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ORIGINAL ARTICLE

The Effect of Green Intellectual Capital on Green Competitive Advantage with the Role of the Mediating Variable of Green Product Innovation and the Moderating Variable of Environmental Transformation Leadership (Case study: Sports Equipment Manufacturing Companies)

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K E Y W O R D S

Green intellectual capital;
Green competitive advantage;
Environmental product innovation;
Ereen transformation leadership

A B S T R A C T

With the increasing environmental concerns of consumers, governments and various societies around the world, as well as manufacturing companies, have sought to develop environmentally friendly programs such as green product development, green brand, green technology and innovation. A review of the background and theoretical foundations of various studies in this regard shows that despite numerous studies conducted in the field of measuring and examining the consequences and antecedents of intellectual capital and innovation in organizations, very limited attention has been paid to the concepts of innovation and green intellectual capital. The main objective of the present study is to investigate the effect of green intellectual capital on green competitive advantage in hotels with the role of the mediating variable of environmental product innovation and the moderating variable of green transformation leadership. The research method is applied in terms of purpose and descriptive-survey in terms of method. The data collection method in this study is field and library type. To collect information in this research, questionnaires designed taking into account the dimensions of the subject under study have been used, which have the necessary validity and reliability. For the validity of the questionnaires in relation to its use in tests, according to the professors of the subject, as well as confirmatory factor analysis for construct validity, have been used, and for its reliability, Cronbach's alpha method and composite reliability have been used. The statistical population of this research includes all managers and employees of sports equipment manufacturing companies, which number 175 people. In this research, 120 questionnaires were distributed and collected by census sampling method among managers and employees of sports equipment manufacturing companies. SPSS and SMART PLS software have been used to examine and test the hypotheses. The results of the research show that green human resource capital, green structural capital, and green relational capital have an effect on green competitive advantage in hotels. Green human resource capital, green structural capital and green relational capital have an effect on environmental product innovation in hotels. Green human resource capital, green structural capital and green relational capital have an effect on green competitive advantage in hotels with the mediating variable role of environmental product innovation. Green human resource capital, green structural capital and green relational capital have an effect on environmental product innovation in hotels with the moderating variable role of green transformation leadership.

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Introduction

Green intellectual capital refers to a new approach to the importance of a company's capabilities and knowledge in the economy and leads to a new strategic management perspective and attitude (Pedro *et al*., 2018). This concept has been discussed for decades, but there is no agreement on its definition. Intellectual capital, as a set of intangible assets, is considered a critical resource for a company's performance and ability to innovate, create and maintain competitive advantage, and knowledge management should use intellectual capital as a source of value generation and priority for organizational performance (Cabrilo & Dahms, 2018). Intellectual capital is the main factor in creating value in companies, and companies are moving towards creating value through intellectual capital available in the organization. Managers' views on creating company value through physical assets have changed (Sardo & Serrasqueiro, 2017). Intellectual capital is a necessary and competitive resource. The two main types of green competitive advantage include cost reduction and differentiation, which, in combination with the scope of the company's activities to achieve competitive advantage, lead to three general strategies for achieving above-average performance in the industry. These three strategies include cost leadership, differentiation, and focus (Song *et al*., 2018). Porter suggests that in cost leadership, the company seeks to become the low-cost producer (produce a cheaper product) in its industry. If the company can achieve and maintain cost leadership overall, it can perform above the industry average. On the other hand, a cost leader cannot ignore differentiation and if its products are not comparable with competitors or are not acceptable to customers, it will have to reduce the price of its products to below the price of competitors, which will result in the benefits of its favorable cost position being nullified (Song *et al*., 2018). However, it seems that this alone cannot be effective. Therefore, two types of tools can be provided for green management: hard and soft; so that the hard tool used to involve employees in green behavior through the development of standards is referred to as green human resource management, and the soft tool used to stimulate green behavior in employees by transferring environmental protection norms to them is referred to as green transformation leadership. Therefore, it can be said that green human resource management, by developing, adopting, and implementing green policies, creates, strengthens, and organizes the ability and skills of employees to have green behavior in the workplace, and green transformation leadership can facilitate the process of green behavior of employees in the workplace with its inspiration and motivation. (Jian *et al*, 2020). On the other hand, in today's world, the existence of various types of pollution and the emergence of numerous environmental issues, including global warming, increased greenhouse gas emissions and pollution from factory activities, ozone layer depletion, resource scarcity, increasing costs, and general changes in society's values and attitudes, have led companies to consider environmental issues as a fundamental component in formulating their strategies. Consumers who are aware of environmental issues are more likely to buy green products; traditional product aspects such as price, quality, and brand are also important factors that people consider when making a purchase decision. A company's performance in the field of green product innovation has a positive and direct impact on the company's overall performance, including market share, sales, profits, and reputation; and a company's environmental performance also has a positive impact on the company's overall performance. Green product innovation has a positive and significant impact on the organization's green competitive advantage and performance; and this impact on the organization's green competitive advantage is greater than performance. Management innovation and green products only indirectly affect organizational performance (Noorlailie *et al*., 2019). The main aspect

of innovation as a determining factor in economic change and progress has been maintained. Given the increasingly competitive context of the contemporary economy and the equivalence of supply in many market segments of sports equipment manufacturing companies, it is argued that innovation can support differentiation and create sustainable competitive advantage. However, apart from strategic and economic development, innovation in sports equipment manufacturing companies is now understood as an important need that must be implemented in a way that also considers social and environmental issues. Therefore, the aim of the present study is to examine the effect of green intellectual capital on green competitive advantage with the role of the mediating variable of environmental product innovation and the moderating variable of green transformation leadership, so that a wise and rational move can be made as much as possible on its basis to follow the path of its transition to a sustainable and profitable organization. Although companies should make serious efforts to improve competitive advantage in various areas of their business, an unanswered question is what is the impact of green intellectual capital on green competitive advantage with the mediating variable role of environmental product innovation and the moderating variable of green transformation leadership?

Research literature

Green intellectual capital

The concept of green intellectual capital was first proposed by Chen in 2008. According to this expert's definition, green intellectual capital refers to all intangible assets, knowledge, capabilities, and relationships regarding environmental protection or green innovation, at the individual or organizational level of a company (Chang & Chen, 2012). green intellectual capital is the sum of all knowledge that an organization can use to manage its environmental processes in order to gain competitive advantage. Green intellectual capital plays a vital role in companies that focus on their stability and sustainability through knowledge transfer, attention to environmental regulations, application of new technologies, implementation of best practices and implementation of initiatives in order to achieve company goals, and enables companies to comply with international environmental regulations and provide satisfaction to environmentally sensitive consumers, which leads to the creation of value for companies. Companies can differentiate themselves from existing competitors through green intellectual capital and prevent new entrants from entering the market. As a result, strengthening the competitive advantage of companies in this way stabilizes their position in the market (Cheng & Fan, 2011). A comprehensive review of the research background shows that most researchers have considered the dimensions of intellectual capital as three dimensions: human, structural and relational (Buenechen, 2017). Green intellectual capital is the main factor in creating value in companies, and companies are moving towards creating value through green intellectual capital existing in the organization. Managers' views on creating company value through physical assets have changed (Sardo & Serrasqueiro, 2017).

Green competitive advantage

The concept of competitive advantage refers to the ability of a company to formulate and implement strategies that create a better position for itself over its competitors by better utilizing available technical, physical, financial, and organizational capabilities and resources. Achieving competitive advantage is related to two main dimensions: perceived customer value and the company's ability to achieve excellence. The importance of competitive advantage is that, in addition to increasing the company's capabilities and production and marketing skills and strengthening relationships with customers, it allows companies to defend their position in the market and maintain their competitive position among their competitors (Sigalas

et al., 2013). Green competitive advantage has been studied by researchers with different approaches. The value creation approach focuses on the company's internal performance and its market performance (Younis *et al*, 2016). In the value creation approach, green competitive advantage focuses on creating value for stakeholders. One of the famous theories related to value is Porter's value chain theory. According to Porter, the value chain is one of the principles of green competitive advantage (Song *et al*, 2018). The two main types of competitive advantage include cost reduction and differentiation, which, in combination with the scope of the company's activities to achieve competitive advantage, lead to three general strategies for achieving above-average performance in the industry. These three strategies include cost leadership, differentiation, and focus. Porter suggests that in cost leadership, the company seeks to become the low-cost producer (produce the product cheaper) in its industry. If the company can achieve and maintain overall cost leadership, it can perform above the industry average. On the other hand, a cost leader cannot ignore differentiation and if its products are not comparable with competitors or are not acceptable to customers, it will have to reduce the price of its products to below the price of competitors, which will result in the benefits of its favorable cost position being nullified (Song *et al*, 2018).

Environmental product innovation

Product innovation is the result of the search for technological competitiveness and market-oriented innovations. Companies update their existing products to improve the quality and variety of the goods they offer (Carboni& Russu, 2018). A review of previous research shows that the product innovation strategy leads to increased competitive advantage and reduced production costs and creating a competitive advantage in the performance of organizations. The product innovation strategy is very visible and customers easily feel its existence and this type of innovation has the ability to create a new market for the business and improve business performance, especially in export industries, this issue is more tangible. When a new and novel product is launched, this product, which has a new and untapped market, increases the company's profit by increasing sales and improves the company's performance (Armanios *et al*., 2017). Product innovation achieves better marketing performance and for this, the quality of electronic customer relationship management should be increased as much as possible (Erlangga, 2022). Environmental product innovation is one of the key factors in the success, survival of the company and creating a sustainable green competitive advantage. Eco-product innovation was defined as the design, marketing, and sale of products, services, and products that are environmentally friendly (PENG *et al*., 2020).

Green transformation leadership

The future and current direction of a company depend on the influence of transformational leadership in active markets. If leaders strongly believe in their vision, produce innovative visions, and clearly communicate their vision to employees, employees will have strong faith. Green transformational leadership is defined by Chen and Chang as the characteristic of a leader who encourages and motivates his colleagues to achieve environmental goals that go beyond what is expected of them from an environmental perspective. While green performance can be defined as the performance of software and hardware that is implemented in the innovation process that a company implements in the green process and products that include technological innovations such as pollution prediction, energy conservation, waste recycling, and business environment management . transformational leadership creates an ideal level of inspiration, faith, strength, confidence, and performance. According to some studies, knowledge-based transformational leadership has certainly inspired talent management, performance management, and employee skills. Green

Aspects of Green Human Resource Management
Green human resource management is related to the green aspect that aims to help organizations achieve, produce, inspire, and sustain green behavior of employees in the organization. Accordingly, we estimate that to achieve green performance and innovation, green transformation leadership plays a vital role in devising and implementing policies that help green human resource management to help the company act according to its vision and strategies to achieve green performance (Jia *et al*., 2018).

Research hypothesis and conceptual model

This study investigated the effect of green intellectual capital on green competitive advantage with the role of the mediating variable of green product innovation and the moderating variable of environmental transformation leadership. By studying the theoretical and empirical background of the research topic and considering the results of Xin & Wang (2023), the following hypotheses are formulated for this study:
Green human resource capital affects green competitive advantage in medical equipment manufacturing companies.
Green structural capital affects green competitive advantage in medical equipment manufacturing companies.

Green relational capital affects green competitive advantage in medical equipment manufacturing companies.
Green human resource capital affects environmental product innovation in medical equipment manufacturing companies.
Green structural capital affects environmental product innovation in medical equipment manufacturing companies.
Green relational capital affects environmental product innovation in medical equipment manufacturing companies.
Green human resource capital affects green competitive advantage in medical equipment manufacturing companies with the role of a mediator of environmental product innovation.
Green structural capital affects green competitive advantage in medical equipment manufacturing companies with the role of a mediator of environmental product innovation.
Green relational capital affects green competitive advantage in medical equipment manufacturing companies with the role of a mediator of environmental product innovation.
Green human resource capital affects environmental product innovation in medical equipment manufacturing companies with the role of a moderator of green transformation leadership.
Green structural capital affects environmental product innovation in medical equipment manufacturing companies with the role of a moderator of green transformation leadership.
Green relational capital has an impact on environmental product innovation in a medical equipment manufacturing company with the moderating variable role of green transformation leadership.
By explaining the basic variables of the research topic and establishing the relationship between them based on the article by Xin & Wang (2023), the hypothesis, model, and conceptual framework of this research have been developed based on theoretical and empirical background, and the conceptual model of this research is presented in Figure 1.

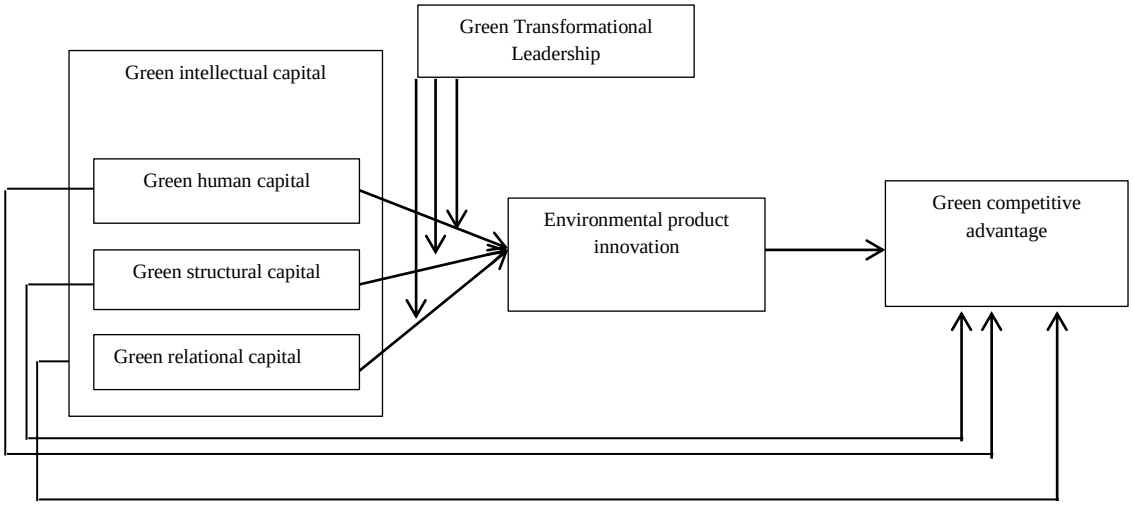

Figure 1. Conceptual research model taken from the article by Xin & Wang (2023)

Materials and Methods

The present study is an applied research in terms of purpose, because it examines the effectiveness of scientific theories on the impact of green intellectual capital on green competitive advantage with the role of a mediating variable of green product innovation and a moderating variable of environmental transformation leadership, and develops applied knowledge about the quality of the relationship and impact between variables. Since this research is conducted in real situations and with large samples, it is field in terms of location, and also because the research studies the relationship and correlation between research variables, it is a correlational research based on data collection. The statistical population in this study includes all managers and employees of sports equipment manufacturing companies, which number 175 people. Various methods are used to determine the sample size, including the Cochran formula. The sample size based on the Cochran formula is 120 managers and employees of sports equipment manufacturing companies. The sampling method is simple random sampling. The data collection tool in this study was the distribution of the standard questionnaire of Zin and Wang (2023), which includes 35 questions, 18 of which are for measuring the green intellectual capital variable, 5 for measuring the environmental product innovation variable, 6 for measuring the green transformational leadership variable, and 6 for measuring the green competitive advantage variable. There are various methods for measuring the validity of the questionnaire, the most important of which are: face validity, concurrent validity, predictive validity, and construct validity. In the present study, face or content validity and construct (convergent) validity were used to examine the validity of the questionnaire. To examine the face validity of the research questionnaire, the questions were provided to a number of management professors, according to the components extracted from past reputable research and with reference to relevant sources, to comment on the validity of the questionnaire. After reviewing and evaluating the questionnaires by professors and experts and making minor corrections, the face validity of the questionnaires was confirmed. In this study, factor loading was used to examine the construct validity. In conducting factor analysis, it must first be ensured that the available data can be used for the analysis. In other words, is the number of data required suitable for factor analysis? For this purpose, the KMO index and Bartlett test are used. Before conducting confirmatory factor analysis, the KMO test must be performed to ensure the adequacy of sampling.

According to Table 1, the sampling adequacy index value for each variable is above 0.6, and also

according to Table 2, the KMO value of the overall model is above 0.6. Also, since the significance level of the Bartlett test of the model is less than the research error value (0.05), the sampling adequacy is confirmed.

Table 1. Confidence statistics of research variables

Variable	Green human resource capital	Green structural capital	Green relational capital	environmental product innovation	Green transformation leadership	Green competitive advantage
Sampling adequacy index	0.846	0.921	0.889	0.854	0.917	0.906
Significance coefficient	0.000	0.000	0.000	0.000	0.000	0.000

Table 2. Data adequacy confidence statistics of the overall model

Sampling quality index		0.832
Bartlett's sphericity test	Chi-square	2.472
	Degrees of freedom	15
	Significance	0.000

After ensuring the appropriate sample size, the item covariance values were examined, and items with values less than 0.3 were excluded from the analysis because they were not consistent with other items and were not a suitable explanatory factor for that dimension. To measure reliability in this study, in addition to Cronbach's alpha coefficient, a composite reliability index was also calculated.

Data analysis

In this study, in order to test the conceptual model of the study, Smart PLS software was used and in two general stages including "model fit examination" and "hypothesis testing". The model fit examination itself has three stages: In the first stage, the measurement model is examined through validity and reliability analyses. In the second stage, the structural model is examined by estimating the path between variables. In the third stage, the overall fit of the model is examined. Finally, if the model had a good overall fit in the above three stages, then the research hypotheses can be examined.

Evaluation of the measurement model

Factor loading coefficients: First, the research model is tested based on the factor loading coefficients. If the factor loading is less than 0.3, the relationship is considered weak and is ignored. A factor loading between 0.3 and 0.6 is acceptable, and if it is greater than 0.6, it is very desirable. The structural equation model of the research model in the standard estimation of factor loading is plotted in Figure 2. The results of the test showed that all factor loadings of the indicators are above 0.4 and the factor loading of the indicators is desirable.

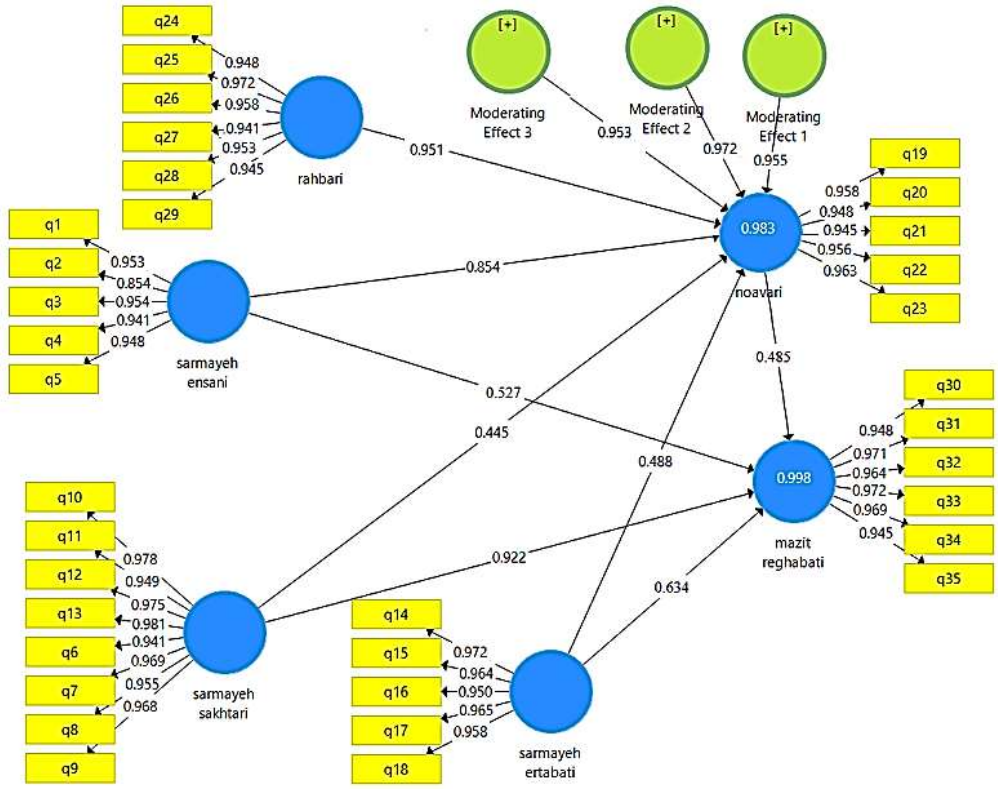

Figure 2. Structural equation model of the research model in the standard factor loading estimation mode.

Cronbach's alpha coefficient: Cronbach's alpha coefficient was invented by Cronbach and is one of the most common methods of measuring the reliability or validity of questionnaires. The validity or reliability of a questionnaire means that if the measured attributes are re-measured with the same instrument and under the same conditions and at different times, the results are almost the same. In this study, the Cronbach's alpha value for the variables was calculated using Smart PLS software and is reported in Table 3. As mentioned, the closer this coefficient is to one, the more appropriate it is. In this study, the reliability value of the questionnaire for independent and dependent variables was obtained at a very acceptable level.

Composite reliability: The composite reliability criterion is a more modern criterion than Cronbach's alpha that calculates the reliability of variables not in absolute terms but according to the correlation of their indices with each other. If the composite reliability value for each variable is greater than 0.7, it indicates the appropriate internal stability of the model. The composite reliability of each of the research variables is as shown in Table 3. As can be seen in the table, all variables have a composite reliability of 0.7 or higher, and therefore, the model is approved in terms of composite reliability. Convergent validity: In order to examine the convergent validity of the model, the mean extracted variance was used. This criterion shows the degree of correlation of a construct with its indicators, and the higher this correlation, the greater the model fit. This index is used in latent variables with a reflective model and is not used in composite models. The criterion is the mean extracted variance to measure convergent validity, and the critical value of this criterion is 0.5; meaning that the mean extracted variance value above 0.5 indicates acceptable convergent validity. The values of this criterion for the research model are as shown in Table 3. As can be seen, the average value of the extracted variance of all variables is greater than 0.5, which means that the convergent validity of the model is confirmed.

Table 3. Cronbach's alpha coefficient values, composite reliability, and mean extracted variance.

Variable	Cronbach's alpha coefficient	Composite reliability	Mean extracted variance
Green human resource capital	0.958	0.970	0.931
Green structural capital	0.987	0.991	0.964
Green relational capital	0.976	0.984	0.962
Eco-product innovation	0.971	0.980	0.953
Green transformation leadership	0.968	0.970	0.951
Green competitive advantage	0.979	0.987	0.961

Divergent validity: In order to examine the divergent validity of the model, the Fornell and Larker criterion has been used. This criterion determines the degree of relationship between a variable and its indicators in comparison with the relationship of that variable with other variables; so that acceptable divergent validity indicates that a variable interacts more with its indicators than with other variables. Fornell and Larker state that divergent validity is at an acceptable level when the average variance extracted for each variable is greater than the shared variance between that variable and other variables. In the Smart PLS software, this is examined by means of a matrix whose cells contain the values of the correlation coefficients between the variables and the square root of the average variance extracted for each variable. The table below shows this matrix, which is related to the variables. The model has acceptable divergent validity if the numbers in the main diagonal of the matrix are greater than the values below it. As can be seen in Table 4, all the numbers in the main diameter are greater than the numbers in the column below them, which means the model has acceptable divergent validity.

Table 4. Divergent validity of the model

Variable	Green human resource capital	Green structural capital	Green relational capital	Environmental product innovation	Green transformation leadership	Green competitive advantage
Green human resource capital	0.931					
Green structural capital	0.656	0.964				
Green relational capital	0.756	0.759	0.962			
Eco-product innovation	0.825	0.685	0.819	0.953		
Green transformation leadership	0.727	0.895	0.829	0.789	0.951	
Green competitive advantage	0.552	0.593	0.847	0.717	0.846	0.961

Evaluation of the structural model

The structural model or external model indicates the relationships between the latent variables of the model. In fact, in this section, questions (indicators) are not considered and only the latent variables along with the relationships between them are examined. Several criteria are used in the evaluation of the structural model, each of which is discussed below.

Significant t numbers: The most basic criterion for measuring the relationship between variables in the model is the significant t numbers. If the value of these numbers is greater than 1.96, it indicates the accuracy of the relationship between the variables and, as a result, the confirmation of that relationship or relationships at a 95% confidence level. Figure 3

depicts the results of the test of the conceptual model of the research in the case of significant t coefficients. The values calculated on the arrows indicate the value of the significant t numbers. The T-value results reported in the figure above are all greater than 1.96, so it can be concluded that at a significance level of 95 percent, all questions are considered for the structural equation model and there is no need to remove any of the questions from the model.

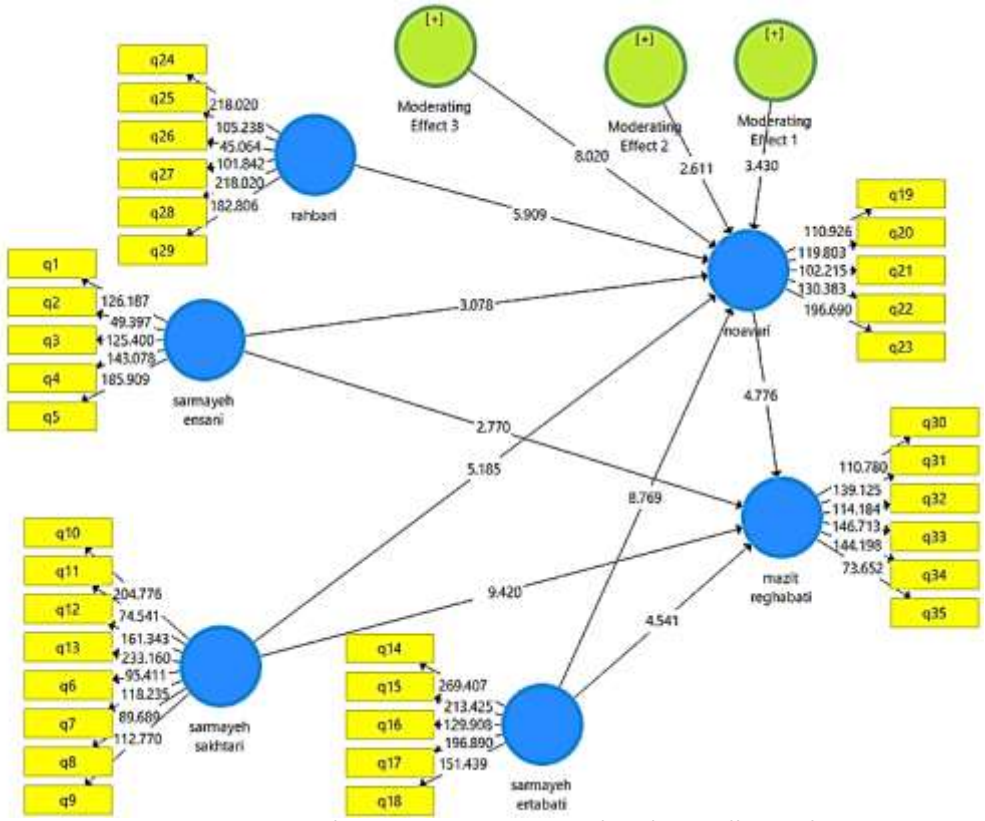

Figure 3. Structural equation model of the research model in the case of significant coefficients of the t-statistics.

Coefficient of determination criterion: The coefficient of determination criterion indicates the effect that an independent variable has on a dependent variable. The coefficient of determination criterion is calculated only for the dependent variable of the model, and in the case of the independent variable, the value of this criterion is zero. The higher the coefficient of determination value related to the dependent variable of the model, the better the model fit. Chin (1998) introduces three values of 0.19, 0.35, and 0.67 as the criterion value for weak, medium, and strong R2 values. If the structures of a given internal path model explain an endogenous latent variable (dependent variable) with a few (one or two) exogenous latent variables, the coefficient of determination is acceptable at a moderate level, but if the endogenous latent variable depends on several exogenous latent variables, the coefficient of determination variable must be at a significant level. Table 5 shows the value of the coefficient of determination of the dependent variable of the study. As can be seen, the values of the coefficient of determination of the research variables have a strong coefficient of determination value for the research variables.

Q2 criterion: Another method for evaluating the structural model is to examine the ability of the model to predict. The dominant criterion for the predictive relationship is the Q2 index. This criterion, which is usually measured using the BF method, claims that the model should be able to provide a prediction of the determinants of the endogenous latent variable. It should be noted that the BF method is only used for the endogenous latent variable that is operationalized as a reflective measurement model. Accordingly, if the value of Q2 for a dependent variable is zero or less than zero, it indicates that the relationships between

the other variables of the model and that dependent variable are not well determined. In other words, if this value is greater than zero for a given endogenous latent variable, their independent variables have a predictive relationship. Regarding the intensity of the predictive power of the model, three values of 0.02, 0.15 and 0.35 have been determined, which respectively indicate the weak, medium and strong predictive power of the model for that variable. Considering the Q2 value obtained for the dependent variables of the model shown in Table 6, it is clear that the predictive power of the model for the dependent variable is at a strong level.

Evaluation of the overall model

The overall model includes both the measurement and structural model parts, and by confirming its fit, the fit examination in a model is complete. For the overall fit of the model, only one criterion is used as GoF (Goodness of Fit Index). Given that this index is partially dependent on the shared mean, then this index can also be used conceptually when the measurement model is of the reflective type.

Table 5. Coefficients of determination and co-efficients of dependent variables of the model

Variable	R2	Shared Value	Redundancy
Green human resource capital	-	0.969	-
Green structural capital	-	0.989	-
Green relational capital	-	0.980	-
Eco-product innovation	0.983	0.976	0.982
Green transformation leadership	-	0.972	-
Green competitive advantage	0.998	0.984	0.998
Average	0.998	0.978	0.998

Also, the coefficient of determination was measured by the researcher to examine the fit of the structural model and the Q2 criterion for the predictive power of the model, and the GOF criterion was used to measure the overall model, which is shown in Table 6.

Table 6. Report on R2 criterion, Q2 criterion and GOF criterion

Variable	R squares	Q^2	GOF
Environmental product innovation	0.983	0.888	0.988
	0.998	0.916	

The GOF value for the model of this study is calculated to be 0.988, which indicates a strong and very appropriate overall fit of the model. Given the strong fit of the overall model, we can now examine the research hypotheses.

Testing the model hypotheses

The present study has twelve hypotheses:

Hypothesis 1: Green human resource capital has an effect on green competitive advantage in a medical equipment manufacturing company.

H0: Green human resource capital has no effect on green competitive advantage in a medical equipment manufacturing company.

H1: Green human resource capital has an effect on green competitive advantage in a medical equipment manufacturing company.

The significance number of the first hypothesis is 2.770 and this value is greater than 1.96. Therefore, H0 is rejected and hypothesis H1, which examined the direct and significant effect of green human resource capital on green competitive advantage in a medical equipment manufacturing company, is confirmed. The standard coefficient related to the relationship between green human resource capital and green competitive advantage in a medical equipment manufacturing company is 0.527. Therefore, the research hypothesis is confirmed.

Hypothesis 2: Green structural capital has an effect on green competitive advantage in a medical equipment manufacturing company.

H0: Green structural capital has no effect on green competitive advantage in a medical equipment manufacturing company.

H1: Green structural capital has an effect on green competitive advantage in a medical equipment manufacturing company.

The significance number of the second hypothesis is 9.420 and this value is greater than 1.96, so H0 is rejected and hypothesis H1, which examined the direct and significant effect of green structural capital on green competitive advantage in a medical equipment manufacturing company, is confirmed. The standard coefficient related to the relationship between green structural capital and green competitive advantage in a medical equipment manufacturing company is 0.922. Therefore, the research hypothesis is confirmed.

Third hypothesis: Green relational capital has an effect on green competitive advantage in a medical equipment manufacturing company.

H0: Green relational capital does not have an effect on green competitive advantage in a medical equipment manufacturing company.

H1: Green relational capital has an effect on green competitive advantage in a medical equipment manufacturing company.

The significance number of the third hypothesis is 4.541 and this value is greater than 1.96, so H0 is rejected and hypothesis H1, which examined the direct and significant effect of green relational capital on green competitive advantage in a medical equipment manufacturing company, is confirmed. The standard coefficient related to the relationship between green relational capital and green competitive advantage in a medical equipment manufacturing company is 0.634. Therefore, the research hypothesis is confirmed.

Hypothesis 4: Green human resource capital has an effect on environmental product innovation in a medical equipment manufacturing company.

H0: Green human resource capital does not have an effect on environmental product innovation in a medical equipment manufacturing company.

H1: Green human resource capital has an effect on environmental product innovation in a medical equipment manufacturing company.

The significance number of the fourth hypothesis is 3.078, and this value is greater than 1.96. Therefore, H0 is rejected and hypothesis H1, which examined the direct and significant effect of green human resource capital on environmental product innovation in a medical equipment manufacturing company, is confirmed. The standard coefficient related to the relationship between green human resource capital and environmental product innovation in a medical equipment manufacturing company is 0.854. Therefore, the research hypothesis is confirmed.

Hypothesis 5: Green structural capital has an effect on environmental product innovation in a medical equipment manufacturing company.

H0: Green structural capital has no effect on environmental product innovation in a medical equipment manufacturing company.

H1: Green structural capital has an effect on environmental product innovation in a medical equipment manufacturing company.

The significance number of the fifth hypothesis is 185.5 and this value is greater than 1.96, so H0 is rejected and hypothesis H1, which examined the direct and significant effect of green structural capital on environmental product innovation in a medical equipment manufacturing company, is confirmed. The standard coefficient related to the relationship between green structural capital and environmental product innovation in a medical equipment manufacturing company is 0.445. Therefore, the research hypothesis is confirmed.

Hypothesis Six: Green relational capital has an effect on environmental product innovation in a medical equipment manufacturing company.

H0: Green relational capital does not have an effect on

environmental product innovation in a medical equipment manufacturing company.

H1: Green relational capital has an effect on environmental product innovation in a medical equipment manufacturing company.

The significance number of the sixth hypothesis is 769.8 and this value is greater than 1.96, so H0 is rejected and hypothesis H1, which examined the direct and significant effect of green relational capital on environmental product innovation in a medical equipment manufacturing company, is confirmed. The standard coefficient of the relationship between green relational capital and environmental product innovation in a medical equipment manufacturing company is 0.488. Therefore, the research hypothesis is confirmed.

Hypothesis 7: Green human resource capital has an effect on green competitive advantage in a medical equipment manufacturing company with the mediating variable role of environmental product innovation.

H0: Green human resource capital has no effect on green competitive advantage in a medical equipment manufacturing company with the mediating variable role of environmental product innovation.

H1: Green human resource capital has an effect on green competitive advantage in a medical equipment manufacturing company with the mediating variable role of environmental product innovation.

The z value was 41.13, which is greater than 1.96, and it can be stated that at a 95% confidence level, the effect of the mediating variable of environmental product innovation on the relationship between green human resource capital and green competitive advantage in a medical equipment manufacturing company is significant. Therefore, the seventh hypothesis of the study is accepted. This means that approximately more than 44% of the total effect of green human resource capital on green competitive advantage in a medical equipment manufacturing company is explained indirectly by the mediating variable of environmental product innovation.

Hypothesis 8: Green structural capital has an effect on green competitive advantage in medical equipment manufacturing companies with the role of the mediator variable of environmental product innovation.

H0: Green structural capital has no effect on green competitive advantage in medical equipment manufacturing companies with the role of the mediator variable of environmental product innovation.

H1: Green structural capital has an effect on green competitive advantage in medical equipment manufacturing companies with the role of the mediator variable of environmental product innovation.

The z value was 23.14, which is greater than 1.96, so it can be stated that at a 95 percent confidence level, the effect of the mediator variable of environmental product innovation on the relationship between green structural capital and green competitive advantage in medical equipment manufacturing companies is significant. Therefore, the eighth hypothesis of the study is accepted. This means that approximately 19 percent of the total effect of green structural capital on green competitive advantage in medical equipment manufacturing companies is explained indirectly by the mediator variable of environmental product innovation.

Hypothesis 9: Green relational capital has an effect on green competitive advantage in a medical equipment manufacturing company with the role of the mediating variable of environmental product innovation.

H0: Green relational capital has no effect on green competitive advantage in a medical equipment manufacturing company with the role of the mediating variable of environmental product innovation.

H1: Green relational capital has an effect on green competitive advantage in a medical equipment manufacturing company with the role of the mediating variable of environmental product innovation.

The z value was 27.56, which is greater than 1.96, so it can be stated that at a 95 percent confidence level,

the effect of the mediating variable of environmental product innovation on the relationship between green relational capital and green competitive advantage in a medical equipment manufacturing company is significant. Therefore, the ninth hypothesis of the study is accepted. This means that approximately more than 27 percent of the total effect of green relational capital on green competitive advantage in a medical equipment manufacturing company is explained indirectly by the mediating variable of environmental product innovation.

Hypothesis 10: Green human resource capital has an effect on environmental product innovation in a medical equipment manufacturing company with the role of the moderating variable of green transformation leadership.

H0: Green human resource capital has no effect on environmental product innovation in a medical equipment manufacturing company with the role of the moderating variable of green transformation leadership.

H1: Green human resource capital has an effect on environmental product innovation in a medical equipment manufacturing company with the role of the moderating variable of green transformation leadership.

In examining the effects of the green transformation leadership variable on the relationship between green human resource capital and environmental product innovation in a medical equipment manufacturing company, as seen in Figure 2; the path coefficient is estimated to be (0.955) and considering that the T-Value is 3.430, it can be concluded that this path coefficient is significant at the 0.05 error level; that is, green transformation leadership moderates the relationship between green human resource capital and environmental product innovation in a medical equipment manufacturing company, so the hypothesis is confirmed.

Hypothesis 11: Green structural capital has an effect on environmental product innovation in a medical equipment manufacturing company with the role of the moderating variable of green transformation leadership.

H0: Green structural capital does not have an effect on environmental product innovation in a medical equipment manufacturing company with the role of the moderating variable of green transformation leadership.

H1: Green structural capital has an effect on environmental product innovation in a medical equipment manufacturing company with the role of the moderating variable of green transformation leadership.

In examining the effects of the green transformation leadership variable on the relationship between green structural capital and environmental product innovation in a medical equipment manufacturing company, as seen in Figure 2; the path coefficient is estimated to be (0.953) and considering that the T-Value is 8.020, it can be concluded that this path coefficient is significant at the 0.05 error level; that is, green transformation leadership moderates the relationship between green structural capital and environmental product innovation in a medical equipment manufacturing company, so the eleventh hypothesis is confirmed.

Hypothesis 12: Green relational capital has an effect on environmental product innovation in a medical equipment manufacturing company with the role of the moderating variable of green transformation leadership.

H0: Green relational capital does not have an effect on environmental product innovation in a medical equipment manufacturing company with the role of the moderating variable of green transformation leadership.

H1: Green relational capital has an effect on environmental product innovation in a medical equipment manufacturing company with the role of the moderating variable of green transformation leadership.

In examining the effects of the green transformation leadership variable on the relationship between green

relational capital and environmental product innovation in a medical equipment manufacturing company, as seen in Figure 2; the path coefficient is estimated to be (0.972) and considering that the T-Value is 2.611, it can be concluded that this path coefficient is significant at the 0.05 error level; that is, green transformation leadership moderates the relationship between green relational capital and environmental product innovation in a medical equipment manufacturing company, so the twelfth hypothesis is confirmed.

Discussion

The results of the present study are consistent with the results of Xin & Wang (2023), and the results of Xin & Wang (2023) show that green intellectual capital contributes positively to green competitive advantage in a medical equipment manufacturing company, and the mediating role of environmental product innovation and the moderating role of green transformational leadership were also statistically significant. Companies spend a lot of time and resources on developing management expertise and training their employees in specific business fields to increase the so-called "mental capacity" of their company. This capital, which is used to increase intellectual capital, provides returns for the company, although it is difficult to quantify, but it is something that can contribute to the value of the business over many years. Apply structures that can drive the job performance of the organization's employees towards achieving the organization's current and future goals. Effective use of competitive advantage allows companies to be sustainable in their industry in the long term and achieve greater efficiency. Therefore, creating and maintaining this type of advantage is proposed as a fundamental strategic goal for companies. Innovation is understood as an important need that should be implemented in a way that also considers social and environmental issues. Improve environmental performance by providing various types of innovation, which can take the form of new products, new production processes or new methods, new markets or even new sources of supply. Organizational management should not only accept prescriptive models and conscious strategies, but also examine organizational growth through low environmental impact activities. By studying the market and fully understanding the needs and demands of customers, and by studying competitors and analyzing the industry, identify your weaknesses and strengths and develop appropriate strategies to attract and retain customers. And by updating technologies and using them in your products and services, you can be present in the market more quickly and leave your competitors behind. It is suggested to direct their activities towards export markets. Because due to the intensity of high competition, technological changes, government regulatory controls and market turmoil, the possibility of inconsistency between the company's products and the needs of export customers increases. Therefore, only companies that have been able to deal with this inconsistency have been able to direct their activities towards export markets to compensate for the perceived environmental uncertainty. It is proposed that competitive strategy focus on cost leadership, marketing differentiation, and delivery differentiation because competitive strategy refers to the superiority of a relative position in the market that allows the company to outperform its competitors. Competitive strategy and cost are focused as a means to achieve competitive advantage. A company can achieve a differentiation advantage as long as customers consider the products offered by that company to be superior to those of its competitors. Also, a company achieves a cost advantage as long as a company can offer a similar product at a lower price than its competitors. Domestic and foreign activities should be expanded because the growth of international economies and the increase in international marketing activities in many industrial companies depend on activities related to international marketing, and international performance also depends on these

domestic and foreign activities. Technology turbulence should be reduced because it represents a response to technological instability and the acceleration of innovation, which causes companies to change their path to respond to this turbulence. Technology stages should be coordinated, strategic, and integrated in the form of information technology as a support for business needs, separated from other activities. Officials should have a systemic view of international marketing because the development of small and medium-sized enterprises and their entry into international markets in the country requires a systemic view of officials on international marketing, so that economic, cultural, social, and regulatory factors related to international markets are taken into account simultaneously and all dimensions are considered in formulating policies for the development of small and medium-sized enterprises. Researchers always face limitations in their research.

1. Lack or absence of accessible and usable scientific resources: There are very few and limited scientific resources (at least in Persian) in this field that are directly related to the subject of study and research. For this reason, I need to use Latin resources, which itself brings other problems such as limited time to use the Internet in the faculty, correct translation of Latin texts into Persian and their unification.
2. Lack of similar work in this field: Despite the researcher's great efforts, he was unable to find a study that directly addresses this issue.
3. Lack of necessary budget to carry out and advance the work: Every research work requires financial expenses at its various stages, which student research is certainly not exempt from due to the researcher's special circumstances.
4. Lack of appropriate cooperation in administrative departments and institutions as well as officials
5. Uncertainty about the accuracy of the answers given to the questionnaire questions by the study population.
6. Uncertainty about the correct and common understanding and interpretation of the respondents of the questionnaire questions.
7. Lack of familiarity and complete information about the subject by the selected individuals in the statistical population.

Conclusions

The present study aims to investigate the effect of green intellectual capital on green competitive advantage in a medical equipment manufacturing company with the role of a mediating variable of environmental product innovation and a moderating variable of green transformation leadership. The present study shows that green human resource capital, green structural capital and green relational capital have an effect on green competitive advantage in a medical equipment manufacturing company. Green human resource capital, green structural capital and green relational capital have an effect on green competitive advantage in a medical equipment manufacturing company with the role of a mediating variable of environmental product innovation. Green human resource capital, green structural capital and green relational capital have an effect on green competitive advantage in a medical equipment manufacturing company with the role of a moderating variable of green transformation leadership.

Conflict of interests

No conflict.

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