coefficient

Variables	Alpha>0.7	CR>0.7	AVE>0.5
Business analysis	0.8923	0.9254	0.7192
Environmental orientation	0.8038	0.8696	0.6254
Green innovation	0.7773	0.7369	0.8617
Green competitive advantage	0.7933	0.8676	0.6239

Finally, divergent validity is the third criterion for assessing the fit of measurement models in the PLS method. The validity of divergence in this method is measured in two ways: a) methods of reciprocal factor loadings; (b) Fornell and Larcker method. In this research, the second method is used to measure the validity of divergence. According to Fornell and Larker, the validity of divergence is at an acceptable level when the average variance extracted for each construct is greater than the shared variance between that construct and other constructs in the model. If the root mean of the extracted variance ($\sqrt{AVE}$) for a variable is greater than the correlation of that variable with other variables, there is divergent

validity for that variable. In Table 6, the numbers on the root diameter of the mean square root are extracted.

Table 6: The results of divergent validity

Variables	Business analysis	Environmental orientation	Green competitive advantage	Green innovation
Business analysis	0.8481			
Environmental orientation	0.7651	0.7910		
Green competitive advantage	0.7986	0.6420	0.9283	
Green innovation	0.7895	0.7378	0.7331	0.7897

According to Table 6, it can be said that the validity of the divergence is at an acceptable level.
The test of the research model has been done using the partial least squares method. Figures 1 and 2 show the research model along with the underlying and observed variables in it in the form of reflective measurement models along with the path coefficients between the variables as well as the values of the coefficient of determination and Student's t-statistics.

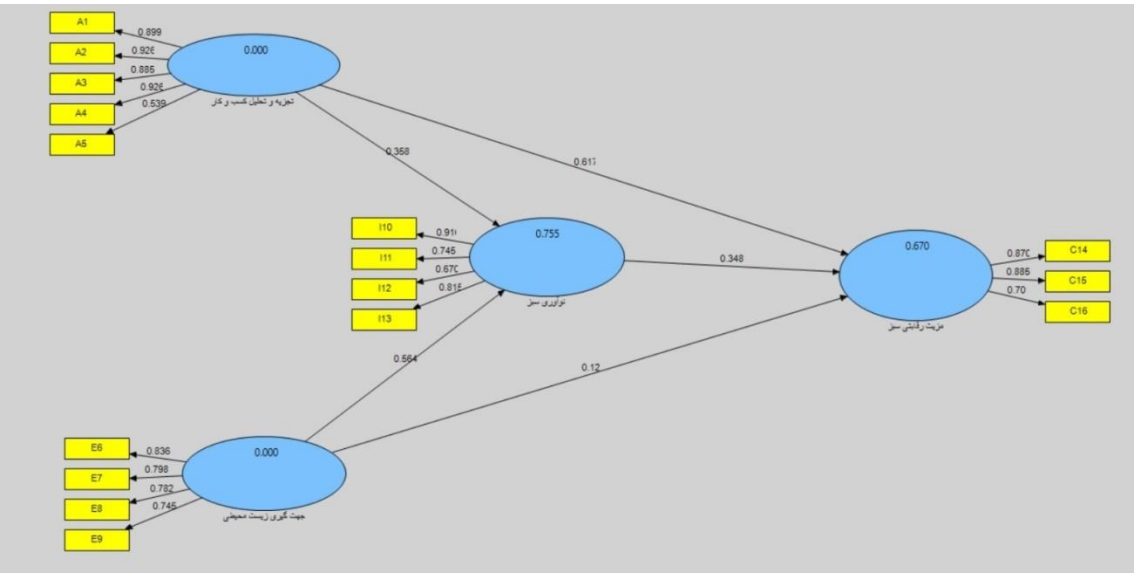

Figure 1: Research model with standard factor loading coefficients

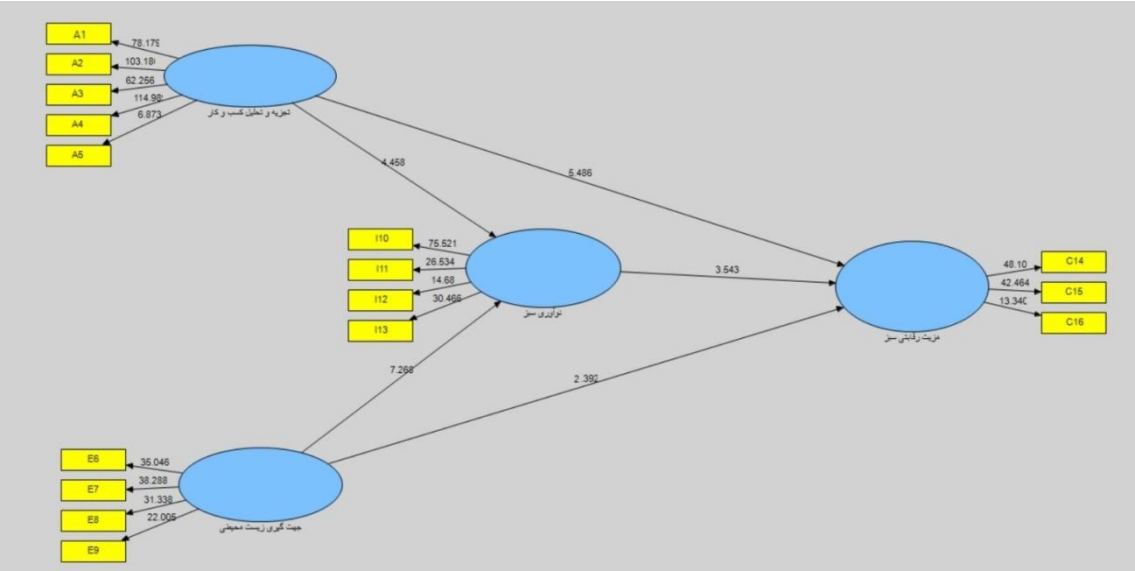

Figure 2: Research model with significant coefficients

Table 7: Hypothesis test results

	Hypothesis	Path coefficient	Sig.	Results
1	Business analysis significantly affects green innovation	0.358	4.458	Accepted
2	Business analysis significantly affects green competitive advantage	0.617	4.486	Accepted
3	Environmental orientation has a significant effect on green competitive advantage	0.120	2.392	Accepted
4	Environmental orientation has a significant effect on green innovation	0.564	7.268	Accepted
5	Green innovation significantly affects green competitive advantage	0.348	3.543	Accepted
6	Green innovation has a significant mediating role in the impact of environmental orientation on green competitive advantage	-	3.1853	Accepted
7	Green innovation has a significant mediating role in the impact of business analysis on green competitive advantage		2.7728	Accepted

The results of Table 7 show that in relation to all hypotheses, the Student's t-statistic was greater than 1.96. Therefore, all seven research hypotheses are confirmed at the 95% confidence level. The obtained path coefficients are also positive in all the confirmed hypotheses, which indicates the significant positive effect of the independent variables on the dependent variable in the respective hypotheses. Among research hypotheses, the effect of business analysis on green competitive advantage was the highest with a path coefficient of 0.617, and the effect of environmental orientation on green competitive advantage was the lowest with a value of 0.120. Finally, the criterion used to evaluate the fit of the structural model includes R2, three values of 0.19, 0.33 and 0.67 are

considered as the criteria for weak, medium and strong values of R2. Therefore, according to the values reported for the research variables in Figure 1, it is 0.755 for the green innovation variable and 0.670 for the green competitive advantage variable, which is more than the value of 0.67 and indicates the strong fit of the model. The value of the overall index of fit (GOF) is also equal to 0.7099, which also confirms the acceptability of the overall fit of the research estimation model.

Discussion and Conclusion

The current research was conducted with the aim of identifying and investigating the impact of business analysis and environmental orientation with regard to the mediating role of green innovation on the competitive advantage of manufacturing companies in Sao Paulo city. In total, seven hypotheses were presented in this research, which were analyzed with the help of inferential statistics methods. In order to examine the relationships between the variables and test the research hypotheses, considering that the results of the Kolmogorov-Smirnov test indicated the non-normality of the main research variables. Therefore, to analyze the data, the structural equation modeling test was used with the help of pls2 software to test the hypotheses. In the following, the results of the hypothesis test and their comparison with the results of other researches are summarized as follows:

The result of the first hypothesis test showed that business analysis has a positive and significant effect on green innovation. In other words, if the company has a large and extensive data analysis system in its executive process. All data and information should be collected and analyzed regularly, in that case coherent and classified information will be provided to organizational departments in the form of visual and comprehensive reports. And managers and employees can use this information and reports and provide the field of innovation in order to reduce waste and adapt to the environment. Because the information derived from business analysis can provide a guiding framework to the company's decision-makers. The result of the first hypothesis test is consistent with the results of the studies (10) because they also showed that business analysis has a positive and significant effect on green innovation. The result of the second hypothesis test showed that business analysis has a positive and significant effect on green competitive advantage. In other words, business analysis helps the company's managers when it is expected that the company's activities will face challenges in relation to the market and its customers, especially the environment. Managers can show protective behaviors for the environment by making appropriate decisions compared to other competitors and act in the direction of reducing environmental pollutants. The result of the second hypothesis test is inconsistent with the results of the conducted studies (10) because in their study, they did not observe a significant direct effect of business analysis on green competitive advantage.

The result of the third hypothesis test showed that environmental orientation has a positive and significant effect on green competitive advantage. Based on this, whenever the industrial production companies put the environment and its protection as the priority of their activities. And carry out plans for raw material procurement, communication with the supply chain, product delivery to customers, and product recycling based on the principles and approach that has the least destructive effect on the environment. In that case, they can have a more appropriate green competitive advantage compared to other competitors who pay less attention to environmental issues. And compared to other competitors, reduce the company's costs that lead to environmental damage. The result of the third hypothesis test is compatible with the results of the conducted studies (10-12) because in their studies they also observed a significant direct effect of environmental orientation on green competitive advantage. The result of the fourth hypothesis test showed that environmental orientation has a positive and significant effect on green innovation. In other words, if the company's employees consider themselves responsible for the environment and are diligent in preserving natural resources, and the company's managers can promote environmental protection as ethical and cultural norms in the organization and among employees. In that case, the employees will act in the form of habitual behaviors in the direction of minimum energy consumption and will improve the level of green innovation of the company. Based on

this, the result of the fourth hypothesis test is consistent with the results of the studies (10 and 12) because they also found that environmental orientation has a positive and significant effect on green innovation.

The result of the fifth hypothesis test showed that green innovation has a positive and significant effect on green competitive advantage. In other words, if the company can provide raw materials compatible with the environment and produce products that can be recycled and do not lead to an increase in the amount of waste in the environment and the production of greenhouse gases. In that case, it will be possible for them to invest more in environmental projects and have better management in the field of environmental issues compared to other competitors. The result of the fifth hypothesis test is consistent with the results of the conducted studies (10, 12-15) because they showed that green innovation leads to green competitive advantage. The result of the sixth hypothesis test showed that green innovation positively and significantly mediates the impact of environmental orientation on green competitive advantage. In other words, the priority of environmental protection and the responsibility of the employees and managers of production companies towards the environment and also the promotion of environmental culture in the organization has increased the capability of green innovation in the organization. and finally lead to the development of environmental capital and the promotion of green competitive advantage of companies. The result of the sixth hypothesis test is aligned and compatible with the results of the study (10) because they also observed the mediating role of green innovation in the impact of environmental orientation on the significant green competitive advantage.

Finally, the result of the seventh hypothesis test showed that the existence of data mining systems in the company and checking the information process accurately along with the control of the company's processes, helps the managers of industrial and production complexes. By having community information related to various suppliers, he cooperated with those suppliers who provide environmentally friendly raw materials and by studying the energy consumption trend charts prepared through the business analysis system. Develop the necessary programs to reduce energy consumption and save it. Based on this, the existence of energy consumption plans and guidelines has increased the company's level of innovation in the field of environment, which in turn causes companies to take appropriate actions towards the environment compared to other industries. and surpass their competitors in this field. The result of the seventh hypothesis test is aligned and consistent with the results of the study (10) because they also observed the mediating role of green innovation in the impact of business analysis on the significant green competitive advantage.

According to the obtained results, it is suggested:

- It is suggested that the managers, using the capabilities and advanced technologies of the day, launch and develop the business analysis system in their production and industrial complex. And by using experts and experts in the field of information technology, quality control and statistics, provide the results of the business analysis system in the field of environment to the supervisors of departments, employees and managers.
- Managers are advised to invite suppliers to the company and encourage them to supply environmentally friendly raw materials to the companies.
- It is recommended to hold regular and periodical meetings as in-service training courses for employees and to provide materials to employees regarding the importance of preserving the environment and reducing energy consumption in these courses. And when determining salaries and wages, pay attention to the employees who passed these courses well and save energy.
- With the help of research and development unit as well as market experts, information should be collected regarding competitors' behaviors towards environmental measures so that the company's policies have more advantages compared to other competitors.
- To be equipped with product recycling technology, for this purpose, they can enter into

cooperation agreements with knowledge-based companies active in this field

- Revise the company's articles of association and instructions and with the help of environmental experts and human resource specialists, try to spread environmental protection solutions in the form of culture and ethical norms in the company.
- Exemplary employees in the field of energy saving should be identified and encouraged, and managers should delegate to these employees the responsibility of training other employees and promoting the culture of energy saving.

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