A Method for Ranking, Assessment and Evaluation of Sustainability Factors in Project

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Abstract
Nowadays, issues such as global climate change, poverty and inequity, and the unsustainable use of resources are driving organizations to incorporate the principles of sustainable development into projects. Sustainable development of organizations and companies requires consideration of all three sustainability dimensions: environmental, economic and social which should integrate economic, social and environmental benefits in projects. Therefore assessment and evaluation of projects that success in sustainability can specify policies and procedures of the organization to achieve the final goals in organization future. The purpose of this study is to establish a systematic method for assessment of effective factors on success of sustainable project. Suggested method will enable evaluating the success of project to meet requirement of sustainability. This method focused on five aspects of sustainability and nine knowledge areas of project management. Steps in this method lead framework of assessment sustainability in projects. Data are gathered by interview from experts and analytic hierarchy process (AHP) technique is used to ranking the effective factors. All of steps are prepared according to the conceptual model. The adequacy and reliability of the model were tested with a pilot study.

Keywords
Sustainable Development, Sustainability, Critical Success Factor, Project Management, Ranking

1. Introduction

Sustainable development is growing in importance and many countries' the governments have made sustainable development one of their administrative focal points [1]. The organizations want to balance social, economic and environmental aspects and resources in order to satisfy present and future generations. Nowadays, countries deal with not only economic benefit but social benefits and environmental issues. There is a high correlation between goals and resources in sustainability. World consumes its resources rashly, but resources are limited on the earth. Also, world is faced with threats and hazards such as over population, damaging of ozone layer, decreasing food resource, climatic changes and pollution which threat future generation. It shows the importance of sustainable development [2].

The organization realized a clear need for achievement of projects' goals. Therefore, managers must manag projects for increasing of projects and project deliverables [3]. Association for management chairman Tom Taylor stated that “project and program managers are significantly placed to make contribution to sustainable management practices” and also Mary McKinley, vice-president of the 2008 IPMA world congress stated that “the further development of the project management profession requires project managers to take responsibility for sustainability” [4]. Business

strategies of almost all organizations are focused on shareholder value that cannot assure long-term survival. But fortunately in recent years, there has been a change of mind and this awareness led to increase pressure on companies and organizations and report sustainability performance for all stakeholders instead of focusing on economic performance accountability to shareholders [5].

Projects are required in order to survive in today's economic world to make a major change in people's lives. Due to the current global crises and lack of resources in the future, project managers need to develop new and innovative approaches to sustainable aspects to ensure that they have achieved the desired sustainability [6]. Nature of project is temporary and discrete, which is created by using different techniques but no sustainability can occur separately and to achieve sustainable development, project activities should be performed in clear condition of economic, social and environmental aspects [7].

As awareness of sustainability is growing globally, project-based industries are under pressure to improve efficiency of project deliverables. Applying different systems to create sustainability in the results of project can be obtained by controlling the environment, minimizing wastes, efficient use of energy and materials and stabling working conditions [8]. Due to different variables and factors of society, government, employees and business partners, companies have forced to consider sustainable development in their projects. Project management as a key business advantage is not exempted from this requirement [9].Therefore identifying effective factors of project sustainability is important and essential [10, 11].

Essential requirement for a general approach to define and identify factors and integrate it into a methodology, enables companies to measure all important aspects of sustainability. Identifying factors is used for evaluation and performance measurement, providing that there be improvements in various aspects of sustainability and preparation of information for decision makers in setting strategies and successful communication with stakeholders [12]. After identifying effective factors of project sustainability, assessment of sustainability performance criteria in design and application of sustainability performance criteria can lead projects results to sustainable path [13]. Although there are various international efforts on measuring of sustainability, only few of them have an integral approach taking into account environmental, economic and social aspects. In most cases, the focus is on an aspect. It could be argued that they could serve supplement to each other. Sustainability is more than an aggregation of the important issues; it is also about their inter linkages and the dynamics developed in a system. This will be missed, if they try to use their supplement and it is one of the most difficult parts to capture and reflect in measurements [12]. The purpose of sustainability assessment is to provide decision-makers with a global evaluation to local integrated nature–society systems in short and long term perspectives in order to assist them to determine which actions should or should not be taken in an attempt to make society sustainable [14]. Developing sustainability assessment tools is one of five steps of integrating sustainability in project management and this step should be performed for completing sustainability life cycle in project [15].

As mentioned above, pay attention to projects sustainability is very important. To lead projects towards sustainability, factors and variables affecting sustainability of project should be identified. Continuous assessment of these factors could determine direction of organization to project sustainability, sustainable development of organization and weakness and then corrective actions

can be done to improve them. After identifying effective factors of project sustainability, assessment of factors is very important. In this study, a method is proposed to help for assessment of projects sustainability by definition of indicators and factors. According to it, proposed way can be used to rank projects regarding sustainability to rate each project and select projects according to priority. Factors will rank by AHP technique. Weight of each index is determined as input in measurement. All stages of the research test in a case study and theoretical foundations accuracy are validated, confirmed and approved by results.

2. Literature

In recent years, several researches are presented to integrate sustainability concepts in project management that each of these efforts has sought to create a sustainable project management. First, 3Ptriangle term (People, Profit and Planet) was proposed in 1994 by John Elkington that was introduced as sustainability concept. This concept offers a wide range of values and ideas to evaluate the success of an organization in aspects of economy, society and environment. Three main aspects of sustainability are included people, planet and profit. Profit aspect represents the economic condition in projects sustainability. People is the second aspect that is as society and a criterion of how organization is socially responsible. The third aspect is an index of environmental impacts [16].

McCullins (2007) studied to determine the current state of the art in sustainable development theory, and determine which sustainability models and principles can be applied to and integrated with project management within Canada's Department of National Defense. In this study, five parts were prepared for integrating sustainability in project management using the framework proposed by Edward such as: Establishing sustainability evaluation team, integrating project management processes with sustainable development strategy, preparing a list of sustainability indicators, developing sustainability assessment measures and improvement [15].

McConville and Mihelcic (2007) in their study provided sustainability assessment tool in project life cycle. In this research, an evaluation of two-dimensional matrix was presented which was composed of aspects of sustainability and life cycle factors. Columns of matrix are sustainability factors and rows of matrix are product life cycle stages [17].

Ostrom (2010) developed a framework to increase long-term success of improved stove projects. The framework integrates sustainability factors into the project life-cycle. It is represented as a matrix and checklist which encourage consideration of social, economic, and environmental issues in projects. The framework is represented by a scoring matrix in which the elements are associated with sets of recommendations and questions in a checklist. The tool can be used in a post-project assessment to increase understanding of results and learn from them for future projects. It can also serve as a guide to assist project managers in considering sustainability issues throughout planning and implementation [18].

Hsueh and Yan (2011) propose to incorporate the factor of "low-carbon development" into policy planning to construct the sustainable community in hopes; thus, the government would be able to make use of regular annual local construction fees to regulate the renovation and redevelopment process of the community as the urban basic unit in line with "energy saving and low-carbon" development policies and use construction subsidies as rewards. The quantitative evaluation model

established in this study is a fair and objective evaluation model that can serve as the basis for the selection of an appropriate target community prior to implementation to develop a low-carbon community. In addition, the evaluation model can be used to validate the performance of the renovated community. This study applies Delphi method, Analytic Hierarchy Process (AHP), and fuzzy logic in making a quantitative evaluation model for sustainable community construction low-carbon development effectiveness, to compare community low-carbon and energy saving development levels by calculating quantitative values as the basis for merits. In addition to test the effectiveness of self-development of features, this study can also provide the government with a reference and criteria to evaluate the performance of low-carbon community construction projects [19].

Kumar et al. (2012) presented a research that covers an overview of various sustainability indices which are practically implemented to measure sustainable development. Attempts have been made to compile the information about how the indexes were formulated, using the three central steps such as normalization, weighting, and aggregation. Indices and rating systems are subject to subjectivity despite lot of objectivity used in assessing the sustainability. The major advantages associated with indices are because of its multidimensionality and use of normalization and aggregation based on scientific rules and robust statistical methods [12].

Li and Chen (2012) stated that the sustainable evaluation of the highway construction should be considered from the two parts of sustainability of social needs and economic development. They studied the sustainable development evaluation of highway construction project using the BP neural network algorithm, through the analysis of sustainable development of the following four areas in road construction: economics, environmental resources, operations, management systems and policy. Statistical analysis methods and practical results have all showed that based on BP neural network model, construct highway project on assessment of sustainable development is feasible and applicable. Using the model based on BP neural network model to construct highway project on assessment of sustainable development is meaningful and this method provides a more reliable reference and evaluation methods for highway projects construction for the sustainable development strategy [20].

Study of Aliyu Shika et al. (2012) is aimed to provide a Post Occupancy Evaluation (POE) sustainability assessment framework for retrofitting commercial office buildings in Malaysia. They presented strategies focusing on expectations and risk planning using content analysis, factor analysis and hierarchical analysis. Also, this research focuses on integrating the POE concept as a means of feedback for retrofitting process for the fulfillment of building user's need towards performance-based sustainability [21]. Principles for sustainability assessment and measurement are presented by Lazlo et al. The paper provides the rationale for the revision of the principles, their detailed description and guidance for their application. In this research, eight principles are presented for sustainability assessment including guiding vision, essential considerations, adequate scope, framework and indicators, transparency, effective communications, broad participation and continuity and capacity.

Simon Pfister (2014) studied a research to develop a framework for development aid NGOs so that they can continuously manage and increase their sustainability and translate them into following research hypothesis: a structured performance measurement framework allows development aid

NGOs to outperform peer organizations regarding sustainability. In order to answer this research hypothesis, this thesis combines the analysis of the relevant theory, a survey of development aid NGOs to capture the views of practitioners as well as interviews which reflect concrete development aid situations. The results obtained in this study are questions of organization (budget, personnel and finance), project proposals (project specifications, project aspects and feedbacks) and organizational assessment (distribution of information, learning) [22].

Brook and Pagnanelli (2014) presenteda5- step framework for integrating sustainability in the innovation project portfolio management process in the field of product development. The framework can be applied for the management of a portfolio of three project categories that involve break through projects, platform projects and derivative projects. It is based on the assessment of various methods of project evaluation and selection, and a case analysis in the automotive industry. It enables the integration of the three dimensions of sustainability into the innovation project portfolio management process within firms. The three dimensions of sustainability involve ecological sustainability, social sustainability and economic sustainability. Another benefit is enhancing the ability of firms to achieve an effective balance of investment between the three dimensions of sustainability, taking the competitive approach of affirm toward the market place in to account [23].

Karaca et al. (2015) presented a framework for a sustainability analysis of a futuristic idea, “City-Blood”, that is proposed to distribute energy and water through a single infrastructure. Analytic Hierarchy Process (AHP) has been used to analyze qualitative and quantitative data to determine the relative sustainability of several City-Blood implementations by comparing them against existing disparate electricity and water delivery systems. Each solution considers extreme economic, social, and environmental contexts that affect the need for the infrastructure and resource use [24].

Lin et al. (2015) developed a framework to enable general application of ANP with a case study using ten company executives from an anonymous Taiwanese company, which is used to illustrate the framework, and also to identify the key factors in supplier selection. Results of this paper, which are consistent with other research findings, showed that product design for sustainability and green supply chain management are the most important factors in supplier selection also consistent with our earlier results in the paper which showed environmental protection has the highest priority index among the three components of sustainability, namely social development, environmental protection, and economic development [25].

3. Theoretical Foundations

The purpose of this study is to develop a method for assessment of sustainability in projects. To achieve it, a systematic process will be presented with several steps. This process is shown in Figure1. According to the model, effective factors of project management and project are input of this process. Critical success factors of project can have different roles in every organization. Main approach of research is to categorize factors according to nine knowledge areas of project management: Cost Management, Time Management, Quality Management, Human Resource Management, Risk Management, Communication Management, Scope Management, Procurement Management and Integration Management. These factors are divided in five aspects of

sustainability: Social aspect, Economic aspect, Environmental aspect, Product aspect and Process aspect. All of data are entered in 5× 9 matrix.

In the next step, weight of the effective factors of project sustainability will be determined. At this stage, factors will be evaluated independency of knowledge areas. These factors have been achieved from combine and integrate sustainability and project management requirements. After determining weight of each factor according to organization conditions, weight of the five sustainability aspects are calculated so that each of these aspects has a specific weight and then similarly, weight of the nine knowledge areas are determined.

The final step of sustainable assessment model is to develop assessment matrix. The two dimensions matrix consists of 45 cells where rows are sustainable aspects and the columns are knowledge areas of project management. Each cell has its own characteristics, condition and weight. Matrix is method that can be used to assess sustainability; therefore, score of sustainability of each cell is determined by weight and performance. The total score of matrix indicates success of project to meet sustainable requirements.

Effective Factors of project sustainability according PMBOK

	Cost	Time	Quality	Human Resource	Risk	Communication	Scope	Procurement	Integration
Social									
Economic									
Environmental									
Product									
Process									

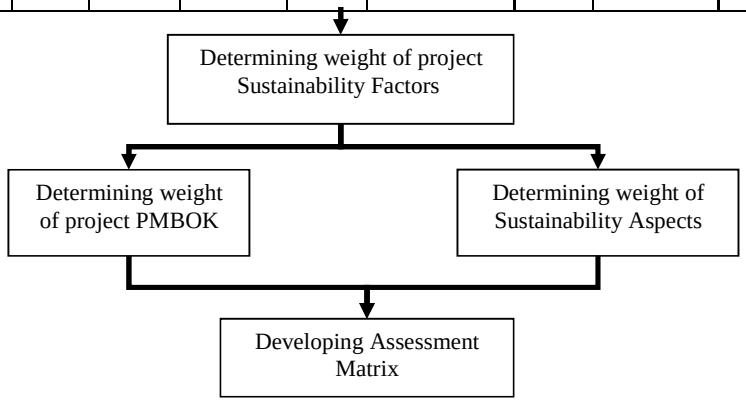

Figure1. Project sustainability assessment model

3.1. Sustainability and Sustainable Development

Sustainability is currently one of the most popular (in quantity) words and it has become embedded in our everyday language52. Sustainability, in general terms, is the ability to maintain balance of a certain process or state in any system. It is now most frequently used in connection with biological and human systems [22].

As Goedknegt and Silvius (2012) stated, sustainability is not a new concept, in 1972 the Club of Rome wrote limits to growth and Our Common Future was produced in 1987 by the World Commission on Environment and Development. Sustainable development was defined as

development that meets the needs of the present world without compromising the ability of future generations to meet their own needs [26].

3.2. Sustainable Factors

Sustainability can be defined by five key factors: socio-cultural respect, community participation, political cohesion, economic sustainability, and environmental sustainability. Socio-Cultural Respect: A socially acceptable project is built on an understanding of local traditions and core values, Community Participation: A process which fosters empowerment and ownership in community members through direct participation in development of decision-making affecting the community, Political Cohesion: It involves increasing the alignment of development projects with host country priorities and coordinating aid efforts at all levels (local, national, and international) to increase ownership and efficient delivery of services, Economic Sustainability: It implies that sufficient local resources and capacity exist to continue the project in the absence of outside resources and Environmental Sustainability: It implies that non-renewable and other natural resources are not depleted nor destroyed for short-term improvements [27].

3.3. AHP Technique

AHP is considered suitable to solve complex multi-objective, multi-factor decision-making problems. AHP, first proposed by Saaty, is widely used in social, political, engineering decision-making problems. The AHP framework organizes logic and personal feelings or intuitive judgments so that researchers can map out complex situations as they are perceived. The AHP framework reflects the simple intuitive way that actually deals with problems, but it improves and streamlines the process by providing a structured approach to decision making [28]. On the basis of professional knowledge from experts, pair comparisons and matrix comparisons of criterion items at each level in the hierarchy framework are carried out. Additionally, consistency of the eigenvector derived from the comparison matrix can be checked; the weighting of each criterion item can be identified. Because the priority of each element is developed systematically and objectively, the AHP results are reliable to provide problem solutions for multi-factors decision-making situations [29].

3.4. Project Management Body of Knowledge

The Project Management Body of Knowledge (PMBOK) is provided by the Project Management Institute. This PM standard consists of nine knowledge areas and five process groups. The nine knowledge areas are: integration, scope, cost, time, quality, risk, human resources, communication, and procurement management. The process groups are: initiating, planning, executing, monitoring and controlling, and closing [30].Each PM process defined within these knowledge areas and process groups is described in terms of its inputs, tools and techniques, and outputs[31].

4. Methodology

Both, qualitative and quantitative methods will be used as a research method to achieve the objectives of this study and to answer research questions. Research method is based on goals and methods of study are descriptive and data gathering is survey. The selected research design is a case study, which is appropriate for research with a focus on ‘‘how’’ or ‘‘why’’ questions. In

according to the steps defined in the conceptual model, research method in each of phases is done as follows:

4.1. Determining weight of sustainability aspects

In order to determine weights of each of factors, Analytic Hierarchy Process (AHP) technique is used. Therefore a questionnaire is prepared and created six paired comparison matrix and importance of aspect of sustainability are determined. The questionnaire was answered by experts. In Figure2, sustainability hierarchy tree is shown.

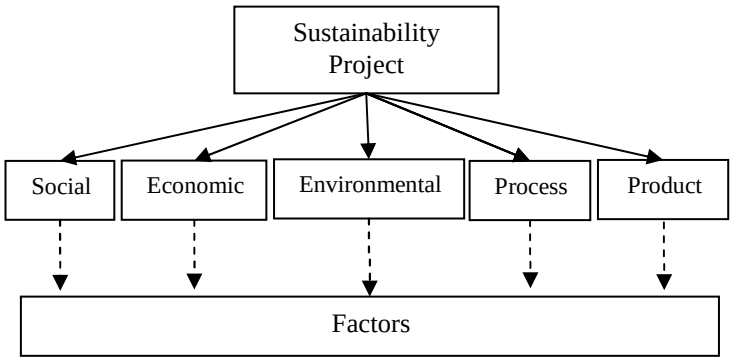

Figure2. Sustainability hierarchy tree

4.2. Determining weight of PMBOK

In this section, weights of nine knowledge areas of project management are determined using AHP. Therefore a questionnaire is prepared and created ten paired comparison matrix and important knowledge areas are determined. The questionnaire was answered by experts. In Figure 3, PMBOK hierarchy tree is shown.

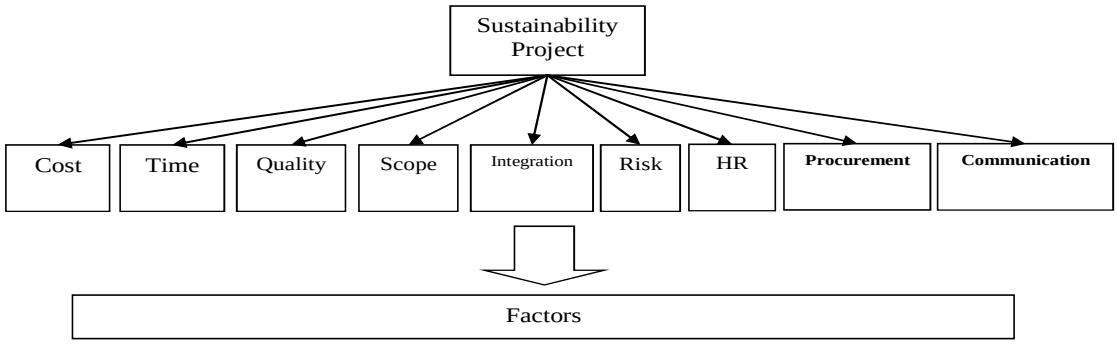

Figure3. PMBOK hierarchy tree

4.3. Developing Assessment Matrix

After determining weight of sustainability aspects and knowledge areas of project management, assessment matrix was established. This matrix is shown in Table1. According to matrix, each of cells in matrix has a weight that is obtained from intersection of sustainability aspects and knowledge areas of project management.

Table1. Assessment Matrix

Sustainability Aspects	knowledge areas ofproject management(PMBOK)									Total
	Cost	Time	Quality	Integration	Risk	HRM	Procurement	Communication	Scope	
Social	W(1,1)	W(1,2)	W(1,3)	W(1,4)	W(1,5)	W(1,6)	W(1,7)	W(1,8)	W(1,9)	W1j
Economic	W(2,1)	W(2,2)	W(2,3)	W(2,4)	W(2,5)	W(2,6)	W(2,7)	W(2,8)	W(2,9)	W2j
Environment	W(3,1)	W(3,2)	W(3,3)	W(3,4)	W(3,5)	W(3,6)	W(3,7)	W(3,8)	W(3,9)	W3j
Product	W(4,1)	W(4,2)	W(4,3)	W(4,4)	W(4,5)	W(4,6)	W(4,7)	W(4,8)	W(4,9)	W4j
Process	W(5,1)	W(5,2)	W(5,3)	W(5,4)	W(5,5)	W(5,6)	W(5,7)	W(5,8)	W(5,9)	W5j
Total	Wi1	Wi2	Wi3	Wi4	Wi5	Wi6	Wi7	Wi8	Wi9	\

The weight of each cell of matrix is calculated:

$W_{ij} = W_i \times W_j; i = 1\ to\ 5\ ,\ \ j = 1\ to\ 9$

That W_{ij} is weight of each cell and W_i is weight of sustainability aspects and W_j is knowledge areas of project management.

4.4. Sustainability Assessment

In order to assess sustainability of a project, following matrix is used (Table2). Sustainability score of each cell of matrix is calculated as follows:

$A_{ij} = W_{ij} \times P_{ij}; i = 1\ to\ 5\ ,\ \ j = 1\ to\ 9$

That A_{ij} is sustainability score and W_{ij} is weight of each cell and $P_{ij}$is performance-related factors in the cell. P_{ij} is measured (quantitative or qualitative) and are shown from 1 to 5.

Table2. Sustainability Assessment

Sustainability Aspects	knowledge areas of project management(PMBOK)									Total
	Cost	Time	Quality	Integration	Risk	HRM	Procurement	Communication	Scope	
Social	W(1,1)	W(1,2)	W(1,3)	W(1,4)	W(1,5)	W(1,6)	W(1,7)	W(1,8)	W(1,9)	
	P(1,1)	P(1,2)	P(1,3)	P(1,4)	P(1,5)	P(1,6)	P(1,7)	P(1,8)	P(1,9)	K1
	A(1,1)	A(1,2)	A(1,3)	A(1,4)	A(1,5)	A(1,6)	A(1,7)	A(1,8)	A(1,9)	
Economic	W(2,1)	W(2,2)	W(2,3)	W(2,4)	W(2,5)	W(2,6)	W(2,7)	W(2,8)	W(2,9)	
	P(2,1)	P(2,2)	P(2,3)	P(2,4)	P(2,5)	P(2,6)	P(2,7)	P(2,8)	P(2,9)	K2
	A(2,1)	A(2,2)	A(2,3)	A(2,4)	A(2,5)	A(2,6)	A(2,7)	A(2,8)	A(2,9)	
Environment	W(3,1)	W(3,2)	W(3,3)	W(3,4)	W(3,5)	W(3,6)	W(3,7)	W(3,8)	W(3,9)	
	P(3,1)	P(3,2)	P(3,3)	P(3,4)	P(3,5)	P(3,6)	P(3,7)	P(3,8)	P(3,9)	K3
	A(3,1)	A(3,2)	A(3,3)	A(3,4)	A(3,5)	A(3,6)	A(3,7)	A(3,8)	A(3,9)	
Product	W(4,1)	W(4,2)	W(4,3)	W(4,4)	W(4,5)	W(4,6)	W(4,7)	W(4,8)	W(4,9)	
	P(4,1)	P(4,2)	P(1,3)	P(1,4)	P(1,5)	P(1,6)	P(1,7)	P(1,8)	P(1,9)	K4
	A(4,1)	A(4,2)	A(1,3)	A(1,4)	A(1,5)	A(1,6)	A(1,7)	A(1,8)	A(1,9)	
Process	W(5,1)	W(5,2)	W(5,3)	W(5,4)	W(5,5)	W(5,6)	W(5,7)	W(5,8)	W(5,9)	
	P(5,1)	P(5,2)	P(1,3)	P(1,4)	P(1,5)	P(1,6)	P(1,7)	P(1,8)	P(1,9)	K5
	A(5,1)	A(5,2)	A(1,3)	A(1,4)	A(1,5)	A(1,6)	A(1,7)	A(1,8)	A(1,9)	
Total	L1	L2	L3	L4	L5	L6	L7	L8	L9	**E**

Score of each row (sustainability aspects) is calculated from following formula:

$$K_i = \Sigma A_i \quad ; \quad i=1 \text{ to } 5$$

Scores of each column (and knowledge areas of project management) is:

$$L_j = \Sigma A_j \quad ; \quad j=1 \text{ to } 9$$

Total score of Project sustainability is calculated as:

$$E = \boldsymbol{\Sigma} k_i = \boldsymbol{\Sigma} L_j \quad ; \quad i=1 \text{ to } 5 \quad , \quad j=1 \text{ to } 9$$

The above steps can be expressed as follows:

$$\begin{bmatrix} W_{11} \dots \dots \dots \dots W_{19} \\ W_{21} \dots \dots \dots \dots W_{29} \\ \\ W_{31} \dots \dots \dots \dots W_{39} \\ W_{41} \dots \dots \dots \dots W_{49} \\ W_{51} \dots \dots \dots \dots W_{59} \end{bmatrix} \times \begin{bmatrix} P_{11} \dots \dots \dots \dots \dots \dots P_{15} \\ P_{21} \dots \dots \dots \dots \dots \dots P_{25} \\ \dots \dots \dots \dots \dots \dots \dots \dots \dots \\ \dots \dots \dots \dots \dots \dots \dots \dots \dots \\ \dots \dots \dots \dots \dots \dots \dots \dots \dots \\ P_{91} \dots \dots \dots \dots \dots \dots P_{95} \end{bmatrix} = \begin{bmatrix} A_{11} + A_{12} + \cdots + A_{19} \\ A_{12} + A_{22} + \cdots + A_{29} \\ A_{31} + A_{32} + \cdots + A_{39} \\ A_{41} + A_{42} + \cdots + A_{49} \\ A_{51} + A_{52} + \cdots + A_{59} \end{bmatrix} = \begin{bmatrix} K_1 \\ K_2 \\ K_3 \\ K_4 \\ K_5 \end{bmatrix}$$

Or

$$\begin{bmatrix} W_{11} \dots \dots \dots \dots W_{19} \\ W_{21} \dots \dots \dots \dots W_{29} \\ \\ W_{31} \dots \dots \dots \dots W_{39} \\ W_{41} \dots \dots \dots \dots W_{49} \\ W_{51} \dots \dots \dots \dots W_{59} \end{bmatrix} \times \begin{bmatrix} P_{11} \dots \dots \dots \dots \dots \dots P_{15} \\ P_{21} \dots \dots \dots \dots \dots \dots P_{25} \\ \dots \dots \dots \dots \dots \dots \dots \dots \dots \\ \dots \dots \dots \dots \dots \dots \dots \dots \dots \\ \dots \dots \dots \dots \dots \dots \dots \dots \dots \\ P_{91} \dots \dots \dots \dots \dots \dots P_{95} \end{bmatrix} = \begin{bmatrix} A_{11} + A_{21} + \cdots + A_{51} \\ A_{21} + A_{22} + \cdots + A_{52} \\ \dots \dots \dots \dots \dots \dots \dots \dots \dots \\ A_{18} + A_{28} + \cdots + A_{58} \\ A_{19} + A_{29} + \cdots + A_{59} \end{bmatrix} = \begin{bmatrix} L_1 \\ L_2 \\ \dots \\ L_8 \\ L_9 \end{bmatrix}$$

5. Finding

Proposed framework in this research is conducted in case study. After collecting questionnaires, construct validity was confirmed by amplification factor Analysis. Cranach's alpha coefficient was used to test validity of the questionnaire. Cranach's alpha coefficient is 0.81, which is higher than 70% and validated questionnaire. 90 factors of project sustainability were designed in questionnaire and that were distributed among 9 control project experts and project managers. After analyzing using the Delphi technique, identified factors were quantified based on the Likert scale. By the Pareto principle (20-80), 45 more effective factors were selected. These factors in Table 3 - Classification of factors- are shown as matrix. After identifying effective factors on project sustainability, paired comparison matrix is filled by experts and weight of sustainability aspects and weight of knowledge areas of project management are calculated by AHP technique (Table 4, Table 5).

Performance score of 45 factors is determined by Likert scale (1 to 5). Result of calculation according to proposed theory is shown in Table 6.

Table3. Project Sustainability Factors

Aspects	knowledge areas of project management(PMBOK)								
	Cost	Time	Quality	Integration	Risk	HRM	Procurement	Communication	Scope
Social	Finished Price	Product life cycle	Innovation	Strategic fit	product Performance	Community participation	responsibly procurement of resources	Society Communications	Urban Sustainability Index
Economic	Productivity	Planning and control mechanisms	quality management system Indicator	Project Information Management System	Staff safety	Economic health	Budget and Investment	Contact to economic and knowledge centers	Urban Development
Environment	Energy consumption	Environmental performance on time	environmental quality Indicators	Environmental Policies	Carbon dioxide emissions	Voluntary participation	The climate	Relationship with NGO's	Difficulties associated with regional issues in the community
Product	Market responsibility	Recruitment	Welfare indicators	Business ethics	Health and Safety	Expertise and skill	Sustainable supply chain	Guarantee and warranty	Create a portfolio
Process	Added Value	On time delivery	Brand	Focus on Strategy	Asset Security Management	Organizational participation	Technological competencies	Distribution of Information	Senior management support

Table4. Weight of sustainability aspects

Sustainability Aspect	Weight
Social	0.2
Economic	0.25
Environmental	0.1
Product	0.22
Process	0.23

Table5. Weight of knowledge areas of project management (PMBOK)

knowledge areas ofproject management	Weight
Cost Management	0.1
TimeManagement	0.1
QualityManagement	0.18
IntegrationManagement	0.07
RiskManagement	0.08
Human ResourceManagement	0.13
ProcurementManagement	0.17
CommunicationManagement	0.1
ScopeManagement	0.07

5.1. Result Analysis

According to Table 6, sustainability score of case is 3.054. This score is considered as Criterion for performance assessment of project and also is used for comparison between projects. All of factors scores are listed in Table 7.

Table6. Result of Assessment Matrix

Sustainability Aspects	knowledge areas ofproject management(PMBOK)									Total
	Cost	Time	Quality	Integration	Risk	HRM	**Procurement**	**Communication**	Scope	
Social	0.02	0.02	0.036	0.014	0.016	0.026	0.034	0.02	0.014	0.0622
	3	4	3	3	4	3	3	3	2	
	0.06	0.08	0.108	0.042	0.064	0.078	0.102	0.06	0.028	
Economic	0.02	0.025	0.045	0.0175	0.02	0.032	0.0425	0.025	0.0175	0.333
	1	1	4	2	3	4	4	4	2	
	0.02	0.025	0.18	0.035	0.06	0.13	0.17	0.1	0.035	
Environment	0.01	0.01	0.018	0.007	0.08	0.013	0.017	0.01	0.007	0.760
	4	5	4	3	4	2	3	2	3	
	0.04	0.05	0.072	0.21	0.032	0.026	0.051	0.02	0.021	
Product	0.02	0.023	0.0414	0.0161	0.018	0.029	0.0391	0.023	0.0161	0.697
	1	2	3	2	3	4	3	4	2	
	0.023	0.046	0.1242	0.0322	0.0552	0.1196	0.1173	0.092	0.0322	
Process	0.02	0.022	0.0396	0.0154	0.017	0.028	0.0374	0.022	0.0154	0.642
	3	3	3	4	3	3	3	4	3	
	0.06	0.066	0.1188	0.0616	0.052	0.085	0.1122	0.088	0.0462	
Total	0.267	0.214	0.553	0.603	0.439	0.162	0.192	0.264	0.360	**3.054**

Table7. Ranking factors of project sustainability

Rank	Factors	Score	Rank	Factors	Score	Rank	Factors	Score
1	Brand	0.18	16	Community participation	0.078	31	Business ethics	0.042
2	Budget and Investment	0.17	17	Environmental quality Indicators	0.072	32	Energy consumption	0.04
3	Economic health	0.13	18	Planning and control mechanisms	0.066	33	Urban Development	0.035
4	Innovation	0.124	19	Productivity	0.066	34	Focus on Strategy	0.035
5	Expertise and skill	0.119	20	Health and Safety	0.064	35	Create a portfolio	0.032
6	Quality management system Indicator	0.118	21	Project Information Management System	0.061	36	Strategic fit	0.032
7	Sustainable supply chain	0.117	22	Market responsibility	0.06	37	Carbon dioxide emissions	0.032
8	Technological competencies	0.112	23	Asset Security Management	0.06	38	Urban Sustainability Index	0.028
9	Welfare indicators	0.108	24	Society Communications	0.06	39	Voluntary participation	0.026
10	responsible procurement of resources	0.102	25	Product Performance	0.055	40	On time delivery	0.025
11	Contact to economic and knowledge centers	0.1	26	Staff safety	0.052	41	Added Value	0.025
12	Guarantee and warranty	0.092	27	The climate	0.051	42	Finished Price	0.023
13	Distribution of Information	0.088	28	Environment on time performance	0.05	43	Difficulties associated with regional issues in the community	0.021
14	Organizational participation	0.085	29	Senior management support	0.046	44	Environmental Policies	0.021
15	Recruitment	0.08	30	Product life cycle	0.046	45	Relationship with NGO's	0.02

As was shown above (Table 7), sustainability score of economic aspectis high and sustainability score of environmental aspect is low. Therefore more activity should be done in environmental

aspect. Also, quality management field score is high and procurement management field score is low. Areas with lowest scores are reviewed and corrective actions are planned.

6. Conclusion

We tried to prepare a systematic approach to evaluate and assess sustainability of projects. Accordingly, the proposed method has the steps and steps that help to assess success of projects sustainability. This study was based on five sustainability aspect including economic aspect, social aspect, environmental aspect, process aspect and product aspect. By following step by step method proposed in this study, success of various project factors is assessed to meet sustainability requirements and sustainable development. Also, performance of organizations and projects is measured in various areas of sustainability and project management and obtained results and scores can identify strengths and improvements and help project managers for decision-making and project goals.

Other applications of this method in organizations are to rank projects with sustainability approach; as various projects are ranked in order of scores. This method can be used for all projects and organizations with different conditions (Figure 4).

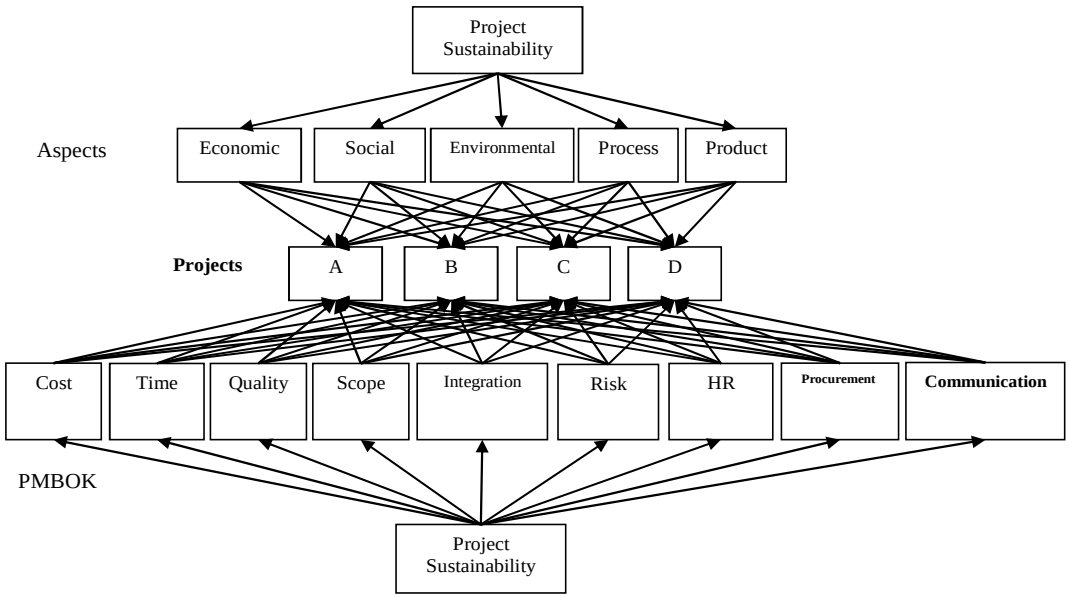

Figure4. Hierarchy tree to select most successful sustainable projects

Steps of the proposed framework were conducted in a case study and finally, validity of this framework is confirmed and acknowledged. The results obtained in this case, 45 effective factors and also five sustainability aspects were summarized in project management knowledge areas. Awareness of factors performance can be oriented to use required resources in specified time and location and organization will lead towards sustain ability. The results showed that the company's focus on some of the identified factors was very little and only is considered to some factors adequately. Therefore sustainability is achieved when various aspects are considered. The

characteristics of this method are: Systematic, simple and practical, focus on five sustainability aspects and study of project management knowledge areas. After assessment of sustainability, strengths and weaknesses are identified and planning to maintain strengths and to correct weaknesses. Accordingly, it is proposed that in future studies should be taken to review improvement. Since the measurements in this study was based on experts interviews in future studies, checklists can be designed and prepared for each of sustainability aspects and the project knowledge areas and performance of factors are calculated to review and audit by checklist.

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