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Procedia - Social and Behavioral Sciences 195 (2015) 1232 – 1237

Procedia
Social and Behavioral Sciences

World Conference on Technology, Innovation and Entrepreneurship

Positive Influences of Green Innovation on Company Performance

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Abstract

This study aims to examine the effects of green innovation on environmentally sensitive company performance. Here, green innovation includes green product and process sub-dimensions and environmentally efficient company performance has also two sub-dimensions as environmental performance and competitive advantage of company through its green facilities. In order to find out relationship between green innovation and environmentally sensitive company performance a survey was performed among companies which present first 500 companies with their turnover according to Istanbul Chamber of Industry's records. With gathered data from survey study, correlation and regression analyses were conducted. Moreover, to detect if there is any difference according to company characteristics, some further analyses were performed. Results of this study states that, green innovation activities have significant effect on a company's environmental performance and competitive advantage. Especially, green process innovation explains changes on environmental performance and competitive advantage. Any green difference of company's basic processes not only reduces company's environmental effects but also moves the company to a better position among its competitors.

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Peer-review under responsibility of Istanbul Univeristy.

Keywords: competitive advantage; environmental performance; green innovation; ISO500 companies

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1. Introduction

Today's competitive world, green innovation attracts increased attention of companies which aim high market ratios and competitive advantage. Specially, manufacturing companies focus on new product designs that enable lower energy consumption during its usage by consumer, minimum waste after consumption or no hazardous material including. These all examples show tendency of companies regarding environmental care and protection. Companies also pay attention to their processes in terms of environmental respect. They seek any solutions to decrease material and energy usage during production phase or recycling of used material and decreasing waste and disposals material after production activities.

Companies recognized importance of environmental protection which also has some advantages to companies beside its benefits to environment. With green applications both in their products and processes, companies have cost advantages or gain customer attention specially from whom places value to environmental issues. From different perspectives, green innovation develops not only environmental performance of company but also provides competitive advantage. Purpose of this study is to state effect of green innovation activities on a companies' green performance which includes both environmental performance and competitive advantage of a firm.

2. Literature Review And Hypotheses

2.1. Innovation and Green Innovation

One of the oldest definitions of innovation is made in 1939 by Schumpeter. According to this definition, innovation is not an invention or development, it is application of technical or organizational novelty (Larsen, 2005). Innovation is defined as realization new or highly improved product or process on organizational applications, a new marketing method or a new organizational method in Oslo Manual published by OECD (OECD, 2005). In any industry (Larsen, 2005); generation, development and adaptation of a new idea or behavior for a company (Damanpour, 1996), successful application of a product or process at the first time (Cumming, 1998) is defined as innovation. According to innovation area, OECD made an innovation grouping on four elements. These are classified as product innovation, process innovation, organizational innovation and marketing innovation (OECD, 2005).

Green innovation facilities are subgroup of general innovation facilities and defined as development of environmental quality or optimum usage of natural resources (Rave, Goetzke & Larch, 2011). In order to define innovation type which occurred to decrease negative effects to environment, different definitive words or concepts are mostly used within the literature such as; green, eco, environmental or sustainable (Schiederig, Tietze & Herstatt, 2011). Although, depending on applied innovation type, green innovation tends to come out when environmental pressures exist (Huber, 2008). Green innovation aims generally, decrease of pollution, energy productivity, decrease of waste, substitution of limited resources with sustainable resources and recycling (Kemp & Arundel, 1998). Green innovation facilities play a key role in company's environmental performance results and comprehensive environmental sustainability realization (Rave, Goetzke & Larch, 2011).

Green innovation is categorized in three types according to its application method and potential effects (Ramus, 2002):

- Green innovation that decreases environmental effects of company (re-usage and recycling)
 - Green innovation that solves environmental problems of company (decreasing usage of hazardous components)
 - Green innovation that develops environmental friendly/effective products/processes (less resource / energy using)
- *Green Product Innovation*

Having a strategic priority today's business cycle green product innovation has been formed as a result of interaction between sustainability and innovation (Dangelico & Pujari, 2010). Either it comes out with some big improvements to current products or changes on materials, components and other characteristics which better the performance (Tübitak, n.d.). Some examples for green product innovation activities are such as; decrease of toxic components within products, decrease of emissions and energy consumption during product usage, increase of useful life of products, including of recycling schemes for products (Dangelico & Pujari, 2010) which can be a differentiation tool for marketing activities and can enable market share continuation (Rave, Goetzke & Larch, 2011). Green product innovation also means developing of products that have positive effects or less negative effects to the environment during their lifecycle (Durif, Bolvin & Julien, 2010).

- *Green Process Innovation*

Green process innovations, which have direct relationship with company's internal productivity, are more difficult than green product innovations to recognize by customers.

With green process innovation activities, companies aim to reduce environmental effects with a development on current production facilities or adding some new processes (Cheng, Yang & Sheu, 2014). Using different kinds of technologies on green process innovations, companies try to reach targets regarding pollution decrease, waste management, water and raw material retention and production efficiency (Shrivastava, 1995). Consequently, green process innovation interested in mostly energy saving, pollution prevention, waste recycling or hazardous materials prevention (Chen Lai & Wen, 2006).

Generally, approaches of companies on environmental management are branching of two categories as; controlling and prevention approaches (Fernandez, Junquera & Ordiz, 2003; Azzone & Noci, 1998). Pollution control approach is defined as eliminating pollution factors after their existence using various technologies (Çevre ve Orman Bakanlığı, n.d.). On the other hand, pollution prevention approach proposes to design and practice production systems of producers as creating no waste and minimizing environmental effects (Yüksel, 2003).

There are also several strategies regarding environmental actions and applications. Pioneer companies see environmental protection as an opportunity resource rather than a problem that needs to be solved with minimum cost. Some companies do not get into action if they feel no pressure from outside (Del Brio & Junquera, 2003). There are miscellaneous classifications in the literature for companies according to degree of their social responsibilities and environmental consciousness such as reactive, effective, pioneer companies (Küskü, 2001) or evangelist, proactive, consistent, reactive and passive companies (Azzone & Noci, 1998). Moreover, rather than classifying companies some authors split up their strategies on environmental management as; passive strategies that resistant to change, supposing environmental subjects as a cost matter and so missing some new opportunities, active strategies that show activity to agree with environmental regulations and laws and lastly proactive strategies that paying attention to targets regarding environment and developing themselves on this issue as using talents and responsibilities accompanying all divisions within a company, combining eco-efficiency and continuous development processes of company and total quality management (Borri & Boccaletti, 1995).

2.2. Environmentally Sensitive Company Performance

Company performance, affected from several factors, is measured with different business outputs on various studies. These outputs can be either economical result such as profit margin, increase of income, new investments or some kinds of different kinds of characteristics which cannot be measured as certainly.

Evaluating company performance as taking into account its sensitivity to environment and environmental management approach, we can call that performance as environmentally sensitive company performance. It has two dimensions; environmental performance and competitive advantage.

In literature, there are some studies investigating about relationship of green innovation performance of companies with their environmental performance and competitive advantage. According to these studies, green product and process innovation performance of a company has a positive effect on competitive advantage (Chen, Lai & Wen, 2006; Chang, 2011). Moreover, green innovation has a positive relationship with green performance and environmental performance is an important dimension of green performance (Conding & Habidin, 2012). According to another study, which investigates green innovation within green supply chain management, making conscious of suppliers effects green innovation positively and also green innovation has an effect on environmental performance and competitive advantage (Chiou, Chan, Lettice & Chung, 2011). Consequently, green innovation effects environmentally sensitive company performance positively. (Cheng, Yang & Sheu, 2014; Lin, Tan & Geng, 2013).

2.3. Research Hypotheses

In this study below two hypotheses were developed:

- H1: Green innovation has a positive effect on environmental performance of company
- H2: Green innovation has a positive effect on competitive advantage of company

In order to test these hypotheses, below research model is presented.

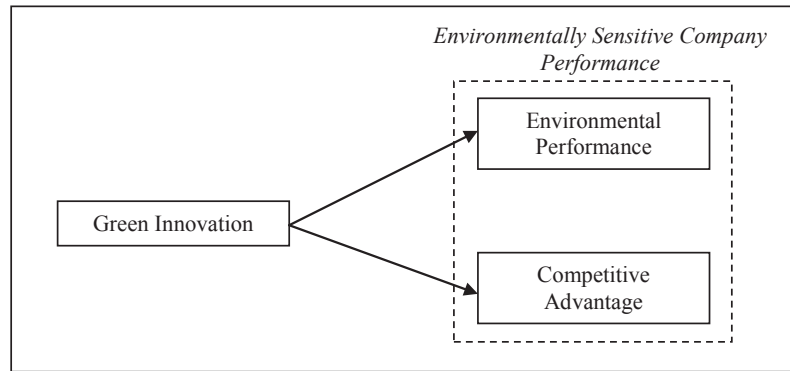


Fig. 1. Research model.

Additionally, it was searched if there is any difference on variables according to some characteristics such as having an environmental reward, respondents division in the company, industry of the company, duration of ISO14001 certificate of company.

3. Methodology

3.1. Research Goal

This study aims to identify the effect of green innovation on environmentally sensitive company performance which includes environmental performance and competitive advantage of a company. In order to get this target a survey study was conducted among Turkish companies.

3.2. Sample and Data Collection

A survey study was performed among companies which present first 500 companies of Turkey and have some common characteristics such as; getting their income from production facilities, having their activities in Turkey, having ISO 14001 environmental management system certificate and having been in the first 500 company list of Istanbul Chamber of Industry during the last three years. According to these common criteria company quantity was obtained as 224 which presents population of this study.

As reaching to all companies, a questionnaire was send by mail. It was targeted that only one division manager operating in production, R&D, quality or environment & safety departments or general manager from each company to fill in the questionnaire. Survey study was completed with participation of 162 companies in total. Data obtained from those 162 companies were analysed through the SPSS statistical program and proposed hypotheses were tested through correlation and regression analyses.

3.3. Analyses and Results

Questionnaire is formed from three parts. First part includes descriptive information such as gender and division of respondents, size of the company according to employee quantity, sector of the company, ISO 14001 ownership years and information about if the company has a reward regarding its environmental activities or not. According to survey results, %75 of respondents are male, %69 of respondents are working in sustainability, environment & safety, R&D or quality departments. %63 of companies are big sized company (251-2000 employees) and %28 of them are very big sized company (over 2000 employees). On the other hand, %69 of companies are belong to automotive, construction, chemical or energy industries. %72 of companies have ISO 14001 certificate more than 5 years. Also, %56 of companies has an environmental award.

Second and third parts of questionnaire have items about green innovation and environmentally sensitive company performance, respectively. To measure green innovation, 13 item-scale adopted from Chen, Lai & Wen (2006) and Chiou, Chan, Lettice & Chung (2011) is used. Company performance scale is adopted from Condong & Habidin (2012); Lin, Tan & Geng (2012); Chang (2011); Chen, Lai & Wen (2006) and Chiou, Chan, Lettice & Chung (2011), which uses 15 items to measure two

dimensions (environmental performance and competitive advantage) of company's green performance. Overall, questionnaire has 28 items in total with 5 likert-type scale in order to measure variables green innovation and company performance.

Before correlation and regression analyses, validity and reliability analyses were performed. According to factor analyses result; green innovation scale had two sub- dimensions as green product innovation and green process innovation and after deleting some items scale was presented with 9 items. The Cronbach's alpha was also calculated for each variable. The Cronbach's alpha of "green innovation" is 0.855, "environmental performance" is 0.882 and "competitive advantage" is 0.925. For each variable, value of Cronbach's alpha coefficient is greater than 0.7 and acceptable according to Hair et al. (1998).

The Pearson correlation analysis was conducted in order to indicate relationships between variables. Table 1 shows the results of correlation analysis. According to analysis results, there is generally positive, statistically significant, medium or high correlation between green innovation and both environmental performance and competitive advantage. In detail, when there is high correlation between green process innovation and environmental performance, on the other hand, there is poor correlation between green product innovation and competitive advantage.

Table 1. Correlation coefficient matrix

Pearson Correlation Analysis Results	Environmental performance	Competitive advantage
Green innovation	.759*	.562*
-Green product innovation	.589*	.424*
-Green process innovation	.733*	.553*

*Correlation coefficient is significant at the 0.01 level

Regression analysis results show that green innovation explains %57,3 of change in environmental performance of a company and %31,1 of change in competitive advantage. The effect of green innovation on environmental performance is higher than competitive advantage. Both hypotheses are supported. On the other hand, we looked also green product and green process innovations' effects on both environmental performance and competitive advantages separately with multiple regression analysis. According to correlation analysis results, firstly green process innovation and after both sub-dimensions were added to analysis. Green process innovation explains % 53,4 of environmental innovation and %30,1 of competitive advantage unaccompanied by green product innovation. Hence, green process innovation has much more importance than green product innovation on environmentally sensitive company performance sub-dimensions same as environmentally sensitive company performance.

Table 2. Regression analysis results

Dependent variables	Environmental performance	Competitive advantage
Independent variable: Green innovation		
R ²	.575	.316
Adjusted R ²	.573	.311
F	216,789	73,780
Sig.	.000	.000

Lastly, we performed t-test and Anova analysis in order to find out any difference on variables according to; environmental reward ownership of company, respondents' department within the company, company's industry and duration of ISO14001 certificate of company. For environmental ownership situation, there is no difference on green innovation or environmental performance; however rewarded companies' competitive advantage average is higher than companies which have no reward about their environmental success. For respondents' department there is no significant difference on any variables. According to company's industry there is no significant difference on environmental performance or competitive advantage. But for green innovation variable there is a significant difference between automotive and energy sectors ($Ave_{\text{auto}} = 4.2560 > Ave_{\text{energy}} = 3.6667$). For ISO14001 certification duration, also there is significant difference for green innovation variable. Companies which have ISO14001 certificate more than 10 years have higher average value than other groups.

4. Conclusion

In order to find out effect of green innovation on environmentally sensitive company performance, this study performed as sending questionnaires to 224 companies which are listed on ISO500 list during last 3 years and ISO 14001 Environmental Management System certificated. Using 162 company data in total, several analyses were conducted to test research hypotheses. Before hypothesis testing, validity and reliability analyses were made and after some items were removed from the scale. According to correlation and regression analyses results, we found that there is a significant relationship between green innovation and environmentally sensitive company performance. Green innovation has an effect on both environmental performance and competitive advantage of a company. Effect of green innovation on environmental performance is found higher than competitive advantage. This study reveals that, environmentally rewarded companies have much more competitive advantage than others. Also, green innovation activities are most probable in ISO 14001 certificated companies.

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