Peer-reviewed version available at *Business & Management Studies: An International Journal* **2018**, *6*, 64-85; doi:

*Article*

# The Mediating Role of Green Organizational Culture between Sustainability and Green Innovation: A Research in Turkish Companies

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**Abstract:** This study aims to examine Turkish companies from a sustainability and green innovation point of view. Through this purpose, this research's objective is to find out relationship between sustainability drivers and green innovation and also to search for green organizational culture's mediation effect in this relationship. Survey was carried in companies operating in Turkey which were listed among İstanbul Chamber of Industry (ICI) Top 500 companies for last 3 years successively and have ISO14001 Environmental Management Certificate. According to the survey results, it was manifested that factors directing companies to sustainability having a positive relationship with green organizational culture and green innovation. It is found that there is a partial mediation effect of green organizational culture between motivating factors for sustainability and green innovation.

**Keywords:** green innovation; green organizational culture; sustainability; sustainability drivers

**JEL: Q56**

## 1. Introduction

In today's world, when sustainability is referred to, the first definition that comes to mind relates to the continuity of resources for coming generations by using them consciously [1]. Both in terms of its social aspect and the business perspective, sustainability is quite an important issue and has gained increasing attention on a daily basis. It is also a popular subject for conferences, meetings, congresses and campaigns in both scientific and non-scientific areas. Thanks to the attention being paid to sustainability, various solutions, proposals and ideas have been developed. From the business side, the results of business operations have an effect, not only on companies, but also on society; hence sustainability has become a matter that should be evaluated with a holistic approach. The ideas that have been developed and the various opportunities that have emerged have produced advantageous outcomes for many parties and ultimately will serve sustainability.

It is obvious that companies have serious responsibilities regarding the environmental dimension of sustainability. This leads to crucial environmental effects as a result of their operational processes from beginning to end. It is possible to eliminate these effects through the use of certain preventive solutions. At this point, environmental-friendly technologies, especially activities that fall under the name of green innovation, are of great importance.

The concept of green innovation is not much different from the generally-known definition of innovation, but additionally includes the mission of decreasing the impact of environmental effects [2]. Companies now implement green innovation applications in many areas in order to contribute to the environmental aspect of sustainability. These applications relate to product, process and organizational innovation [3] or according to other classifications including technological, organizational, social and institutional categorizations [4] from different perspectives.

There are many factors that trigger companies to engage in sustainability activities. In the literature, these factors are referred to as drivers or determinants of green innovation. These can be either company-specific internal or external factors [5]. All of these factors have an important impact on the green innovational processes of companies. One of the research objectives of this study is to find out the extent of such an impact. Besides investigating relationships between the sustainability drivers as they relate to companies and green innovation, another research aspect of the study is to identify similar relationship between sustainability drivers and the green organizational culture. Here, the green organizational culture represents an organizational culture that encourages employees to engage in environmentally conscious behaviors and prepares a climate that allows the development of new ideas, behaviors or cooperation in such a way as to decrease the negative environmental effects of the company concerned [6]. A green organizational culture enables an atmosphere to develop that encourages new ideas that lead to green innovations within the company. In this context, the effect of the environmental aspect of the existing organizational culture on green innovation performance is one of the research tasks of this study.

This study intends to determine the relationships between sustainability drivers, green organizational culture and green innovation. The paper is organized as follows. The next section presents a theoretical background and a brief review of sustainability, green organizational culture and green innovation concepts respectively. Section 3 includes the methodology, research hypotheses and the research model. The analytical results and the main findings are provided in Section 4. The paper ends with a discussion and concluding remarks.

## 2. Background

### *2.1 Sustainability and Its Environmental Perspective*

Sustainability aims to ensure a trustworthy, healthy and high quality life for current and future generations of all the living creatures on the earth in an economic, social and environmental way [7]. Sustainable development was firstly officially introduced in 1987 in the Brundtland Report as "…development that meets the needs of the present without compromising the ability of future generations to meet their own needs" [1]. Prior to this official definition, a group of analysts published a report entitled "Limits to Growth" which introduced us to the sustainability concept in 1972. This report reviews interactions between economic systems and their subsystems (population, food production, industrial production, environmental pollution and non-renewable resources) and declared that if the global economy continues growing in the same way, limits will be exceeded by the 21st Century and most probably population and economic systems will collapse if no fundamental changes are undertaken in political and behavioral terms [8].

According to Stead and Stead [9], sustainability contains a large number of different issues such as the drain of resources, environmental pollution, waste contamination and disposal, population increase, social justice, environmental justice, etc. Dangelico and Pujari [10] declare that challenges are becoming larger on a daily basis in terms of maintaining sustainability, and that companies should understand the importance of the integration of sustainability issues with their production processes. On the other hand, Labuschagne et al. [11] comment on corporate sustainability that refers to protecting, maintaining and developing the human and natural resources which are necessary for the realization of facilities, and of business strategies to meet a company's and its stakeholders' requirements. It can be said that, sustainability has clearly become a way of doing business [12].

Sustainability requires much more changes and challenges from different perspectives. Basically, as we think about human needs such as food, water, shelter etc. there are many elements to be dealt with. Moreover, there are many dimensions on which sustainability needs to be achieved, including technical, socio-economic, cultural, environmental preservation, distribution of wealth. In order to be able to stimulate transitions towards sustainability we need to structure a strong knowledge base in this area [13].

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Sustainability is a three-dimensional concept which includes economic, social and environmental points of view. In order to achieve sustainable development, each dimension should realize its own sustainability, and interactions between these dimensions need to be balanced [14]. From a business perspective, sustainability can be defined as a composite of social, environmental and economical practices within a company [15] and a sustainable corporate financial performance is linked to social and environmental performance. This means that companies should evaluate their success in terms of sustainability, not only with financial results, but also in terms of environmental and social aspects [16].

Environmental sustainability aims to develop the welfare level of people by protecting raw material resources that are used to meet personal needs, and also by preventing various effects resulting from the creation of waste [17]. According to OECD's environmental strategy, 4 criteria have been identified regarding sustainability in the form of regeneration, substitutability, assimilation and avoiding irreversibility [18]. Cowan et al. [19] analyzed the sustainability reports of companies from different sectors, and stated that environmental sustainability programs can be split up into three main areas in the form of resource management, energy management and product sustainability. Henriques and Sadorsky [20] declare that policy makers, customers, shareholders, society and some other micro-environmental factors have a positive effect on companies in terms of persuading them to present an environmental plan. Company managers should strike a balance between corporate sustainability and a sustainable planet and society [5]. When dealing with ecological problems, companies have benefit also by moving toward environmental sustainability. There are many ways such as having positions in emerging green markets, taking first mover advantage among competitors or cost reduction opportunities through ecological efficiencies [21].

There are some key factors that influence companies with regard to the adaptation of sustainability development policies. Law and Gunasekaran [5] classify these factors into three categories - managerial (strategy/policy and mindset), internal (system, measures, needs to advance and performance) and external factors (laws, regulations, social pressure, market trends and competition).

#### *2.1.1 Sustainability Drivers*

Company executives need to balance between sustainability of planet and society with sustainability of company [22]. Each company has some negative effects to the environment through their resources, process and activities or generated waste. However, most of them avoid finding out any solution to decrease their effects [23]. All in all, environmental consciousness of companies is not spontaneous process. Hence, there are some accelerating factors which are called here as sustainability drivers. In literature, sustainability drivers separated into three groups as management, internal and external factors. Company strategy and policies that supports sustainability and also top management's point of view take part in management factors. Internal factors include financial resources, knowledge and expertise, infrastructure, measuring system. Lastly, external factors are laws and regulations, social pressure, global market trend and competition. [22]. Either as a result of their interactions with each other or through their own dynamics all these factors come together and start change on the way of sustainability by the help of readiness or willingness of management and internal supportive measures. Each company's level of influence and reaction from management, internal and external factors become different. This difference also reveals the level of adaptation of companies to sustainable development.

### *2.2 Definition of Green Organizational Culture*

From the corporate point of view, it is not enough to just support pollution prevention through operations, minimizing resource allocation or selling greener products for being sustainable organizations or industries. They should think green and seek to be green [24]. Realization of sustainability on the part of companies depends on a cultural transformation including respect for the environment with an awareness of improved social responsibility [25]. The ideological structure of organizational culture plays an important role in terms of ensuring successful cultural

transformation. Therefore, organizational culture provides a climate to encourage sustainability outputs within an organization [26].

According to Schein, organizational culture has three levels in the form of assumptions, values and artifacts from bottom to top respectively [27]. These levels are also accepted as green organizational culture's levels [25]. In general terms, a green organizational culture includes assumptions, values and artifacts that reflect the desires and requirements of companies with regard to their environmentally sustainable operations [24].

In the form of a simple definition, green organizational culture is the integration of environmental management with organizational culture [28]. Green organizational culture defines a company's evaluation of the environment as a variable with values and norms [29]. Additionally, it is an interpretive and symbolic concept that guides all employees' behaviors and the company processes in terms of environmental management and protection [6]. Green organizational culture-based companies recognize and analyze various issues, develop strategies, and solve their problems with the guidance of environmental values [30]. As part of transforming current organizational cultures in this way (greener), companies will improve their environmental performance, leading to higher levels [25]. Some factors such as encouraging participation, increasing motivation, introducing rewards systems and incentives, better communication, the introduction of training activities will all be very important aspects for building a green culture within an organization [31–36]. Additionally, human resources departments play a crucial role when effectively bringing these issues to life [28,34,37].

#### 2.2.1 Studies about the Green Organizational Culture

When investigating studies about the green organization culture, it is obvious that attention to the subject has increased lately. Ramus [38] conducted a study involving the employees of six different companies regarding six categories of managerial behaviors (communication, competence building, rewards and recognition, management of goals and responsibilities, innovation, information dissemination) in order to find out usable and suitable areas that serve sustainability, and to find out the effect of company policies and the actions of departmental managers on the awareness of employees with regard to green initiatives. Harris and Crane [24] undertook semi-structured interviews with managers from different levels in various industries about the green organizational culture to discover and define these managers' opinions. Wang et al. [39] performed research into the relationship between responsible leadership and green organizational culture, and presented a conceptual framework about the effect of this relationship on corporate social performance. Linnenlucke and Griffiths [26] searched for answers to three basic questions about the nature of sustainability-oriented organizational culture, the possibility of a sustainability-oriented common culture development within a company, and the probability of more sustainable organizations as the result of cultural transformation. Galbraith, Kates, and Downey [40] developed a model which includes five factors as people, strategy, structure, process and rewards to handle sustainability based organizational culture. Each factor has an effect on building green organizational culture. For example "people" refers to employees within the company who need to have a clear understanding about the sustainability concept.

Chen [6] analyzed the effects of green organizational culture and green leadership on the green organizational identity and on the competitive advantage with method of the structural equality model (SEM). He found positive relationships between these variables and the green organizational culture, and that appropriate leadership can increase the environmental competitive advantage through a green organizational identity. Zibarras and Ballinger [34] conducted a survey to company employees in England about the general environmental activities in companies, investigating people in charge of relevant applications and the management of these initiatives, the methods used to encourage the environmental initiatives of employees, the evaluation of the effectiveness of these methods, defining the drivers and barriers associated with green applications, and the role of organizational culture in supporting environmental initiatives. In terms of this

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research, the most important factors were found to be the engagement and the support of top management and line managers, and stressed the importance and need for human resources to spread a green organizational culture within the company.

Gupta and Kumar [41] also emphasized role of an organizational culture based on green initiatives. They proposed that if company incorporates its adopted green culture with operations, management and marketing functions, then will have opportunities to get better performance.

### *2.3 Green Innovation and Its Dimensions*

In the literature, there are several definitions of green innovation. Sometimes, eco-innovation or environmental innovation is used with regard to the green innovation phrase. Generally, green innovation definitions emphasize decreasing negative impact or increasing positive effects on the environment through product, process or organizational innovations which serve environmental sustainability, and they have quite a close relationship with environmental management issues such as waste minimization and disposal, energy and material saving. There are some definitions from the literature:

- "Environmental innovations can be defined as innovations which aim at reducing the negative environmental impacts caused by production methods (process innovations) and products (product innovations)" [42]
- "Environmental innovation consists of new or modified processes, techniques, systems and products to avoid or reduce environmental harms" [43]
- "Hardware or software innovation that is related to green products or processes, including the innovation in technologies that are involved in energy-saving, pollution-prevention, waste recycling, green product designs, or corporate environmental management" [44]
- "Environmental innovations can be defined as innovations that consist of new or modified processes, practices, systems and products which benefit the environment and so contribute to environmental sustainability" [45]
- "Eco-innovations reduce the environmental impact caused by consumption and production activities, whether the main motivation for their development or deployment is environmental or not" [2]
- "Green innovation can be defined as a method to identify, implement and monitor the new ideas that have a positive impact on the environment and increase the company's competitiveness" [46]

Green innovation is generally categorized as product-, process- or organizational-based innovations [3,47]. Ramus [33] classifies green innovation types such as decreasing on the environmental impact of the company (reuse and recycling), solving an environmental problem for the company (hazardous substance use reduction) or developing a more eco-efficient product/service (fewer resources and/or energy intensive). On the other hand, some authors have classified green innovation in terms of the use of technologies such as clean technologies (clean products) or end-of-pipe applications (pollution control technologies, waste management, recycling, etc.) [29,43].

Beginning from the 1990s, some researchers have investigated the drivers of green innovations. Some of them have searched for the effect of environmental regulations, others have looked at supply- and demand-oriented factors. All these studies reveal heterogeneous discussions from both a methodological perspective and in terms of the results obtained [48]. Technological trends or technological capabilities, regulations and environmental policies, market or customer demands, company-specific factors such as strategies, are listed as the main drivers [49–53]. Also clearly-defined sustainability goals trigger companies to innovate [54].

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## 3. Research methodology

### 3.1 Research Goal and Hypotheses

Attention to the sustainability concept increases from both an academic and a social perspective. As a result of consuming resources rapidly and unconsciously, the value of unrenewable resources has increased. Conversely, companies have negative effects on the environment as a result of their activities. This situation highlights the environmental side of sustainability. From an environmental perspective, it is proposed that sustainability drivers enable an existing organizational culture to be more environmentally-oriented. These sustainability drivers affect green innovation activities directly, and also through the mediation effect of existing organizational culture. With this purpose, we have developed four hypotheses:

*Hypothesis 1: Sustainability drivers have a positive effect on green organizational culture*

*Hypothesis 2: Green organizational culture has a positive effect on the green innovation performance of a company*

*Hypothesis 3: Sustainability drivers have a positive effect on the green innovation performance of company*

*Hypothesis 4: Green organizational culture has a mediation role between the sustainability drivers and green innovation*

In addition to the developed hypotheses, we also seek answers to the following question:

*Is there any difference in terms of research variables with regard to gender, the department of the respondents, company size, and industry, having or not having the environmental award certificate, duration of ISO14001 certificate*?

In order to examine the above hypotheses, the proposed conceptual research model of this research is as shown in Figure 1.

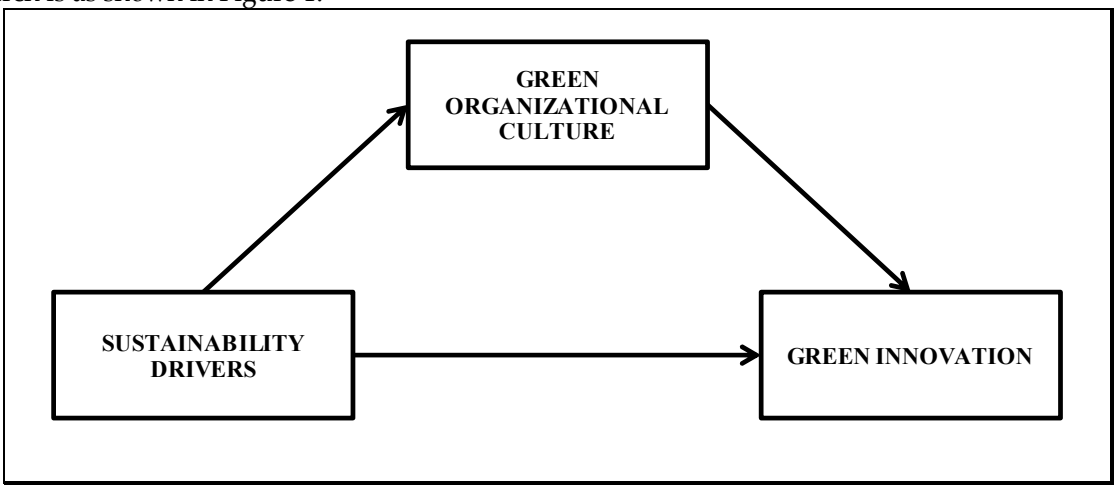


**Figure 1.** Conceptual research model.

Although, in the literature, there are several studies about sustainability, organizational culture and innovation which also take into consideration environment factors, there is no research which investigates relationships among all these variables. In this context, this study aims to fill this gap in the literature and to be one of the premised studies doing research into Turkish companies from a sustainability and green innovation point of view. This research's objective is to find out relationship between sustainability drivers and green innovation and also to search for green organizational culture's mediation effect in this relationship.

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### 3.2 Sample and Data Collection

In this research context, a survey study was conducted among the 500 biggest companies in Turkey according to the list published annually by the ICI based on sales revenue [55]. This list is referred to as ICI Top 500. The population of this study constituted the 500 biggest Turkish companies is determined according to certain criteria. One of these criteria is to have been in the list for 3 consecutive years between 2010 and 2012 in order to be seen as a stable company. Secondly, companies should be in possession of the ISO14001 Environmental Management System Certificate. After the first elimination, the websites of the remaining companies were searched to see if they possessed the ISO 14001 certificate. Based on the first and second criteria, a total of 224 companies was obtained which then represented the population of the study. The common characteristics of the companies that were included in the population of this study are summarized as below:

1. Companies should have their operations in Turkey
2. Companies should obtain their sales revenue from their production activities
3. Companies should be on the ICI Top 500 list during years 2012, 2011 and 2010
4. Companies should be in possession of the ISO 14001 Environmental Management System Certificate

Companies that have above characteristics were accepted as being suitable for the purpose of this study and for being applicable in terms of the research model. On-line survey forms were sent to all companies that represented the population. Because of problems in opening the on-line survey forms, forms were sent as a Word file to some companies. For the companies which provided no feedback or answered the survey, a reminder e-mail was sent and then they were called by telephone. Some of the companies would not answer the survey because of their company policy. The survey was therefore completed with the participation of 162 companies in total.

### 3.3 Measurement

The survey form has 4 sections. The first section contains the aim of the survey and some of the descriptive information requested, such as gender and the department of the respondents, company size and industry, ownership of any environmental award and duration of ISO14001 certification. Other sections include questions about each of the research variables in the form of sustainability drivers, green organizational culture and green innovation respectively. The sustainability drivers scale was developed by Law and Gunasekaran [5], the green organizational culture scale was adapted from the study of Zibarras and Ballinger [34], the green innovation scale was developed from Chen et al. [44] and Chiou et al. [56]. All scales were translated from English to Turkish by the researchers of this study. The survey has Likert-type answer options.

### 3.4 Validity and Reliability

Validity and reliability analyses were performed for each scale. For construct validity, the Kaiser-Meyer-Olkin sample validity co-efficient was calculated and factor analysis was undertaken. Validity explains the suitability of a scale for the purpose of usage. In any research, before generalization is made based on measurement data, the validity of the data should be reviewed [57]. In this study, after the translation of each scale, we asked the opinions of academics and some other authorities from sustainability, environment and quality departments from a number of companies about the clarity of the items and the propriety of the words and sentences used as a means of determining content validity. According to the feedback received, some corrections were made. Then exploratory factor analysis was applied to determine the construct validity of each scale. For all scales, in terms of factor analysis, Principal Component Analysis and Varimax with the Kaiser Normalization Rotation Method were used.

Reliability analysis explains how accurately a measurement tool is in terms of measuring the research variable. The most commonly used reliability co-efficient is Cronbach's Alpha in reliability

analysis. Suggested minimum $\alpha$ value is 0.70. In practice, the $\alpha$ value is evaluated according to the following criteria [57]:

- If $0 \leq \alpha \leq 0.40$ then the scale is not reliable
- If $0.40 \leq \alpha \leq 0.60$ then the scale's reliability is low
- If $0.60 \leq \alpha \leq 0.80$ then the scale is fairly reliable
- If $0.80 \leq \alpha \leq 1$ then the scale's reliability is high

For the sustainability drivers scale, all items were collected with regard to two factors. The first was referred to as internal drivers while the second one was referred to as external drivers. Drivers belonging to management within the Law and Gunasekaran's [5] study were identified as internal drivers here. According to the factor analysis results, total variance was found as being 61.718% and this variance was explained 40.181% in terms of the internal drivers and 21.537% in terms of the external drivers. Internal drivers were presented in the form of 7 items and external drivers in the form of 4 items. The scale had 11 items in total after factor analysis. These two factors had reliability values of 0.901 and 0.706 respectively. Scale reliability was found to be 0.854.

The second variable considered in this study, the green organizational culture scale, also had two factors in the form of green behavior development and green behavior evaluation. Total variance was found to be 65.826%, the green behavior development factor explained 42.480% of the total variance and the green behavior evaluation factor explained 23.345% of total variance according to the factor analysis results. Following reliability analysis, the Cronbach's Alpha value for this scale was 0.942. Green behavior development had 13 items and the Cronbach's Alpha value was 0.952. Green behavior evaluation had 4 items, and the Cronbach's Alpha value was found to be 0.837.

Regarding the last variable's factor analysis result, the scale had two factors in the form of green products and process innovation. The green innovation scales' total variance was 61.995%. Green product innovation, having 4 items, explained 31.425% of the total variance and had a 0.861 Cronbach's Alpha value. Green process innovation explained 30.570% of total variance and, in terms of reliability analysis, the Cronbach's Alpha value was found to be 0.777 which is acceptable. It had 5 items.

## 4. Data Analysis

### *4.1 Descriptive Analysis*

First of all, frequency distribution was calculated for the respondents' departments and gender, company size, industry, environment award ownership and ISO14001 certificate duration. In addition, mean and standard deviation values were found. Secondly, in order to test hypotheses, correlation and regression analyses were performed. Finally, difference analyses were made to find out if there was any difference in research variables in terms of the gender of the respondents, the departments of the respondents, the industry involved, environmental reward ownership and the ISO14001 certificate duration. All analyses were performed using the SPSS 20.0 program.

Demographic information relating to the respondents indicates that most of them were female (75%) and employed in sustainability, environment, R&D or quality-related departments (69%). Most of the companies were very large - having more than 2000 employees- (91%), they had their facilities mostly in the automotive, construction, chemical or energy industries (69%). Additionally, 72% of the companies had been in possession of the ISO14001 environmental management system certificate for more than 5 years, and 56% of these companies had an environmental award. Details of the demographic statistics of the respondents and also some characteristics of the companies involved are shown in Table 1.

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**Table 1.** Demographic details of respondents.

| | N=162 |
|---|---|
| **Gender** | |
| F | 122 |
| M | 40 |
| **Departments** | |
| Sustainability, environment & work safety | 41 |
| R&D and P&D | 39 |
| Quality | 32 |
| Production | 20 |
| Other | 17 |
| Top management | 13 |
| **Company size** | |
| Large (251-2000) | 102 |
| Very large (>2000) | 45 |
| Middle (51-200) | 13 |
| Small (1-50) | 2 |
| **Industry** | |
| Automotive | 46 |
| Construction | 27 |
| Chemical | 22 |
| Energy | 16 |
| Food | 13 |
| Other (Defense, Iron&steel, more than one industry) | 13 |
| Textile | 11 |
| White goods | 8 |
| Packaging | 6 |
| **ISO 14001 certificate duration** | |
| >10 years | 74 |
| 5-9 years | 43 |
| 0-4 years | 26 |
| No answer | 19 |
| **Environmental reward ownership** | |
| Yes | 90 |
| No | 55 |
| Don't know | 17 |

With data obtained from the survey results, the statistical values of each variable were calculated in the form of maximum, minimum, average value and standard deviation. According to the results, for the sustainability drivers variable had an average value of 3.94, for the green organizational culture the average value was 3.98, while the green innovation average value was also 3.98. With an average value close to 4.00 for all variables - sustainability drivers, green organizational culture and green innovation, - the general status of the companies is at a good level.

### *4.2 Correlation Coefficients*

In order to define relationships between research variables, Pearson Correlation Analysis was applied. Correlation analysis aims to find out the degree and the direction of relationships between two variables. The Pearson correlation coefficient ranges between "-1" and "+1". in its positive form the coefficient means a direct proportional relationship between variables while a negative value means the opposite. A "0" value means no relationship between variables and values close to "0" indicate a weak relationship [57,58].

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Table 2 shows the correlation analysis results. It is clear that sustainability drivers have a positive medium level correlation (or close to the medium level) with green organizational culture and green innovation variables. When we review internal factors and external factors in detail, we can see that especially external factors have a weak positive correlation with all variables. Secondly, there is also a medium level correlation between green organizational culture and green innovation. In summary, all variables and their sub-dimensions have positive relationships with each other in different degrees.

**Table 2.** The correlation coefficient matrix.

| Variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| 1.Sustainability drivers | 1 | .901** | .678** | .564** | .573** | .434** | .491** | .451** | .419** |
| 2.Internal factors | | 1 | .293** | .631** | .653** | .353** | .512** | .476** | .432** |
| 3.External factors | | | 1 | .176* | .158* | .159* | .215** | .189* | .191* |
| 4.Green organizational culture | | | | 1 | .964** | .739** | .621** | .449** | .626** |
| 5.Green behavior development | | | | | 1 | .535** | .622** | .459** | .620** |
| 6.Green behavior evaluation | | | | | | 1 | .400** | .266** | .422** |
| 7.Green innovation | | | | | | | 1 | .850** | .907** |
| 8.Green product innovation | | | | | | | | 1 | .549** |
| 9.Green process innovation | | | | | | | | | 1 |

### *4.3 Regression Analysis*

As a statistical tool, regression analysis indicates the causal effect of an independent variable on a dependent variable [57,58]. In order to test the research hypotheses, regression analysis was conducted. In this context, independent variable, dependent variable, mediator variable in regression analysis and concerning hypotheses are listed below:

Hypothesis 1: Sustainability drivers have a positive effect on green organizational culture

- Independent variable: Sustainability drivers
- Dependent variable: Green organizational culture

Hypothesis 2: Green organizational culture has a positive effect on the green innovation performance of a company

- Independent variable: Green organizational culture
- Dependent variable: Green innovation performance

Hypothesis 3: Sustainability drivers have a positive effect on the green innovation performance of company

- Independent variable: Sustainability drivers
- Dependent variable: Green innovation performance

Hypothesis 4: Green organizational culture has a mediation role between the sustainability drivers and green innovation

- Independent variable: Sustainability drivers
- Dependent variable: Green innovation performance
- Mediator variable: Green organizational culture

To test the first hypothesis, simple regression analysis was applied between sustainability drivers and green organizational culture, then multiple regression analysis was applied between the

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sub-dimensions of the sustainability drivers and green organizational culture. According to the simple regression analysis results, sustainability drivers explained 31.4% of the variance in green organization culture. In multiple regression analysis, the stepwise method was used. In this method, correlation coefficient values are important for analysis of the order of the sub-dimensions. In the first step, the internal factors sub-dimension was applied to the analysis and then, for the second step, the external factors were added. According to the results, in the first step, the effect of the internal factors on green organizational culture was significant ($p<0.05$). Internal factors explained 39.4% of the variance in terms of the green organizational culture. In the second step, when external factors were added to the analysis, the results became statistically insignificant for external factors ($p>0.05$). Only the internal factors of the sustainability drivers variable was found to have an effect on green organizational culture. According to simple regression analysis, we should accept Hypothesis 1. However, when we go into detail and added the sub-dimensions of the independent variable into the analysis to see their partial effects on the dependent variable, we applied multiple regression analysis. As the second sub-dimension was statistically insignificant according to the multiple regression analysis, hypothesis 1 was partially supported. Table 3 shows the regression analysis results.

**Table 3.** Simple and multiple regression analyses results of the sustainability drivers and the green organizational culture.

| **Dependent variable:** Green organizational culture | **Model Summary** | | **ANOVA table summary** | | **Coefficient table summary** | | |
|---|---|---|---|---|---|---|---|
| **Independent variable** | **$R^2$** | **Adjusted $R^2$** | **F** | **Sig. level** | **Std. Beta** | **t value** | **Sig. level** |
| Sustainablity drivers | .318 | .314 | 74.772 | .000 | .564 | 8.647 | .000 |
| **Dependent variable:** | **Model Summary** | | **ANOVA table summary** | | **Coefficient table summary** | | |
| Green organizational culture | **$R^2$** | **Adjusted $R^2$** | **F** | **Sig. level** | **Std. Beta** | **t value** | **Sig. level** |
| **1. Step:** **Independent variable:** Internal factors | .398 | .394 | 105.738 | .000 | .631 | 10.283 | .000 |
| **2. Step:** **Independent variables:** Internal factors External factors | .398 | .390 | 52.560 | .000 | .634 -.010 | 9.847 -.160 | .000 .873 |

Green organizational culture explained 38.2% of the variance in green innovation performance according to simple regression analysis results. In addition, multiple regression analysis indicated that the green behavior development sub-dimension of green organizational culture explained 38.3% of the variance in green innovation performance ($p<0.05$). However, when the green behavior evaluation sub-dimension was added to the analysis, the contribution of this sub-dimension to the model became statistically insignificant ($p>0.05$). Only the green behavior development sub-dimension of green organizational culture had an effect on green innovation. As with hypothesis 1, hypothesis 2 was also partially accepted. In table 4, both simple and multiple regression analyses results are shown.

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**Table 4.** Simple and multiple regression analyses results of the green organizational culture and the green innovation performance.

| **Dependent variable:** Green innovation | **Model Summary** | | **ANOVA table summary** | | **Coefficient table summary** | | |
|---|---|---|---|---|---|---|---|
| **Independent variable** | **$R^2$** | **Adjusted $R^2$** | **F** | **Sig. level** | **Std. Beta** | **t value** | **Sig. level** |
| Green organizational culture | .386 | .382 | 100.448 | .000 | .621 | 10.022 | .000 |
| **Dependent variable:** | **Model Summary** | | **ANOVA table summary** | | **Coefficient table summary** | | |
| Green innovation | **$R^2$** | **Adjusted $R^2$** | **F** | **Sig. level** | **Std. Beta** | **t value** | **Sig. level** |
| **1. Step:** **Independent variable:** Green behavior development | .387 | .383 | 100.982 | .000 | .622 | 10.049 | .000 |
| **2. Step:** **Independent variables:** Green behavior development Green behavior evaluation | .393 | .386 | 51.541 | .000 | .571 .095 | 7.819 1.294 | .000 .198 |

**Table 5.** Simple and multiple regression analyses results of the sustainability drivers and the green innovation performance.

| **Dependent variable:** Green innovation | **Model Summary** | | **ANOVA table summary** | | **Coefficient table summary** | | |
|---|---|---|---|---|---|---|---|
| **Independent variable** | **$R^2$** | **Adjusted $R^2$** | **F** | **Sig. level** | **Std. Beta** | **t value** | **Sig. level** |
| Sustainability drivers | .241 | .237 | 50.932 | .000 | .491 | 7.137 | .000 |
| **Dependent variable:** | **Model Summary** | | **ANOVA table summary** | | **Coefficient table summary** | | |
| Green innovation | **$R^2$** | **Adjusted $R^2$** | **F** | **Sig. level** | **Std. Beta** | **t value** | **Sig. level** |
| **1. Step:** **Independent variable:** Internal factors | .263 | .258 | 56.980 | .000 | .512 | 7.548 | .000 |
| **2. Step:** **Independent variables:** Internal factors External factors | .267 | .258 | 28.993 | .000 | .492 .071 | 6.922 1.002 | .000 .318 |

In order to test the third hypothesis, using simple regression analysis we found that there is 23.7% effect of sustainability drivers on green innovation performance. Internal factors explained 25.8% of the green innovation performance. However, external factors had no statistically significant effect on green innovation performance ($p>0.05$). Hypothesis 3 was partially supported. Table 5 shows the analysis results.

External factors with regard to the sub-dimension of sustainability drivers and green behavior evaluation with regard to the sub-dimension of green organizational culture are not included in further analyses because of statistically insignificant results in terms of the multiple regression analysis. Sustainability drivers variable is presented with only internal factors, and the green organizational culture variable is presented with green behavior development sub-dimension for mediating effect and difference analyses.

Preprints (www.preprints.org) | NOT PEER-REVIEWED | Posted: 24 November 2016 doi:10.20944/preprints201611.0122.v1

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For the last hypothesis, we used Baron and Kenny's [59] three step approach in order to find out if there is a mediation effect of the green organizational culture. According to Baron and Kenny [59], a variable's mediator role should be searched using the following steps:

- The independent variable should have an effect on the mediator variable
- The independent variable should have an effect on the dependent variable
- When the mediator variable is added to the regression analysis during the third step, if a relationship between independent and dependent variables becomes statistically insignificant, then a full mediation effect occurs; otherwise, if there is a decrease in the relationship between the independent and dependent variables, then a partial mediation effect occurs.

First of all, independent variable sustainability drivers and mediating variable green organizational culture were put into the regression analysis. The first step regression analysis indicated that sustainability drivers were significantly related to green organizational culture ($\beta$=0.653; $p<0.05$). Then the second step regression analysis was conducted between the sustainability drivers and the dependent variable green innovation performance. There was a positive and significant effect of sustainability drivers on green innovation performance ($\beta$=0.512; $p<0.05$). After that, the mediating variable green organizational culture was added to the analysis, and there was a positive and significant effect of green organizational culture on green innovation performance ($\beta$= 0.520, $p<0.05$). However, the $\beta$ coefficient of sustainability drivers decreased from 0.512 to 0.177 ($p<0.05$). With this result, it is obvious that there is a partial mediating effect of green organizational culture on the relationship between sustainability drivers and green innovation performance. Hypothesis 4 was supported with this result. Table 6 shows the details of the analysis.

**Table 6.** Regression analysis result of mediating effect of green organizational culture.

| **1. Step** | | | | **Independent variable:** Sustainability drivers(internal factors) **Dependent variable:** Green organizational culture (green behavior development) | | |
|---|---|---|---|---|---|---|
| **$R^2$** | **Adjusted R2** | **F** | **Sig. level** | **Std. Beta** | **t value** | **Sig. level** |
| .426 | .422 | 118.719 | .000 | .653 | 10.896 | .000 |
| **2. Step** | | | | **Independent variable**: Sustainability drivers(internal factors) **Dependent variable:** Green innovation | | |
| **$R^2$** | **Adjusted R2** | **F** | **Sig. level** | **Std. Beta** | **t value** | **Sig. level** |
| .263 | .258 | 56.980 | .000 | .512 | 7.548 | .000 |
| **3. Step** | | | | **Independent var.:** Sust. drivers (int. fac.), Green org. culture (green beh. dev.) **Dependent variable:** Green innovation | | |
| **$R^2$** | **Adjusted R2** | **F** | **Sig. level** | **Std. Beta** | **t value** | **Sig. level** |
| .421 | .413 | 57.725 | .000 | .177 | 2.246 | .026 |
| | | | | .520 | 6.586 | .000 |

### *4.4 Difference Analysis*

In order to find out if there was any difference in research variables in terms of the gender of the respondents and environmental award ownership of companies, an independent groups T-test was applied. Then, One-way Anova analysis was also conducted to search for any difference in research variables in terms of the department of respondents, industry of company or duration time of having held the ISO14001 certificate.

In accordance with the results, only for green product innovation sub-dimension of green innovation was there a significant difference between female and male respondents ($p_{g.product\ inno}$=0.031 < 0.05). The average value of female respondents was found to be greater than that of male respondents ($F_{g.product\ inno}$=4.3250 $M_{g.product\ inno}$=4.0943). Regarding environmental award ownership on

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the part of companies, and the department of respondents within the company, there was no significant difference in terms of research variables. But, in terms of the industry of the company, regarding green innovation and also the green process innovation sub-dimension of the green innovation variable, there were differences between groups ($p_{gren\ inno}$=0.015<0.05; $p_{g.\ process\ inno}$ = 0.021<0.05). To find the groups from which this difference emerged, the Tukey test was applied. Between automotive and energy industries there were significant differences. The automotive industry average was higher than that of the energy sector (For green innovation; $Ave_{automotive}$ =4.2560 and $Ave_{energy}$ = 3.6667; for green process innovation; $Ave_{automotive}$ =4.2174 and $Ave_{energy}$ = 3.7000). Finally, for ISO14001 certification duration, in total 4 groups were identified as 0-4 years, 5-9 years, above 10 years and no answer group. There was a significant difference for the sustainability drivers and the internal factors sub-group ($p_{sust\ drivers}$= 0.021<0.05 $p_{internal\ fac.}$= 0.001<0.05). After the Tukey test, it was found that there was a difference between the 0-4 years and the above 10 years groups. For the above 10 years group, the average value was higher than that of the 0-4 years group (Sustainability drivers => Ave0-4 years =3.6678 and $Ave_{above\ 10\ years}$ = 4.0442; Internal factors=> Ave0-4 years =3.6044 and $Ave_{above\ 10\ years}$ = 4.1988). This result indicated that having the ISO14001 certificate for many years triggers companies in terms of sustainability, and especially the internal factors became more important. There were also differences for green organizational culture and green behavior development regarding ISO14001 certificate duration (p= 0.012<0.05). The averages of the 5-9 years and above 10 years groups were found to be higher than the average of the no answer group (Green organizational culture; $Ave_{above\ 10years}$ = 4.0994; Ave5-9 years = 4.0575 and ,$Ave_{no\ answer}$ = 3.5882; Green behavior development; $Ave_{above\ 10years}$ = 4.3607; Ave5-9 years = 4.3274 and $Ave_{no\ answer}$ = 3.8300). The difference between groups was also found for green innovation and green product innovation ($p_{green\ inno}$= 0.018<0.05; $p_{green\ product\ inno}$= 0.021<0.05). There was a significant difference between the above 10 years group and the no answer group (p=0.012 < 0.05). The average value for the above 10 years group was higher than that for the no answer group in terms of the green innovation variable ($Ave_{above\ 10\ years}$ = 4.2220 and $Ave_{no\ answer}$ = 3.7544). Similar results were also found for green product innovation ($Ave_{above\ 10\ years}$ = 4.2905 and $Ave_{no\ answer}$ = 3.7632). These results mean that the environmental system certification duration has a positive influence on both green organizational culture and green innovation, especially in terms of product innovation.

## 5. Discussion and Conclusions

Sustainability is defined in basic terms as today's resources' continuity for the coming generations. From a corporate perspective, one of the main goals of companies is to remain in existence in the future. Hence, their goal is in line with the sustainability philosophy. It is not possible to imagine a company that survives in a world while consuming resources unconsciously and harming its environment with its operations. From the environmental point of view associated with sustainability, there are some factors which trigger companies in directing some different processes on behalf of maintaining current methods and facilities. Law and Gunasekaran [5] identified key factors influencing the adoption of sustainability development strategies on the part of companies. These factors were entitled sustainability drivers and are classified as internal factors and external factors. This study investigating these factors from Turkish companies' perspective finds that internal factors are more effective than external factors in generating action on the part of companies.

Under the effect of sustainability drivers, while companies put operations into place in such a way as to minimize their negative effects on the environment, and also to use their production resources more productively, these companies shift to certain changes in their products and processes. One of these changes is associated with green innovation activities. On the other hand, organizational culture plays an important role when companies are realizing green innovation activities. If a company's organizational culture has a tendency to support green behaviors and this leads to an emphasis on the importance of developing new ideas, then it enables the company to increase total value and serves to achieve the company's targets.

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This study aims to be original in terms of investigating interactions among sustainability drivers, green organizational culture and green innovation performance in Turkish companies and fill the gap in this area. The results of this study lead to some contributions to the management literature. First, the results show that sustainability drivers have a relationship with both green organizational culture and green innovation performance. From management point of view, companies need to take into account these three elements together. For example, sustainability drivers express factors that trigger companies for realizing some activities regarding environmental sustainability. Developing environmental sustainability inside the company is achieved through people, which means employers. When employers act to serve environmental sustainability then organizational culture will shape on this way. It means, environmental sustainability helps building green organizational culture. Moreover, if environmental sustainability develops within the company then innovation activities are also supported by this way. Innovation will have its own share from environmental perspective.

However, external factors have no effect on developing a green organizational culture and realizing both green product and process innovations. Hence, improvements in this area are the outcome of internal factors. The internal factors presented here are the personal interest of the top management, supporting policies, promoting business objectives, sufficient financial support, specific knowledge and expertise, well-developed infrastructure, and effective measuring systems to monitor performance. The external factors; law and regulations, market trend and social pressure have no significant effect on both green organizational culture and green innovation.

Evaluating this study in terms of its findings shows that some factors do not reflect the expected results. Taking into consideration certain dynamics in Turkey, it is possible to comment differently. There can be some reasons associated with finding the external factors' effect on green innovation to be statistically insignificant. Regarding environmental protection there are limited law and regulations which have limited restrictions and penalties for companies to act in sustainable and environmental-friendly manner. Environmental protection and sustainability is very important subject of Turkey's future agenda, so there are some ongoing arrangements and regulations for the next term. Also, companies feel very few pressures from customers and social communities regarding environmental issues. For example, customers sometimes pay attention to product price much more than other factors. Lack of enough non-profit organizations and societies that supports environmental facts in Turkey reveals external factors' ineffectiveness on this study.

Secondly, a green organizational culture has an effect on green innovation activities. The green behavior evaluation sub-dimension of a green organizational culture has a very low relationship with green innovation performance, and its effect on green innovation performance is found to be statistically insignificant. This result highlights lack of enough practices within companies to evaluate and support positive environmental behaviors such as reward systems. Otherwise, the green organizational culture without a green behavior evaluation sub-dimension has a partial mediating effect on the relationship between sustainability drivers and green innovation performance. Accordingly, Turkish companies target green products and process innovations as motivated by internal factors. This situation is improved by an organizational culture which gives importance to the environment.

Today, companies increasingly pay attention to environmental activities and day-by-day, more companies are known in terms of their green activities. It is obvious that, together with growing consciousness, companies' activities in terms of environmental protection and green innovation will increase in the coming years. Therefore, it is suggested that there is a need to repeat this research at a later date to observe improvements in this area.

This research was performed with companies which already had an ISO14001 certificate and had been on the ISO500 list for three years consecutively in 2010, 2011 and 2012. Renewing this research with a new company population taken from the next ISO500 list will also give feedback about the consistency of the results and allow us to observe any changes in the external factors' effect.

This study was performed among companies which operates in Turkey. Limitation of research population of this study with just one country inhibits generalization of research results. It is recommended that similar research be undertaken for other countries and for a comparison of the outcomes to allow for a generalization of the research findings. It can be beneficial to think this study within the European context of green innovation for further studies.

Moreover, ISO certification for environment management in companies brings changes to organizational culture to be more than a compliance exercise. Hereby, a comparison between certified and not certified companies as taking into account whole population of ISO500 companies to control out certification as a default for green organizational culture and innovation.

## Author Contributions

Mübeyyen Tepe Küçükoğlu and Recep İbrahim Pınar developed the model, conducted the analysis and wrote the paper together.

## Conflicts of Interest

The authors declare no conflict of interest

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