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RESEARCH ARTICLE

Evaluation of Manufacturing Companies According to their Green Capabilities in the Context of Developing Countries

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Abstract

Having environmentally friendly products and processes in order to provide sustainable competitive advantage has become an important issue for companies which are a step forward in globalizing economy. Firstly, this study aimed to investigate what the situation of manufacturing companies about eco-innovation and green capabilities in the context of developing country, secondly if companies vary according to their sector and capital structure in green capabilities. For this aim, a survey was performed among 278 manufacturing company in Turkey. Statistical analysis is performed by Lisrel 8.80 and SPSS 18.0 statistical software. Findings show that while there is no difference between companies according to the sector, firms vary on the base of the capital structure about green capabilities.

Keywords: *Eco-innovation, Green capabilities, Developing countries, Turkey.*

Introduction

Manufacturing companies which are the most important elements of the economic systems are the most affected institutions in market and competitive conditions due to developments in trade and technology in a globalizing world markets. Survival of companies depends on being sustainable structure while minimizing these effects. Sustainability can be defined as a capacity to endure. Sustainability has environmental, social and economic dimensions, and It is required that they should maintain a combination of all of them Sustainability is basically perceived as the ability to sustain the functions, processes, and productivity of ecology and ecological systems in the future [1]. In terms of economy, sustainability by considering of sustainable development can be defined as turning to renewable resources in manufacturing processes and being responsible for the effects of production activities on the environment [2].

In recent years, there is an increasing contest and interest in understanding the environmental responsiveness and sustainability among academia, industry and businesses in the world as well in the developing countries [3]. Because of global environmental problems such as global warming, ozone depletion, water pollution, and deforestation, many institutions and organizations around the world are trying to address these problems and are demanding immediate solutions, and governments have made new legislations and arrangements to force companies to be green [4]. Specifically, new environmental legislation such as WEEE (Waste from Electronic and Electrical Equipment), RoHS (Restriction on the Use of Hazardous Substances), and EuP (Ecodesign Requirement for Energy-using Product) in the European Union have forced many businesses to make their production or supply chain more environment friendly [5]. Therefore, todays, environmental issues are considered strategically essential for business operations with the aim to survive and to be sustainable. Therefore, companies need regular business innovation and environment management in order to cope with fluctuating environments and sustain competitive edge. For this, companies should reorganize their organizational capabilities by harmonizing with the external environment. Accordingly, companies must integrate organizational capabilities and business innovation to provide corporate survival, namely, green business innovation capabilities [6].

Green operations are include environmental practices such as eco design, cleaner production, recycling and reuse with a focus on minimizing the expenses associated with manufacturing, distribution, use and disposal of products. According to environmental management literature, green operations are concerned with both product and process oriented environmental practices to reduce the damage of products and supply chain in processes on natural resources [7].

Developing countries have received little attention from an innovation perspective. In developing countries, there has been a lack of positive economic goals and visions which could guide the transformation from the current high carbon resource inefficient economy to low carbon resource efficient economy [8]. There is a need to carry out internationally comparable eco-innovation studies in developing countries. Researches to measure environmental innovation strategies and drivers based on developing countries are very useful. But, there is a lack of the available required data sources, and there is a lack of standard methods to perform such a comparison [9]. This paper contributes to filling this gap in the literature. Therefore this study was performed in a developing country, Turkey. Research questions of the study are (1) Does capital structure has any effects on green capabilities of the companies in developing countries? (2) Can international companies from developed countries make any contribution to the companies of developing companies about green capabilities?

This paper is constructed as following; in the next section, a literature survey was performed related with eco-innovation and green organizational capabilities. Then, methodology of the study was explained. This section includes questionnaire design, sampling techniques and characteristics of respondents. Following this, application steps of the study was explained. Finally, findings of the study were examined and discussed.

Literature Review

Eco-Innovation

In The OECD *Oslo Manual,* innovation is defined as "the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations" [10]. Also, this definition generally applies to eco-innovation. But eco-innovation has two further significant, distinguishing characteristics:

- It is innovation that reflects the concept's explicit emphasis on a reduction of environmental impact, whether such an effect is intended or not.
- It is not limited to innovation in products, processes, marketing methods and organizational methods, but it also includes innovation in social and institutional structures [11].

According to the MEI (Measuring Eco-Innovation is a EU funded research project called "Measuring Eco-Innovation") eco-innovation is defined as follows [12]: "Eco-innovation is the production, application or exploitation of a good, service, production process, organizational structure, or management or business method that is novel to the firm or user and which results, throughout its life cycle, in a reduction of environmental risk, pollution and the negative impacts of resource use (including energy use) compared to relevant alternatives".

While most researchers and policy makers are well acquainted with the concept of innovation, *eco-innovation* is a new concept for which a standardized definition does not exist yet [13]. The interdisciplinary project 'Innovation Impacts of Environmental Policy Instruments' has defined the term eco-innovation as [14]:

"Eco-innovations are all measures of relevant actors (firms, politicians, unions,

associations, churches, private households) which develop new ideas, behavior, products and processes, apply or introduce them, and which contribute to a reduction of environmental burdens or to ecologically specified sustainability targets".

Eco-innovation contains all types of innovation-technological and non-technological innovations, new products and services, process innovations and new business practices-that creates and develops new business opportunities and benefits for environment by preventing or reducing their hazardous impact, or by optimizing the use of natural resources. Eco-innovation is included to the development and usage of environmental technologies, and it is related to the concepts of eco-efficiency and eco industries [15].

Chen et al. [16] investigated the impacts of green innovation on the corporate competitive advantage in information and electronics industries (involving information hardware, consumer electronics, optoelectronic, semiconductor, electronic component industries, and communication) in Taiwan. They found a positive relationship between green product/process innovation and corporate competitive advantage. Their results presented that while the performances of green product innovation are better than the performances of green process innovation in the industry of consumer electronics and communication, there are opposite results in the semi-conductor and optoelectronic industries.

Wagner [17] identified the relationship among environmental management systems (EMS), eco-innovations, and firms' patenting activities for manufacturing firms in Germany. He proposed that while the impact of EMS on environmental process innovation is positive, it is negatively related with firms' patenting activities. According to his findings, the impact of environmental product innovation and patented eco-innovation on environmentally concerned is positive, but they are negatively correlated with environmentally neutral stakeholders.

Chen [18] examined the relationship among a company's green core-competence, green innovation, and green image in information and electronics industries in Taiwan. He found positive impacts of green core competences on the performance of green innovation and green image, and the positive relationship between green image and green innovation performance.

Kammerer [19] employed a novel unit of analysis, environmental issues, to examine the impact of customer benefits and regulatory factor on environmental product innovation in the industry of electrical and electronic appliance in Germany. According to the findings of this study, the potential of customer benefits has a positive effect on the environmental product innovations implementation of companies.

Dangelico and Pujari [20] identified different incentives that affect companies' green products development, environmental policies and targets for products, and disparate aspects of green product innovation with multiple cases in Italy and Canada. They found that legal compliance, competitiveness enhancement, and ecological responsibility are the main motivations for companies to develop green products. Moreover, various types of reasons usually co-exist in a company. Organized environmental policies and targets for products into documents is beneficial in creating green products.

Hermosilla et al. [21] identified eco-innovation in terms of its various dimensions (design, user, product service, and governance). They proposed that new business opportunities derived from the capacity of eco-innovation, and the interactions of different dimensions and key stakeholders involvement contribute to the capacity of eco-innovation in the innovation process.

Eco Innovation in Developing Countries

The potential market for eco-technologies has been estimated at between 500 billion euro and 1,000 billion euro in 2005, with

Roland Berger strategy Consultants predicting a global market of 2,200 billion euro by 2020. According to this situation, the importance of eco-innovation is increasing in the world including in developing countries [22]. The deployment of eco-innovations in developing countries is one of the key drivers in order to determine global environmental stimulations efficiently. Eco innovation is also one of the key drivers of markets for eco-innovation and sustainable economic development [23].

By the view of environmental issues, developing countries are characterized by highly pollution-intensive conditions, weak or non-existent formal environmental regulatory frameworks and enforcement mechanisms, limited institutional capacity, inadequate information on emissions and nearly zero government-imposed-price of pollution [24]. Developing countries will be suffer negative influences of many global environmental problems. The quick understanding of eco-innovations in developing countries will provide global advantages by determining critical environmental problems such as climate change and biodiversity loss [23]. Because of resource scartcity and increase in environmental degradation, eco-innovation can no longer be seen as a luxury. Developing countries utilise from building on the basis to create their own information systems to deal with pollution and usage of natural resources sustainably [22]. Local eco-innovation capabilities are required necessarily to facilitate the diffusion of existing eco-innovations within developing countries, and adoption of developing countries into new eco-innovations. Also these capabilities are required for sustainable economic development based on the adaption of environmental technologies in developing countries [23].

Developed countries have an interest in encouraging the uptake of eco-innovations in developing countries due to their public good nature and related potential to reduce and adapt the impacts of global environmental problems. International firms also potentially stand to gain as a result of new market opportunities in developing countries for existing or new clean technologies [23]. They help, support and develop eco innovations, clean manufacturing etc by importing their green abilities and technologies for developing countries.

Green Capabilities

Green innovation consists two concepts as innovation and environmental management. Aim of the green innovation is to increase environmental performance and to be able to make eco-friendly innovations [25]. Being able to make eco friendly innovations is called green innovation.

In the eco innovation literature, eco-innovation is influenced by the capabilities of the firms. Specifically, companies request to maintain their sustainable and economic development. They build their organizational capabilities and practices by focusing on source reduction, recycling, pollution prevention, and green product design and they invest in eco-innovation [13]. These organizational capabilities are referred as green capabilities.

After synthesizing the insights that are obtained from our field work with those in the literature, we identified three key dimensions which are green innovation capability, green design capability and green manufacturing capability.

Green innovation capability (GIC) refers to organizational members' capabilities and commitment to implement new forms of eco-innovation management. Eco-organizations cannot reduce environmental impact directly, but they can facilitate the implementation of eco-processes (e.g., in manufacturing) and eco-product innovations [26]. According to Arundel and Kemp [27], the implementation of eco-innovation in eco-organizations includes eco-training programs, eco-product design programs, the introduction of eco-learning techniques, the creation of management teams to deal with eco-issues, and eco-management systems. In short, a wide range of efforts in an organization can provide a result in eco-innovation.

Green design capability (GDC) brings environmental improvements for existing eco-products or the development of new eco-products. Because the principal environmental impact of many products stems from their usage (e.g., fuel consumption and CO2 emissions of cars) and disposal (e.g., heavy metals in batteries). Eco-product implementation focuses mainly on a product's life cycle in order to reduce hazardous environmental impact. Pujari et al. (Pujari et al. 2004) referred that, product life cycle analysis involves all aspects of a product from its creation, through its use, to its disposal [28].

Green manufacturing capability (GMC) refers to the introduction of manufacturing processes that leads to reduced environmental impact, such as closed loops for solvents, material recycling, less energy usage, or filters. Green manufacturing capability includes the improvement of current production processes and the development of new processes to reduce hazardous environmental impact [28]. Developing new processes can provide additional solution methods (e.g., smoke stack scrubbers). They can also be integrated into production processes by means of substitution of inputs, optimization of production, or renewal of outputs [29].

Green manufacturing capabilities also can be defined as "the set of physical, financial, human, technological, and organizational resources that are coordinated by organizational routines and deployed inside a manufacturing plant to improve its environmental performance" [30].

Methodology

Questionnaire Design

The measure for green innovation, green design and green manufacturing capabilities in the study were gotten previous studies. Five measures of green innovation capability (Definition of a green technological innovation strategy; formulation of green innovative projects; evaluation of technical, economic and commercial feasibility of green ideas; production staff quality level and specific budget for green innovative ideas) were adapted from Lin et al. [6] three measures of green manufacturing capability (Clean production technology; materials used in the supplied components that reduce the impact on natural resources and ability to alter process and product for reducing the impact on natural resources) were adapted from Lee et al. [31], three measures of green design capability (Design of products to avoid or reduce use of hazardous of products and/or their manufacturing process; design of products for reuse, recycle, recovery of material, component parts and Design of products for reduced consumption of material/energy) were adapted from Zhua and Sarkis [32]. Each measure was evaluated by 7 point Likert scale (1: Certainly disagree, 7: Certainly agree).

Sampling Techniques

Aim of this study is to identify situation of eco-innovation in a developing country, Turkey. Also, companies included the survey were divided into three groups on the basis of the capital structure. Thus another aim of this study is to determine whether there is a difference between three groups in terms of green innovation capability. Therefore a questionnaire was applied to senior managers in different sectors in Turkey. Separation of companies according to the sectors is performed taking into account sector in chambers of commerce that they were registered. The questionnaire was sent to 180 business managers via email and 95 of them were returned. Then we get an appointment from 183 business managers and questionnaires were filled by face to face meeting. Number of filled questionnaire reached to 278. To test whether there is a difference between email method and face-to-face method, t test was performed and as a result there is no difference between two groups at the significance level of 0.05.

Characteristics of Respondents

Some characteristics of respondent companies are shown in Table 1. In Table 1, When respondent accompanies are investigated according to age of the firm, % 55 of the respondent companies has work experience more than 20 years. % 26 of them has work experience of 11-20 years. % 25.9 of respondent companies is performing in automobile industry. According to employee number, most of the companies have 101-500 employees. According to sector, most of the companies are performing in automobile sector (%25.9). According to capital structure, most of the companies are national companies (%44.6), % 40 of them are foreign companies, and % 20.5 of them are multinational companies.

Table 1: Some characteristics of respondents

Age of firm (Year)	Freq.	%	Number of employees	Freq.	%
1-5	15	5.4	Less than 20	2	0.8
6-10	37	13.3	21-50	14	5.0
11-20	73	26.3	51-100	28	10.1
21-30	66	23.7	101-500	149	53.6
31-40	38	13.7	501-1000	41	14.7
Above 40	49	17.6	Above 1001	44	15.8
Total		100.0	Total		100.0
Industry	**Freq.**	**%**	**Capital structure**	**Freq.**	**%**
Electric-electronic industry (1)	37	13.3	National	124	44.6
Metal and Steel Industry (2)	45	16.2	Foreign	97	34.9
Machine industry (3)	41	14.7	Multinational	57	20.5
Automobile sector (4)	72	25.9			
Chemistry and paint industry (5)	40	14.4			
Rubber, Packaging and Plastic Industry (6)	43	15.5			
Total		100.0	Total		100.0

Application

Exploratory Factor Analysis

First, exploratory factor analysis with varimax rotation method is used to determine the main factors for green capability. In order to determine the factor number, "eigen value greater than one method" is preferred. As seen in Table 2, the factor loadings ranged from 0.498 to 0.872, which are well exceeded the generally recommended minimum value of 0.3 in the literature [33] and all items in each scale loaded on a single factor and factor number is three. Explained variance of these three factors is % 63.75

Table 2: Explaratory factor analysis for green capabilities

Measures	Explanation	Factor 1	Factor 2	Factor 3
A1	Definition of a green technological innovation strategy	**0.774**	0.253	0.178
A2	Formulation of green innovative projects	**0.758**	0.207	0.248
A3	Evaluation of technical, economic and commercial feasibility of green ideas	**0.727**	0.176	0.244
A4	Production staff quality level	**0.723**	0.209	0.202
A5	Specific budget for green innovative ideas	**0.718**	0.311	-0.076
B1	Clean production technology	0.157	**0.872**	0.145
B2	Materials used in the supplied components that reduce the impact on natural resources	0.362	**0.713**	0.195
B3	Ability to alter process and product for reducing the impact on natural resources	0.480	**0.632**	0.196
C1	Design of products to avoid or reduce use of hazardous of products and/or their manufacturing process	-0.005	0.121	**0.796**
C2	Design of products for reuse, recycle, recovery of material, component parts	0.279	0.137	**0.663**
C3	Design of products for reduced consumption of material/energy	0.417	0.190	**0.498**
	Eigenvalues	3.378	2.016	1.619
	Explained variance	30.706	18.327	14.714
	Cumulative explained variance	30.706	49.033	63.747

Reliability Analysis

It is assumed that observed variables measure latent variables. There are three latent variables that are green innovation capability, green manufacturing capability and green design capability. Reliability analysis of latent variables was performed on the basis of Cronbach alpha statistic. Means, standard deviations and cronbach alpha values are presented in Table 3.

Table 3: Descriptive statistics and reliability analysis results

Variable	Mean	S.D	Croncbach's α
Green Innovation Capability (GIC)		0.855	
A1	5.14	1.422	
A2	5.07	1.527	
A3	5.15	1.463	
A4	5.12	1.414	
A5	5.07	1.718	
Green Manufacturing Capability (GMC)		0.782	
B1	5.53	1.201	
B2	5.44	1.298	
B3	5.57	1.361	
Green Design Capability (GDC)		0.742	
C1	5.13	1.385	
C2	5.56	1.303	
C3	5.61	1.131	

When Table 4 was investigated, Cronbach alpha values of each measure/latent variable - GIC (0.855), GMC (0.782), GDC (0.742) -surpass the 0.70 threshold recommended by Nunnally [34] for the test of scale reliability. Also, observed variable of A3 (evaluation of technical, economic and commercial feasibility of green ideas) was found as the key variable for GIC (mean value of A3=5.15). Similarly, observed variable of B3 (ability to alter process and product for reducing the impact on natural resources) was found as the key variable for GMC (mean value of B3=5.57). Observed variable of C3 (design of products for reduced consumption of material/energy) was found as the key variable for GDC (mean value of C3=5.61).

Confirmatory Factor Analysis

In this step, in order to determine whether three-factor structure of the scale is compatible with the collected data, and how it is compliance with the collected data, Confirmatory Factor Analysis (CFA) was performed by using Lisrel 8.80 Statistical Software. CFA tests the factor structure which is previously determined on the basis of relationships between variables [35]. In DFA, in order to assess the validity of factor structure of the criteria Confirmatory Factor Analysis of the factor structure of the criteria (model) to assess the validity of the many fit index are used as well as chi-square statistics such as Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), Comparative Fit Index (CFI), Root Mean Square Residuals (RMR), Standardized Root Mean Square Residual (SRMR) and Root Mean Square Error of Approximation (RMSEA). Acceptable levels of these goodness fit statistics are presented in Table 4.

Table 4: The best and acceptable value interval of fitness indexes [36]

Fitness Criteria	The Best Fitness	Acceptable Fitness
RMSEA	0<RMSEA<0.05	0.05≤RMSEA<0.08
RMR	0<RMR<0.05	0.05≤RMR<0.08
SRMR	0<SRMR<0.05	0.05≤SRMR<0.08
CFI	0.95<CFI≤1	0.90≤CFI≤0.95

GFI	0.95<GFI≤1	0.90≤GFI≤0.95
AGFI	0.95<AGFI≤1	0.90≤AGFI≤0.95
χ^2/df	χ^2/df ≤2	2<χ^2/df <5

CFA results of the measurement model are shown in Table 5 and Figure 1. When Table 6 is investigated, it can be seen that CFA model is valid and acceptable model. ($\chi^2(41) = 69.18$, p = 0.00386< 0.05) . Goodness fit statistics are RMSEA = 0.050; CFI = 0.99; SRMR = 0.038, GFI = 0.96; AGFI = 0.93. χ^2/df = 1.69

Table 5: Exploratory factor analysis results

Latent variable and Item	Std. factor loading	Std. error	Critical Ratio (CR)	R^2
Green Innovation Capability (GIC)				
A1	0.76	0.073	14.02	0.57
A2	0.74	0.081	13.70	0.55
A3	0.69	0.079	12.40	0.48
A4	0.69	0.077	12.43	0,48
A5	0.62	0.096	10.79	0,38
Green Manufacturing Capability (GMC)				
B1	0.63	0.068	10.70	0.39
B2	0.71	0.073	12.54	0.50
B3	0.77	0.076	13.93	0.59
Green Design Capability (GDC)				
C1	0.33	0.092	4.77	0.11
C2	0.54	0.088	7.96	0.29
C3	0.65	0.079	9.47	0.43

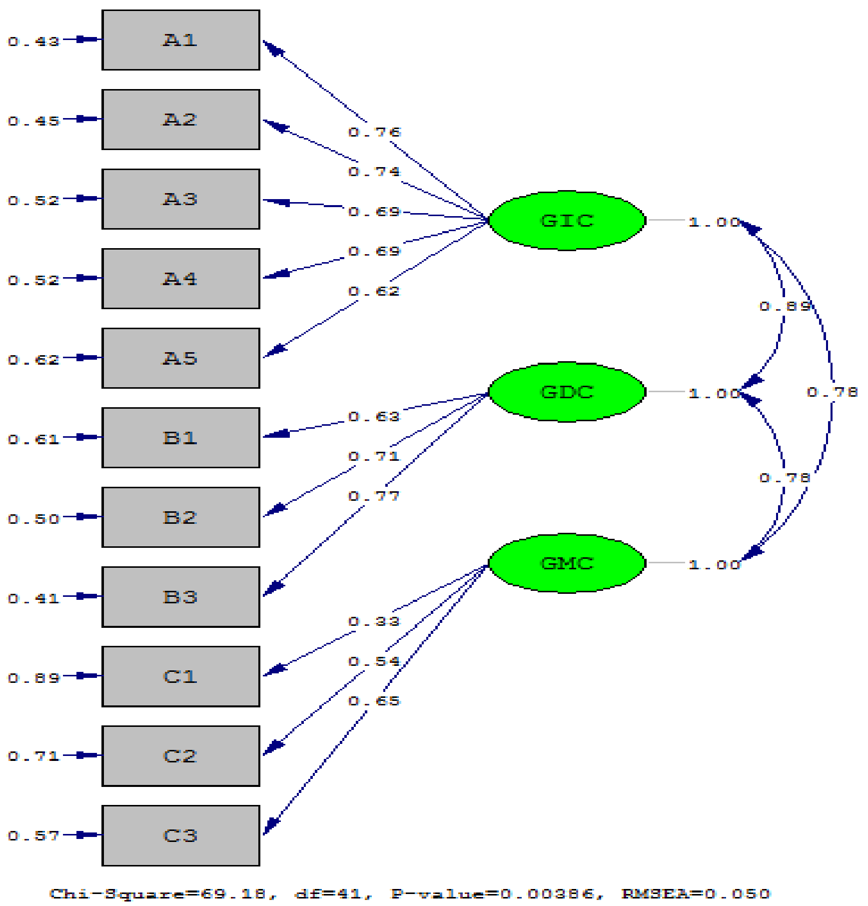

Figure 1: Figural representation of confirmatory factor analysis

Results of two-way ANOVA

To evaluate green capability of companies, three different green capabilities were determined to evaluate green capability of companies. These are GIC, GMC and GDC. To determine that if there is a difference between companies according to sectors and the capital structure, two-way-variance analysis was performed. To see sectoral differences, companies divided into six sectors based on respondents' answers which are S1-electric-electronic sector; S2-metal and steel sector; S3-machine sector; S4-automobile sector; S5-chemistry and paint sector; S6-rubber, packaging and plastic sector. Companies divided into three groups based on respondents' answers (which are CS1- National company (owner of the company from Turkey); CS2- Multinational companies (a national company and a foreign company has made partnership) and CS3- Foreign companies (owner of the company from abroad of the Turkey)) to see differences on the basis of the capital structure. Two way anova results are shown in Table 6. According to analysis results at the level of % 95 confidence interval, there is a difference according the capital structure ($F(2, 270) = 12.917$).

Table 6: Two way Anova analysis results

Source	Sum of Squares	df	Mean Square	F	Sig.
The capital structure	18.712	2	9.356	12.917	0.000
Error	195.561	270	0.724		

As seen above, we found differences among companies on the basis of the capital structure about green capabilities. Therefore, in order to investigate differences related green capabilities on the basis of the capital structure, one way anova analysis was performed.

In Table 8, descriptive statistics of each group on the basis of the capital structure are presented about each green capability. Anova results for each green capability are shown in Table 9. Anova statistics for each green capability variable are significant at 0.05 level. Group differences are shown in Table 10. Here, I and J refer group numbers (CS1, CS2, CS3). When three variables are taken into account, CS1 and CS2 are different, CS1 and CS3 are different. These differences are statistically significant. There are not statistically significant differences between CS2 and CS3. They show similar characteristics.

Table 8: Descriptive statistics according to the capital structure

		N	Mean	Std. Dev.	Std. Error	Min.	Max.
GIC	National	124	4.7613	1.28927	.11578	1.00	7.00
	Multinational	97	5.4639	.72258	.07337	2.80	7.00
	Foreign	57	5.5684	.99985	.13243	2.00	7.00
	Total	278	5.1719	1.12198	.06729	1.00	7.00
GDC	National	124	5.2634	.90594	.08136	2.67	7.00
	Multinational	97	5.5292	.81045	.08229	3.67	7.00
	Foreign	57	5.6550	.95528	.12653	2.33	7.00
	Total	278	5.4365	.89599	.05374	2.33	7.00
GMC	National	124	5.2823	1.13022	.10150	2.67	7.00
	Multinational	97	5.7698	.75975	.07714	3.33	7.00
	Foreign	57	5.6842	1.15542	.15304	1.33	7.00
	Total	278	5.5348	1.04386	.06261	1.33	7.00

Table 9: Anova results

	Sum of Squares	df	Mean Square	F	Sig.

GIC	Between Groups	38.140	2	19.070	16.886	.000
	Within Groups	310.561	275	1.129		
	Total	348.701	277			
GDC	Between Groups	7.268	2	3.634	4.646	.010
	Within Groups	215.109	275	.782		
	Total	222.377	277			
GMC	Between Groups	14.536	2	7.268	6.957	.001
	Within Groups	287.295	275	1.045		
	Total	301.831	277			

Table 10: Multiple comparisions

						95% Confidence Interval	
Variable	**(I) CS**	**(J) CS**	**Mean Difference (I-J)**	**Std. Error**	**Sig.**	**Lower Bound**	**Upper Bound**
GIC	CS1	CS2	-.70263*	.14405	.000	-1.0421	-.3632
		CS3	-.80713*	.17006	.000	-1.2079	-.4064
	CS2	CS1	.70263*	.14405	.000	.3632	1.0421
		CS3	-.10450	.17736	.826	-.5224	.3134
	CS3	CS1	.80713*	.17006	.000	.4064	1.2079
		CS2	.10450	.17736	.826	-.3134	.5224
GDC	CS1	CS2	-.26577	.11988	.070	-.5483	.0167
		CS3	-.39153*	.14153	.017	-.7250	-.0580
	CS2	CS1	.26577	.11988	.070	-.0167	.5483
		CS3	-.12576	.14760	.671	-.4736	.2221
	CS3	CS1	.39153*	.14153	.017	.0580	.7250
		CS2	.12576	.14760	.671	-.2221	.4736
GMC	CS1	CS2	-.48750*	.13855	.001	-.8140	-.1610
		CS3	-.40195*	.16356	.039	-.7874	-.0165
	CS2	CS1	.48750*	.13855	.001	.1610	.8140
		CS3	.08555	.17058	.871	-.3164	.4875
	CS3	CS1	.40195*	.16356	.039	.0165	.7874
		CS2	-.08555	.17058	.871	-.4875	.3164

*The mean difference is significant at the 0.05 level. CS: The Capital Structure

Discussion

In this study, it is aimed to investigate green capabilities in a developing country, Turkey. For this aim, first we determined dimensions of green abilities and then we developed a questionnaire. Then we applied this questionnaire to manufacturing companies in Turkey. We investigated validity and reliability of the criteria. Then we investigated green abilities of companies depending on their sector and the capital structure in a developing country, Turkey. We found that companies are not different based on their sectors in Turkey. Sectors are the similar related with green capabilities–green innovation capability, green design capability and green manufacturing capability- in Turkey.

When we investigated the companies according to their capital structure related green capabilities, they vary according to the capitals structure. We splitted companies into three groups according to their capital structure-national, foreign, multinational- as mentioned previous sections of the paper. National companies differ from foreign companies and multinational companies about each of three green abilities. Foreign companies do not show any statistically significant differences from multinational companies. Foreign companies and multinational companies show similar characteristics about green capabilities. Answer of the research question (Does capital structure has any effects on green capabilities of the companies in developing countries?) is that the capital structure affects level of companies in green abilities in developing countries. Companies are different in green abilities according to their capital structure. Sectors which are related with green capabilities are similar in Turkey.

Second research question is if international companies from developed countries can make any contribution to the companies of developing countries about green capabilities. According to our findings, national companies differ from international companies (foreign and multinational). International companies are in a better condition than national companies. This is an important finding. First companies from developed countries make investments in developing country because of some advantages (i.e. employee costs, investment incentives of governments). Then they bring and transfer new technologies, new approaches to developing countries. Clean technologies are first developed in the world's leading economies and developed countries. International trade and foreign investments provide access to these technologies. Then, these technologies are transferred to developing countries by making direct investments or making partnership with national companies of developing countries. Thus globalization plays an important role in moving clean technologies, and hastens the transfer of environmentally-friendly technologies to developing countries.

Also, this study has some limitations. One of the limitations is that we use only qualitative measures to evaluate green capabilities. Quantitative measures should be included to variables in future studies. Another limitation of this study is that this study carried out for only one developing country. Also this study can be expanded on other developing countries, and then comparative studies can be performed.

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References

1. Chapin III FS, Torn MS, Tateno M, (1996) Principles of Ecosystem Sustainability. American Naturalist, 148(6):1016-1037.
2. Yavuz VA (2010) Sürdürülebilirlik kavramı ve is letmeler acisindan sürdürülebilir üretim stratejileri. Mustafa Kemal University Journal of Social Sciences Institute, 7(14):63-86.
3. Pujari D, Peattie K, Wright G (2004) Organizational antecedents of environ-mental responsiveness in industrial new product development. Journal of Industrial Marketing Management, 33(5):381-391.
4. Cordano M, Marshall RS, Silverman M, (2010) How do small and medium enterprises go "green"? A study of environmental management programs in the U.S. wine industry. Journal of Business Ethics, 92:463-478.
5. Tsai WH, Hung SJ (2009) A fuzzy goal programming approach for green supply chain optimisation under activity-based costing and performance evaluation with a value-chain structure. International Journal of Production Research, 47(18):4991-5017.
6. Lin Y, Tseng ML, Chen CC, Chiu ASF (2011) Positioning strategic competitiveness of green business innovation capabilities using hybrid

method. Expert Systems with Applications, 38(3):1839-1849.

7. Wong CWY, Lai KH, Shang KC, Lu CS, Leung TKP (2012) Green operations and the moderating role of environmental management capability of suppliers on manufacturing firm performance. International Journal of Production Economics, 140(1):283-294.
8. Andersen MM (2009) Combating climate change through eco-innovation towards green innovation system., Chapter in Innovative Economic Policies for Climate Change Mitigation, 1st edition, ed. Valentina Piana , Economic Web Institue, 37-58.
9. Lopez FJD (2008) A tailored method for eco innovation strategies and drivers (in the South). DIME international Conference "Innovation, sustainability and policy", 11-13 September 2008, GREThA, University Montesquieu IV, France. Online at: http://www.dime-eu.org/files/active/0/DIAZTNO-UEA_full%20paper.pdf
10. OECD and Statistical Office of the European Communities (Eurostat), Oslo Manual: Guidelines for Collecting and Interpreting Innovation Data (3rd ed.), 2005; OECD, Paris. Online at: http://unstats.un.org/unsd/EconStatKB/KnowledgebaseArticle10270.aspx
11. Rennings K (2000) Redefining innovation-eco-innovation research and the contribution from ecological economics. Journal of Ecological Economics, 32(2):319-332.
12. Kemp R, Pearson P (2008) Final report MEI project about measuring eco-innovation. Online at: http://www.oecd.org/env/consumption-innovation/43960830.pdf
13. Kesidou E, Demirel P (2012) On the drivers of eco-innovations: Empirical evidence from the UK. Research Policy, 41(5):862-870.
14. Klemmer P, Lehr U, Lobbe K (1999) Environmental Innovation. Volume 3 of publications from a Joint Project on innovation impacts of environmental policy instruments. Synthesis Report of a project commissioned by the German Ministry of Research and Technology (BMBF), Analytica- Verlag, Berlin.
15. Sarkar AN (2013) Promoting eco-innovations to leverage sustainable development of eco-industry and green growth. European Journal of Sustainable Development, 2(1): 171-224.
16. Chen YS, Lai SB, Wen CT (2006) The influence of green innovation performance on corporate advantage in Taiwan, Journal of Business Ethics, 67:331-339.
17. Wagner M (2007) On the relationship between environmental management, environmental innovation and patenting: evidence from German manufacturing firms. Research Policy, 36(10):1587-1602.
18. Chen YS (2008) The driver of green innovation and green image-green core competence Journal of Business Ethics, 81:531-543.
19. Kammerer D (2009) The effects of customer benefit and regulation on environ mental product innovation: empirical evidence from appliance manufacturers in Germany. Ecological Economics, 68(8-9):2285-2295.
20. Dangelico RM, Pujari D (2010) Mainstreaming green product innovation: why and how companies integrate environmental sustainability. Journal of Business Ethics. 95: 471-486.
21. Hermosilla JC, Rio PD, Könnölä T (2010) Diversity of eco-innovations: reflections from selected case studies. Journal of Cleaner Production, 18(10-11):1073-1083.
22. Kemp R (2008) Measuring eco innovation. Reseach Brief. United Nations University, Number 1, Online at: http://www.merit.unu.edu/publications/pb/2008-01.pdf
23. Ockwell D, Watson J, Mallett A, Haum R., Mac Kerron G, Verbeke A-M (2010) Enhancing developing country access to eco-innovation: The case of technology transfer and climate change in a Post-2012 policy framework. OECD Environment Working Paper: No. 12, OECD Publishing.
24. Adelegan J, Carlsson B, Perelli S (2010) Eco-Innovation and Corporate

Performance in Africa: The African Experience. Online at: http://edocs.fu-berlin.de/docs/servlets/MCRFileNodeServlet/ FUDOCS_derivate_000000001313/

25. Leenders MAAM, Chandra Y (2013) Antecedents and consequences of green innovation in the wine industry: the role of channel structure. Technology Analysis & Strategic Management, 25(2):203-218.
26. Murphy J, Gouldson A (2000) Environmental policy and industrial innovation: integrating environment and economy through ecological modernization. Geoforum, 31(1): 33-44.
27. Arundel A, Kemp R (2009) Measuring eco-innovation. Working Paper Series, Online at: http://www.merit.unu.edu/publications/wppdf/2009/wp2009-017.pdf
28. Cheng CC, Shiu EC (2012) Validation of a proposed instrument for measuring eco-innovation: An implementation perspective. Technovation, 32:329-344
29. Kemp R (2009) Measuring eco-innovation: results from the MEI project. Global Forum on Environment on Eco-innovation, 4-5 Nov 2009, OECD, Paris.
30. Gavronski I, Klassen RD, Vachon S, Nascimento LFM (2011) A resource-based view of green supply management. Transportation Research Part E., 47(6):872-885.
31. Lee AHI, Kang HY, Hsu CF, Hung HC (2009) A green supplier selection model for high-tech industry. Expert Systems with Applications, 36(4):7917-7927.
32. Zhu Q, Sarkis J, (2004), Relationships between operational practices and performance among early adopters of green supply chain management practices in Chinese manufacturing enterprises. Journal of Operations Management, 22(3):265-289.
33. Hair JF, Anderson RE, Tatham RL, Black WC (1992) Multivariate Data Analysis with Readings, 3rd ed. Macmillan. New York.
34. Nunnally J, (1978) Psychometric Theory, McGraw Hill New York:
35. Tabachnick BG, Fidell LS (2001) Using Multivariate Statistics. 4rd ed. Allyn and Bacon Boston.
36. Yuluğkural Y, Yörür B, Akman G, Aladağ Z (2013) Assessment of model validity of analytic network process using structural equations modelling: an application of supplier evaluation problem. European Journal of Industrial Engineering,7(1):55-77.