



# Investigating the Effective Factors on Green Project Management based on Sustainable Development of Human Resource

Mohammad Aghania, Peyman Attariani, Babak Afshar and Behnaz Torabi

Department of management Limkokwing University, Limkokwing Cyberjaya, Malaysia

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## Abstract

Wide application of the project management standards for assessment and progress of professional competence are based on a rational perspective through which it is possible to observe the competence defined by a series of specifications in the form of the scientific subjects. In present research, it has been attempted to use the most valid methods in order to gather the newest data and information in the field of green project management oriented into sustainable development of human resources whereby the data analysis and use of statistical software came useful to gain results. Statistical population used in this research encompasses 200 experts who are specialized in the field of project management. The data obtained from questionnaires distributed among the population have been analyzed using SPSS software. Considering the research findings, the social, economic, structural, and environmental indices have a mean of more than 3 indicating that the components of sustainable development highly affect project management.

**Keywords:** Project, project management, sustainable development, human resource.

## Introduction

The sustainable development of social, economic and environmental balance for longer performance is considered as one of the essential issues of the present world<sup>1</sup>. Powerful human resource is one of the important factors of sustainable development<sup>2</sup>. Human resource has always been the most important factor to achieve development<sup>3</sup>. Today, humans have achieved many progresses in the field of the science and technology; however, the role of the technology in obtaining industrial and economic development has not decreased importance of human resources<sup>4</sup>. In fact, the issue of human resource is significantly considered as the creator and applier of technology<sup>5</sup>.

Any research begins with a problem and the problem makes some questions in the researcher's mind, and finally leads to research hypotheses<sup>6</sup>. Therefore, any researcher's main duty is to study in order to answer research questions and arrive at a conclusion based on collected data, and finally confirm or reject research hypotheses regarding the collected data<sup>7</sup>. However, it is obvious that data is not reliable and should be changed into applicable information. To do so, the data should be analyzed and decisions should be made<sup>8</sup>.

The present paper aims to answer the following questions: Have inherent capabilities of green management been fully optimized in integrating sustainable development concepts?, What should be done for integrating these concepts?, Is green management a strong mechanism to achieve four balances of sustainable development" community, environment, economy, and structure"?

Zain-al-Abidin studied the relation between knowledge of green value management members and sustainable development; he also aimed to determine whether it is possible to include sustainable development in workshops of green value management<sup>9</sup>. Results of the studied indicated that considering sustainable development in workshops of green value management was different from other workshops and it was because of dependence on employers' different commitments and advantages related to construction aspects, level of awareness, knowledge of members of green value management team and time limit of the workshops. Moreover, recognized behavioral and scientific obstacles prevented from effective integration of sustainable development green value management<sup>10</sup>.

Cheung and colleagues tried to develop a performance control and monitoring system for construction projects based on web regarding factors such as human resource, cost, time, security, environment, and beneficiaries' satisfaction. Their system included development of functional criteria for each of the above factors and how they could be measured. One of the advantages of the web-based system for project managers was that the project team and other beneficiaries could monitor project progress<sup>11</sup>.

Hemanta Kumar Doloi has studied perception of stockholders' viewpoint toward cost estimation in project management. Increase of cost is one of the main problems of any project<sup>12</sup>. Many studies have focused on the issue, however, its main causes and the methods to solve it are not successfully presented<sup>13</sup>. In fact, the previous studies have investigated

factors that are related to project environment directly or indirectly, they have also determined effect of the factors on increase of project costs<sup>14</sup>. Contrary to the traditional methods, the present paper aims to present a conceptual model that indicates the most dominant issues related to life cycle of a project<sup>15</sup>. Such subjects are in close relation with what involves stockholders<sup>16</sup>.

**Methodology**

The process of research in any field of science is aimed at reaching to a series of results and research findings; along this, findings of any research include definitions based on the relations and differences<sup>17</sup>. Hence, hypotheses of data analysis using descriptive and inferential statistics have been examined regarding data collection<sup>18</sup>. Descriptive statistics used in this paper include frequency tables, display data and central indices where on Friedman test, one way analysis of variance

(ANOVA), multiple regression and so forth using SPSS software-version 17 have been used in inferential level<sup>19</sup>.

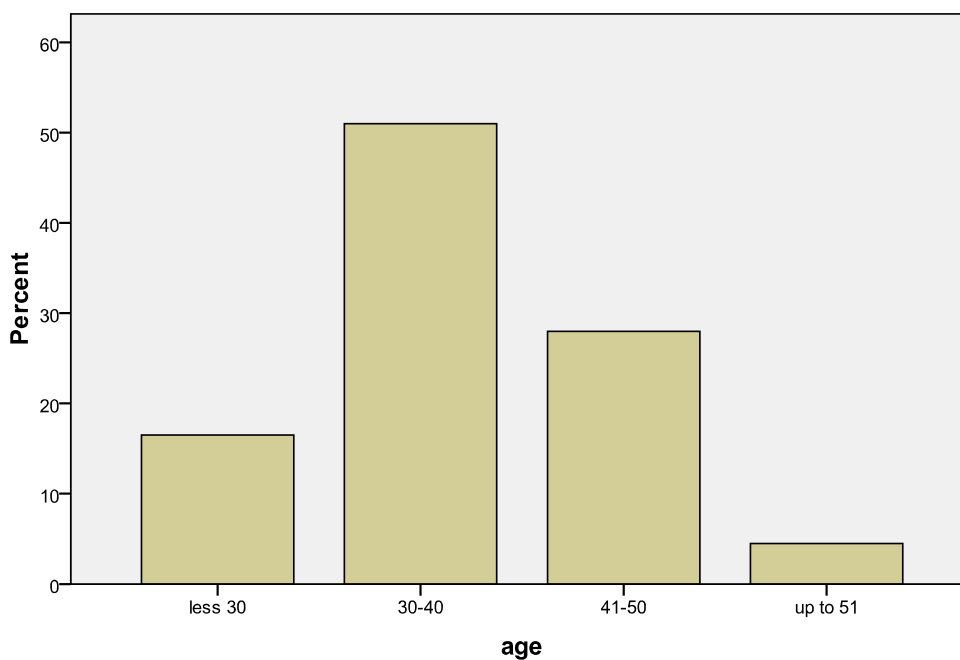
**Descriptive Statistics:** Descriptive statistics and tables associated to characteristics of sample have been represented in this part<sup>20</sup>. Getting to know characteristics of sample is useful in a way that the characteristics of the whole society can be examined and general characteristics of that for other researchers can be specified<sup>21</sup>. Further, this helps to use the information in generalizing the results to other societies or in designing the questions of next researches<sup>22</sup>.

As observed, it can be perceived from the statistics shown in table 1 that age of 16.5%, 51%, 28% and 4.5% of experts is younger than 30, 31-40, 41-50, and elder than 50 years old, respectively. Also, the mean of age equals to 38.6 years old.

**Table-1**  
**Frequency Distribution in Terms of Age**

Variables	Frequency	Frequency percentage	Validity percentage	Mean
Younger than 30 years old	33	16.5%	16.5%	38.6
31-40 years old	102	51%	51%	
41-50 years old	56	28%	28%	
Elder than 50 years old	9	4.5%	4.5%	
Total	200	100%	100%	

age



**Figure-1**  
**Frequency Distribution in Terms of Age**

## Results and Discussion

**Inferential Statistic: Ranking of Independent Variables Using Friedman Test:** As mentioned, Friedman test is used to prioritize and rank the variables based on the highest effect on dependant variable<sup>23</sup>. Friedman test is used to compare several groups in terms of mean of their ranks in order to specify whether these groups are from a society or not; scale in this test has to be dedicated of minimum rank<sup>24</sup>. This Corresponding nonparametric test is F test which it is usually used in ranking scales instead of F<sup>25</sup>. Also, Friedman test is used to analyze two-way variance using ranking which it is also used to compare mean of ranking for different groups. Independent variables include social indicator, environmental indicator, economic indicator and structure indicator so as we would have the following:

**Table-2**  
**Ranks and Mean of Ranks**

	Mean of ranks
Social indicator	33/70
Environmental indicator	4/09
Economic indicator	3/34
Structural indicator	3/28

As observed, mean of ranks for each of variables has been estimated in table-2. According to calculation of mean of ranks, the most effect relates to social indicator, Environmental indicator, Economic indicator and structural indicator, respectively.

**Table-3**  
**Estimation of Friedman Statistic**

	Mean of ranks
number	200
calculated $X^2$ value	33/249
Degree of freedom	5
P-Value	0/000

According to values of Friedman statistic and also error level which is less than 0.05(P – Value < 0/05), it can come into the conclusion that the relationship is significant at 0.99% confidence level. Hence, null hypothesis is rejected.

**Hypothesis Testing:** First hypothesis: there is a significant relation between green project management and sustainable development of human resources.  $H_0$ : there is not a significant relation between green project management and sustainable development of human resources.  $H_1$ : there is a significant relationship between green project management and sustainable development of human resources. A variance analysis method (ANOVA) is used to determine the relation between green project management and sustainable development of human resources. To use this test, the condition of equality of variances has to be true. Refer to following for this.

**Table-4**  
**Levene's Test for Equality of Variances**

Row	Value of Levene's Test	First freedom degree	Second freedom degree	P-value
1	1.815	13	156	0.045

As observed, Condition of homogeneity of variances is true at 0.95 confidence level, so use of ANOVA test is permissible.

**Table-5**  
**Variance Analysis**

Sources of variations	Sum of Squares	Freedom degree	Mean of squares	F statistics	P-value
Inter-group	56.216	43	1.307	1.762	0.007
Intra-group	115.764	156	0.742		
Total	171.980	199			

According to values of Friedman statistic and also error level which is less than 0.05(P – Value < 0/05), it can come into the conclusion that the relationship is significant at 0.99% confidence level. In other words, there is a significant relationship between green project management and sustainable development of human resources<sup>26</sup>. Hence, null hypothesis is rejected and the research hypothesis is accepted<sup>27</sup>. Also, the diagram of relation between green project management and sustainable development of human resources would be as following in figure-2.

Also, Pearson correlation coefficient is used to measure the effect of green project management on sustainable development of human resources, so as we would have:

**Table-6**  
**Estimation of Pearson Correlation Coefficient**

Row	Variable	Pearson correlation coefficient	P-value	Total
1	Green management and sustainable development	0.670	0.000	200

The relationship between green project management and sustainable development of human resources has been measured referring to views of 200 experts<sup>28</sup>. As observed, according to the value of Pearson statistic (0.670) and error level which is less than 0.05(P– Value < 0/05), it can come into the conclusion that the relationship among variables is significant at 0.99% confidence level. Also, Pearson correlation coefficient between two variables shows that the intensity of relationship between two variables is strong, direct and positive<sup>29</sup>. In other words, applying green project management influences the sustainable development of human resources for about 67%.

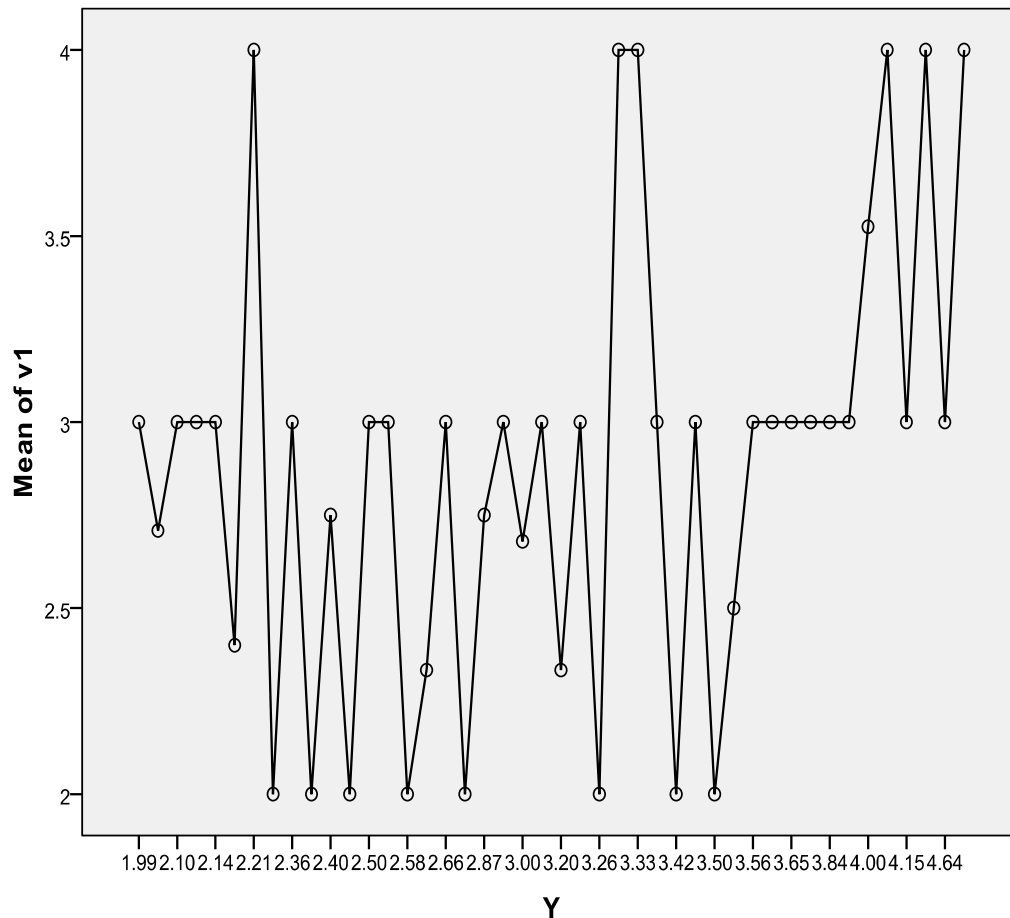


Figure-2

The Diagram of Relation between Green Project Management and Sustainable Development of Human Resources

Second hypothesis: there is a significant relation between systematic thinking of sustainable development and green project management.

H<sub>0</sub>: there is not a significant relation between systematic thinking of sustainable development and green project management. H<sub>1</sub>: there is a significant relation between systematic thinking of sustainable development and green project management.

Analysis of variance method (ANOVA) is used to determine the relation between systematic thinking of sustainable development and green project management<sup>30</sup>. To use this test, the condition of equality of variances has to be true. Refer to following for this<sup>31</sup>.

Table-7  
 Levene's Test for Equality of Variances

Row	Value of Levene's Test	First freedom degree	Second freedom degree	P-value
1	2.495	4	195	0.044

As observed, Condition of homogeneity of variances is true at 0.95% confidence level, so use of ANOVA test is permissible.

Table-8  
 Variance Analysis

Sources of variations	Sum of Squares	Freedom degree	Mean of squares	F statistics	P-value
Inter-group	31.259	4	7.815	12.177	0.007
Intra-group	125.144	195	0.642		
Total	156.403	199			

According to values of Friedman statistic and also error level which is less than 0.05(P – Value < 0/05), it can come into the conclusion that the relationship is significant at 0.99% confidence level. In other words, there is a significant relation between systematic thinking of sustainable development, and green project management<sup>32</sup>. Hence, null hypothesis is rejected and the research hypothesis is accepted. Also, the diagram of relationship between systematic thinking of sustainable development and green project management would be as following:

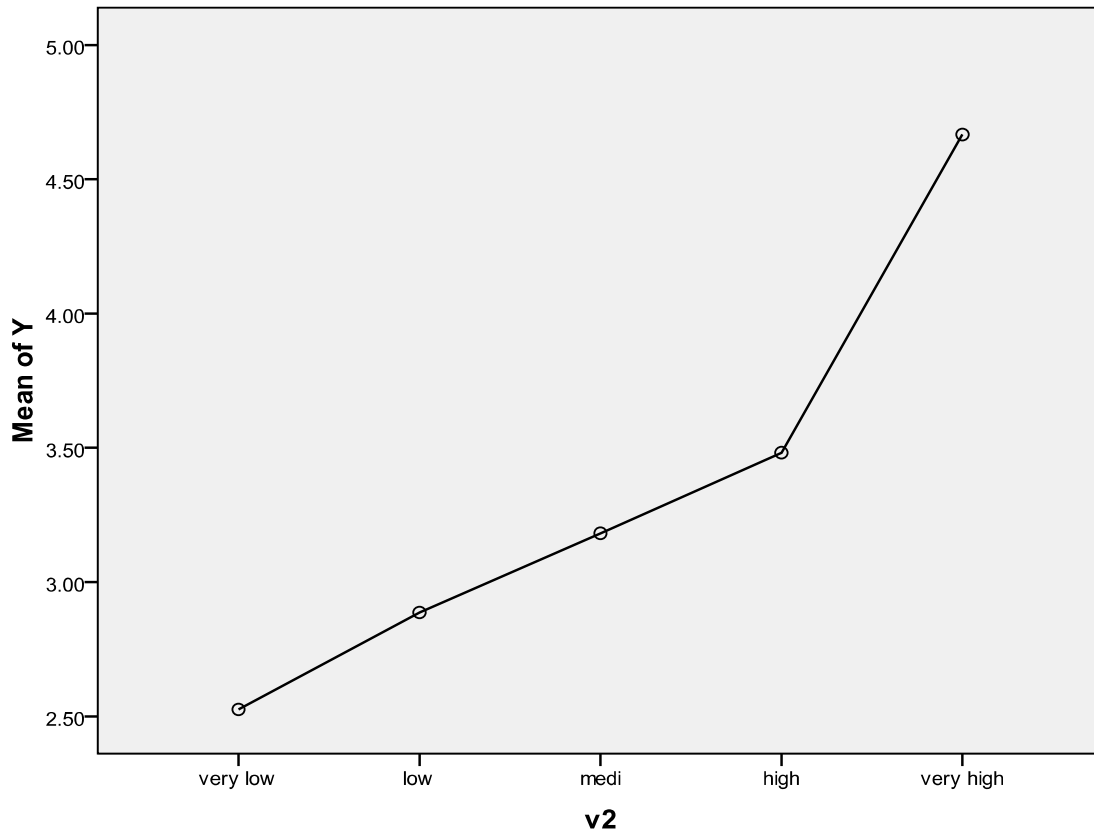


Figure-3

**Diagram of Relationship between Systematic Thinking of Sustainable Development and Green Project Management**

Also, Pearson correlation coefficient is used to measure the effect of systematic thinking of sustainable development on green project management, so as we would have:

**Table-9**  
**Estimation of Pearson Correlation Coefficient**

Row	Variable	Pearson correlation coefficient	P-value	Total
1	systematic thinking of sustainable development and green project management	0.408	0.000	200

The relationship between systematic thinking of sustainable development and green project management has been measured referring to views of 200 experts<sup>33</sup>. As observed, according to the value of Pearson statistic (0.408) and error level which is less than 0.05 (P – Value < 0/05), it can come into the conclusion that the relationship among variables is significant at 0.99% confidence level. Also, Pearson correlation coefficient between two variables shows that the intensity of relationship between two variables is strong, direct and positive. In other

words, systematic thinking of sustainable development influences the green project management for about 41%.

Third hypothesis: there is a significant relationship between social, environmental, economic and structural indicators and green project management.

H<sub>0</sub>: there is not a significant relation among social, environmental, economic - structural indicators and green project management. H<sub>1</sub>: there is a significant relation among social, environmental, economic - structural indicators and green project management.

Multiple- regression is such a statistical analysis in which the variations of one or several dependent variables to one or several independent variables are determined and examined, i.e., the regression is a useful statistical technique which examines the effects of one or several independent variables on dependent variables<sup>34</sup>. In this hypothesis, the regression is firstly used to recognize the effect of social, environmental, economic and structural indicators on green project management, and then the analysis of model is represented<sup>35</sup>. In this method, in addition to significant measuring of each of the independent variables on green project management, effect of each of variables has been also examined.

**Table-10**  
**Entered and Removed Variables**

Model	entered variables	removed variables	Regression method
First	Independent variables	-	Enter

In this model, all the variables have been entered into model without any specific ordering or blocking whereby the analysis of them has been provided.

**Table-11**  
**Estimation of Regression Model**

Row	Model	Multiple correlation coefficient	Determination coefficient	Adjusted determination coefficient
1	Variables	0.765	0.585	0.577

Table-11 shows the relations between key factors as social, environmental, economic and structural indicators and variable of green project management. In this table, multiple correlation coefficients of independent variables in relation with variable of green project management equals to 0.765. Determination coefficient of independent variables equals to 0.585 and adjusted determination coefficient which is based on freedom degree of variables equals to 0.577. In other words, the variation of green project management based on the effects of mentioned variables is reported equal to 0.58 which the accurate estimation of freedom degree dedicated to each variable reports this value of variations equal to 0.57. Hence, 58% of variations of green project management is forecasted and determined via the mentioned variables.

**Table-12**

**ANOVA Analysis and Determination of Significant Level of Model**

Model	Sum of Squares	Freedom degree	Mean of squares	F statistics	P-value
Determined (regression)	91/536	4	22/884	68/794	0/000
Residual	64/866	195	0/333		
Total	156/403	199			

According to values of Friedman statistic and also error level which is less than 0.05 ( $P - Value < 0/05$ ), it can come into the conclusion that the relationship is significant at 0.99% confidence level. In other words, there is a significant relationship among social, environmental, economic - structural indicators and green project management. Null hypothesis is rejected and researcher hypothesis is confirmed.

Value of weighted regression coefficients for each key factor as environmental indicator, economic indicator, structural indicator, social indicator on dependent variables including non-

standard  $\beta$ , standard  $\beta$ , t-value and P-value has been shown. Along this, value of weighted regression coefficients for social indicator, environmental indicator, Economic indicator and structural indicator is reported equal to 0.219, 0.365, 0.182 and 0.326, respectively; it has to be noticed that the environmental indicator had the most effect on green project management. Hence, regression equation of green project management based upon key factors and value of constant factor can be determined using the weighted regression coefficients<sup>36</sup>. Also, value of t-statistic and significance level show the net effect and significance of variables on green project management. Also, the scatter plot of the dependent variable based on standard value of variables is as following in the table-4.

**Table-13**  
**Weighted Regression Coefficients**

Factors of model	Non-standard $\beta$	Standard $\beta$	t-value	P-value
Constant factor	0/719	-	1/796	0/074
Social indicator	0/190	0/219	2/526	0/012
Environmental indicator	0/326	0/365	4/063	0/000
Economic indicator	0/187	0/182	2/330	0/016
Structural indicator	0/641	0/326	4/888	0/000

## Conclusion

Researcher in any research searches to find a response for questions of research, so as all the information and data obtained in this research have been discussed in the conclusion part and the most appropriate responses have been chosen for the questions of research<sup>37</sup>. As mentioned previously, the statistical population of this research includes 200 experts who are specialized in this field of research which most of the experts are in 31-50 age groups. Also, the average education status of the statistical population is bachelor's degree which is estimated approximately 60%, and the average work experience years of statistical population is estimated between 6-15 years. Average view of experts about the importance of project management in improving development shows an average level. Also, it has been stated that 41.5% of individuals believed in applying components of sustainable development in average. Obtained statistics of frequency distribution in terms of systematic role in project management show that 35.5% of the individuals believe in systematic role in average level. In following, it has been concluded that social, environmental, economic and structural indicators have the mean over 3 which this matter shows that components of sustainable development are over the average level as if it can be said that they are in a high level to influence the project management. Also, the highest effect respectively relates to environmental, social, economic and structural indicators which this is resulted

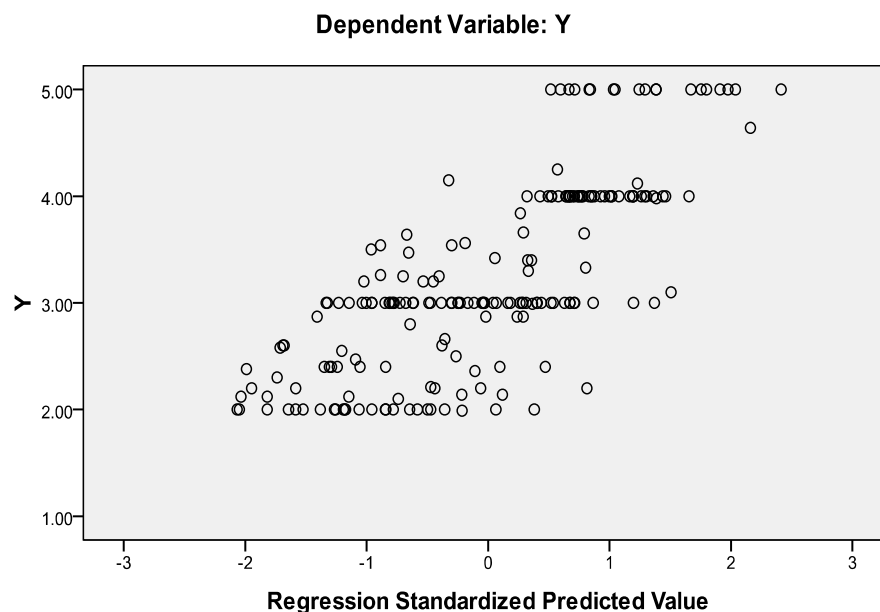
regarding the obtained results of mean of components of sustainable development.

According to the results of hypothesis tests, it was specified that there is a significant relationship between green project management and sustainable development of human resources : There is a significant relation between systematic thinking of sustainable development and green project management. There is a significant relationship among social, environmental, economic and structural indicators and green project management. Minimizing environmental impacts. Minimizing the use of non-renewable resources. Utilization of renewable resources.

**References**

1. Pier Luigi Maffei and Raffaele Boccacini, Ph.D., From value to sustainability index, Value World, *spring*, (2007)
2. Stansfield K., Setting a new agenda for sustainable construction, *Struct Eng*, 79(12), 19 (2001)
3. MaSC., Managing sustainable companies (formerly known as Managing Sustainable Construction Profiting from Sustainability), [http:// projects.bre.co.uk/masc/pdfs/masc\\_brochure.pdf](http://projects.bre.co.uk/masc/pdfs/masc_brochure.pdf), (2002)
4. Bed ZED, Bio Regional Zero Energy Development, <http://www.bioregional.Com/zero>, (2002)
5. Dai an-na., the study of green project management, Industrial Engineering and Engineering Management (IE and EM), 2011 IEEE 18Th International Conference on, 1, 267-271 (2011)
6. Xia Bo, Skitmore Martin, Zuo Jian, Zhao Zhenyu and Nepal Madhav, Defining sustainability requirements for design-build (DB) contractorselection in public sector projects, In 18th International Symposiumon Advancement of Construction Management and Real Estate (CRIOCM2013), Xi'an, China (2013)
7. Silvius G., Tharp J., Sustainability Integration for Effective Project Management, IGI Global, 1, 482 (2013)
8. Shah Mohammadi A., A book about the method of research, Qoraysh publication (2012)
9. Salil Sharma, Green project management practices for construction industry, *International Transactions in Applied Sciences*, 3(4), 657 (2011)
10. Zainul Abidin N and Pasquire CL, Delivering sustainability through value management: the concept and performance overview, *Eng. Constr, Archit. Manage*, 12(2), 168-80 (2005)
11. Zainul Abidin N and Pasquire CL, Delivering sustainability through value management: the concept and performance overview, *Eng. Constr, Archit. Manage*, 12(2), 168 (2005)

**Scatterplot**



**Figure-4**  
 The Scatter Plot of the Dependent Variable Based on Standard Value of Variables

12. Jun Ying Liu, Sui Pheng Low and Jie Yang, Conceptual Framework for Assessing the Impact of Green Practices on Collaborative Work in China's Construction Industry, *Journal of Professional Issues in Engineering Education and Practice*, **139(3)**, 248-255 (2013)
13. Koskela L., Howell G., Ballard G., Tommelein O., Salem J., Solomon A., Genaidy M. and Luegring, Lean Construction: From Theory to Implementation, Site Implementation and Assessment of Lean Construction, *Techniques journal*, **2(2)**, 1-20 (2005)
14. Silvia C.A., Ferrao P., A Systems Modeling Approach to Project Management The Green Islands Project example, Second International Symposium on Engineering Systems MIT, Cambridge, Massachusetts, 15-17 (2009)
15. Shenhar A.J. and Dvir D., How project differ and what to do about it. In Pinto J. and Morris P. (eds) Handbook of Managing Projects, New York: Wiley forthcoming, (2004)
16. Steyn H., A framework for managing quality on system development projects, Portland international conference on management of engineering and technology, 1-5, 1295-1302 (2008)
17. Lauras M., Marques G. and Gourc D, Towards a multi-dimensional project performance measurement system, *Decision Support System*, **48(2)**, 342-353 (2010)
18. Leu S.S. and Lin Y.C., Project performance evaluation based on statistical process control techniques, *journal of construction engineering and management-ASCE*, **134(10)**, 813-819 (2008)
19. Locatelli G., Mancini M. and Scalet L., Project controlling in mega events: the expo 2015 case, Project perspective, 34, 58-65. ISSN 1455-4178 (2012)
20. Meredith J., Mentel Jr and Samuel J., Project management: A managerial approach, 8<sup>th</sup> edition, ISBN-13: 978-0470533024 (2011)
21. Pajares J. and Lopez-Paredes A., An extension of the EVM analysis for project monitoring: the cost control index and the schedule control index, *International journal of project management*, **29(5)**, 615-6 (2011)
22. Imami H., A comprehensive guideline about green management as a necessity for sustainable development, Iran's industrial research and education center publication, (2007)
23. Joshqani A., The application of HSE management strategies in green management and its role in critical activities, the second national health, *Environment, and Security Association*, (2013)
24. Khoda Bakhshi Z. and Khoda Bakhshi B., The application of managerial guidelines for industrial engineering in environmental studies management, *the third national association of industrial and system engineering*, (2012)
25. Dirbaz A. and Dadgar H., An outlook toward Islam and sustainable development, *cultural institute of knowledge and attitude* (2002)
26. Sadeqi H and Fathi M., Culture, sustainable development and environment, *Cultural Engineering Journal*, third year, 29 and 30, (2009)
27. Ayouzi M.R., Attitudes toward the issue of development, *Yas strategic economic journal*, 4 (2005)
28. Pier Luigi Maffei and Raffaele Boccacini, Ph.D., from value to sustainability index, *Value World*, spring (2007)
29. Stansfield K., Setting a new agenda for sustainable Construction, *Struct. Eng.*, **79(12)**, 19(14 15), (2001)
30. MaSC, Managing sustainable companies (formerly known as Managing Sustainable Construction Profiting from Sustainability), [http:// projects.bre.co.uk/ masc/ pdfs/masc\\_brochure.pdf](http://projects.bre.co.uk/masc/pdfs/masc_brochure.pdf), (2002)
31. Bed ZED, Bio Regional Zero Energy Development, <http://www.bioregional.Com/zero>, (2002)
32. Mosaei Meysam and Ahmadzadeh Maryam, Training about sustianble development, *Yas strategic economy publication*, 18 (2007)
33. Akhtar Shoab Ch., Naseer Zainab, Haider Maqsood and Rafiq Sana, Impact of Organizational Culture on Organizational Commitment: A Comparative Study of Public and Private Organizations, *Res. J. Recent Sci.*, **2(5)**, 15-20 (2013)
34. Riaz Ahmed, Noor Azmi and Muhammad Tahir Masood, The Essence of Project Leadership is Significant to Project Management, *Res. J. Recent Sci.*, **2(5)**, 44-48 (2013)
35. Mohammad Aghaei and Mahdi Ebadati, Design Supply Chain Management Networks by New Risk Passive Defense Model and solved it by Heuristic Algorithm Case Study: Warehouse and Retail ETKA Organization Research, *Journal of Recent Sciences*, **2(9)**, 18-24 (2013)
36. Mohammad Aghaei and Mahdi Ebadati, Design Supply Chain Management Networks by New Risk Passive Defense Model and solved it by Heuristic Algorithm Case Study: Warehouse and Retail ETKA Organization, *Research Journal of Recent Sciences*, **2(9)**, 18-24 (2013)
37. Amir A Khaliq, I.M. Qureshi, Jawad Ali Shah, Suheel Abdullah and Ihsanulhaq, Covariance based BSS Algorithm for Functional Magnetic Resonance Imaging (fMRI) data Source Separation, *Research Journal of Recent Sciences*, **2(9)**, 86-91 (2013)