

Identification of Iran's road construction project risks in order to implement sustainable development (Pavement Technologies and Construction Activities)

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Abstract

Sustainable development in modern societies is an important debate among decision-makers of the industry. Among industries, the construction industry is among the most important industries in the sustainable development debate due to the extent of its impact on human communities and the global economy. It seems that the main problem in the development of the construction industry is the low number of efficient women at managerial level of this industry. Because a society can be developed that all people have the capacity to develop. But in the construction industry of Iran a small number of women have achieved the managerial levels and many of them do consulting, design and office responsibilities. Women as half of the active labor force have still not found their rightful place in the field of employment in the construction industry. Review of the existing laws, including the constitution and other laws of the country, shows that women are not legally forbidden to work at management levels. But special individual, organizational, cultural and traditional factors in the form of unwritten rules prevent full participation of women in the development process of industry. But this valuable force during the process of participation and decision-making could have an active role in economic, social and environmental development of construction industry. In fact, the realization of sustainable development in the country is not possible regardless of the capabilities of women and a look at this issue to improve society is necessary. In this paper it is attempted to address different aspects of women's role in sustainable development of the construction industry and barriers against them theoretically.

Keywords

Sustainable development, road construction projects, risk identification, qualitative analysis

1. Introduction

Developing countries have to increase investment in infrastructure to achieve growth. In addition to provide the basic needs, these sectors have a positive effect on accelerating economic development [1]. Horizons to achieve economic development are dark in minds. In fact, humanity wants development but knows it as a mixture of good and bad. Development and the process of achieving it, is with risks and uncertainties and mismanagement in development helps to Dark Horizons [2]. Today, the concept of development is taken into consideration with respect to the protection of natural resources and the environment and is considered as a sustainable development that restores the environment and compensates the destruction caused by changes in the environment. Developing countries like Iran face with the limitations and uncertainties for achieving this objective [3]. Of course, construction plans and projects have short-term and long-term effects on the environment which can be either an opportunity or a threat to it [4], in addition to the negative environmental effects, road construction has positive features, such as reducing air pollution resulted by reduced travel time and length, increased safety and reduced noise pollution [5], since the arrival of sustainable development to construction projects cannot be denied and implementing it in construction projects is difficult and has numerous risks [6]. It is needed to identify risks in the implementation of sustainable development in Iran's road projects. In this paper after defining the key concepts, objectives, dimensions of sustainable development, implementation methods of sustainable development, and concepts related to risks in road projects have been presented and then, the risks of failing to achieve sustainable development have been identified.

1 sustainability

1.1 The definition of sustainability and sustainable development

World Environment Commission has defined sustainable development as follows: "Sustainable development is a development that meets the present generation's needs, without limiting the ability of future generations to meet the needs of their own time [6]. What is common in the definitions of sustainable development is its dynamic aspects and meeting basic needs while considering the protection of the natural resources [7]. Sustainable development encompasses all aspects of human life and in its process, policies in the fields of economy, commerce, education, technology, natural resources, industry and health are designed in such a way that sustains socio-economic and environmental development [8].

1.2 Three main branches of sustainability

Sustainable development has been defined as an integrated system of social, economic and environmental objectives that, through these three dimensions is connected with three social social, economic and environmental [6].

2 project risk management

Project risk management includes the processes related to conduction of risk management planning, identification, analysis, responses and monitoring and controlling it in the project [10]. Risk is a potential that could cause problems in project implementation and the achievement of its objectives and there is the possibility of its occurrence in one of project's aspects such as time, cost and quality. In today's world in addition to the factors of time, cost and quality, sustainability is studied as a fourth factor to assess the success of a construction project [6]. So identification and prioritization of risks have an important role in the success of the project.

3 Current practices for sustaining road

Due to the increasing development of road networks and their adverse effects on the environment and boundless consumption of primary resources, the need to examine the concept of sustainable development in these projects is felt more than ever [11]. Construction of road and bridge is considered as an essential part in the development of economies and societies of countries [12]. Because of the importance of this

sector, in consecutive years researchers have tried to gain systems for measuring the stability of roads and rating such as; Green LITES, Green roads, I-LAST, INVEST, Green Guide for Road, Green Pave, to construct sustainable roads in order to achieve a development that meets current needs without destroying the ability of future generations in meeting their needs [13].

4 Green roads rating system

In this paper, the Green roads rating system has been used due to covering all road projects including the construction, reconstruction, renovation projects and even pavement and bridge construction. The project requirements in this system consists of five main parts as follows [12].

Table 1: PROJECT REQUIREMENTS IN ORDER TO IMPLEMENT SUSTAINABLE DEVELOPMENT IN ROAD CONSTRUCTION PROJECTS

Environment & Water	Pavement Technologies	Access & Equity	Construction Activities	Materials & Resources
	Warm Mixed Asphalt		Quality Management System	
	Long Life Pavement		Environmental Training	
	Permeable Pavement		Site Recycling Plan	
	Cool Pavement		Fossil Fuel Reduction	
	Quiet Pavement		Equipment Emission Reduction	
	Pavement Performance Tracking		Water Use Tracking	
			Paving Emission Reduction	
			Contractor Warranty	

Thus, after investigation of the library studies, due to breadth of the subject, the road stabilization methods were studied only in two area of construction activity and road construction technology and were included in the classification provided by Green roads as follows:

5 Pavement Technologies

Considering the large dimensions of construction and development of land transport projects in the long range of natural areas, consideration of environmental issues has great importance, so the appearance of new technologies in the world will cause maintaining the resource as much as possible [5].

Appearance of new technologies and methods and make recommendations to reduce the environmental impact of road construction according to Green roads rating system is as follows:

5.1 Warm Mixed Asphalt

One of the causes of pollution associated with the construction of transportation infrastructures is the emission of greenhouse gases into the atmosphere [14]. Using Warm Mix Asphalt technology has many advantages such as Reduce fossil fuel use at the hot mix asphalt plant, decrease emissions at the plant, and decrease worker exposure to emissions during placement Washington [12]. WMA technology is also good for the environment because it produces asphalt at temperatures 20–40° lower in comparison to Hot Mix Asphalt [14].

5.2 Long Life Pavement

The goal of Long Life Pavement is minimizing life cycle costs by promoting design of long lasting pavement structures [12]. The success of such pavements in reducing environmental impacts over their life cycle hinges on their ability to serve their intended purpose for their design life [15].

5.3 Cool pavement

Pavement Conventional pavements have dark surface and large thermal inertia [16] and have a very high fraction of the urban areas and contribute highly to the development of heat island in cities. The use of cool pavements presenting substantially lower surface temperature and reduced sensible heat flux to the atmosphere, appears to be one of the most important proposed mitigation solutions [17].

5.4 Permeable Pavement

Traditional solutions for storm water management have not been widely successful; in contrast, permeable pavements can be one element of a more promising alternative approach to reduce the downstream consequences of urban development [18]. Permeable pavement systems (PPS) have become an important integral part of sustainable urban drainage systems [19]. This system Improve flow control and quality of storm water runoff [12].

5.5 Quiet Pavement

Noise pollution is a growing concern all over the world. Quiet Pavement Improve human health by reducing tire pavement noise [12]. implementation include evaluating the use of double-layer porous asphalt mixes to reduce noise on high-speed roadways, reducing the size of the aggregate used in mixes applied to the wearing surface, and trying thin-textured surfacing using a small aggregate in urban and other areas with lower traffic speeds [20]

5.6 Pavement Performance Tracking

Allow for more thorough performance tracking by integrating construction quality and pavement performance data [12].

6 Construction Activities

It is necessary in order to achieve sustainable development projects to be implemented in the following cases:

6.1 Quality Management System

The prime contractor, design builder or construction management firm shall have a documented quality management system (QMS) for the entire company or at least the portion(s) of the company participating

in the project. The QMS must be in place for the duration of project construction. And it can improve construction quality [12].

6.2 Environmental Training

Environmental Training, provide construction personnel with the knowledge to identify environmental issues and best practice methods to minimize environmental impacts [12].

Improving the knowledge and level of awareness of sustainable applications could make a large impact on the applications of sustainable construction [21].

6.3 Site Recycling Plan

Building and construction industry. Construction companies benefit from reduced waste generation by lower deposition costs and lower purchasing costs of virgin materials [22]. Site recycling plan, minimize the amount of construction related waste destined for landfill and promote environmental stewardship through good housekeeping practices at the work site [12].

6.4 Fossil Fuel Reduction

Reduce the fossil fuel requirements of no road construction equipment by using biofuel or biofuel blends as a replacement for fossil fuel. Support the environmental and health benefits of biodiesel by providing economic incentive to the general contractor [12].

6.5 Paving Emission Reduction

Subjective symptoms and exposure to organic compounds were recorded in road repair and construction workers. Abnormal fatigue, reduced appetite, laryngeal/pharyngeal irritation, and eye irritation were recorded more often in such workers handling asphalt than in a corresponding reference group without asphalt exposure [23]. Using paving emissions reduction can improve human health by reducing worker exposure to asphalt fumes [12].

6.6 Equipment Emission Reduction

Strategies of Equipment Emission Reduction are, Retrofit exhaust equipment on no road vehicles. Replace engines where this option is more cost effective than retrofit. Switch to use ultra-low sulfur diesel (ULSD) in conjunction with the add on fuel efficiency technologies installed in the equipment fleet. By using this technology air emissions from no road construction equipment Reduce [12].

6.7 Water Use Tracking

Generate project level information about construction water use and create a spreadsheet that records total water use during construction [12].

7 Methodology

To formulate questions about identification of risks of sustainability implementation in construction projects, there is a need for a basis for practices to achieve sustainability of the roads, therefore the Green roads rating system was used as the base, so following that, by extracting sustainability criteria for each indicator introduced in this system, the basis for the formation of the final structure of classified questions will be created. In this regard before the original distribution process, questionnaires were distributed among four experts of construction industry and they expressed their opinions about the form of a

questionnaire, and its phrases and content. According to the feedback of this group of audience, modifications were made in the terms of glossary and then the modified questionnaire were distributed among seven project managers with experience of at least 15 years. After selecting interviewees, due to their lack of knowledge in the field of sustainable development and the importance of this issue, explanations were first provided in the context of sustainable development and road stabilization methods, then due to lack of application of road stabilization methods, questions on risks were expressed in order not to implement the sustainability in both areas of road construction activities and construction technology. Risks discussed were expressed in two branches of construction activities and construction technology.

7.1 Road construction technology

All respondents cited lack of application of modern methods in road construction and each of them expressed risks in implementation of sustainability in construction technology.

I1 believes that this new emerging technologies have risks because of newness, such as lack of estimation of general scheduling plan - lack of accurate estimation of project cost - the lack of accurate estimation of resources and equipment and these risks may impede the project to its original purpose.

I2 knows the risk of incorrect and non-standard implementation as the main reason of using this technology. While he believes that implementing green roads can bring more profits for them.

I3 knows project failure and poor profit as the most important risk of using this technology, because he believes that the lack of financial ability of contractor in the preparation of consumable items required cannot be profitable for them. In addition, inappropriate construction technology in Iran and the lack of efficient and well-trained specialists in the project team can be barriers in implementing these methods.

I4 has used hot asphalt technology in one of the last projects. But he believes that this approach cannot lead to success of the project due to the constantly changing quality of the materials during the operation and inability to provide asphalt with the features listed because of unexperienced contractors.

I5 considered the political instability of the government as most important risks in the non-implementation of these technologies despite the society's need for sustainable development, and he did not find any reasoning in implementation of these factors for his projects because of the risk of inflation and rising prices.

I6 expressed green roads as a very important factor in economic growth after the awareness about sustainable development and its implementation factors. Because he believed that despite the high initial cost of the project, these roads would have economic justification during its life cycle. However he considered the sanctions and the lack of funds as the main risks of not using the new technologies.

I7 that itself was the project manager of the road construction project in the city of Qom, considered reflective road technology as an appropriate method for his project because of the high temperature in the area, but because of the sanctions to import materials, it was impossible to use it in his project.

In the category of road construction technology in order to implement sustainable development, 15 risks of, lack of estimation of the overall schedule, the lack of accurate estimation of project costs, the lack of accurate estimation of resources and equipment, the risk of incorrect and non-standard implementation, project failures and inadequate profit, financial inability of the contractor in the preparation of consumable items, inappropriate construction technology, lack of efficient and well-trained specialists in the project team, inflation and rising prices, political instability, constantly varying quality of materials during the operation and inability to provide asphalt with the features listed and lack of enough experience of contractors were expressed that, sanctions and the lack of enough knowledge in the field of sustainable development benefit are the most important factors in project managers to refuse the implementation of sustainable development.

7.2 Construction activities

Activities during road construction may help the projects to achieve sustainable development. One of the activities that helps economic and environmental growth is reuse of waste.

I3 and I4 believe that due to lack of manpower familiar with this process, they can implement this process in their project. Therefore, they considered some trainings for their executive team and believed that environmental education has high costs for organizations. This is despite the fact that I5 knew investment in this sector unprofitable because of the risk of permanent change of managers and project leaders.

I1 believes that the executive team may due to lack of adherence to moral principles, spends these courses simply to spend time and this project has not only profit but also imposes additional costs to the organization.

I2 and I6 and I7 believed that, these courses and courses of Quality Management System (ISO), despite having high costs for the organization could grow the project in terms of social dimension in addition to the environmental dimension.

I4 presented lack of human resource performance after training in the field of quality management system and I1 presented lack of providing proper training and inappropriate implementation by the executive team as risks of this process.

Reduced amount of fossil fuel was not important for none of the interviewees because they only consider profitability as their target, but they knew devices that reduce pollutants and installation of them on construction machinery as a required issue, because they believed that their executive team is at exposure of these smokes which are risks for their health risks. According to interviews conducted with experts in this field it can be said that, one of the most important risks for them is insufficient profit, that the cost of implementing them may be increased due to implementation of the above processes and this is one of the most important reasons for non-implementation of sustainability in road construction activities in the country.

8 CONCLUSION

One of the manifestations of development in any country is the expansion of its roads. Since the communication paths and the roads are considered as the lifeblood of society, lack of their development, disrupts economic and social life and development of the society. But with the expansion of the network environmental issues and sustainable development should also be considered. Therefore, application of methods of road construction based on the principles of sustainable development is required, because developmental activities currently performed by humans in nature must be justified from the perspective of sustainable development. That's why, after examining stabilization methods in two sectors of road construction activities and technologies, risks of implementing techniques presented in each sector were identified. According to this study, the most important obstacle to the implementation of sustainable development is lack of project managers' awareness about the benefits of this development for road construction projects, and project managers due to numerous risks do not decide to implement these factors in their projects. The most important identified risks are risk of sanctions and lack of knowledge on the benefits of sustainable development in the field of construction technology and the risk of project non-profitability due to increased costs in the branch of construction activities. According to the survey, it is recommended that in order to implement sustainable development, governmental policies and legislations should be considered in implementing the projects in the future in order to ensure the certain implementation of projects, so that sustainable development goals can be achieved by it.

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