



## Environmental Factors Influencing the Adoption of Best Practices and Safety among Construction Companies: A Preliminary Study in Malaysia

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**Abstract:** The construction industry on realizing the consequences of the effects of certain environmental factors both internal and external sort to promote the implementation of best practices in the conduct of its job. The aim is to come up with best ways and procedures of project designs that will reduce job risks and maintain quality and quantity of the job. The variables considered in this study include the internal and external environmental factors that influence the adoption of best practices in the construction sites. In doing this the study uses quantitative method with managers at the selected sites (Pilau in Penang state of Malaysia) as respondents. The total numbers of managers interviewed for this research are 30 using a simple random sampling technique. The demographic characteristics of the respondents are 80.0% were male, 20.0 females, project managers (23.3%), marketing managers (6.7%), engineers (36.7%), sale managers (6.7%) and other positions (26.7%). Descriptive and inferential statistics was used to analyze the data collected using SPSS software package version.20. It was found that there is the significant relationship between only two environmental factors and best practices. The factors were competitors ( $r = 0.506, p < 0.01$ ) and suppliers ( $r = 0.574, p < 0.05$ ). There was no significant relationship between NEP (natural environmental protection) and best practices ( $p > 0.05$ ). Environmental factors explained for 76.4 percent of best practice ( $R^2 = 0.764, F = 28.058, p < 0.01$ ). Result also showed that the changes in all environmental factors will significantly impact on the adoption of best practice as follows: competitors ( $B = 0.173, t = 5.352, p < 0.01$ ), natural environmental protection ( $B = 0.298, t = 5.791, p < 0.01$ ) and suppliers ( $B = 0.311, t = 7.019, p < 0.01$ ). The result show that 76.4% more than 50% are the environmental factors supporting the adoption of best practice which are effective in the operation of construction companies. The objective and aims of this research have been

achieved with several environmental factors having influence on the adoption of best practices in construction industry. Although the environmental factor significantly influences the adoption of best practice, the construction companies have more to do for continuous improvement.

**Keyword:** Natural Environmental Protection; Best Practices; Competitors; Suppliers; Adoption.

## I. INTRODUCTION

A number of studies have been conducted to come up with best ways and procedures of project designs that will reduce job risks and maintain quality and quantity (Yahya, Liman and Lawal, 2013). This comment is in tandem with the principles of best practices. The concept of 'Best Practice' entails the fortification of the processes, procedures, policy and systems that delivers the optimal outcome (Fazzi, 2006). Such policies, procedures, process and system, given a number of input that transform into an output through best practices often translated into a model worthy of adoption by competitors and other stakeholders (Fazzi, 2006). Part of the policy and procedures engendered by Best Practice principle is the formation of an excellent work group to come up with practical recommendations for architects, engineers, project managers, and designers on site to use (Yahya *et al.*, 2013). The concept and model of Best practices has proven to be evidence-based practices that accelerated the achievement of superior and better measurable outcomes in safety and project management practices (Fazzi, 2006).

This therefore proves that 'Best Practice' as a process, procedure, policy and system serves as knowledge based that underpins examples of excellence (Willard, 2009). The advantage associated with the knowledge of best practice requires that all organizations must endeavor to hold it, share it and implement it throughout their production or construction processes (Willard, 2009). The emergence of series of models of technology for use in the construction industries in the last 10 years dramatically change the way construction activity is being undertaken. Not only that but also in the way that construction projects are safely procured and managed using these new technologies (Pitt, Tucker, Riley and Longden 2008). The Best Practice concept as a new thinking has been very successfully applied in other industry throughout the world (Pitt *et al.*; Wallard, 2009). The success stories recorded by organizations like South East and London Construction Board for Excellence (SECBE) and Constructing Excellence, Bovis Lend Lease, Cox Schepp Construction, Balfour Beatty Construction all using the best practice model, widely demonstrate the business case for action and the call for its support and application (Pitt *et al.*, 2008; Wallard, 2009; Shah, 2007).

Best practice serves as a guideline, or an ethics for practice or an idea that represent the most efficient or prudent course of action and safety on site (Zhang, Shen, Love, and Treloar, 2000). It is often set forth by an authority, such as a governing body or management, depending on the circumstances. While best practices generally dictate the recommended course of action, some situations require that such practices be followed (Meltz, 2009). In Construction Industry the best practice is a process or method that when executed effectively, leads to an enhanced project performance (Federal Facilities Council, 2007; Hans Van Winkle, 2007). It also has been proven through extensive industry use and validation. According to Beard, (2015), embracing best practice and exploring opportunities for continuous improvement should be ingrained in all project managers thinking, which will serve as a core to delivering a construction solutions that exceed the client expectations.

While best practice model may serve as a supporting instrument ready to use for efficient, safe and prudent service delivery in project management certain environmental related factors can influence its

effective adoption (Aksorn, & Hadikusumo, 2007). Hence the need to study best practice in relation to environmental factors in the Construction industries (Pekuri, Haapasalo, and Herrala, 2011; Kim 2014). The best practice is important to project management especially when relating it to environmental factors considerations (Pekuri *et al* 2011). The desire to improve environmental safety or reduce the risk of the environmental factors in the project in the construction sites enormous (Kim, 2014). The premise under which best practice model is hinged on through its principle of choosing the best way or method without wasting resources and/or making the surrounding environment unsafe and dangerous for the construction project team and its inhabitants makes it a lot more important (Pekuri, *et al*, 2011; Kim, 2014; American Society of Civil Engineering ASCE, 2013).

These environmental factors as it relates to project management safety and best practices can be divided into two thus: internal and external (Wilmort, 2010). In choosing the best practice model to use, the project manager needs to benchmark the organization's practices with the one considered to be superior. The failure of the project manager to consider the environmental factor while adopting best practice model can impact negatively on the project (Rinaghani, 2007). This non consideration of environmental factors and safety may leads to the cancellation or stoppage of the project by the regulating authorities in most advanced countries (Audit and Advisory, 2013). The usual practices of negligence at constructions sites translated into recording poor internal environment call for the insistence on best practices, (ASCE, 2013). These practices has a long term effects on both the project and the environment, though with records of few exceptions having immediate life threatening conditions makes the adoption of best practices and safety paramount on construction sites (Willmott, 2010).

This paper therefore aims at determining the relationship between environmental factors, best practice and safety in construction industries. The result of the research can help to bring to fore which of the several environmental factors can facilitates the adoption of best practice in the construction industries.

## **2. LITERATURE REVIEW**

### **2.1. Definition of Best Practice**

The term best practice has application in many fields, and there are available literature surrounding its evolution practices and development in the identified fields and disciplines. Definitions of best practice abound, from the vague definition referring to be 'a method generally accepted as successful' to those that plain fully specific to particular fields of endeavor (Tobey, 2012). Besides that, a best practice generally consists of a technique, method, or process regarded as safe and cost effective, (ASCE, 2013). The concept implies that if an organization follows best practices, it has the potentiality to delivering an outcome with minimal problems or complications, (ASCE, 2013; Beard, 2015). Best practices are often used for benchmarking and represent an outcome of repeated and contextual user actions (Cory, 2007).

According to Fazzi (2006), best practices are evidence-based practices that have proven superior to others in achieving better measurable outcomes. It means using a method that produces the same or better outcomes in less time than your two fingers, hunt and peck approach (Caldas, Kim, Haas, Goodrum, and Zhang, 2014). Moreover, best practice also is the process of finding and using ideas and strategies from outside the company and industry to improve performance in any given area (Caldas *et al.*, 2014). Big business has used best practice benchmarking over decades and realized billions in savings and revenues in

all areas of business operations and sales. Small business can reap even greater rewards from best practices (Saurin, Formoso, Reck, Beck da Silva Etges, and Ribeiro, 2015).

On the other hand, 'Best Practices' are viewed in context of reasonable cost and schedule limitations, desires for objectivity and rigor; differing building and equipment types, project size, and complexity (Building Commissioning Association, 2011). It also connotes policy, systems, processes and procedures that delivers the optimal outcome, such that they are worthy of adoption. (Construction Industry Institute, 2006).

Best practices have been repeatedly used and improved to produce consistent outcomes and are documented as examples, baselines and measures, (Saira, 2011). Some of the more commonly used are: an iterative development process, requirement management, quality control, and change control (Margaret, 2007). However, best practices in health promotion are those sets of processes and activities that are consistent with health promotion values/goals/ethics, theories/beliefs, evidence, and understanding of the environment and that are most likely to achieve health promotion goals in a given situation (Kahan and Goodstadt, 2002; Yahya, Shahmi and Gorodutse, 2015).

Among the available best practice, is the typology presented in Cory (2007) the study accepted is propositions. This is so because of its emphasis on, method or a process that a company or manager is using to achieve maximum success in the project completion and/or accomplishment.

### **2.3. The Importance of Best Practice**

Best Practice is important because it can help to introduce new ideas for the company, improves the performance and set new standards of excellence to propel company forward (Phil, 2013). Though best practices may be adequate but it must be carefully adopted for the desired goal to be achieved. It is always good to carefully study any best practice intervention that need to be adopted (Phil, 2013). Study have shown that successful adoption have resulted to best practice after benchmarking by big businesses which have resulted to savings of billions and improves revenue from both operations and sale supports (Bill, 2011). It implementation in small businesses has also proven to producing an un expected good outcome (Bill, 2011).

According to Bill (2011); Fazzi, (2006) best practice in conjunction with the development and use of elaborate goals and objectives if properly crafted will provides both a focal point and a measurement tool to build the company. Both the description by Phil (2013) and Bill (2011) are relevant to this study. The two emphasizes method, procedures, goals, objectives as the basic nucleus for an effective best practice.

### **2.4. Implementation of Best Practice**

The reason for the adoption of Best Practice by construction companies is to improve performance, safety, reduce cost, efficiency and more. According to Ploeg *et al.* (2007), Best practice guideline implementation strategies should address barriers related to the individual practitioner, social context, organizational context and environmental factors. Moreover, a successful implementation of a best practice financial modeling methodology shows a result of a decreased modeling risk, increased team productivity, increased financial returns, more informed investment decisions, stronger professional reputation in the market, internal consistency, timely and accurate analysis to external stakeholders and decreased review and audit costs (Blake, 2012). Construction Financial Management Association, (2009) reported that the

time and money to invest to properly configure and implement new enterprise software and to train the staff to use it correctly pay much higher dollar-for-dollar returns than the raw cost of the hardware and software itself. For the CRC Construction Innovation (2006) mentioned that the guide to best practice for safer construction implementation kit suggests a framework for clients, designers and constructors to improve safety performance at all stages of a construction project.

However, best practice can also be implemented in health and safety part of construction. Registered Nurses' Association of Ontario (2012) mentioned that this Toolkit was designed to assist health care settings in maximizing the potential of Buccini/Pollin Group (BPGs), through systematic and well-planned implementation. The likelihood of success in implementing Buccini/Pollin Group (BPGs) increases when a systematic process is used to identify well-developed the areas of application.

## **2.5. Environmental Factor**

Environmental factor is an identifiable element in the physical, cultural, demographic, economic, political, regulatory, or technological environment that affects the survival, operations, and growth of an organization (Abdul Razak, Jaafar, Abdullah and Muhammad, 2006). Environmental Factor also can be subdivided into two categories which are internal environmental factor and external environmental factor.

According to Neil and Demand (2013), environmental factors refer to external influences on a business that it has limited control over but that it must consider as part of strategic planning. Typically, environmental factors addressed by companies fit into four categories which are social, legal, political and economic (Pheng, and Chuan, 2006). In another study, Pheng and Chuan (2006), revealed that environmental factors such as working hours, physical condition of project site, complexity of project, material and supplies, project size, duration of project and time availability are fundamental to influencing business. These factors affect small businesses in different ways than larger competitors. Besides that, Jacquelyn (2013) mentioned that companies in the industrial or manufacturing industry often work with different kinds of equipment, machinery and chemical-producing agents. In effect, a business' day-to-day operations can pose an ongoing threat to the natural environment. To reduce the likelihood of damage to the environment, federal and state regulations require businesses to consider certain natural environmental factors in their overall operations plans (European Union, 2012). Best practices are also used in designing facilities that are cost-effective, efficient and functional for staffs that also cultivate a caring, healing environment for patients (Tammy *et al.*, 2002). Business environmental factors are those elements surrounding an organization that impact on its survival and growth opportunities positively or negatively. Common factors include physical, cultural, demographic, economic, political, regulatory or technological environmental factors, (Pheng and Chuan, 2006).

External environmental factors such as access to capital, technology, people, project leaders ability to make maximum use of available resources, this is in addition to unanticipated changes in the environment all could cause even the most well-managed and smoothly proceeding project to lose momentum (Leigh, 2013). On the other hand internal environment refers to internal factors and resources that affect the running of the business. This primarily includes the environmental uncertainties, market competition, customer demands or requirements. The employees play a vital role in affecting the company's performance (Leigh 2013).



## 2.6. Environmental Factor in Construction Companies

There are different environmental factors that are impacting on construction companies operating every day. According to Thong (1999), outside support may come either from a third party or the partner company whose best practices are adopted. Direct state interventions in business activities minimization could impact positively on construction business. Government policies concentrate on creating a competitive environment for enterprises and on providing macro-economic and social conditions that are predictable, thus minimizing the external risks for economic activities (Griffins and Hauser, 1992). Griffin and Hauser (1992), proposed that in order to address the challenges of external environment a customer feedback system can be set-up and frequent meetings with customers conducted for better understandings and success of the project. It is important for organizations to understand as well as to respond to their customer's needs. This so because environmental factors that can affect the running of an organization are those factors over which the management has no control (Jayantrow, 2010).

Moreover, benchmarking is a commonly used tool in meeting the challenges that an organization's environment possesses and this is what best practice stand to address (Brah *et al.*, 2000; Underdown and Talluri, 2002).

### 2.6.1. External Environmental Factor

It is important to monitor changes occurring in the external environment, considering that these environmental factors significantly affect the project and business performance. Consequently, it is necessary to take measures in order to minimize the impact of threats and create a favorable business climate to increase profits and longevity in the market by the companies (Enida, 2013). One of the most serious environmental factors is political factors. The political factors affecting the construction and housing industry mostly consists of documentation and permits that has to be obtained during the various phases of construction of a structure and its sale. Due to technical nature of the construction process, the technical environment keeps on changing every day (Yogin, 2009). Competitive environmental factors are also one of external factors. Study conducted by Simerly and Mingfang (2000) shows that competitive environments moderate the relationship between capital structure and economic performance and that the match between environmental dynamism and capital structure is associated with superior economic performance. In another study by Sofiah (2011) a cost leadership strategy is positively associated with a more bureaucratic Management Control Systems, while a differentiation strategy is associated with a less bureaucratic Management Control Systems. The study found that cost leadership, being firms with tighter cost control and vigorous pursuit of cost reduction, is positively associated with a bureaucratic Management Control Systems.

## 3. METHODOLOGY

### 3.1. Research Design

This research used the quantitative and cross sectional approach to collect data for this study. The research instruments are based on the environmental factors influencing the adoption of best practice and safety in construction industry (Sekaran and Bougie 2010; Chris, 2011). Therefore, this research uses Managers at the various construction sites in Pulau in Pinang Malaysia to collect the data by filling up the questionnaire for analysis.

### **3.3. Sample size and Sampling Technique**

Being a preliminary study, this research obtains 30 responses from the various construction sites in the study area as the sample of the study through a simple random sampling technique. The goal is to estimate the mean and the variance of a variable of interest in a finite population by collecting a random sample from it (Moulinath, 2012).

### **3.4. Respondents Characteristics**

The basic demographic characteristics of the 30 respondents selected for this study as present in appendix 1 includes; 80.0 percent of the respondents were male and only 20.0 percent were females. The respondent also includes, project managers (23.3%), marketing managers (6.7%), engineers (36.7%), sale managers (6.7%) and other positions (26.7%). Their characteristics according to working experience shows that those who have worked for less than 3 years (30.0%), 3 to 6 years (30.0%), 7 to 9 years (6.7%) and more than 10 years (30.0%). Those who participated in less than three projects a year (73.3%) and more than three project a year (26.7%).

### **3.6. Data Analysis**

To analyze the data so far collected descriptive and inferential analysis was conducted using SPSS software package version 20. This is to ensure that analytical and /or logical description and illustration are done to distinguish the signal phenomenon of interest from the noisy statistical fluctuations present in most data collected pre-processing (Shamoo and Resnik 2003). Specifically in this research quantitative analysis such as descriptive, correlation and regression were used to arrive at the result (Best and Kahn 2007; Neeru, 2012; Marilyn and Jim, 2011; Peter, 2010).

### **4.3. Descriptive Analysis**

Descriptive analysis was carried out to determine the level of perception towards the variable and statements asked in the questionnaire. For the purpose of this study, this analysis attempts to identify the relationship between environment factors and the adoption of best practices in construction business in Malaysia. Respondents were asked about their agreement towards the statements using Likert scale of five, 1: strongly disagree, to 5: strongly agree.

#### **4.3.1. Environment Factors**

Table 2 and Figure 1 illustrate the results of descriptive analysis that examines the level of perception of impact of environmental factors on best practice adoption. Respondents' perceived the highest degree of

**Table 4.1**  
**Descriptive Analysis of Environmental Factors**

	<i>Mean</i>	<i>Standard Deviation</i>	<i>Ranks</i>
Competitors	3.31	1.02	1
Natural Environmental Protection	3.28	0.74	2
Suppliers	3.02	0.83	3

agreement on competitors' factors (mean = 3.31, standard deviation = 1.02), followed by natural environmental protection (NEP) (mean=3.28, standard deviation = 0.74) and suppliers (mean = 3.02, standard deviation = 0.83).

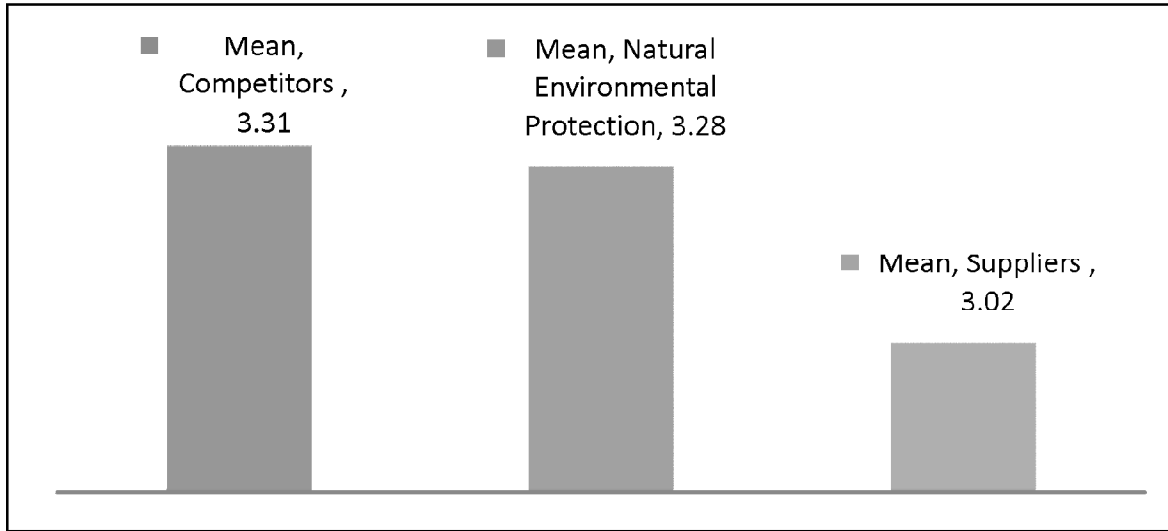


Figure 4: Descriptive Analyses of Environmental Factors

#### 4.3.2. Best Practice

The results indicated that respondents perceived that operational benefit was the important factors in best practices (mean = 3.76, standard deviation = 0.69). It is followed by codification (mean = 3.17, standard deviation = 0.72) and compatibility (mean = 3.13, standard deviation = 0.50). Respondents perceived the lowest perception towards complexity factors (mean = 2.89, standard deviation = 0.61).

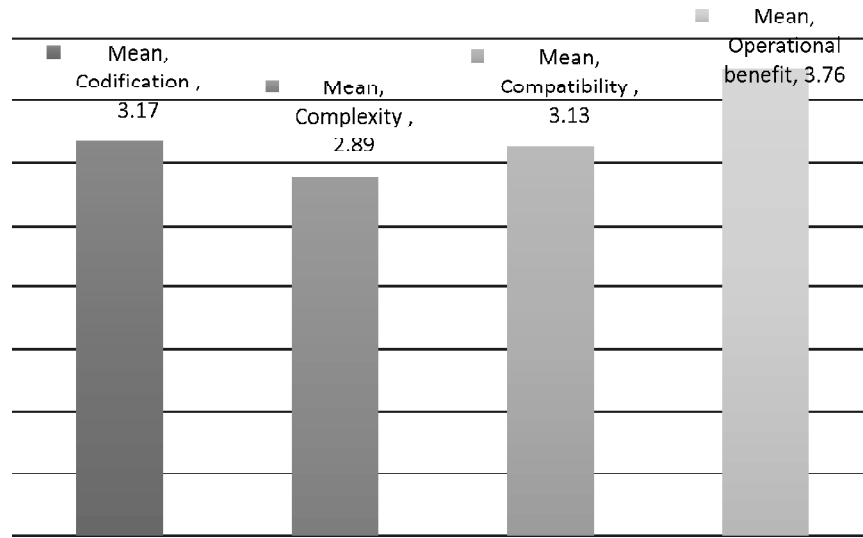
Table 4.2  
Descriptive Analysis of Best Practice

	Mean	Standard Deviation	Ranks
Codification	3.17	0.72	2
Complexity	2.89	0.61	4
Compatibility	3.13	0.50	3
Operational benefit	3.76	0.69	1

#### 4.4. Relationship between Environmental Factor and Best Practice

Correlation analysis was carried out to examine the relationship between environmental factor and the adoption of best practice. The result is illustrated in Table 4. It was found that there is the significant relationship between only two environmental factors and best practices. The factors were competitors ( $r = 0.506$ ,  $p < 0.01$ ) and suppliers ( $r = 0.574$ ,  $p < 0.05$ ). There was no significant relationship between NEP (natural environmental protection) and best practices ( $p > 0.05$ ).





**Figure 4.1: Descriptive Analyses of Best Practices**

**Table 4.3**  
**Relationship between Environmental Factors and the Adoption of Best Practice**

	<i>Best Practice</i>	<i>Competitors</i>	<i>NEP</i>	<i>Suppliers</i>
Best Practices	1			
Competitors	.506**	1		
NEP	.026	-.395*	1	
Suppliers	.574**	.279	-.559**	1

Note: \*\* $p < 0.01$ ; \* $p < 0.05$

#### 4.5. Effect of Environmental Factor on the Adoption of Best Practice

Regression analysis computes the effect of independent variable on dependent variable. In this study, the analysis computes the effect of environmental factors on the adoption of best practices. The result in Table 5 indicated that environmental factors explained for 76.4 percent of best practice ( $R^2 = 0.764$ ,  $F = 28.058$ ,  $p < 0.01$ ). Result also showed that the changes in all environmental factors will significantly impact

**Table 4.4**  
**Effect of Environmental Factors on the Adoption of Best Practice**

	<i>B</i>	<i>T</i>	<i>Sig.</i>
Competitors	.173	5.352	.000
NEP	.298	5.791	.000
Suppliers	.311	7.019	.000
$R^2$	0.764		
$F$	28.058		
$Sig.$	0.000		

\*\*  $p < 0.01$

on the adoption of best practice as follows: competitors ( $B = 0.173$ ,  $t = 5.352$ ,  $p < 0.01$ ), natural environmental protection ( $B = 0.298$ ,  $t = 5.791$ ,  $p < 0.01$ ) and suppliers ( $B = 0.311$ ,  $t = 7.019$ ,  $p < 0.01$ ). The result show that 76.4% more than 50% is the environmental factors supporting the adoption of best practice which is effective in the operation of construction companies.

## **5. DISCUSSION AND CONCLUSION**

The main focus for this research is to identify the environmental factor that influencing the adoption of best practice operating in construction companies in Pulau Pinang. This study, attempt at analyzing the challenges that faced the relationship between the environmental factors and best practice in construction industry in Malaysia.

### **5.1. Discussion**

The findings have showed that several environmental factors do influence the adoption of best practices among construction companies operating in Penang. However, the result found that adoption of best practice among the construction companies is below average. From the results it was established that relationship between the environmental factors and best practice especially between competitor and supplier has recorded a significant relationship with each other. In the result that can compare with Thong (1999) shows that competitive environment can be independent and succeed without the involving of the government. However, the NEP showed no significant relationship with the best practice. This shows that construction company are presently having less focus and/or experience on the best practice in natural environmental protection. This therefore requires more effort towards improving a significant relationship between the factor and best practice principle.

Besides that, these factors are showing significant effect on the adoption of best practices. From the three environmental factors shown it can then be concluded that the variable is making a significant unique contribution to the prediction of dependent variable. This may not be due to overlap with other independent variables in the model. According to Simerly and Mingfang (2000), competitiveness has relationship with capital structure and economic performance but at the same time the result shows that competitiveness also has a relationship with the adoption of best practice which has potentials to improve the performance of construction project.

### **5.2. Conclusion**

This study had been carried out to identify the environmental factors influencing the adoption of best practice. The objective and aims of this research have been achieved. This is because the research shows that several environmental factors do influence the adoption of best practices in construction industry. From the overall result, it shows that most of the company's adoption of best practice in relation to environmental factor is good and bring benefits to the company's. However, the adoption of best practice among construction companies is an important issue that should be given much attention in the construction industry. More so the Natural Environment Protection (NEP) has an important role to play in reducing the environmental related factors impacts on construction business.

### 5.3. Implication

Although the environmental factor significantly influences the adoption of best practice, the construction companies have more to do for continuous improvement. This became imperative through the assessment of the records on available literature with very low records of overcoming the effects of NEP regulations on the application of best practice method in the construction industry in most developing countries. The construction companies need to have serious concern in this area with the aim of improving its relationship with NEP regulations and reduces the risk these environmental factors could pose on best practice implementation in construction industries. Besides that, construction companies can educate their managers on the need to focus more on those factors that influences the adoption of best practice.

On the other hand, government also can give support and encourage the construction companies on the need to focus more on environmental factors that influences the adoption of best practice. This will help to increasing the efficiency of the construction companies and small – medium enterprise (SME). Construction companies should use the best practice technique to improve their project performance. This if well-articulated and put to practice can assists in the reduction of the effect or influence the environmental factors are having on the company projects. This study recommends that the adoption of best practice will assists more in the processing and execution of project and will facilitates project performance and success.

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