



**Research Article**

# Perspective View of Stakeholders into the Impact of Construction Industries Development on Environment: Case Study in Penang, Malaysia

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The main objective of this paper is to explore the views of developers about the impact of construction industries development on the environment to ascertain feasibility practice of sustainable construction principles. A survey of developers registered with REHDA community was conducted to assess their views on the impact of construction industries development on the environment when implementation of their projects. Results reveal that environment problems are the effect of construction industries development. Furthermore, results identified a need for adopting environmental sound management approach in construction projects. Developers are very important people, who can play a significant role in planning and implementing sustainability strategies for the construction sector so environment and natural energies can be preserved for good. Cross-section views of these developers form the basis of this study, thus, it was a cross-sectional study based on the relationship of construction industries with environment within Penang. The study magnified the effect of localized construction industries into the environment, which was concurrent with the worldwide issues happening in the contemporary environment. The study of these relationships explores the current environmental practices in depth and incurs the attention of implementation of sustainability performance in built environment.

**Keywords:** construction industries development, environment, stakeholders, Penang

## INTRODUCTION

Penang had undergone a booming economy development. However, the rapid development of the economy has to pay off with the environmental deterioration. According to what results show, many occurrences of environmental problems, such as, pollution, deforestation, ozone depletion, greenhouse effect and ecological defect area an immense threat to all the living creatures on earth. Environment has provided us the valueless and precious supply to all the Earthlings, either in the form of the living system or non-living system. It is a special resource, which should not be owned by any individual or businessman (Li et al., 2004). It been well known that construction industry

development can contribute to the welfare of people through economic and social development. In fact, construction industries generated the major sources for environmental problems (Azqueta, 1992).

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Construction itself creates a variety of environmental problems, which is due to the layouts and locations of the construction, materials used in the construction, physical appearance of the building structures and the nature of the design methods of construction, (Ramachandran, 1990). One of the examples of damage to the environment can be understood through the water-related pollution. Construction industry pollutes water by 22 percent in comparison to the all substantiated pollution initiated incidents in the sector (Morledge and Jackson 2001). Unfortunately, construction industry is one of the least sustainable practices in the entire industrial sector (Willmott Dixon Group, 2010).

Penang, a well-known developed state amongst others state in Malaysia. However, the construction sector in Penang state is not different from other developing countries. Penang focuses on construction industry development after the demand for manufacturing sector getting decrease gradually. The growth of construction sector was 15.4 per cent in 2012 and increased to 14.7 per cent in 2013, which implicated the highest growth amongst all sectors in Penang (Mok, 2015). Apparently the development of construction industry can contribute to the social and economic gains; but the impact of construction industries development on environment is the price to pay. The construction built environment had exploited the most of both renewable and non-renewable natural resources if compared with others industry sector (Spence and Mulligan, 1995; Curwell and Cooper, 1998; Uher, 1999).

Many researchers have proven the development of the building had contributed to the environmental deterioration with thus advocated the need of sustainable practice for construction activities (Hill and Bowen, 1997; Barret et al., 1999; Cole, 1999; Holmes and Hudson, 2000; Morel et al., 2001; Scheuer et al., 2003). In addition, Green Restaurant Association (1990) reported many construction waste and environmental problem particular pollution issues were a part of construction by-products. UNEP (2003) did emphasize in the report the construction industry exploited more than one third of the planet's resources and had generated tremendous huge volume of solid waste. Thus, the huge consumption of construction projects on resources had exaggerated the environmental problems which caused by the high release of greenhouse gas (GHG) emissions.

Except the built of the building project such as: residential housing; commercial building; facility building for education center, hospitals, welfare center and etc.; industrial zone and recreation for tourism spot, this included the built up for civil engineering works of transportation routes and accessibility. The development of these kinds of construction project (ibid) significantly

consumed a huge quantity of natural resources through the physical environment either renewable or non-renewable had caused the paradoxical consequences. The case became ever worse where the practice of not sustainable construction process. Thus, the impact of construction on the environment is huge and massive. In order to preserve and conserve the natural environment, construction industry should play a significant role by undertaking the effective approaches, such as practicing environmental management system in the building projects. Synchronously, the purpose of this study is to survey the extent of the awareness in stakeholders regarding the impact of construction industries on the environment.

## LITERATURE REVIEW

Penang state is located in the north-western part of the Malaysia country where tucked in between the much larger Kedah and Perak states along Peninsular Malaysia's west coast. Penang is a metropolitan city and is one of the most developed among the states in Malaysia. However, Penang only occupied six per cent of the population in Malaysia but yet contributed 36% of Malaysia's foreign direct investment (FDI) in 2010 (Lim, 2011). The development of Penang propelled by it prosperous growth of real estate market plus its abundance of attractive tourism hotspots had lead the burgeoning of tourism industries. These scenarios have given rise to a host of construction opportunities. Formerly, the state's gross domestic product (GDP) increased from RM1.3 billion in 1970 to RM21 billion in 2009, of which 39 per cent was contributed by the manufacturing industry and a substantial 57 percent from the services sector (OECD, 2011). But in the recent year by looking into the construction sector, Penang state had ranked the fifth-largest value of contracts awarded in Malaysia.

According to the recorded data in the Construction Industry Development Board Malaysia (CIDB), the total amount was up to RM6.59bn (\$2.06bn) worth of projects for which spread over to 479 contracts (Oxford Business Group, 2015). The historical of economic development in Penang can show the overall picture of the evolution in industrial sector. The interesting fact is, the transformation progress of the state was stimulant by the Penang Chief Ministers. Penang had undergone the fourth time of chief ministers swapping since the year of independence, 1957 till the current year. There are Wong Pow Nee (1957-1969) who is the first State Chief Minister, Lim Chong Eu (1969-1990) is the second State Chief Minister, then followed by KohTsu Koon (1990-2008) for being the third State Chief Minister, and the fourth State Chief Minister is Lim GuanEng (2008 till the present) (Wan Fairuzat et al., 2013).

The well-established construction sector in Penang is induced by the development of infrastructure and transportation projects; residential and non-residential of projects development. The paradigm shift of development plan in Penang has changed into construction sector because of plunging demand for the manufacturing sector in the recent year (Mok, 2015). However, the burgeoning development of construction sectors are harmful to the environment for which might give the impact detrimentally. The significance impacts of construction industries into the environment are attributed by the huge exploitation of natural resources and the generation of pollutants and wastes as construction byproducts. The statistically data recorded the construction industry consumed approximately 45-50 percent proportional of the global energy usage; approximately 50 percent of worldwide water usage; and approximately 60 percent of the total usage of raw materials (Willmott Dixon Group, 2010).

Meanwhile, based on the report of US Environmental Protection Agency (EPA) in archive document (2009), the emissions of construction industries are ranked the top amongst the sector. Based on their statistical report, the construction sector in the worldwide had produced side elements which harmful to the environment are such as: 23 percent of air pollution, 50 percent of climate change gases, 40 percent of water pollution, and another 50 percent of landfill wastes. The development of construction sector in Penang (a part of state in Malaysia) not excluded for its contribution to environment catastrophe. Unfortunately, these harmful emissions of construction byproducts had caused the serious impact into the environment had given the cascade impact on the ecological system and thus threatened all living creatures in the Earth.

The economic oriented development in the end has to compensate by the loss good environmental due to the deterioration of the environment. The evidence of climate change can be seen through the International Panel of Climate Change (IPCC) (2014), they reported the increment of temperature by average 0.6°C for this new age compared with the last hundred years ago. However, the infinitesimal increment of the temperature had induced the global warming problem to the Earth for which was the catalyst to the nature disaster of evolvement. The cause of global warming due to the increasing discharge of man-made concentration trace such as: greenhouse gases, notably carbon dioxide and nitrogen oxide.

The proven evidences for which given by the international scientists are firstly, the rising of global temperature due by the increased amount of carbon dioxide in the atmosphere had prevailed the accepted safe level. The unexpected of dangerous level carbon

dioxide had reached 400 parts per million (PPM) had beyond the underestimated 350 ppm of the optimum level for which permissible the increase of global temperature below 2 degrees centigrade, reported in the International Panel of Climate Change (IPCC) (2014).

The scientists believed the development in the construction sector had been counted for the large extent impact in the detrimental of the environment. Except the huge consumption of natural resources, the construction industry had produced various forms of wastes and pollutants during the different stages of construction typical processes. According to US EPA (2009), the construction industry contributed the wastes and pollutants in the forms of greenhouse gas elements; toxicity gases, liquidity and solid substances elements; plus the construction byproducts of such as: electric wiring, particle woods, rubble, concrete, dredging materials, rubber, and asbestos. Nonetheless, the buildings substantially contributed ample of carbon dioxide emissions due to its huge consumption of energy utility. In fact, the buildings had counted for the primary of energy consumption amongst other sectors that in turn accelerated the deterioration of climate change (US Department of Energy, 2009).

The adverse environmental impacts of climate change are complex and complicated that indirectly influence the environment and economic sectors. Climate change is the powerful weapon and can kindle a devastating loss to the Earth. Beside the global warming problem, the climate change can cause the acidification of sea water and dying off of coral reefs that harmful to marine productivity. In addition, the increase of sea temperature had caused the drastic change of temperature induced the occurrence of frequent and destroying typhoons and tornados. However, the ironic of climate change had caused drought problems in some of the countries like China, India, and Australia; but severe flooding faced by certain countries at particular experienced by the East Coast of Peninsular Malaysia in December 2014.

Moreover, the impact of global climate change had caused the suffering of extreme climatic events locally, especially the facing of bad weather in frequently. The example cases such as: the formation of mini tornadoes in Kedah in year 2014 (Oh, 2014) for the respectively year; the increased rainfall and high winds in certain areas; and the flooding strikes with heavy rain and high tides happened in some areas of Penang. However, the most worrisome part is the rise of sea level with just a few centimeters would capable to flood the large parts of the Penang Island. Although Malaysia have not been threaten by the dire projections of the impacts of climate change as some other countries are already facing, but it

is the right time to take the precautionary principles and undertake the efforts to preserve the environment with the purpose to increase the capability to withstand for such changing as well.

To achieve these objectives, it is necessary to take the efforts to investigate the possible scenarios which will contribute to climate change problem that concurrently to this research study purpose. To range between the best cases scenario to the worst cases scenario of climate change, construction industries have been ranked the worst scenario in climate change contribution by most scientists unanimously. Therefore, this study has undertaken the survey of the impact of construction industries development on environment based on the perspective view of those stakeholders involved in Penang construction sector. The purpose of the study is to examine the perspective views of the locally construction stakeholders whether in consistency views with those scientists. This in turn raises the awareness of the impact of climate change by construction industry to the project stakeholders and prepares to devise the strategies to overcome this problem in the consequences.

## RESEARCH METHOD

A questionnaire was adopted in order to assess the impact of construction industries development on the environment. The response of questionnaire is based on the perspective view of housing developers,. The coverage of the survey area focused in Penang which located at the North part of Peninsular Malaysia. Total developers registered in Real Estate Housing Developers' Association (REHDA) are 78 companies. . However, the sample size of the respondent which based on the REDHA in the region's population is 43 of project stakeholders. The adopted formula for sample size ( $n$ ) calculation is  $n = n^1 / [1 + (n^1/N)]$  (Sediary, 1994).

Where,

$n$  = sample size;

$n^1 = S^2/v^2$ ;

$N$  = total population;

$v$  = standard error of the sampling distribution (0.05);

$S$  = standard deviation in population at a confidence level of 95%,

$S^2 = (p) * (1 - p) = (0.5) * (0.5) = 0.25$ .

## THEORY AND CALCULATION

The questionnaire using five-point Likert scale and respondents were asked to assign appropriate rating to the variables. Data Analysis was done by the help of Statistical Package for the Social Science (SPSS) version 16.0 for Windows. Significance <0.05 was revealed in the

results of data analysis. Parametric and non-parametric correlation tests were the subjects of the sample data. The statistical significance of standard probability between 0 and 0.1 was used for examining the direct relationship between the impact of construction industries development and environment matters are exactly true. 38 percent of response rate was achieved; however, the sample size of this survey is very small but is acceptable for it regional survey study. The number of respondents indicated a very good sample of developers in Penang and all the information given is adequately represents the population.

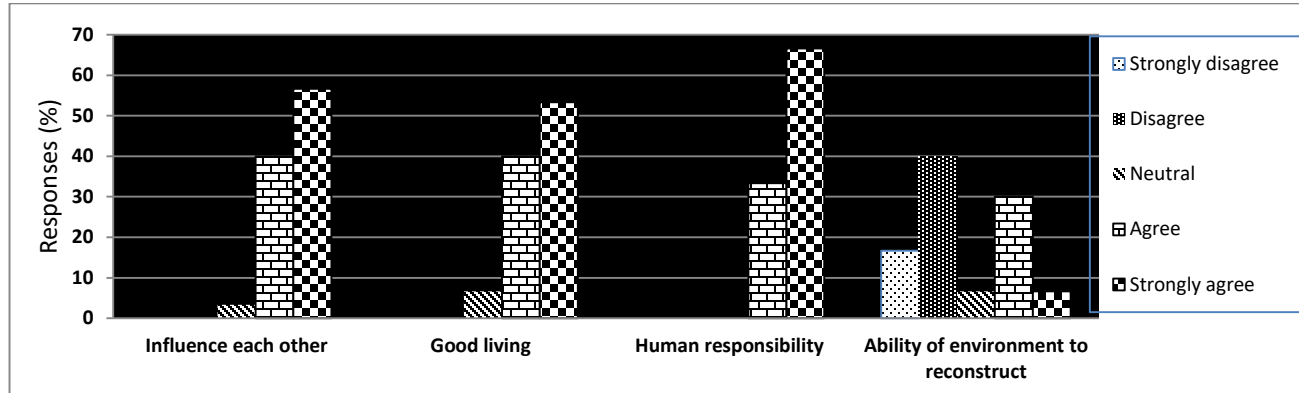
## RESULTS AND DISCUSSION

### Relationship between Human Beings and Environment

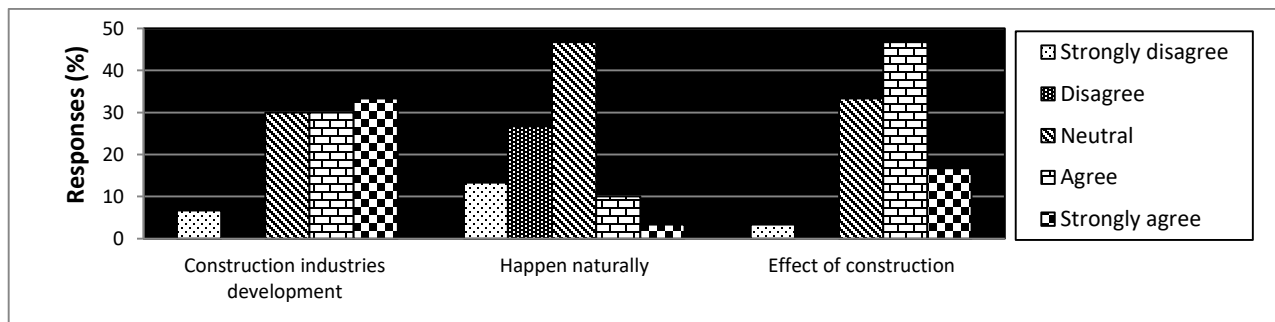
The relationship between the man and the environment has been established in the early periods itself and interaction of human beings with the nature works in constantly. Meanwhile,, The definition of environment is defined as the physical factors surrounding our earth in the Environment Quality Act 1974 These are the constituents of air, water, soil, sound, particles of the atmosphere, smell, the variety of color and included the biological factors of flora and fauna with the social aesthetical factors. However, the sensation of nature towards human life can be implicated through the air we are breathing; the water we are drinking, the food we are eating, and the cycle flow of energy metabolizing. In this survey, **Figure 1** presented the majority respondents, who unanimously agreed that there is a relationship between the reactions of human beings with the mechanisms of the environment. Cited by UNEP (2012) in World Environment Day "*Any change in the environment can not only result in devastating effects, but can also pose a threat to the human race*". This indicates that humankind should play an important role for the protection of the environment with coincide feedback because environment itself is unable to reconstruct once being affected by the pace of earth's restoration capability, which is rather slow in comparison to the speed of human beings at which, they are deteriorating earth's environment.

### The Causes of Environmental Matters

Many scientifically proven researches and facts indicate that the earth is suffering sick due to ozone depletion, greenhouse effect, acid rain, and extinction of creatures and the sign of natural disasters. According to the report of United Nations Human Settlements Program (UNHSP), natural disasters cause a considerable amount of damage every year in the entire world. This damage costs around US\$24 billion every year. Due to this high



**Figure 1.** Relationship between human-being and environment  
Source: Given by the Author.



**Figure 2.** Causes of Environmental Matters.  
Source: Given by the Author.

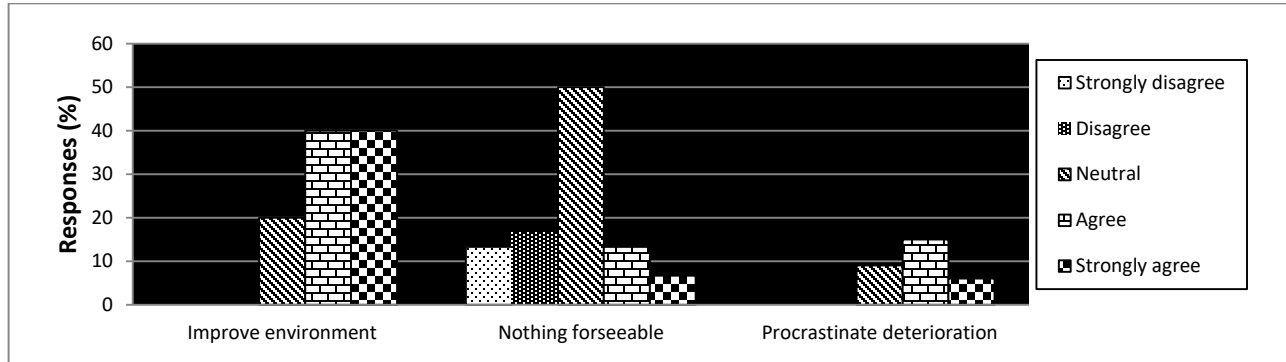
ratio of damage, a number of living creatures are affected, and a number of important buildings and resources are sabotaged. Killing of innocent living creatures due to natural disasters is not a justified act in the present world of technology. In addition, the die of innocent living creatures should attribute to human beings who are responsible for making environment suffer. Most of the respondents agreed that the development processes in construction activities result in the occurrence of environmental problems (Pulaski, 2004).

Meanwhile, Bennett (1991) advocated the environment do interfere with the planned progress of construction projects. It is been acknowledged that the obsolescence of the earth might happen naturally but the progression of human development activities accelerated the problem of environment. Figure 2 represents the causes of environmental methods, both which occur naturally and due to the construction carried out by human activities. The construction industry itself accounted for around 4% of particulate emissions. The observed environmental problem due to the effect of construction activities is the nuisance of pollution from noise which mainly from vehicles, heavy equipment and machinery; air emitted dust which is classified as PM10

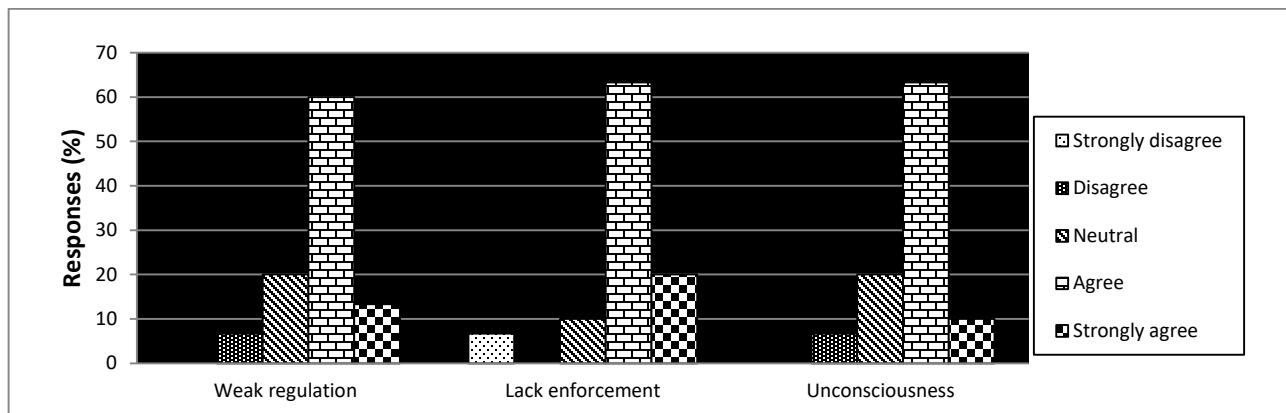
(invisible to the naked eye); sewage discharge and solid wastage, plus water pollution from the sources of diesel and oil; paint, solvents, cleaners and other harmful chemicals; and construction debris and dirt (Gray, 2016).

### Consciousness of Environmental Problem

Paraskevopoulos et. al. (1998) stated that people will act to preserve environment if they are aware of the need for and the ways of protecting the environment. Several of the environmental problems presently faced by humankind are directly or indirectly caused by exploiting of environment and unconsciousness of the society about environmental education (Özmen and Karamustafaoglu, 2006). The scenario did reflect in this study survey. The responded stakeholders concurred that the impact of construction industries development into the environment will be reduced if consciousness about environmental problems due to the construction projects is raised. This is reflected in the views of respondents for the improvements in environmental conditions and the procrastination of environment deterioration are necessary if conscious of the occurrence of environment problem due by construction activity. However, there is uncertainty in the argument of the respondents that whether their efforts are feasible because of not



**Figure 3.** Consciousness of Environmental Problem.  
Source: Given by the Author.



**Figure 4.** Obstacles to Improve Environment Quality.  
Source: Given by the Author.

foreseeable prospection. **Figure 3** represents the level of consciousness regarding environmental problems in the local population.

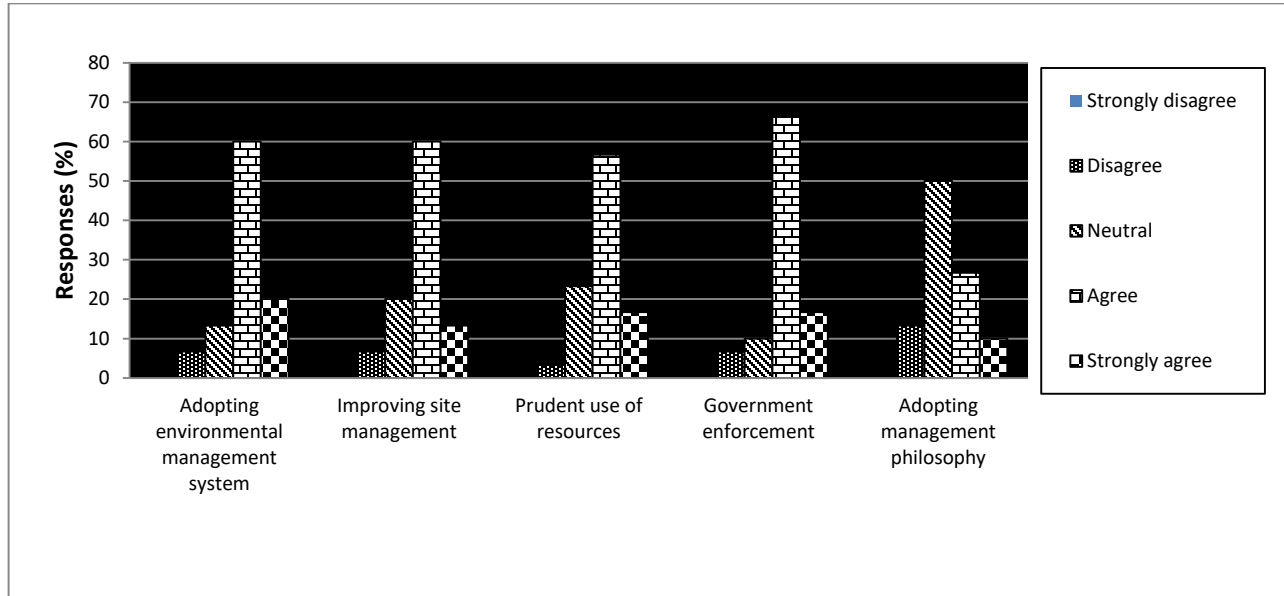
**Obstacles to Improve Environment Quality**

In this survey, it is demonstrated the blame circle exists amongst the stakeholders in construction industries. The developers presumed no enforcement and regulations being undertaken for the preservation of the environment during a construction process. However, the regulation of Eco-Management and Audit Scheme (EMAS) is inapplicable in the construction processes and had been suggested to be customized prior for application (Zobel and Burman, 2004). In addition, they admitted the unconsciousness of the society welfare also one of the factors contributing to the lack of confinement and improvement in environment quality. This reflected the citation of Langston and Ding (1997) whom justified the lack of environmental awareness amongst building practitioners may not practice for the usefulness of recycling. Figure 4 represents different hurdles that come across in the improvement process of environmental quality.

**Efforts to Improve Construction Industries Sustainability Performance**

According to the World Report (1994), one-tenth of the global resources is exploited by construction activities, which is equal to 40 percent of the material flows entering the world economy. This obviously indicated the development of construction industries accurately give the concrete impact on the environment. The respondents unanimously agreed that they are responsible for catering the needs of their environment in order to have sustainability practice by adopting the environmental management system, improving site management, wise use of resources, and certain of management philosophy, such as, lean construction and principle of just in time. Most of every nation’s savings is represented by its construction as construction plays a very important role in up boosting the economic conditions of the countries.

However, according to the report of World Bank, natural disaster losses in developing countries are 20 times larger than the industrialized nations. This can be attributed to the construction development process where



**Figure 5.** Efforts to Improve Construction Industries Sustainability Performance.  
Source: Given by the Author

has implication with the environmental destruction. The example case of Kazakhstan the poorest water supply and sanitation systems due to deficient design, use of poor construction materials and methods, and insufficient maintenance and rehabilitation (Jarbussynova, 2001). Unsustainable approaches in the construction business leads to further social problems, such as, poverty, inflation, economic depression, criminal and etc. In order to avoid them, it is necessary to incorporate sustainable means of construction (Ofori, 2004). **Figure 5** represents the efforts made by construction industries to sustain their performances with regard to the environment.

## CONCLUSION

This research study has explored different stages of awareness amongst the stakeholders towards the impacts of construction industries development into the environment. Most of the event that took place in the last decade made natural disaster management authorities contact government and international organizations to build sustainable environment with their help. Health and safety of human beings should be one of the top most priorities of all the construction authorities. They should keep in mind that human beings in the neighborhood have a right to safer life. Government should also play their integral role in making strict construction policies for all private and government. Construction organizations should follow in the matters of land use. It is always to be remembered that ineffective construction polices will make natural disasters more worst and cause lethal damage. The aim of this research study is to measure the current practice of stakeholders in the construction

industries by assessing their perspective view of the impact of current construction industries development on environmental matters, plus ascertain their views on the implementation of environment management system approach for the conservation of the environment.. The results show that developers have a good level of knowledge about the adverse effects of construction industries development on the environmental issues. This would promote the production of environmentally sound building by implementing sustainable construction strategies in order to minimize the deterioration of the environment through waste production minimizing and maximizing the use of recycling.

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