Investigation of the moderating role of environmental strategies and technical innovation performance in the relationship between innovativeness and competitiveness

Majid Dastafshan[1], Shahnaz Nayebzadeh[2*], Mahmoud Moeinadin[3]

[1]Department of Management, Sirjan Branch, Islamic Azad University, Sirjan, Iran
[2*]Department of Management, Yazd Branch, Islamic Azad University, Yazd, Iran.
Corresponding Author: Snayebzadeh@iauyazd.ac.ir
[3]Department of Accounting, Yazd Branch, Islamic Azad University, Yazd, Iran

Abstract: *The present study aims to investigate the moderating role of environmental strategies and technical innovation performance in the relationship between innovativeness and competitiveness. The research model has been formed by the variable of "innovativeness" as independent variable; "environmental strategies" and "technical innovation performance" as mediator variables; and "competitiveness" as the dependent variable. In terms of objective, this is an applied study and in terms of method, this is a correlational study and the required data have been collected using questionnaires and survey methods. The statistical population of this study consists of Yazd textile factories and companies and related industries and simple random sampling method is used. Data analysis is done using LISREL and SPSS softwares. The results show that "innovativeness" influences "competitiveness" by considering the role of "environmental strategies" and "technical innovation performance".*

Keywords: *environmental strategies, technical innovation performance, competitiveness, innovativeness*

INTRODUCTION

Major changes have occurred in markets in recent decades, due to forward progress and developments in technology, IT and communications. These changes make companies and institutions seek solutions to increase and maintain their competitive power. One of the critical elements of success in the competitive world and survival of companies is the ability of their personnel. In business, companies should enhance the ability of their human capitals for being superior to their competitors and attract and retain their customers (Pakdel, 2011). Therefore, today, paying attention to the staff of organizations is the condition of success and survival of organizations in the competitive environment. Indoor environmental management and its development are considered as organizational and managerial strategic necessities; these factors are created through the commitment and support of senior and middle management of organizations (Yee et al., 2008). Previous studies show that perception and attention of a company from the environmental demands of stakeholders are associated with active environmental strategies; thus, companies apply active environmental strategies due to the pressure from interest owners (Olavarrieta & Friedmann, 2007). Customers are more sensitive to environment than the past and expect it also from companies. So they welcome more green products. Accordingly, studies related to eco-friendly activities have increasing necessity and importance.

Environmental proactivity persuades companies to prevent environmental degradation with the continuous development of products, processes and technologies. In this process of continuous adjustment, companies

should apply skills and complementary competencies, but these were not available in previous studies (Gonzalez et al., 2005). As recently Delmas, Hoffman and Cass (2011) pointed out, researchers may have just paid attention to the tip of the iceberg "by studying the relationship between proactive environmental strategies and competitive advantage, independently from more general organizational capabilities of companies". These researchers may have ignored the most basic element of success of proactive environmental strategies. Among these capabilities, the innovativeness can participate in a successful implementation of a proactive environmental strategy. Innovativeness provides the required experience for the production of ideas, new products and operational reforms (Sahi et al., 2013). Business models have attracted increasing attention of researchers in the fields of strategy, competition and technical innovation. This study has emphasized on the impact of business models on technical innovation performance, cause a great number of previous studies have noted the very important effects of business models on the improvement of technical innovation performance. On the other hand, for a successful commercialisation of innovative technology, a suitable business model is required. The lack of a suitable business model reduces the obtained profits of technological innovation and makes companies abolish the application of a new technology. This study investigates the relationship between proactive environmental strategies, capabilities and organizational competitiveness and finally, the main objective is to answer the question whether the innovativeness by considering the role of environmental strategies influences the competitiveness. Exploring the roles of other including factors in this relationship is the other objective of the present study.

2- Theoretical foundations and hypotheses of research
2-1- Innovativeness
Product innovation consists of changes in outputs (including products and services). The innovation means the accomplishment of a new task with a spirit of innovation and transformation. There are necessary and sufficient conditions for considering a product, service or method as innovative. Firstly, they should be new; and secondly, their application should create a significant change in the status quo and also a major impact on the implementation of task (Gounaris, 2006). The term of innovation in technology management is referred to new ideas in processes, products, techniques and methods. The innovated subject is inherently new or it is new just in certain areas. Decisions about technologies and innovations are very strategic and one should face them with a completely systematic approach. Being pioneer in technology requires bearing many costs and risks. For this reason, it is not considered as the best approach for an organization. What attracts innovators and pioneers of technology is the possibility of gaining high profits and benefits from "being the first". If being pioneer in technology promotes the efficiency of the organization in comparison with its other competitors, this will lead to the creation of cost advantages. The time of accepting the technology depends on strategic needs and the existing technological skills in the organization, equal to potential benefits of the new technology (Awwad et al., 2011).

2-2- Technical innovation performance
Decisions about technological innovations should make a balance between many related factors. Not only the most effective approach in technology depends on the ability of technology to support and meet the strategic needs of the organization, but it depends also on the capabilities of organizations in the successful application of technology (Merlo & Auh, 2009).
- Level of market acceptance (expected): Market potential is the first issue in devising a strategy of technological innovations. At the time of the estimation of market demands, executives should determine two things. Firstly, a set of applications should exist in the long term. These applications show that the new technology is a certain means to meet those market needs.
- Technical feasibility: Some technical barriers may interrupt making progresses.
- Economic justification: This case is also closely related to technological feasibility. Executives should consider if the project includes a suitable fiscal stimulus (likely return).
- Development of future competencies: organizations must develop their own strategies based on their axial competencies. This is also true about the technological and innovative strategies.
- Organizational fit: Last cases to consider when deciding about technological innovations are as follows: Culture of the organization, directors' interests, expectations of stakeholders and shareholders. Pioneer organizations in technology choose usually technological strategies based on "aggressive competition" and

"being first". In many cases, executives who are concerned about costs prefer not to work, rather than being in the failure conditions.

According to the aforementioned principles, the first hypothesis is as follows:

Hypothesis (1): Innovativeness influences technical innovation performance.

2-3- Environmental performance

Production managers are responsible for functions of environmental practices of organizations in which they work. In managerial systems, companies should accept to create conditions to reduce environmental damaging impact with value-added processes. Management support of environmental issues and using managerial strategies can change threats caused by environmental issues to competitive opportunities for organizations. Management support of green products or environmental practices will lead to innovations in technologies that have positive effect on energy saving and preventing environmental pollution (Lings et al., 2005). Protective behaviour refers to efforts that are made after the purchase of product or while using it, for the conservation of the nature.

Intention to support is customer's willingness to engage in preserving the integrity of the environment. The willingness to pay additional income tax to protect forests and reducing the use of fossil fuels are items that can be noted. Taiwan's Environmental Protection Agency has offered a plan since 1993 that is based on (GREEN MARK) products. By using this sign, it is hoped that the reuse of the product, less use of environment saved energy and also the encouragement of customers to buy this product increase (Salimian & Jamshidi, 2005). Therefore, it can be argued:

Hypothesis (2): Innovativeness influences environmental strategy.

2-4- Competitiveness

Innovativeness has often been shown as one of the major strategic directions for companies to achieve long-term success. Especially in turbulent and competitive scenarios, the innovation allows companies to respond more quickly to environmental changes and exploit product and market opportunities (Brown & John, 2004). Innovative commercialisation allows organizations to increase the perception of customers from new products and services and this fact has a negative effect on the reactivity of rivals. Also this literature supports empirically the positive effect of innovativeness on organizational results (Kotler et al., 2002). Kalanton et al. (2002) found that innovativeness and learning orientation had positive relationship with competitive advantage. Recently, Jimenez and Sanz-Valle (2011) found that innovativeness in product, process and management has a positive relationship with organizational performance. Unlike Kalanton et al. (2002), they found that the effect of innovativeness on organizational performance is stronger that the effect of learning orientation. In the field of textile companies, Tajeddini (2010) found that innovative textile companies have achieved lower costs and higher quality outputs. Tajeddini and Truman (2012) have also confirmed that innovativeness in the industry of textile companies has positive and significant impact on financial performance and marketing. However, in textile industry, this study is more important, cause few articles have investigated these relationships so far. Thus, it can be said that:

Hypothesis (3): Technical innovation performance influences competitiveness.
Hypothesis (4): Environmental strategy influences competitiveness.
Hypothesis (5): Innovativeness influences competitiveness.

For exploring the mediating role of technical innovation performance and environmental strategies, the following hypotheses were devised and tested:

Hypothesis (6): Innovativeness influences competitiveness, through technical innovation performance.
Hypothesis (7): Innovativeness influences competitiveness, through environmental strategies.

3- Research method
Kind of method
The expected results of the present research can be applied in the improvement process of competitiveness of organizations and also methods of implementing environmental strategies, so it is an applied study. In terms of controlling variables, this is a correlational study and in terms of data collection method, this is a descriptive study. In addition to this, since the present study explores the data related to a certain period of time, so this is a sectional study.

Statistical population and sample
In the present study, the managers of active textile companies in Yazd province have been selected as the statistical population. The simple random sampling method was used. The size of statistical population is equal to 215 and the number of studied samples was 139. In order to achieve a sufficient number of responses, 140 questionnaires were distributed and 139 questionnaires were gathered.

Data collection
For data collection in this study, field method was used and for gathering the data related to research variables, international standard questionnaire with approved validity and reliability, for the period of summer and fall 2015 was used. For ensuring about appropriate and reasonable items of questionnaire, two factors of validity and reliability were used. For examining the reliability of this questionnaire, Cronbach's alpha was used. In this study, Cronbach's alpha coefficient was calculated using SPSS software and the obtained amount is shown in the table below; this amount indicate the acceptable reliability of research tools. For measuring the reliability, Cronbach's alpha method was used. If alpha coefficient is more than 0.7, the questionnaire has an acceptable reliability.

Table 1: Results of reliability calculation of questions related to the questionnaire

Number of questions	Cronbach's alpha	Variable
5	0.811	Innovativeness
4	0.745	Technical innovation performance
26	0.857	Environmental strategies
4	0.809	Competitiveness

The table above shows Cronbach's alpha and number of questions related to the variables of questionnaire. Since the amount of Cronbach's alpha is higher than 0.7, so the questionnaire has an acceptable reliability. For determining the validity, content and face validities were used, so the comments of supervisor and consultant professors were used and when conducting the pilot study, a survey of respondents was done.

Evaluation of variables
The variables of the present study are as follows: Innovativeness as the independent variable; environmental strategies and technical innovation performance as mediator variables; and competitiveness as dependent variable. These variables are shown in the table below:

Table 2: Variables and indices of research

Variable	Number of questions	Reference
Innovativeness	5	Fraj et al.,2015
Technical innovation performance	4	Hu, 2013
Environmental strategies	26	Gonzales-Benito , 2010
Competitiveness	4	Fraj et al.,2015

In this study, for testing variables, international standard questionnaire was used and the data related to variables are obtained in this way.

Data analysis
Investigation of the approval of direct and indirect relationships between variables and factors was done through path analysis and by using univariate and multivariate regression equations. For the classification and analysis of data, EXCEL and SPSS18 softwares were used. Also the mediating role of variables was explored and tested.

4- Research findings
4-1- Tests and analyses related to research hypotheses
In this part, for finding the relationship between variables with path analysis, one univariate regression equation and three multivariate regression equations were used. The results of multivariate regression model for the variables of technical innovation performance as the dependent variable and also the independent variable of innovativeness are as follows:

Table 3: Summarized model

Model	R	Coefficient of determination	Adjusted coefficient of determination	Durbin-Watson statistic	ANOVA	
					F	Sig.
1	0.808	0 .653	0.647	1.843	126.804	0.000

Table 4: Regression coefficients

Model	Unstandardized coefficients		Standardized coefficients	t	Sig.	Collinearity statistics	
	B	Standard error	Beta			Tolerance	VIF
(Constant)	0.382	0.184	-	2.080	0.039	-	-
Innovativeness	0.443	0.072	0.456	6.143	0.000	0.467	2.142

Significance level is obtained (0.000) which is less than 0.05, so the linear regression equation is significant. Also according to the coefficient of determination, it can be said that only 65% of changes in the response variable (dependent) can be expressed by predictive variables (independent). Durbin-Watson statistic for this model is near to 2 and represents the randomness of the residuals. In the resulting output of the table, coefficients of the linear regression equation and also test are 0. According to the significance level of the variables of organizational learning and innovativeness that is less than 0.05, it becomes clear that in the confidence level of 95%, the coefficient of variables in the regression equation is significant. Also according to the standardized coefficients, the variables of innovativeness (0.456) and organizational learning (0.412) have respectively had the most effect on the variable of technical innovation performance. According to the statistics of collinearity, the amount of the statistic VIF related to variables is 2.142 which is less than 5. So, there is no collinearity.
The results of multivariate regression for the variable of environmental strategy as dependent variable and independent variable of innovativeness are as follows:

Table 5: Summarized model

Model	R	Coefficient of determination	Adjusted coefficient of determination	Durbin-Watson statistic	ANOVA	
					F	Sig.
1	0.826	0 .682	0.677	1.579	144.765	0.000

Table 6: Regression coefficients

Model	Unstandardized coefficients		Standardized coefficients	t	Sig.	Collinearity statistics	
	B	Standard error	Beta			Tolerance	VIF
(Constant)	0.419	0.173	-	2.414	0.017	-	-
Innovativeness	0.498	0.068	0.519	7.309	0.000	0.467	2.142

Significance level is obtained (0.000) which is less than 0.05, so the linear regression equation is significant. Also according to the coefficient of determination, it can be said that only 68% of changes in the response variable (environmental strategies) can be expressed by predictive variables (organizational learning and innovativeness). Durbin-Watson statistic for this model is near to 2 and represents the randomness of the residuals. In the resulting output of the table, coefficients of the linear regression equation and also test are 0. According to the significance level of the variables of organizational learning and innovativeness that is less than 0.05, it becomes clear that in the confidence level of 95%, the coefficient of both variables in the regression equation is significant. Also according to the standardized coefficients, the variables of innovativeness (0.519) and organizational learning (0.367) have respectively had the most effect on the variable of environmental strategies. According to the statistics of collinearity, the amount of the statistic VIF related to variables is 2.142 which is less than 5. So, there is no collinearity.

The results of multivariate regression for the variable of competitiveness as dependent variable and independent variables of technical innovation performance, environmental strategies and innovativeness are as follows:

Table 7: Summarized model

Model	R	Coefficient of determination	Adjusted coefficient of determination	Durbin-Watson statistic	ANOVA	
					F	Sig.
1	0.827	0 .684	0.675	1.929	72.109	0.000

Table 8: Regression coefficients

Model	Unstandardized coefficients		Standardized coefficients	t	Sig.	Collinearity statistics	
	B	Standard error	Beta			Tolerance	VIF
(Constant)	0.655	0.167	-	3.929	0.000	-	-
Technical innovation performance	0.284	0.088	0.308	3.221	0.002	0.260	3.849
Environmental strategy	0.223	0.093	0.239	2.392	0.018	0.238	4.204
Innovativeness	0.107	0.077	0.119	1.386	0.168	0.321	3.119

Significance level is obtained (0.000) which is less than 0.05; so, the linear regression equation is significant. Also according to the coefficient of determination, it can be said that 68% of changes in the response variable (competitiveness) can be expressed by predictive variables (independent). Durbin-Watson statistic for this model is near to 2 and represents the randomness of the residuals. In the resulting output of the table, coefficients of the linear regression equation and also test are 0. According to the significance level of the

variables that is less than 0.05, it becomes clear that in the confidence level of 95%, the coefficients of the variables of organizational learning, technical innovation performance and environmental strategy in the regression equation are significant. Also according to the standardized coefficients, the variables of technical innovation performance (0.308), organizational learning (0.240) and environmental strategies (0.239) have respectively had the most effect on the variable of competitiveness. According to the statistics of collinearity, the most amount of VIF statistic is related to the variable of environmental strategies (4.2) and less than 5. So there is no collinearity.

4-2- Hypotheses of the main model
Now, by using the amount of t statistic and the standard coefficient, we explore the effect of each of independent variables on dependent variable based on the model.

Hypothesis (1): Innovativeness influences technical innovation performance.

Table 9: For hypothesis 2

Coefficient	t statistic	Significance level	Standardized coefficient
0.443	6.143	0.000	0.456

According to the amount of the absolute value of t statistic (6.143) that is more than 1.96 and the significance level (0.000) that is less than 0.05, the H0 is rejected. It means that in confidence level of 95%, innovativeness has significant impact on technical innovation performance and the amount of this impact is 0.456 and it is positive (direct). Therefore, it can be concluded that by increasing the level of innovativeness, the level of technical innovation performance will also increase.

Hypothesis (2): Innovativeness influences environmental strategies.

Table 10: For hypothesis 4

Coefficient	t statistic	Significance level	Standardized coefficient
0.498	7.309	0.000	0.519

According to the amount of the absolute value of t statistic (7.309) that is more than 1.96 and the significance level (0.000) that is less than 0.05, the H0 is rejected. It means that in confidence level of 95%, innovativeness has significant impact on environmental strategies and the amount of this impact is 0.519 and it is positive (direct). Therefore, it can be concluded that by increasing the level of innovativeness, the level of environmental strategies will also increase.

Hypothesis (3): Technical innovation performance influences competitiveness.

Table 11: For hypothesis 7

Coefficient	t statistic	Significance level	Standardized coefficient
0.284	3.221	0.002	0.308

According to the amount of the absolute value of t statistic (3.221) that is more than 1.96 and the significance level (0.002) that is less than 0.05, so the H0 is rejected. It means that in confidence level of 95%, technical innovation performance has significant impact on competitiveness and the amount of this impact is 0.31 and it is positive (direct). Therefore, it can be concluded that by increasing the level of technical innovation performance, the level of competitiveness will also increase.

Hypothesis (4): Environmental strategy influences competitiveness.

Table 12: For hypothesis 8

Coefficient	t statistic	Significance level	Standardized coefficient
0.223	2.392	0.018	0.239

According to the amount of the absolute value of t statistic (2.392) that is more than 1.96 and the significance level (0.018) that is less than 0.05, the H0 is rejected. It means that in confidence level of 95%, environmental strategy has significant impact on competitiveness and the amount of this impact is 0.239 and it is positive (direct). Therefore, it can be concluded that by increasing the level of environmental strategies, the level of competitiveness will also increase.

Hypothesis (5): Innovativeness influences competitiveness.

Table 13: For hypothesis 9

Coefficient	t statistic	Significance level	Standardized coefficient
0.107	1.386	0.168	0.119

According to the amount of the absolute value of t statistic (1.386) that is less than 1.96 and the significance level (0.168) that is more than 0.05, so the H0 is not rejected. It means that in confidence level of 95%, innovativeness has no significant impact on competitiveness.

Hypothesis (6): Innovativeness influences competitiveness, through technical innovation performance.

Table 14: For hypothesis 10

	Path	Estimation	t statistic	S.E	Standardized coefficient
1	Innovativeness → Technical innovation performance	0.443	6.143	0.072	0.456
2	Technical innovation performance → Competitiveness	0.284	3.221	0.088	0.308

According to the table above, for path 1, the amount of the absolute value of t statistic is 6.14 and more than 1.96. Therefore, innovativeness has significant impact on technical innovation performance. On the other side, for path 2, the amount of the absolute value of t statistic is 3.22 and more than 1.96. So technical innovation performance has significant impact on competitiveness.

Table 15: For Sobel test

Standard indirect effet	Indirect effect	Significance level of p	S.E	Statistic of Z test
0.14	0.126	0.004	0.044	2.858

According to the statistic of Sobel test (2.858) and significance level (0.004) that is less than 0.05, so the H0 is rejected. Therefore, since the relationship between innovativeness and competitiveness in the model is not significant, the variable of technical innovation performance plays completely the role of mediator and its indirect effect is equal to 0.14. Thus, in confidence level of 95%, innovativeness influences competitiveness, through technical innovation performance.

Hypothesis (7): Innovativeness influences competitiveness, through environmental strategies.

Table 16: For hypothesis 11

	Path	Estimation	t statistic	S.E	Standardized coefficient
1	Innovativeness → Environmental strategies	0.498	7.309	0.068	0.519
2	Environmental strategies → Competitiveness	0.223	2.392	0.093	0.239

According to the table above, for path 1, the amount of the absolute value of t statistic is 7.31 and more than 1.96. Therefore, innovativeness has significant impact on environmental strategies. On the other side, for path 2, the amount of the absolute value of t statistic is 2.39 and more than 1.96. So environmental strategy has significant impact on competitiveness.

Table 17: For Sobel test

Standard indirect effet	Indirect effect	Significance level of p	S.E	Statistic of Z test
0.124	0.111	0.023	0.049	2.279

According to the statistic of Sobel test (2.279) and significance level (0.023) that is less than 0.05, the H0 is rejected. Therefore, since the relationship between innovativeness and competitiveness in the model is not significant, the variable of environmental strategies plays completely the role of mediator and its indirect effect is equal to 0.12. Thus, in confidence level of 95%, innovativeness influences competitiveness, through environmental strategies.

Discussion and conclusion

The results showed that the variables of technical innovation performance, organizational learning and environmental strategies have respectively the most effect on the variable of competitiveness; also the variable of innovativeness in organizational learning has the most effect on the variables of environmental strategies and technical innovation performance. In this study, technical innovation performance is considered as influenced by environmental strategies. In textile industry, this issue is more important cause this industry should enhance its innovative performance more than other industries, due to the need to the improvement of technical and technological capabilities. This can be an interesting finding of the present study.

Like in all industries, in textile industry, activities in the field of environmental protection have been started and this can be observed in studied sample of the present research. Certainly in today's world that environmental responsibility of companies has raised more than before, environmental measures can be effective in promoting corporate reputation. Customers have more tendencies to be green and also use green products and in addition to companies, people also assume the responsibility to protect the environment. Unfortunately, in the present study, the relationship between environmental measures and competitiveness was not confirmed. The reason can be the lack of a great difference between surveyed companies in terms of eco-friendly activities that could influence the competitive positions of these companies in the present financial crisis of the country.

Suggestions based on obtained results of the present study

It is recommended to managers of active companies in textile industry to provide necessary fields for the improvement of the position of company in public opinion. Sometimes, eco-friendly activities can have

substantial contribution to profit earning by saving different costs. Usually Activities like paying attention to recycling, planting trees in company yard and like this do not cost too much.

Since the innovation is the condition of survival of companies that work in today's competitive world, so it is suggested to all active staff in this market, especially in textile industry to pay attention to enhance their skills and capabilities through learning and provide for themselves, the requirements for being more creative and having an open and dynamic mind. This ability is effective in the competitiveness of active companies in this industry.

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