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by Nova Nevila Rodhi .

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OVERVIEW OF RISK ANALYSIS AS A REACH OF SUSTAINABLE CONSTRUCTION (CASE STUDY: BOJONEGORO – TUBAN PIPELINE)

Nova Nevila Rodhi

Faculty of Faculty of Science and Engineering, Universitas Bojonegoro.

Email : nova.nevila@gmail.com

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ABSTRACT

The construction project and all of their activities have been considered as a major source of environmental problems in all the world. Meanwhile that activities are also make some positive contributions.

The achievement of a sustainable construction projects must be have an effective and acceptable method that is accepted by all participants on that project. Based on these problems, this study focus on the integration of risk analysts to achieve sustainable construction using the literature review method.

The results of this study indicate that there are 5 variables that affect the achievement of sustainable construction, namely social, environmental, economic, disaster and technical. The 5 variables are fully integrated in 2 forms of relationship, they are reinforcing and balancing, where these variables can strengthen each other, weaken each other and also balance each other. So that these variables can be integrated to achieve sustainable construction, some previous research results state that this can be achieved by risk analysis.

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1. Introduction

Risk is a condition or situation from internal also external that it can be give an effect and change the first condition of thing, and change the time, cost and safety [1] [2] [3] [4] [5]. Basically, the activities of construction industry should be a positive contribution if they do all the process are using the principles of sustainable development [6] [7] [8]. Sustainable development is a development concept that is having purpose to provide a better quality of life for everyone, both now and for generations to come [9] [10]. The major point of SDGs (Sustainable Development Goals) is to achieve sustainable development and and rise the poor people up into prosperity. In an effort to alleviate poverty, it must be accompanied by economic growth, so that all kinds of negative impact on economic growth must be managed properly and corfully, including those related to natural disaster risks and vulnerabilities in development plans. This is because disasters can be a significant dangerous in achieving and maintaining development plans and goals [11] [12] [13].

At this time, besides the principles that are must be adhered, there is also a concept that must be considered and taken into account in every activity. This is the concept of sustainable development [14] [15], thus, the risk management of construction projects must also be carried out by considering the concept of sustainable development. so that the planned project can achieve a sustainable construction project and can support sustainable development targets [16].

The sustainable construction project (Sustainable Construction) is a project that is based on a balance, both financial, environmental and operational considerations in all existing processes [17]. This concept can inspire construction service actors and other project actors in determining methods and plans to achieve project implementation efficiency. Among them is done by integrating the preparation of designs and process maps of the project to be carried out [18] and project scheduling [19]. Sustainable development has 5 (five) main principles that must be adhered to, the are the principles of linkage, diversity, usability, harmony and sustainability [20]. There are 5 (five) variables that affect sustainability, they called, planning, processing, system reliability, community and system sustainability. Sustainable development is something fundamental, contradictory and irreconcilable. In general, sustainable development has been accepted as a policy that must be carried out, but in practice it is more concerned with economic growth than sustainable development itself [21].

To maintain the function of sustainability in improving the quality of human life, there are several principles of sustainable living that should be adopted into development. The principles can be detailed as follows:

1. Respect and nurture the community of life
   This principle reflects the obligation to care for others people and for creatures, now and forever.
2. Improve the quality of human life
   The real goal of development is to increase the quality of human life. It is a process that enables human beings to realize their potential, build their self-confidence and comes to the rewarding and fulfilling life.
3. Preserve the life force and diversity of the earth.
   This principle requires us to:
   • Preserving life support systems,
   • Conserving biodiversity,
   • Ensure that the use of renewable resources is sustainable.
4. Avoid non-renewable resources.
   Non-renewable resources are materials that cannot be used sustainably, but their lifespan can be extended by recycling, economizing, or by making a product that substitutes for these materials.

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5. Try to do not to pass over the earth's carrying capacity.
   The carrying capacity of the earth's ecosystem has certain limits. To some extent, the earth's ecosystems and biosphere still withstand disturbances or loads without experiencing any harmful damage.
6. Change individual behaviour and lifestyles
   In order to implement a new ethic for sustainable living, we must reexamine people's values and change their attitudes. Society must introduce values that support this new ethic and abandon values that are not in accordance with the philosophy of sustainable living.
7. Support creativity of the people to protect their own environment.
8. Provide a national framework for integrating conservation development efforts. In this case, a national program is needed which is intended to create a sustainable life.
9. Create the global cooperation.
   To achieve global sustainability, it must be strong cooperation from all countries. The level of development in each country is not the same. The countries which are having low income must be given some support system to make their development continually.

The sustainable construction project can be reached by an effectively and acceptably method that is accepted by all participarts on that project. It can be happened by managing risk with considering safety at the design and planning stages, building efficient communication between both designer and constructor, also make the effective and safety management planning during the contruction period [22]. Risk management is an important tool to achieve sustainable development, this is because risk management is an important key to maximizing activities in achieving sustainable development goals [4] [23].

2. Research Method

The method that employed in this study was literary methode. This method was synthesized using the narrative method. This data was collected in the same type that was relevant with the answer of the questions. The step of result begun with collecting papers relevant to this research, which are related to sustainable construction and risk management. Furthermore, these sources were identified in depth so that a literature review framework can be made and finally a literature review is compiled in accordance with the objectives of the research.

3. Result and Discussion

3.1. Sustainable Construction (SC)

The concept of sustainable development inspired the people who concern in construction service to reach the efficiency of their projects, so that construction projects can be categorized as sustainable construction projects. Sustainability in construction projects can be achieved if each stage is carried out by considering the long-term environmental, social and economic impacts [24]. That component of the categories are succesfully when they are combain in the integrate of the preparation of design and process maps of the project perfectly [25] [26], and also with project scheduling [19] [25]. Badi (2017), stated that the base for a project to achieve sustainability is a balance of financial, environmental and operational considerations in all existing processes [27]. Sustainable project development can be achieved in several ways, including:

1. Improve quality and offer customer satisfaction;
6 Offers flexibility and potential to meet future user changes;
3. Provide and support the desired natural and social environment;
4. Maximize the efficiency of resource use.

The achievement of SC can be influenced by taking into account 4 (four) important aspects, namely environmental, social, economic and technical aspects [28]. Using the SC the physical construction can be guaranteed and sustainable, the construction project can also have a positive impact on the social and economic environment. So that the sustainability and balance of the universe can also be maintained. Sustainable construction can be planned, one of the tools to support planning in achieving

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sustainable construction is to use risk management, success in risk mitigation is success in sustainable construction [19].

Sustainable development has 5 (five) main principles that must be adhered to, they are the principles of linkage, diversity, usability, harmony and sustainability. there are 5 (five) variables that affect sustainability, namely, planning, processing, system reliability, community and system sustainability. Based on the description above, it can be summarized the Key Performance Indicators (KPI) of sustainable construction as in table 1.

Table 1. Key Performance Indicators (KPI) for Sustainable Construction

No		KPI	Sources
1	Environment	Reduce the use of four common sources used in construction; energy, water, materials, and land, at every stage in the project life cycle (Reduce) Maximize resource reuse, and/or recycling to reduce waste (Reuse) Recycling (reduction of raw materials used in new products) (Recycle) Use renewable resources to select non-renewable resources (Renewable) Minimize air, soil and water pollution Making and using environmentally friendly products in construction, regarding human health and safety and minimizing environmental damage. Conservation efforts by preserving life support systems, preserving the biodiversity of plants, animals and other organisms Minimizes damage to sensitive landscapes, including areas valuable from a scenic, cultural, historical, or architectural point of view, and minimizes disturbance to wilderness areas	[9] [23] [14] [17] [18] [19] [21] [22] [24] [25] [26] [27] [28]
2	Social	Improving the quality of human life by reducing poverty Customizable planning by local human institutions and technology Health and safety Skills of the people participating in the project Avoid the negative social impact of construction work Social benefits during the construction process (example: opportunity to be involved in work) Equivalent compensation for environmental changes	[9] [23] [14] [17] [18] [19] [21] [22] [24] [25] [26] [27] [28] [29]
3	Economy	Financial affordability Employment Opportunity Balance full cost accounting and real costing for efficiency in the process Increase competitiveness in the market by adopting policies and practices that promote sustainability issues Selecting environmentally responsible suppliers and contractors who can demonstrate environmental performance	[9] [23] [14] [17] [18] [19] [21] [22] [24] [25] [26] [27] [28] [29]
4	Technical	Build structures that are durable, reliable and functional. Pursue quality in creating an artificial environment. Use serviceability to promote sustainable construction. Humanize larger buildings so that individual users can control indoor environmental conditions (requiring a move away from centralized and uniform control). Replenish and revitalize existing urban infrastructure with a focus on rebuilding a multi-purpose pedestrian area that integrates housing, retail space and workplaces	[19] [22] [24] [27] [28] [18] [30]
5	Disaster	Strive for construction industry activities to be one that can reduce disaster risk	[11] [12] [23] [31] [32]

Source: Identification results, (2022)

3.2. Risk Analysis and Sustainable Construction (SC)

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From various research results that have been carried out by previous researchers, it is stated that there are many models and methods that can be used in integrated risk management applications in a construction project that refers to the concept of sustainable development, but the existing integration concept is still analyzed in a separate form, where the majority the research only integrates the project with the environment to achieve sustainable development [32] [33] [34] [35] [36] [37]. However, from the results of several previous studies that have not been integrated with management to achieve sustainable development as a whole. Where in sustainable development there is one aspect of risk that is often overlooked, namely disaster risk. Disasters must be one of the factors that are integrated to achieve sustainable development. This is because natural disasters can be a significant threat in achieving and maintaining development plans and goals [23].

To achieve sustainable construction with complex risk characteristics, a detailed risk analysis must be carried out in each existing project scope, namely project risk and environmental risk by taking into account sustainable factors. Based on the results of the initial identification obtained from previous research reviews, it can be seen that risk factors can affect sustainability. As has been mentioned in previous research, where risk factors if not addressed immediately can reduce the value of existing sustainability, and vice versa, if the concept of sustainability is applied in a project, then the concept can minimize the existing risks.

Table 2. Relationship Between Risk Factors

No	Risk classification	Risk factors	Relationship
1	Environment	Economy	Reinforcing
		Policy	Reinforcing
		Technology	Reinforcing
		Health and safety	Reinforcing
		Human Resources	Reinforcing
		Design	Reinforcing
		Social	Reinforcing
		Disaster	Reinforcing
		Employment Opportunity	Reinforcing
		Communication to the public	Reinforcing
		Land use	Reinforcing
		Conservation of cultural and natural heritage	Reinforcing
2	Social	Technology	Reinforcing
		Health and safety	Reinforcing
		Design	Reinforcing
		Policy	Reinforcing
		Environment	Reinforcing
		Disaster	Reinforcing
		Social	Reinforcing
		Financial performance	Reinforcing
		Energy efficiency	Reinforcing
		Design	Reinforcing
3	Economy	Policy	Reinforcing
		Environment	Reinforcing
		Technology	Reinforcing
		Renewable	Reinforcing
		Disaster	Reinforcing
		Material	Reinforcing
		Method	Reinforcing
		Standard Operating Procedure	Reinforcing
		Contractor experience	Reinforcing
4	Technical	Energy efficiency	Reinforcing
		Design	Reinforcing
		Technology	Reinforcing
		Disaster	Reinforcing
		Human Resources	Reinforcing

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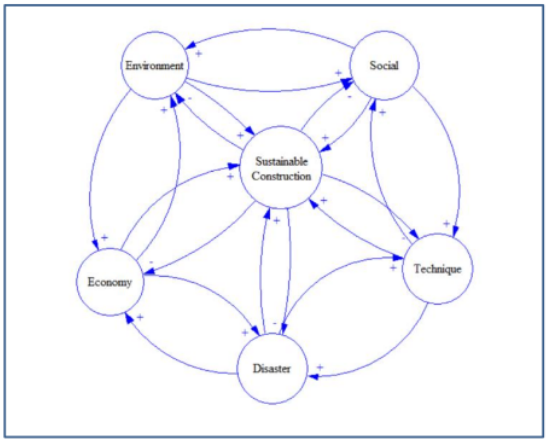
Table 2. continued

No	Risk classification	Risk factors	Relationship
5	Disaster	Natural disasters	Reinforcing
		Technology	Reinforcing
		Social	Reinforcing
		Economy	Reinforcing
		Environment	Reinforcing
		Energy efficiency	Reinforcing
		Renewable	Reinforcing
		Conservation of cultural and natural heritage	Reinforcing
6	Sustainable Construction (SC)	Environment	Balancing
		Social	Balancing
		Economy	Balancing
		Technical	Balancing
		Disaster	Balancing

Source: Identification results, (2022)

From the table 2 shows that there are 5 risk classifications, there are namely environmental, social, economic, technical and disaster. Each classification has risk factors that influence each other, the effect can influence environment economy, Policy, Technology, Health and safety, human resources, design, social and disaster. Social have a reinforce relationship with employment opportunity, communication to the public, land use, conservation of cultural and natural heritage, technology, health and safety, design, policy, environment, disaster. Economy have a reinforce relationship with social, financial performance, energy efficiency, design, policy, environment, technology, renewable, disaster.

Technical have a strengten relationship with material, method, standard operating procedure, contractor experience, energy efficiency, design, technology, disaster, human resources. Disaster have a reinforce relationship with natural disasters, technology, social, economy, environment, energy efficiency, renewable, conservation of cultural and natural heritage. Sustainable Construction (SC) have a reinforcing deeply with environment, social, economy, technical, disaster. These relationships are described as follows:



Source: Identification results, (2022)

Figure 1. Relationship Between Variables

From the figure above, it can be explained that among social, environmental, economic, disaster and technical risk factors can influence each other, the plus + symbol means that it can add to the existing risk value. while social, environmental, economic, disaster and technical risk factors can affect sustainable construction negatively, it means that they can be a source of risk SC, in this case it is symbolized by plus (+), but if the risk factor is managed properly, it can reduce the risk and than become

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a positive value, in this case it is symbolized by the minus symbol (-). If both of them variables have 2 symbols plus (+) and minus (-) it can be called the relationship means balancing each other.

5. Conclusion and Suggestion

5.1 Conclusion

The conclusion and the result based on the literature review there are 5 variables, there are namely social, environmental, economic, disaster and technical. The five (5) variables are fully integrated in two (2) forms of relationship, they are called reinforce and balance, where these variables can strengthen, weaken and balance each other. Based on the discussion above, it can be concluded that some previous research results agree that sustainable construction can be achieved by minimizing the risks that exist..

5.1 Suggestion

There is a need for further research development in this topic, so that it can be seen how much influence between variables that have been identified, and how much influence risk analysis has to achieve sustainable construction.

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