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ASSESSMENT OF CRAFTSMEN TURNOVER IN THE CONSTRUCTION INDUSTRY

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ABSTRACT

The paper gives an insight on construction craftsmen turnover in the construction industry. In the study, the main factors responsible for craftsmen turnover, the effect of craftsmen turnover on contractors' performance and suggestions that will tackle the problem of turnover were considered. A total of 50 questionnaires were distributed and 46 of the administered questionnaire was responded to and returned. The data obtained were analysed with statistical tools such as standard deviation, mean and variance. Also pie charts, bar chart, column chart and line chart were used in presenting results. The four-point Likert scale was used to rank factors in order of their importance based on the relative Important Index (R.I.I) of the factors. The result shows that poor payment and benefits, poor treatment of workers and absence of advancement and promotion opportunities are the main cause of turnover while tribal differences and religious differences as regard cultural diversity are the main factors responsible for turnover. The study observed that craftsmen turnover has both direct cost and indirect cost effect on the performance of construction companies. Cost of hiring new employees, training of new workers and replacing old workers was shown to be the main direct cost effect on the performance of a contractor while indirect cost such as Project overtime, additional workload on remaining workers and reduction of project performance are the main effect of indirect cost. The study also shows that the problem of craftsmen turnover can be reduced by paying competitive compensation and benefit packages, fair treatment of workers and reward for dedicated workers are some of the best ways of reducing turnover while fairness, equal opportunity and respect for all and conducive workplace and cultural relation balance are ways of reducing turnover resulting from the cultural diversity of workers. The study also identified that motivation of craftsmen by increasing wages and salaries, promoting committed workers and training of craftsmen can be used to reduce the effect of craftsmen turnover. Based on the findings in the work, appropriate recommendations were being made to help tackle the challenges of craftsmen turnover in the construction industry.

Keywords: *Turnover, Craftsmen, Construction Industry*

INTRODUCTION

Craftsmen are the major employee of the construction industry since most of the work in the construction industry has to be done manually by hand. According to Muya et-al,(2006) the availability of craftsmen is considered as one of the most critical factors for the effectiveness of the construction industry and construction output productivity depends significantly on craftsmen but cases of craftsmen turnover is becoming a big challenge to the construction industry. Shamsuzzoha, (2007) explained that craftsmen turnover is one of the factors that affect productivity which is fast becoming a serious concern. Craftsmen turnover is the rate at which craftsmen leave an organization and are replaced or the change or movement of craftsmen within an organization or from one

organization to the other. Reib (2008) defined craftsmen turnover as the degree of craftsmen replacement within and outside the organization. Sigma (2005), explained that employee turnover is the most difficult challenge faced by an organization and the causes of employee turnover is beyond the control of the employing organization. Understanding the problems associated with craftsmen turnover and measuring their factors are very significant to the success of the construction industry. Many researchers have suggested reasons behind the movement of construction workers within and outside the organization which includes that craftsmen tend to leave an organization where they are unhappy or not satisfied with Job. According to William *et.al* (2001), the wages of workers from different organization who perform similar jobs differs, a worker that receives competitive pay will have greater tendency to stay compared to workers in other organization who are underpaid. Wei and Chen (2007) stated employee turnover may be as a result of avoidable or unavoidable reasons. Unavoidable turnover of an employee may be as a result of death of an employee or organization policies; that is Organization retrenchment exercise for workers, while avoidable turnover may be due to employee dissatisfaction on the Job. Tulascz (2001) pointed some of the reasons behind workers' turnover as discontent with their direct supervisors, Job security, unfilled promises, unpaid bonuses, incompetent Leadership among others. Labour in the construction industry is an element which is not easy to manage and as such, it is the duty of the employer to ensure that everything is well coordinated and managed. The turnover cost research carried out by the Workforce Stability Institute (2000) explained that it is necessary to recruit and hire the right people to maintain a steady workforce on construction projects. Shamsuzzoha, (2007) stated that employee turnover is a terrible situation for companies which make the operation of an employer difficult to maintain. Employee turnover cause companies to incur some financial loss which will have direct and indirect cost on the organization (Morrel, *et. al*, 2004). Direct cost according to the workforce Stability Institute (2000) are cost that can be determined and monitored which are mostly the prices paid to replace employees who leaves suddenly. Decreases in productivity and employee morale are indirect costs of turnover; they are also very important part of turnover. Hinkin, (2000) stated that indirect cost of turnover leads to decrease in productivity, project overtime and an increase in payment of those that are retained. Turnover of construction workers have an adverse effect on performance and productivity, it also reduces the profit realized by a company. Derek et al (2007) stated that employee turnover directly affects the performance of an organization. This was also supported by the regression analysis of Muhammad *et.al* (2013) that employee turnover has a relationship with organization performance. The efficiency and performance of craftsmen is mostly dependent on the management of an organization. In situations where the turnover of craftsmen is high, productivity decreases. Contractors incur costs due to turnover; costs incurred may be cost of replacing, training of new workers and preparation of relevant documents.

It is against this background that this study seeks to identify the reasons, effects, and ways of reducing crafts turnover in the construction industry so as to enhance productivity and performance of craftsmen in the Nigerian construction industry.

OBJECTIVES OF THE STUDY

1. To determine the factors responsible for craftsmen turnover.
2. To determine the effects of craftsmen turnover on contractors' performance.
3. To recommend suggestions in tackling the challenges of craftsmen turnover in the construction industry in Nigeria.

RESEARCH METHODOLOGY

Data for the study was collected via oral interviews and the use of a structured questionnaire designed to assess the views of respondents on craftsmen turnover in the construction industry with particular emphasis on the factors responsible for craftsmen turnover, the effects of craftsmen turnover on contractors performance and suggestions that will help tackle the challenges of craftsmen turn over

in the construction industry. The study population was the construction craftsmen themselves. The study was carried out in Lokoja the Kogi state capital. The questionnaires were administered to the craftsmen on construction sites and in their respective companies and the construction craftsmen considered in this study are the masons, carpenters, iron/steel workers, painters, electricians and plumbers. A total of 50questionnaires were distributed. Hinkel et al (1988) however believes that the minimum sample size that allows normal distribution assumptions to be used rather than using a t-distribution is 30. Hence the sample size of 50 is justifiable.

The sample Respondents were asked to rate their level of agreement on a number of factors generated from literature review on craftsmen turn over on a four point Likert ordinal scale where 4 = Strongly Agree, 3 = Agree, 2 = Disagree and 1 = Strongly Disagree. Results obtained are presented in a tabular form, graphical charts such as Bar charts, pie charts, and column charts was used to illustrate data's for easy and clear understanding.

Data obtained from the survey were analysed using Statiscal tools such as mean, variance and standard deviation, simple percentages and Relative importance Index (RII) method. The Relative importance index (RII) was calculated using the formula:

1. R.I.I Relative Important Index = T.S / N.R

   Where T.S = Total Score, N.R = Number of Respondents.

2. (S.I) Significant Index = R.I.I / 15

   Where R.I.I = Relative Importance Index, 15 = Significant important constant

The limits of definition of S.I were: Very Significant (VS) ≥ 0.25, Significant (S) $\geq 0.20 < 0.25$, Slightly Significant (SS) $\geq 0.15 < 0.20$

RESULTS AND INTERPRETATION

Craftsmen Distribution of Respondents

A total of fifty (50) questionnaires were administered to the construction craftsmen in Lokoja out of which a total of 46 duly completed questionnaires were returned.

Table 1 and figure 1 below shows the distribution of craftsmen from the number of construction companies sampled within the city. The results show that mason/bricklayers and carpenter has the highest number of respondents of 15 and 9 respectively with their percentages amounting to 32.6% and 19.6% respectively followed by Electricians with 7 respondents and 15.2%, painters has respondents with 13.0 % and plumber has 4 respondents with 8.7% . Roofers and iron steel workers has the least number of respondents of 3 and 2 with percentages of 6.5% and 4.4% respectively.

Table 1. Craftsmen Distribution of Respondents

CRAFTSMEN	NO OF RESPONDENTS	PERCENTAGE OF RESPONDENTS
Mason/Bricklayers	15	32.6
Roofers	3	6.5
Carpenters	9	19.6
Iron/steel workers	2	4.4
Painters	6	13.0
Electricians	7	15.2
Plumbers	4	8.7
TOTAL	**46**	**100**

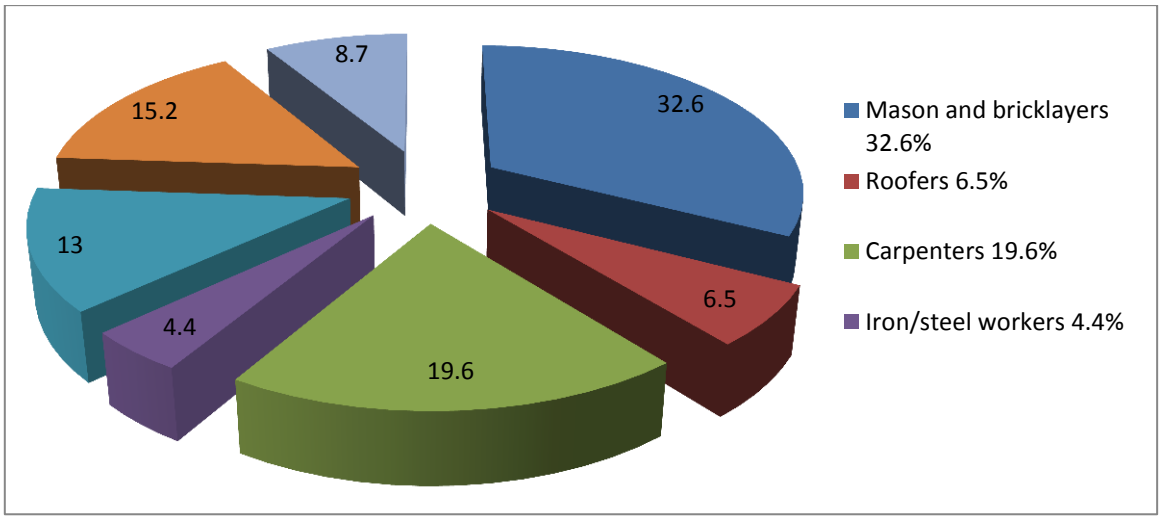

Figure 1. Craftsmen distribution of questionnaires

Factors Responsible For Craftsmen Turnover

The Reponses were then ranked for comparison of the factors. The result shows that factors which are of very significance importance are Poor payment and benefits to workers (R.I.I=3.89, S.I=0.26), Poor treatment by supervisors (R.I.I=3.85, S.I=0.26), and Absence of Advancement and promotion opportunities (R.I.I=3.78, S.I=0.25) with ranking from 1st to 3rd respectively. These results is consistent with previous study by Arie and Erick (2013). Factors such as Company policies (R.I.I=3.63, S.I=0.24), Poor social connection and interaction (R.I.I=3.50, S.I=0.23), Poor working environment (R.I.I=3.41, S.I=0.23), Work overtime (R.I.I=3.35, S.I=0.22), and poor working tools and equipment (R.I.I=3.26, S.I=0.22) shows a significant importance of the factors with ranking from 4th to 8th respectively. Factors such as Arrival of workers and No employee engagement have the same Relative importance index and significant importance (R.I.I=3.24, S.I=0.22) were ranked 9th. Poor health of workers is the least ranked with (R.I.I=3.22, S.I=0.22).

Table 2. Ranking of Factors Responsible for Craftsmen Turnover

	S.A	**A**	**D**	**S.D**	**N.R**	**T.S**	**R.I.I**	**S.I**	**RANK**	**RMK**
Factors	4	3	2	1						
Poor working environment	20	25	1	-	46	157	3.41	0.23	6TH	S
Work Overtime	16	30	-	-	46	154	3.35	0.22	7TH	S
Arrival of new workers	19	21	4	2	46	149	3.24	0.22	9TH	S
Poor health of workers	14	29	2	1	46	148	3.22	0.22	11TH	S
Poor payment and benefits	41	5	-	-	46	179	3.89	0.26	1ST	VS
Non employee engagement	18	23	3	2	46	149	3.24	0.22	9TH	S
Absence of advancement and promotion opportunities	36	10	-	-	46	174	3.78	0.25	3RD	VS
Company policies	31	13	2	-	46	167	3.63	0.24	4TH	S

Factors	S.A 4	A 3	D 2	S.D 1	N.R	T.S	R.I.I	S.I	RANK	RMK
Poor social connection and interaction	24	21	1	-	46	161	3.50	0.23	5TH	S
Poor treatment from supervisors	39	7	-	-	46	177	3.85	0.26	2ND	VS
Poor working tools and equipment	24	15	4	1	46	150	3.26	0.22	8TH	S
Mean					160.50	3.488	0.2336			
Variance					142.50	0.067	0.00027			
Std. deviation					11.94	0.259	0.0163			

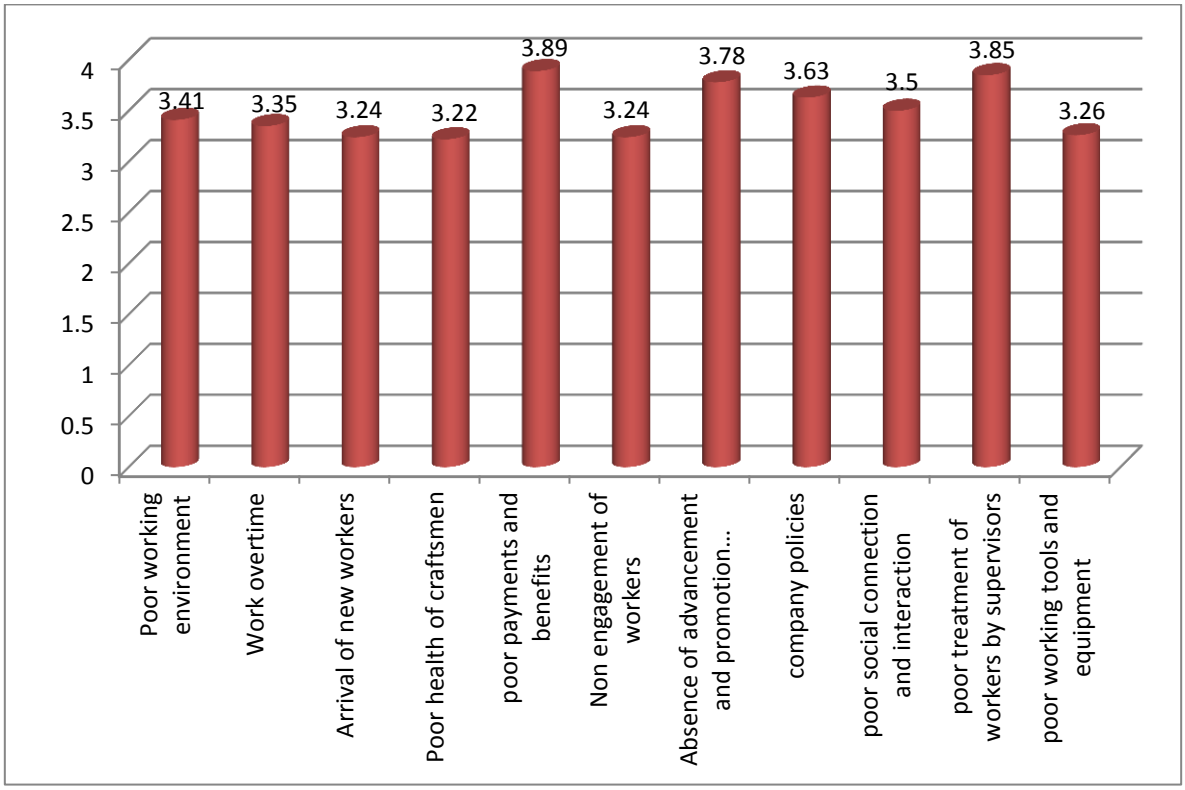

Figure 2. Factors responsible for craftsmen turnover

EFFECTS OF CRAFTSMEN TURNOVER ON CONTRACTORS' PERFORMANCE

The effects of craftsmen turnover on contractor's performance are categorized into two (2) which are Direct and Indirect costs. Direct costs are costs that can be measured and quantified while indirect costs are costs that are difficult to measure or quantify. The Reponses were then ranked for comparison of the factors in each category.

Direct cost ranking

The result shows that the direct costs effects on contractor's performance are all of significant importance as regard the effect of craftsmen turnover on contractor's performance. Hiring of new

employees is ranked 1st with (R.I.I=3.52, S.I=0.24) as the main direct cost effect on contractors performance. Training of new employees and Replacement of old workers have the same value of significant important which were ranked 2nd and 3rd with (R.I.I=3.24, S.I=0.22) and (R.I.I=3.22, S.I=0.22) respectively. Administrative costs and Marketing costs also have the same value of significant importance which was ranked 4th and 5th with (R.I.I=3.15, S.I=0.21) and (R.I.I=3.50, S.I=0.23) respectively. Preparing new employee files have the least ranking of 6th with (R.I.I=2.98, S.I=0.20).

Table 3. Ranking of Direct Cost Effects of Craftsmen Turnover on Contractors Performance

Factors	**S.A**	**A**	**D**	**S.D**	**N.R**	**T.S**	**R.I.I**	**S.I**	**RNK**	**RMK**
Direct Cost	**4**	**3**	**2**	**1**						
Hiring new employees	26	18	2	-	46	162	3.52	0.24	1ST	S
Training of new workers	19	21	4	2	46	149	3.24	0.22	2ND	S
Replacement of old workers	15	28	2	-	46	148	3.22	0.22	3RD	S
Preparing new employees files	12	24	7	3	46	137	2.98	0.20	6TH	S
Administrative cost	9	35	2	-	46	145	3.15	0.21	4TH	S
Marketing cost	15	24	4	3	46	143	3.11	0.21	5TH	S
Mean						147.333	3.2033	0.21667		
Variance						69.867	0.0327	0.00019		
Std. deviation						8.359	0.1808	0.0138		

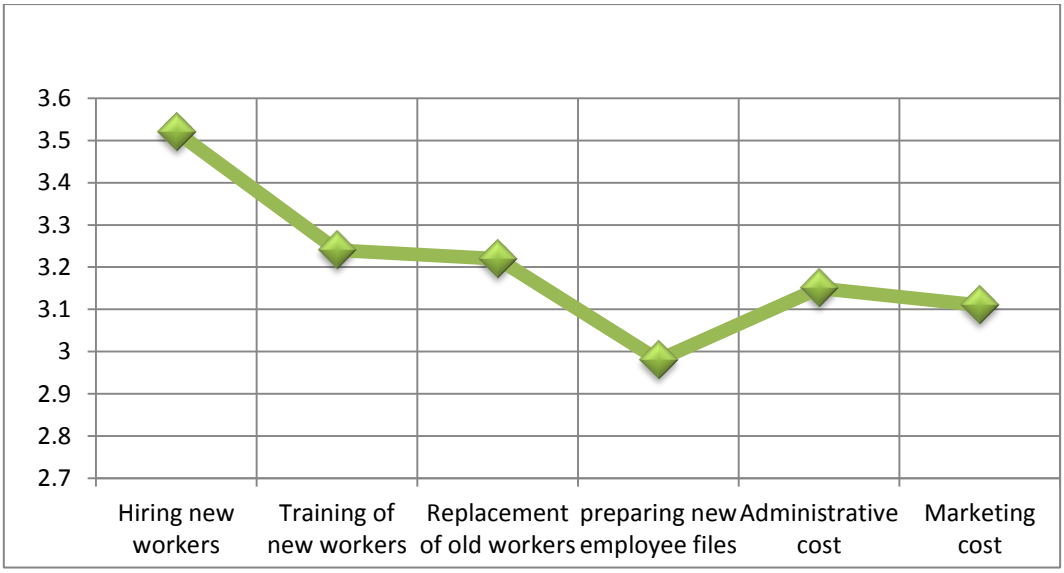

Figure 3. Ranking of direct cost effect on contractor's performance

Indirect cost

The result shows that the dominant effect of indirect costs on contractor's performance is Project Overtime which was ranked 1st with (R.I.I=3.41, S.I=0.23), it is of significant importance. Additional workload on remaining workers which is of significant importance was ranked 2nd with

(R.I.I=3.37, S.I=0.23). Factors such as Reduced project performance and Degenerate product and service quality have the same value of significant important which were ranked 3rd and 4th with (R.I.I=3.30, S.I=0.22) and (R.I.I=3.28, S.I=0.22) respectively. Bad reputation to contractor is ranked 5th with (R.I.I=2.98, S.I=0.20). The least of the ranking is Decreased employee morale with (R.I.I=2.48, S.I=0.17) which is ranked 6th.

Table 4. Ranking of Indirect Cost of Craftsmen Turnover on Contractor's Performance

Factors	S.A	A	D	S.D	N.R	T.S	R.I.I	S.I	RNK	RMK
Indirect Cost	4	3	2	1						
Project Overtime	20	25	1	-	46	157	3.41	0.23	1ST	S
Reduced project performance	15	30	1	-	46	152	3.30	0.22	3rd	S
Decreased Employee morale	13	17	5	1	46	114	2.48	0.17	6th	SS
Additional Workload on remaining workers	19	25	2	-	46	155	3.37	0.23	2nd	S
Degeneration product and service quality	16	27	3	-	46	151	3.28	0.22	4TH	S
Bad reputation to organization.	9	29	6	2	46	137	2.98	0.20	5TH	S
Mean						144.33	3.137	0.21167		
Variance						270.27	0.126	0.00054		
Std. deviation						16.44	0.355	0.0234		

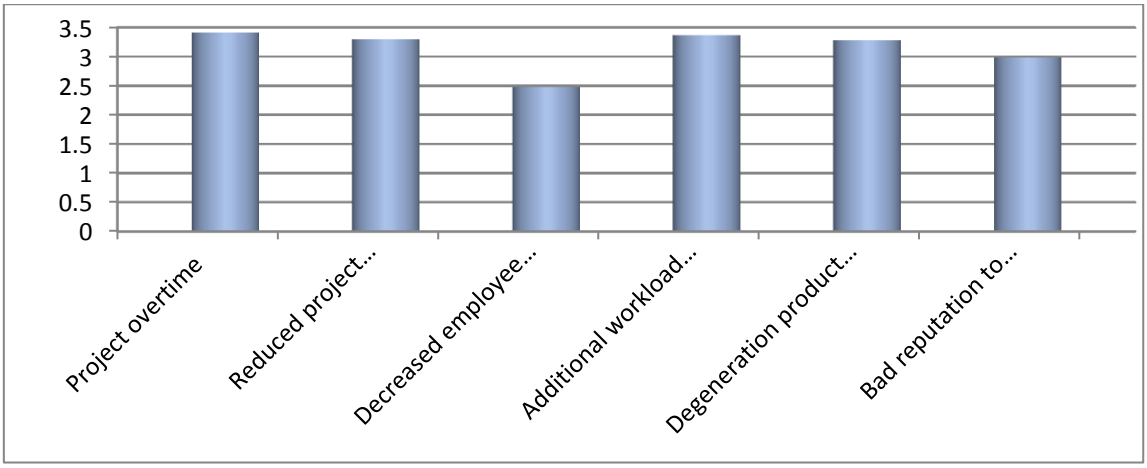

Figure 4. Ranking of Indirect Cost Effect of Craftsmen Turnover on Contractor's Performance

Ranking of Direct cost and Indirect cost

The combined ranking of the direct cost and indirect cost effect on contractor's performance shows that Hiring of new employees with (R.I.I=3.52, S.I=0.24) is the main cost effect on contractors performance which is a direct cost and it was ranked 1st. Project Overtime with (R.I.I=3.41, S.I=0.23) is ranked 2nd. Additional workload on remaining workers which is of significant importance was ranked 3rd with (R.I.I=3.37, S.I=0.23). Factors such as Reduced project performance and Degenerate product and service quality were ranked 4th and 5th with (R.I.I=3.30, S.I=0.22) and (R.I.I=3.28, S.I=0.22) respectively. Training of new employees and Replacement of old workers with the same value of significant important were ranked 6th and 7th with (R.I.I=3.24, S.I=0.22) and (R.I.I=3.22,

S.I=0.22) respectively. Administrative costs was ranked 8th with (R.I.I=3.15, S.I=0.21). Marketing costs was ranked 9th with (R.I.I=3.11, S.I=0.21). Preparing new employee files and bad reputation to contractors have the same relative importance index and significant importance with (R.I.I=2.98, S.I=0.20) which are both ranked 10th. The least of the ranking is Decreased employee morale with (R.I.I=2.48, S.I=0.17) which is ranked 12th, it is the only factor which is slightly significant.

Table 5. General Ranking of Direct and Indirect Cost effects on Contractor's Performance

EFFECTS	FACTORS	N.R	T.S	R.I.I	S.I	RANK
Direct cost	Hiring new employees	46	162	3.52	0.24	1ST
	Training of new workers	46	149	3.24	0.22	6TH
	Replacement of old workers	46	148	3.22	0.22	7TH
	Preparing new employees files	46	137	2.98	0.20	10TH
	Administrative cost	46	145	3.15	0.21	8TH
	Marketing cost	46	143	3.11	0.21	9TH
Indirect cost	Project Overtime	46	157	3.41	0.23	2ND
	Reduced project performance	46	152	3.30	0.22	4TH
	Decreased employee morale	46	114	2.48	0.17	12TH
	Additional workload on remaining employees	46	155	3.37	0.23	3RD
	Degenerate product and service quality	46	151	3.28	0.22	5TH
	Bad reputation to contractor	46	137	2.98	0.20	10TH
Mean			145.833	3.17	0.214	
Variance			157.061	0.0735	0.00034	
Std. deviation			12.532	0.2711	0.08439	

REDUCTION OF CRAFTSMEN TURNOVER

The result shows that all the factors are significant except Paying competitive compensation and benefit packages which is very significant, it was ranked 1st with (R.I.I=3.70, S.I=0.25), fair treatment by supervisors was ranked 2nd with (R.I.I=3.65, S.I=0.24), Reward for dedicated workers was ranked 3rd (R.I.I=3.46, S.I=0.23), creating advancement and promotion opportunities was ranked 4th with (R.I.I=3.41, S.I=0.23), Provision of positive work environment was ranked 5th with (R.I.I=3.39, S.I=0.23), Review of compensation and benefit packages annually was ranked 6th with (R.I.I=3.35, S.I=0.22), reduce working hours was ranked 7th with (R.I.I=3.28, S.I= 0.22), Review of company policies(retrenchment exercises) was ranked 8th with (R.I.I=3.20, S.I=0.21), Hiring competent and dedicated workers was ranked 9th with (R.I.I=3.17, S.I=0.21), Social interaction with employees was ranked 10th with (R.I.I=3.11, S.I=0.21), effective communication with employee was ranked 11th with (R.I.I=3.20, S.I=0.20) and the least of the ranking is Paying attention to personal needs of workers. All this factors will help to reduce craftsmen turnover in the construction industry.

Table 6. Ranking of Factors that will Reduce Craftsmen Turnover

FACTORS	S.A 4	A 3	D 2	S.D 1	N.R	T.S	R.I.I	S.I	RNK	RMK
Hiring competent and dedicated workers	13	29	3	1	46	146	3.17	0.21	9TH	S
Paying competitive compensation and benefit packages	32	14	-	-	46	170	3.70	0.25	1ST	VS

FACTORS	S.A 4	A 3	D 2	S.D 1	N.R	T.S	R.I.I	S.I	RNK	RMK
Provision of positive work environment	18	28	-	-	46	156	3.39	0.23	5TH	S
Reward for dedicated workers	21	25	-	-	46	159	3.46	0.23	3RD	S
Paying attention to personal needs of workers	7	32	5	2	46	136	2.96	0.20	12TH	S
Reduced working hour	15	29	2	-	46	151	3.28	0.22	7TH	S
Review of compensation and benefit packages annually	20	23	2	1	46	154	3.35	0.22	6TH	S
Provision of working tools and equipment	6	36	2	2	46	138	3.00	0.20	11TH	S
Creating advancement and promotion opportunities	20	25	1	-	46	157	3.41	0.23	4TH	S
Regular communication with workers	4	39	1	2	46	137	3.00	0.20	11TH	S
Social interaction with workers	10	32	3	1	46	143	3.11	0.21	10TH	S
Review of company policies	14	28	3	1	46	147	3.20	0.21	8TH	S
Proper treatment of workers by supervisors	30	16	-	-	46	168	3.65	0.24	2ND	S
Mean						150.923	3.283	0.219		
Variance						123.244	0.0572	0.0003		
Std. Deviation						11.102	2.3917	0.017		

CONCLUSION AND RECOMMENDATIONS

The research work studied craftsmen turnover in the construction industry. Findings show that the factors responsible for craftsmen turnover in the construction industry are: Poor payment and benefits, Poor treatment by supervisors, Absence of Advancement and promotion opportunities, Company policies, Poor social connection and interaction, Poor working environment, Work overtime, poor working tools and equipment, Arrival of workers, Non employee engagement, and Poor health of workers. The study also established that the main effect of craftsmen turnover on contractor's performance is classified into direct costs and indirect costs. Direct costs are; hiring of new employees, Training of new employees, Replacement of old workers, Administrative costs and Marketing costs. Indirect costs include: Project Overtime, Additional workload on remaining workers, reduced project performance, Degenerate product, service quality, Bad reputation to contractor and Decreased employee morale. Furthermore, the research identifies the following measures as ways by which craftsmen turnover can be reduced; Paying competitive compensation and benefit packages, fair treatment by supervisors, Reward for dedicated workers, creating advancement and promotion opportunities, Provision of positive work environment , Review of compensation and benefit packages annually, reduce working hours, Review of company policies(i.e retrenchment exercises), Hiring competent and dedicated workers, Social interaction with employees, effective communication with employee, and Paying attention to personal needs of workers. All this factors will help to reduce craftsmen turnover in the construction industry.

The study recommends that Construction firms should provide incentives so as to motivate construction craftsmen. Employers should treat their workers with respect, give equal opportunity to all craftsmen and embrace cultural diversity. There should be an agreement between construction firms and craftsmen on duration of a craftsman involvement in a project. Construction companies should recruit competent and skilled workers and also provide training programs to craftsmen.

Government should pay off debts owed to contractors in other to prevent retrenchments of craftsmen as a result of the inability to pay salaries and wages. Employers should review and pay competitive wages and benefit packages of craftsmen.

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Singgora Tiles: Perception of the Community in Kota Bharu, Kelantan

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ABSTRACT

Plain tile, locally known as Singgora tile, is a type of traditional tile that has been widely used in Kelantan as a roof covering before the advent of modern roofs. With the passage of time, these tiles are now almost forgotten and most of the buildings that still use it are old buildings and newly constructed traditional buildings. The goal of this study is to find out community perceptions towards Singgora tiles by the age of the community members, and analyzing the potential for demand for Singgora tiles to develop in the market. In this study, it has been concluded that users agree on the advantage of Singgora tiles in providing a cool indoor temperature in the house, but the product is easily broken. The majority of users turn to other types of roof covering because of the limited supply of Singgora tiles. However, most users are interested in using Singgora tiles if the quality is improved. With regards to the new generation, the awareness of the existence of this traditional tile decreases with age.

***Keywords**: Roofing tiles, Traditional Malay house, Singgora tiles, Conservation, Clay tiles*

INTRODUCTION

The traditional Malay buildings in Peninsula Malaysia include palaces, mosques and houses. The Malay house is a reflection of the Malay community's customs and way of living. There are three main parts in a traditional Malay house; the pillars, the walls and the roof (Nasir & Teh, 2011). According to Killmann et al. (1994), the roofs of buildings in Malaysia were traditionally covered with organic and combustible material such as palm leaves and wood. Repeated fires subsequently forced the owners to switch to more expensive but safer terracotta tiles. Roof covering of the Peninsular East-Coast houses use the plain clay tiles, known locally as Singgora tiles, is the roofing material that has received the foreign influence due to historical and cultural traits with Thailand and Indo-China (Salinger, 1997; Killmann, 1994). It has been widely used in Kelantan as a roof covering before the advent of modern roofs. With the passage of time, these tiles are now almost forgotten and most of the buildings that still use it are old buildings and newly constructed traditional buildings.

Figure 1 shows the major growth and decline of Singgora tiles industry in Kelantan as reported by Adit (1994). He noted the Singgora tile industry was booming between 1950 and 1965 especially after the independence of the Malay States in 1957. The author states in 1960s, modern roofs were introduced into the Kelantan market when the road system between Kuala Lumpur and Kelantan was improved. He adds, towards 1965, the use and demand of Singgora tiles declined gradually and this continued up to 1970s, partly due to strong competition with other modern roofs available in the market.

Adit (1994) further states the emergence of the tobacco industry in 1963 which gave a relatively higher income, has affected the production of Singgora tiles industry due to shortage of labors. He adds, in 1970s, the demand for Singgora tiles decreased and many entrepreneurs began to shut down their operations. The author further mentions in 1975, the price of tiles were increased because of the immediate demand from Singapore. However, this demand was temporary and it declined afterwards.

Shamsu and Zulkifli (2011) claim that since 1977 up to present, there was only one Singgora tile factory in Malaysia that was still operating and it became the sole supplier for conservation works and new traditional buildings.

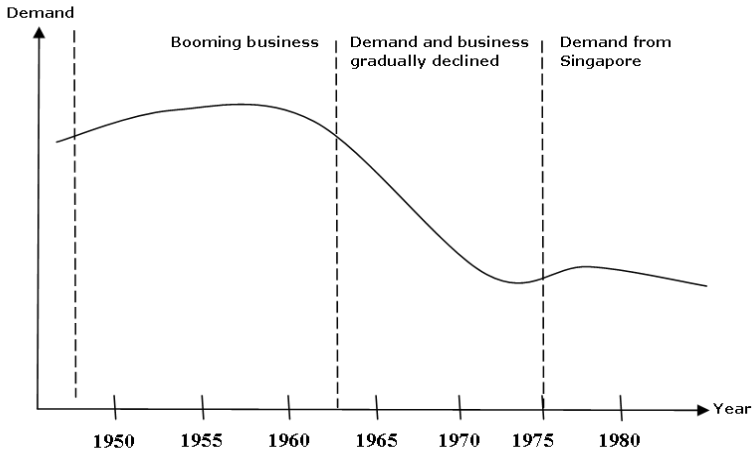

Figure 1: The illustration of market trend of Singgora tiles
Source: Adapted from Adit (1994)

Nowadays, most of the demand for this traditional tile is to repair damage to the roofs of old dwellings, and for use in pavilions, museums, restaurants and chalet gazebos, as well as for conservation projects. While little effort has been made to prevent the decline of this folk industry, much less has been done to educate the new generation on this heritage craft. Important questions arise: Does the old generation still prefer to retain the use of Singgora tiles as roof covering for their houses? What is the community perception about these tiles? Does the new generation know about this old roof covering? Is there any hope to redevelop this industry? The current study explores the community's perceptions of the knowledge and their viewpoints on Singgora tiles.

METHODOLOGY

The questions in the questionnaire used to elicit information for the study were asked verbally in face-to-face interviews. The respondents were categorized into two set of questionnaires:

i) Set A: Adult and senior citizen questionnaire (24 years and above).
Section A requested factual information from respondents (i.e. their race, age, sex, income level, and type of residence) that might contribute to the later study of the relationship between variables as well as to build some rapport between the interviewee and researcher at the start of the interview (Gray, 2004). Section B posed a number of multiple response answer questions that aimed to obtain information about Singgora tiles from the respondent. Specifically, these items asked about any experience of living in a house roofed with Singgora tiles and their thoughts on this traditional tile. We also asked adults about the difference between Singgora tiles and other roof coverings, and their interest in Singgora tiles if this product were to be improved and easily available in the market.

ii) Set B: Child and young adult questionnaire (9 - 23 years old).
The first few items addressed basic demographics such as gender, age and race. This study focused on survey research where respondents were asked: Do they know what Singgora tiles are? How do they know about these tiles? The remainder of the questionnaire addressed their interest to use Singgora tiles in the future.

Data analysis. A quantitative approach was undertaken with the descriptive analysis of results from the multiple-choice and multi selected items in the questionnaire.

RESULTS AND DISCUSSIONS

Set A: Adults and senior citizens

Demographics. For adults, a total of 100 persons were surveyed, out of which 66 were males and 44 females. The majority of the respondents were Malay (97%) with a very small number being Chinese (3%). Most of the respondents had modest family monthly incomes which were less than RM 3,000.00 (87%). The respondents had categorized into four subgroups based on age: Age 24 to 45 (65 respondents); Age 46 to 50 (10 respondents); Age 51 to 65 (19 respondents) and Age more than 65 (6 respondents).

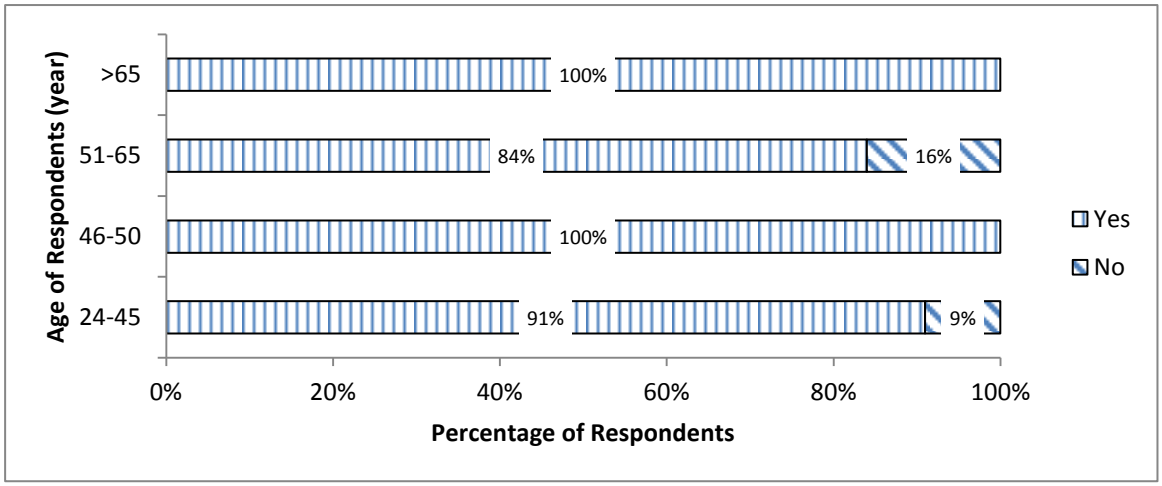

Figure 2: Respondents' knowledge about Singgora tiles

Knowledge of Singgora tiles. In this study, we first focused on the people's knowledge about Singgora roof tiles. The earliest question asked was whether the respondents knew or had seen Singgora roof tiles in Kelantan. The result shows that all respondents knew Singgora tiles except nine of them. Based on Figure 2, all of respondents aged between 46 and 50 as well more than 65 years old were familiar with Singgora tiles. However, 16% of the respondents aged 51 to 65 did not know about Singgora tiles. In fact, a higher percentage was also shown by the middle-aged generation in Kelantan aged 24 to 45 years old. Out of 91 respondents that knew of Singgora tiles, only 80 of them claimed that the supply of these traditional tiles is hardly available.

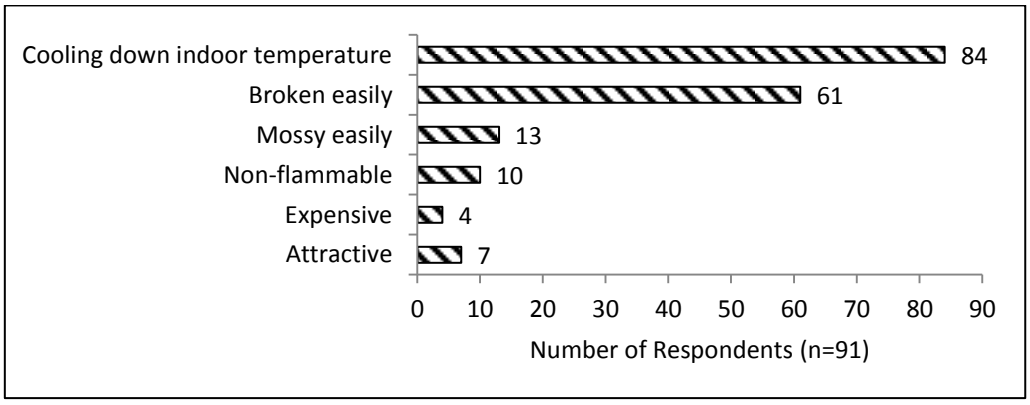

Figure 3: Respondents' positive and negative perception about Singgora tiles

Perception of tile quality. Figure 3 shows the viewpoint of the respondents on Singgora tiles. This multiple response answer obviously shows that 92% of respondents agreed that Singgora tiles cool down the indoor temperature of a building. This is due to the characteristics of the raw material. Singgora tile is considered as a sustainable product as it is made from clay. According to Costa and Mauroof (2005), the clay tile has the thermal mass characteristic to help the building to cope with the

temperature variations throughout the day. During peak temperature, the tiles will absorb the heat, thus provide a cool indoor temperature to the living space. This keeps the interior of the room comfortable during peak temperature hours. At night, the absorbed heat is released, keeping the room to stay warm. Therefore, Singgora tiles help to improve the comfort of building and reduce the demands for energy.

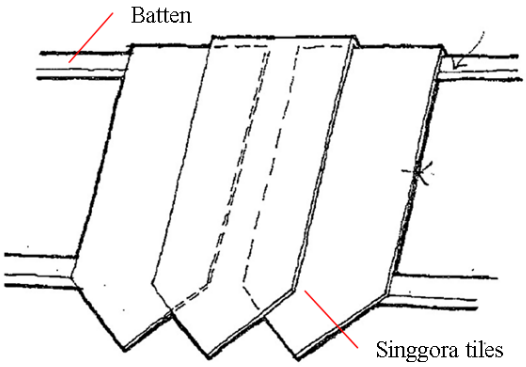

Figure 4: The installation of Singgora tiles
Source: USM (1991)

Figure 4 shows the installation of Singora tiles in the roof structure. According to Schunck (2003), type of roof installation is calls as double-lap tiling, which only one course of tiles is hung on each batten. He further mentions this installation forms ventilated roof covering because the air can flow in defined cavity beneath the installation. As a result, the ventilation system of the building is improved.

67% of the respondents agreed that this traditional roofing tile has a weakness - that it is easily broken. In order to truly comprehend the claim that Singgora tiles are brittle, the respondents were also asked open-ended questions about the sources of fracture. Here is some of the feedback as reported by 61 respondents representing negative perception:

- *Caused by animals (i.e. trampled by foxes, pigeons and fighting cats)*
- *Heavy rain and storms*
- *Broken tree branches falling on the roof*
- *Too thin*
- *The hook of tiles cracks easily*

The comments above seem to indicate that most of the defects are caused by the low quality of the tiles. In fact, attrition from cats, pigeons and rainwater should not break the tiles. This due to the current Singgora tiles being thinner compared to old Singgora tiles. Approximately one in seven respondents (14%) agreed with the statement 'Singgora tiles become mossy easily'. This is because the porous body of Singgora tiles traps the water, thus making them susceptible to moss growing on them, especially during the rainy season. In our study, only 10% of respondents reported that the Singgora tiles were non-flammable, probably because their buildings had once been exposed to fire. The clay product is characteristically non-flammable in nature. Only 4% of respondents felt that these tiles were expensive. This is due to the limited source of Singgora tiles, with only one supplier in Malaysia. 8% of these respondents agreed that the design of Singgora tiles was attractive. The arrangement of the tiles in the roof frame gives an aesthetic value to the building as the tiles look like fish scales.

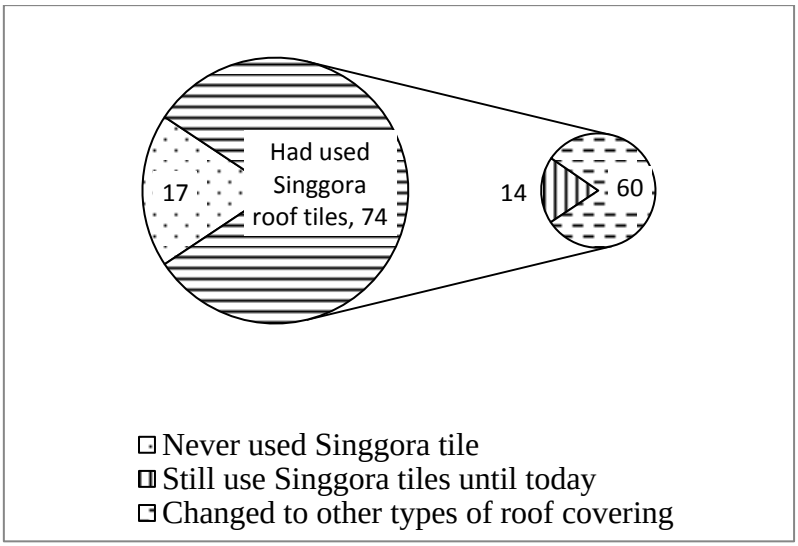

Figure 5: The usage of Singgora tiles by respondents

In fact, refer to Figure 5 above, not all the respondents knew that Singgora tiles had been used as the roof covering on their dwellings. Of 91 respondents, only 74 of them had used Singgora tiles as the roof covering of their houses while others knew about this tile because their relative or friend had used it. However, only 14 of 74 still used it up to the present, while 60 had changed to some other type of roof covering.

From those who had changed the roofing tiles, 78% was due to the inconvenience of getting Singgora tiles, 11% was due to greater durability of other roof materials while the rest wanting to follow the changing housing style. No doubt, technical obsolescence of Singgora tiles occurs when a new product or technology supersedes them, and it is preferred to use the new technology in place of the old, even though Singgora tiles are still functional. The changing in housing style has contributed to the decline for demand of Singgora tiles (Zulkarnian and Norlizaiha, 2013). In fact, modern tiles attract the users because they are more easily available in the market and are of better quality, thus reducing the maintenance cost. These 60 respondents were also asked about the comparison between Singgora tiles and new roof covering. The results show that 53 of the respondents indicated that Singgora tiles provide a cooler indoor temperature, 6 respondents claim that Singgora tiles produce noise when there is rainfall or trampled on by animals and only 2 respondents indicated that there was no difference between them.

The survey has also proven that the industry has the opportunity to develop, as 78% out of 91 respondents were still interested in using it if the quality of the product was improved. 60% of them suggested that the quality of the product can be improved by increasing the thickness of the tiles. However, for them to use singgora tiles for their buildings, somesuggested the following:

- *Cheaper sales price*
- *Change the design of the tiles to a modern one*
- *Increase the number of suppliers*

22% of the total respondents gave strong reasons not to use Singgora tiles if there were an improvement in quality because of the installation of Singgora tiles uses a lot of timber battens as a frame, broken tiles are complicated to replace and, in terms of design, are not attractive and outdated.

Set B: *Children and teenagers*

Demographics. Set B questionnaire was distributed to 50 people below the age of 24 years old. The variables in the questionnaire were focused on their knowledge of Singgora tiles and their experience living in a house using this type of clay roof tiles. The percentage of respondents based on

age subgroups is that Age 9 to 12 (11 respondents); Age 13 to 16 (6 respondents); Age 17 to 20 (13 respondents); and Age 21 to 23 (20 respondents). All respondents are Malay and the percentages of female and male are 60% and 40% respectively.

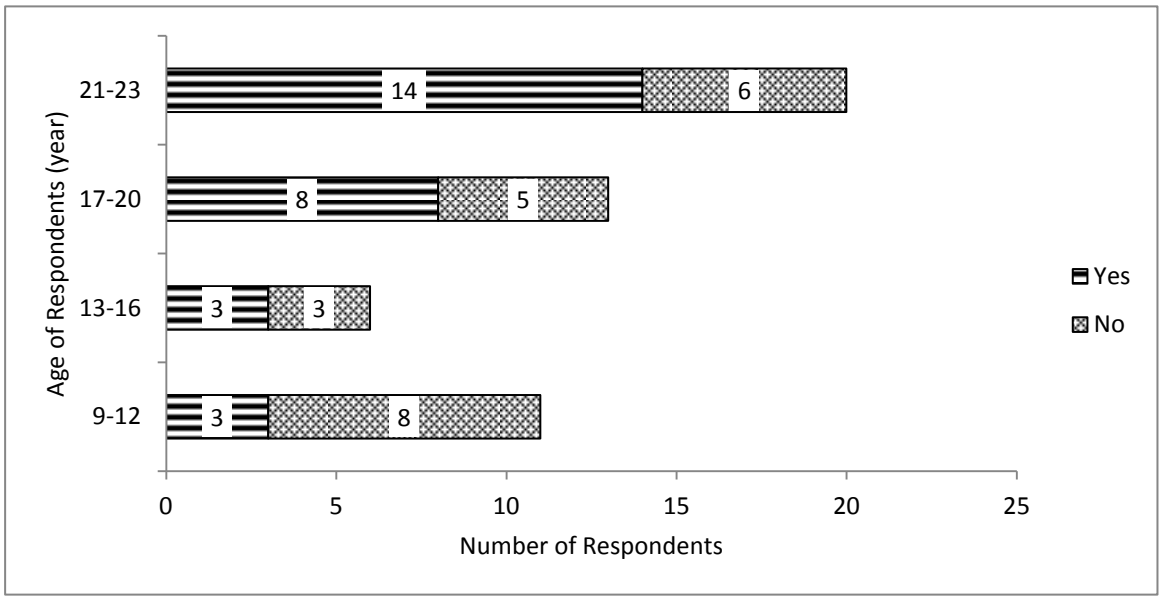

Figure 6: Respondents' knowledge about Singgora tiles.

Knowledge of Singgora tiles. Figure 6 shows the awareness of respondents of the Singgora tiles. The result shows that the knowledge of traditional tiles is declining with the respondent's age. The majority of teenager/young adults (more than 62%) aged between 17 to 23 years old know about Singgora tiles. The balance of the percentage of knowledge for those aged between 13 to 16 years is indicated in the graph. In conclusion, the awareness of the new generation of Singgora tiles is gradually decreasing, especially in the community aged below 12 years old (27%).

In order to understand better how children and teenagers know about Singgora tiles although they were not widely used in the present time, respondents were asked to provide open responses to the question about how they knew about Singgora tiles. The result shows that the highest sources of knowledge were gained from existing historic buildings (66%). This positive response shows that there are still many buildings covered with this type of roof tile in these areas. In addition, 24% of the respondents said that they knew about Singgora tiles by the fact that the house of their grandparents had this type of tile as the roof covering. Only three of the respondents (10%) were staying in houses covered with Singgora tiles.

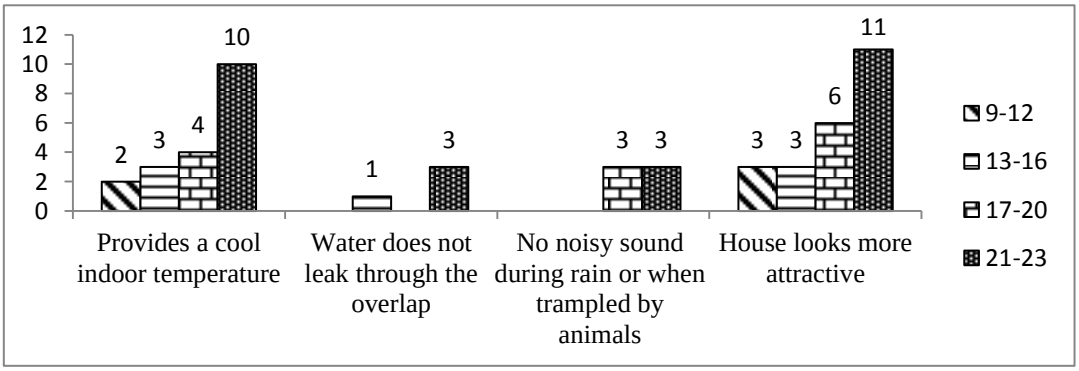

Figure 7: Perception of teenagers and children about Singgora tiles.

In referring to Figure 7 above, the survey data denotes that the majority of respondents (83%)

consider Singgora tiles to have contributed more attractive features to the house, and that they cooled the indoor temperature (68%). This answer was mostly selected by young adults ranging from 21 to 23 years old. The survey findings show that 14% of the respondents agree with the statement that water does not leak through the overlap of the Singgora tiles in the roof frame. It can be said that the installation method of Singgora tiles is effective although they were just hung in the batten, and they do not produce noise when it rains, as stated by 21% of the respondents. This research points out that these young people and children are aware about the advantage of using Singgora tiles compared to other tiles. When they were asked whether they were interested to use Singgora tiles as roof covering in future, 62% of them chose to answer 'yes'. This percentage, in so far as our survey is concerned, provides some evidence that the Singgora tile industry has the opportunity to be redeveloped.

CONCLUSIONS

Based from findings, we can conclude that the majority of the community from older generation aged between 24 to 65 years old knows about Singgora tiles while the new generation's knowledge of Singgora tiles is decreasing with age. Most of the older generation have experienced using Singgora tiles as roof covering in their houses, but most of the young generation are aware the existence of these tiles because they were still in used for old and traditional buildings. Majority of older generation are interested to use Singgora tiles if their quality is improved provided that the price is cheaper and easily available in market. Most of the new generation had a positive perception about the characteristics of Singgora tiles. They are also interested to use Singgora tiles as roof covering in their houses in the future due to its aesthetic and comfort characteristics.

ACKNOWLEDGEMENT

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COMPARATIVE STUDIES OF REMOTELY SENSED COASTLINE MAPPING TECHNIQUES

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ABSTRACT

The shoreline is always changing its shape and position dynamically. There are many remote sensing techniques can be used to depict coastline. Band Ratio, Tasselled Cap Transformation, ISODATA and NDWI are amongst the established technique use to map coastline. A comparison is needed to identify which of these techniques is offer better accuracy. Thus, the aim of this study is to identify the optimum method for mapping coastline. In order to achieve this aim, the objectives of this project are: i) to study technique of coastline extraction using remote sensing image, ii) to map coastline using the selected remote sensing technique for comparison and iii) to determine accuracy these techniques by using local authority data as the baseline. The study area for this research is at Pantai Puteri, Tanjung Keling, Melaka. The techniques explored in this study are Band ratio, Tasseled Cap Transformation, Unsupervised Classification (ISODATA) and Normalized Difference Water Index (NDWI). For processing, the main data use is Landsat 8 OLI imagery which is downloaded from USGS website. The result shows that Band Ratio offer highest accuracy as compared to the other tested techniques.

Keywords*: coastline, remote sensing, band ratio, tasseled cap, isodata, ndwi*

INTRODUCTION

The coastal management is a crucial and important issue for government and community as it's provides economic, social and environmental benefits and services (Nayak, 2002). Monitoring coastline changes is important to environmental protection and sustainable development. Major issue in coastal management is the impacts of coastal erosion to the dynamics changes of coastline. Coastline erosion happens because of two major elements; the human activity (anthropogenics) and the environmental factors (wave, tides, tsunami etc.).

In the past, aerial photo, photogrammetry techniques and ground survey were used to detect changes in coastal area. Aerial photo is used together with ground survey to determine the changes (Kauth and Christ, 1986). The progress of the surveying works is time consuming, with the drastic and dynamics changes of coastline getting the results in time would be difficult. In some cases, the processes take months or even years to achieve a complete result especially when the sites involved multiple coastal boundaries. Besides, conventional method also demands for professional surveyor and hydrographer and thus it is costly. It is also involved a few sophisticated instruments to add up to the expensive professional fees. In this study, remote sensing technique is explored and investigates to detect the coastline. The availability of various techniques to depict coastline has become a major challenge. Thus, it is at urge to identify which one of these techniques offer better accuracy. Recently, remote sensing and Geographical Information System (GIS) have been widely used as another option than conventional method for monitoring shoreline position (Raju et al., 2010). Early research in the

application of satellite sensor images for shoreline mapping relied on coarse spatial resolution satellite sensor images (Lipakis, 2006).

METHODOLOGY

Study Area and Research flow

Pantai Puteri, Tanjung Keling, Melaka has been chosen as a study area. Pantai Puteri is previously known as Pantai Kundur. This area is chosen because the place is well-known and situated at a strategic point in west coast. Melaka is located at western of east coast Semenanjung Malaysia. The coordinate of Pantai Puteri is at Latitude 2’13’36’’, Longitude 102’09’27’’. Figure 1 show the processes adopted in this study while the location of the study area, is illustrated in Figure 2.

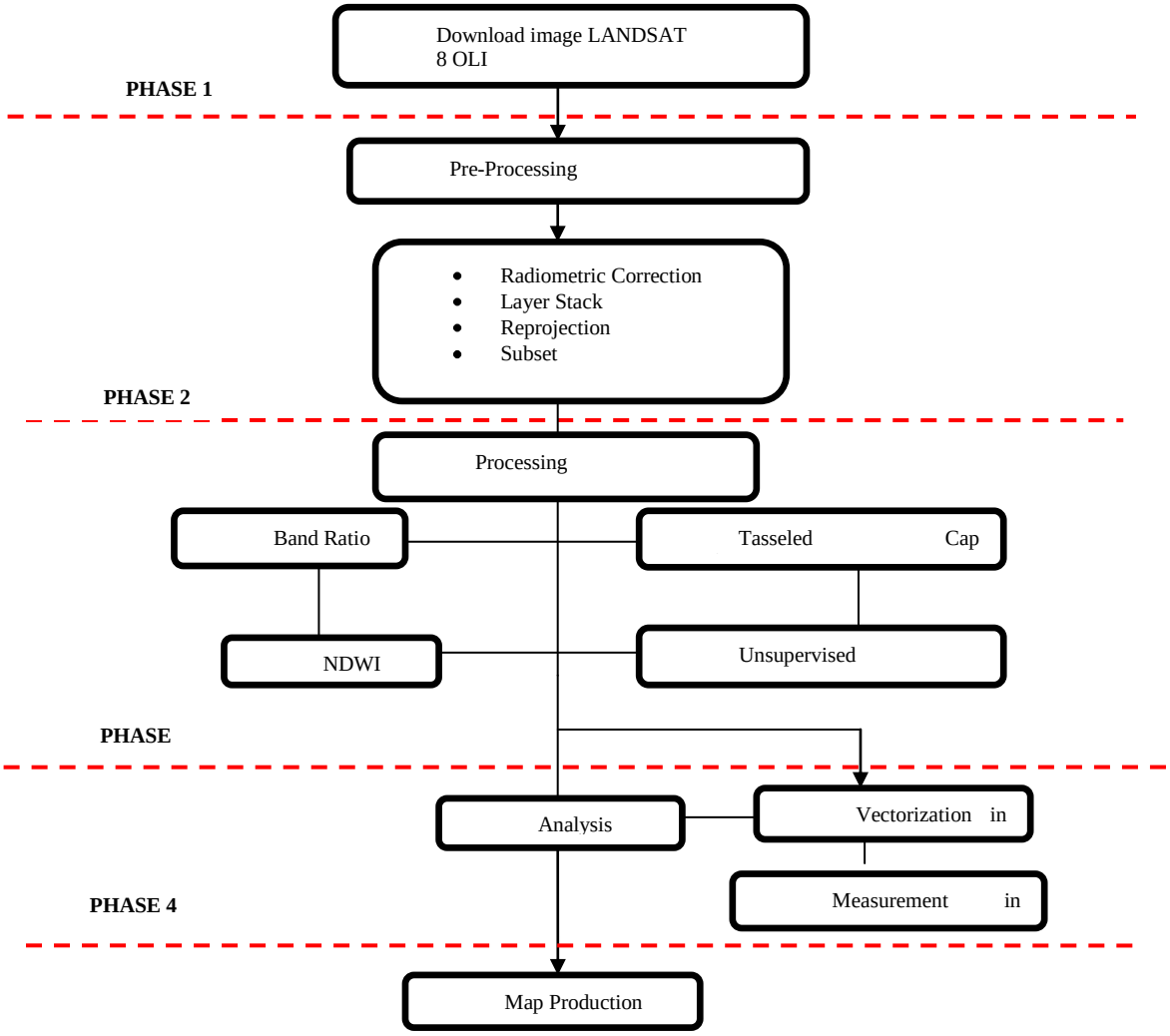


Figure 1: Methodological Flowchart

Figure 2: The Study Area.

Remote Sensing Techniques for Mapping Coastline

Several studies were conducted for monitoring the dynamic changes of coastal line for sustainable environmental management (Li and Damen, 2010; Rahman et al., 2011 and Alesheikh et al., 2007). It is important to monitor a coastline for sustainable development and environmental protection. The coastline detection can be determine by several techniques such as unsupervised ISODATA, band ratio, vector slicing, supervised classification, histogram thresholding and mores (Gen, 2007).

Band ratio is applied to multi spectral image data and known as one of the most common mathematical operations. The calculations involved by calculate the ratio of image by divide DN values in one spectral band with corresponding pixel value in another band (Klemas, 2009). This technique can decrease the environmentally induced variation in DN values of a single band impact from topographic slope and aspect, shadows in sunlight illumination angle. Besides, band ratio can give information that is not providing in any single band for extract earth surface feature. Tasselled cap transformation on the other hand is a semi-automated method that compresses spectral data into several bands. This method can divide into three categories which are brightness, greenness and wetness (Baig et al., 2014).

The Normalized Difference Water Index is used to study the areas covered with water. It is similar to NDVI but using the green band instead of the red one. With this algorithm, the water was assumed to be positive values, while terrain and vegetation have negative values; dry sand, due to its high reflectance in a green band and in the near infrared band, is characterized by positive values but near to zero. Unsupervised training is dependent upon the data itself for the definition of classes. This method is usually used when less is known about the data before classification. They are simply clusters of pixels with similar spectral characteristics.

Baseline and Transect

Using AutoCAD, baseline and transect is construct. Baseline is acquired to construct in order to make transect perpendicular to baseline. To construct a baseline, each baseline segment must be placed entirely offshore perpendicular to the shorelines. Then, construct transect line by offset 500 meter. The transect line that intersect with each shoreline is then being measure using measurement tool in AutoCAD. The distance between reference shoreline to shorelines is calculated. Figure 3 shows the baseline; transect line and spacing, reference line and all shorelines.

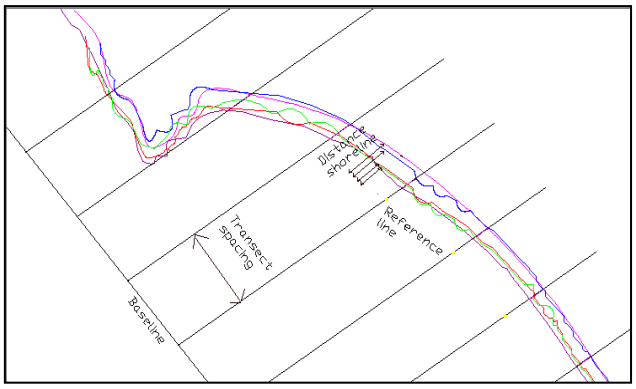


Figure 3: Baseline and transect line

The baseline approach or also called transect method is implied for determining the degree of shoreline recession. The comparison between reference line which is reference coastline acquired from JUPEM with test coastline which is the four techniques used is calculated. Figure 4 shows that the illustration of baseline approach or transect method to compare the true coastline and the test line. The true coastline represents the reference line acquired from JUPEM while the test line represents the 4 techniques used. Then transect is constructed perpendicular to the baseline and transect will intersect with true coastline and the test line

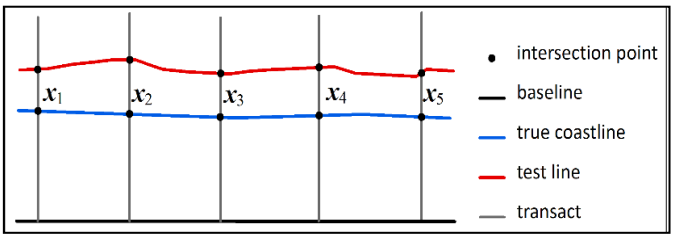
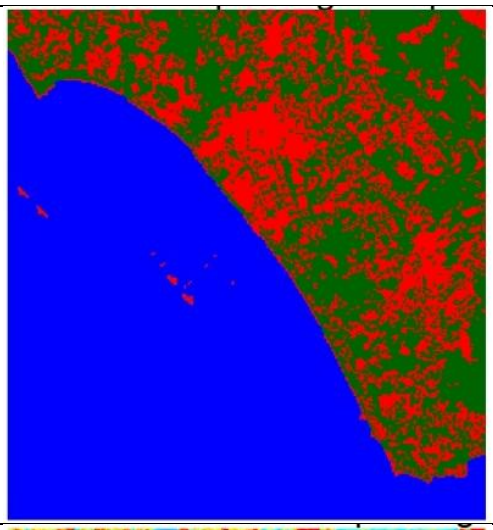
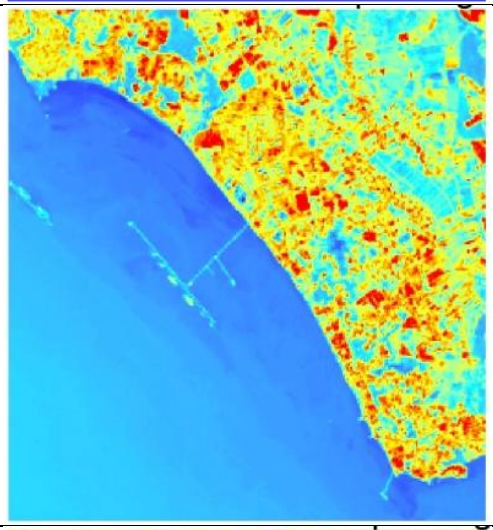
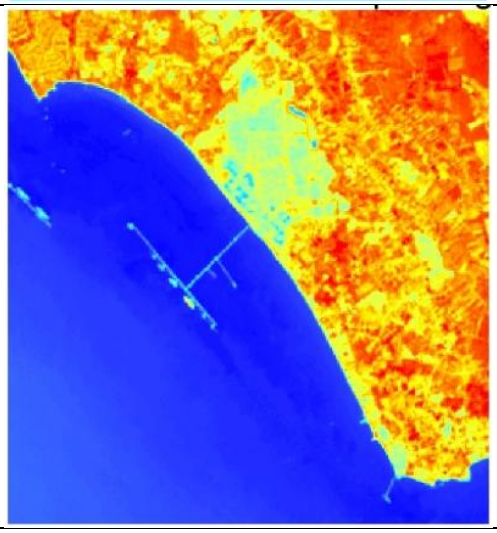
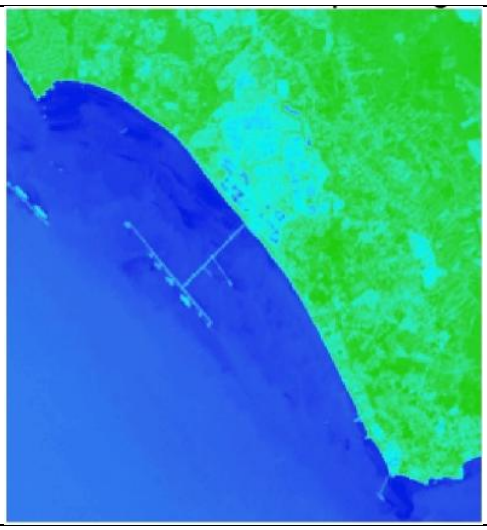


Figure 4: Illustration of baseline approach (Source: USGS, 2014).

RESULTS AND DISCUSSIONS

There are four (4) implied automated and semi-automated remotely sensed coastline detection techniques involved in this study. These techniques are band ratio, tasselled cap transformation, NDWI and unsupervised classification (ISODATA). In this study, the Landsat 8 (21 June 2014) image is used. Thus, on 21 June the mean tide recorded by Malaysia Surveying and Mapping Department (JUPEM) is 289.6 which are near to total mean of one month. Overall the mean tide recorded on 21 June is normal. Figure 5 shows the result of coastline detection by using ISODATA, Tasselled cap, NDWI and Band Ratio techniques.

	ISODATA water urban vegetation The accuracy recorded for this technique is 83.33% while overall Kappa Statistics recorded is 0.7458.
	TASSELLED CAP High : 3961.03 Low : -42736.5 The average maximum and minimum value is between -42736.5 and 3961.03. The highest value represents blue colour while the lowest value represents red colour.
	NDWI High : 0.24786 Low : -0.4875 The positive values are assumed to be water while vegetation or terrain has the negative values. The coastline is classified as sandy coast (<0), while other coastline types such as bed rock coast (> 0.26) is not coastline.



BAND RATIO

High : 1.39801

Low : 0.278094

The highest value which is represents the water area while the lowest value which is represents soil / vegetation. The water is represented in blue colour.

Figure 5: The Coastline Maps

The lowest mean and standard deviation of the calculation obtain is considered as the most accurate when referred to reference line. From the Table 1, the lowest mean and lowest standard deviation is band ratio technique. Band ratio technique recorded the lowest mean distance with 169.68m and standard deviation 29.15.

Figure 6: The Construction of Transect and Baseline of the Case Study

Table 1: Transect Summary

Statistic	Tasselled Cap Transformation (m)	Band Ratio (m)	Unsupervised (ISODATA) (m)	NDWI (m)
Minimum	156.10	105.54	115.37	176.67
Maximum	266.54	212.89	221.92	295.22
Mean	203.85	169.68	173.59	242.68
Median	192.37	165.42	171.93	240.11
Standard deviation	33.01	29.15	29.23	35.15

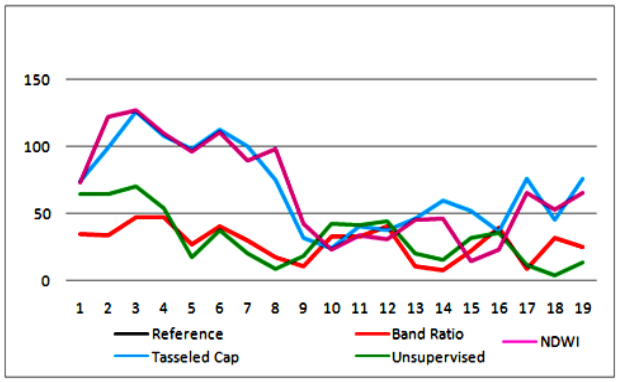


Figure 7: Coastline Extraction Method

Figure 7 shows graph of coastline extraction method. From this graph, the purple line is indicates the reference line which is recorded zero value. The x axis is indicates the transect point while the y axis is indicates the distance of four techniques from reference line. This graph shows that the band ratio method which represents red colour line is the closest to the reference line. The second close from reference line is Unsupervised Classification method which represents green colour line. This method also is nearest to the band ratio method. The blue line which is tasselled cap transformation method is quite far from reference line while the farthest method from reference line is NDWI method represents pink colour line.

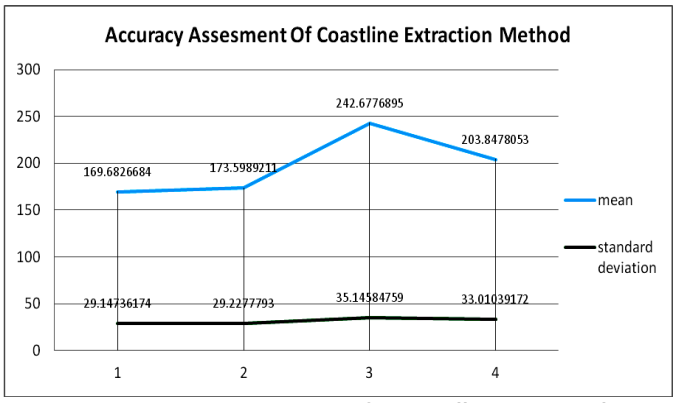


Figure 8: Accuracy Assessment of Coastline Extraction Method

Figure 8 shows the graph of accuracy assessment of coastline extraction method. This graph shows mean and standard deviation which represent line of blue colour and black colour. The x –axis shows the 4 technique involves which is method 1 is Band Ratio technique, method 2 represents Unsupervised Classification method, method 3 represents NDWI and method 4 represents Tasselled Cap transformation technique. Hence, it shows that the lower the mean values, the lower the standard deviation values as Band Ratio technique has the lowest mean and standard deviation value.

CONCLUSIONS

Based on the comparison of four (4) remotely sensed techniques to separate the water and land with refer to the baseline data acquired from JUPEM. Four remote sensing techniques (Tasselled cap transformation, Band Ratio, ISODATA and NDWI) were successfully used to extract the same coastline area. The results from this study exhibited that Band Ratio method for coastline extraction offers more accuracy. The fundamental principle in extraction of coastline is the accuracy. Thus, the spatial resolution of the source of data is important. Data that was used in this study is Landsat 8 OLI with 30 meter resolution for visible, NIR and SWIR while 15 meters for panchromatic. Using semi-automated techniques extraction of coastline, the processes can be conducted smoother and faster, hence, saving time, cost and maintenance as compared to the traditional method of coastline mapping techniques.

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A COMPARATIVE ANALYSIS OF THE COST OF CASH RETENTION AND RETENTION BOND

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ABSTRACT

The practice of cash retention has been identified to be an opportunity cost to the contractor, equivalent to interest loss on cash retained, which could amount to a huge sum for larger contract. Literature revealed the use of retention bond as the best solution to the problems of cash retention. Hence, the need to evaluate and compare the cost of 'cash retention' and 'retention bond' costs to the contractor. This study will assist in improving payment practice in the construction industry and also improves financial stability of the contractor. Data were collected from interim valuations of completed projects and subsequently analyzed using "compounding method" to evaluate the compound interest loss on cash retained by the client and the cost of providing retention bond in-lieu of cash retention. T-test analysis was further used to determine the level of significance of the difference between both costs. The results of both analyses reveal that there is a significant difference between both cost and the utilization of retention bond in-lieu of cash retention will reduce the cost of retention by 65%. Subsequent to the findings of this research, it is therefore suggested that, clients should adopt retention bond in-place of cash retention as this will reduce the cost of retention to the contractor, while still providing adequate level of security to the clients' money.

Keywords: *Comparative, Retention, Bond, Cost.*

INTRODUCTION

Cash Retention, also commonly called Retainage, is a term that refers to the percentage of payments held back on a construction contract by the client. Most standard forms of building contracts provide for the deduction of retention from amount due to the main contractor or sub-contractor. Failure to release the retention at the appropriate time can have a significant effect on the profitability and solvency of a contracting firm (Hughes et al., 2000).

Retention remains the main mechanism for protecting the employers' money within standard forms of building contract (JCT) which recommends that retention is set at 5% of cost of executed work, unless the contract value is high, in which case a lower rate may be agreed. This seems reasonable because larger rates of retention could amount to a greater impact on the cost of retention to the contractor (Hayward, 2011).

Cash retention is equivalent to compound interest loss on cash retained by the client. This is compounded by the principle of the time-value of money which established that the value of a given amount of money now is not the same as its value in future due to the unsteadiness of the economy.

This therefore implies that the value of the retention withheld by the client is not the same as its value when it is been paid after the expiration of defect liability period (Hughes et al., 2000).

The retention bond is an expressed agreement which states that, in return for the client (the obligee) not holding cash retention, the surety provider will undertake to indemnify the client up to the amount that they would have had by way of cash retention should the Contractor (obligor) fail to carry out the works or remedy defects.

A retention bond is a win-win system, the client has the monetary protection it requires and the Contractor keeps hold of its cash. Offering a retention bond in place of cash retention can result in substantial cost savings for the Contractor. In addition, the retention bond will normally contain a fixed expiry date so there is no confusion about when the Contractor has been released from his obligations. This thereby prevents the holding of second moiety of the retention sum for more than the contractual period which is peculiar to cash retention (Mutti and Hughes 2002).

Statement of Hypothesis

The utilization of cash retention in construction contract has been identified to increase the cost of construction to the contractor and it negatively affects his financial stability. Literature reveals that the substitution of retention bond for cash retention will reduce construction cost and increase profitability. Hence, in-order to determine whether there exists a significant difference in the cost of retention for both alternatives, the following null hypothesis was formulated

Null Hypothesis (H_0): There is no significant difference between the cost of retention bond and the cost cash retention.

Evolution of Retention Practice and Retention System

The retention system originates in the railway construction sector in the 1840's. The vast and rapid expansion of the railway network led to a high demand for construction workers and the subsequent creation of a large number of small construction companies. Inevitably a lot of these newly formed companies became insolvent. The rate at which such companies were becoming insolvent caused delays and cost's to the clients that employed them. Therefore the client's started deducting monies from payments to ensure there was a fund available to them to help defray the cost of completion and thus retention was born (ARV Quantity Surveying Limited, 2012).

Retention is deducted first by the client who has employed the main contractor and then the deduction of retention is usually mirrored in all subsidiary contracts throughout the supply chain. Main contractors are, therefore, to a large degree the 'middle man' in this chain of deductions. Retentions of 3% are usual, although some contracts provide for higher retentions.

Failure to release the retention sums at the appropriate time can have a significant effect on the profitability and solvency of companies.

The issue of who owns the retention has long caused problems for the construction industry. As the retention is money already earned most standard forms of contract provide for the retention to have trust status, although this is often negotiated or amended and in recent years certain contract forms have removed retentions completely. The importance of trust status is a key to determining the status of retention if the party holding the retention becomes insolvent.

If the retention has been segregated from other funds then it is separately identifiable as trust property and the claiming party has first call on the fund. Difficulties arise because the retention is rarely set aside into a separate fund and the clauses relating to trust status are frequently deleted or adapted. For all parties subject to retention this means that their retention is often at risk in the event of insolvency.

Impact of Retention

There has been considerable evolution of retention policy, there remains a spirited debate on the merits of its practice. Proponents of retention bond as reported by Dennis (2004) argue that it provides financial protection for the owner and ensures performance while imposing minimal financial hardship on contractors. It was also reported that retention reduces competition, increases project cost and provides a financial disincentive for timely completion of the work, and places a severe financial hardship upon contractors and subcontractors.

Impact on Construction Cost

Retention reduces competition and increases the cost of construction as evident from previous researches. In 1999 the American Subcontractors Association (ASA, 1999) conducted a national survey of its membership on retention practices. In that study they found that 91% of their memberships are more likely to pursue a project if no retention is withheld. Also 69% of the responding subcontractors indicated they would lower their bid by an average of 3.1% if the project did not require retention. ASA's conclusion was that owners and contractors utilizing retention on their project(s) reduced competition and increased price. The study also reveals that lowering the retained percentage by 50% (i.e. from 10% to 5%) results in construction savings of 1% to 1½ %.

Impact on Cash flow

Mutti and Hughes (2002) identified four main deficiencies that are attribute of failed companies: cash flow forecasts, costing system, budgetary control, and asset valuation. Cash flow problems and shortage of working capital can, in extreme circumstances, push efficient and profitable firms into insolvency. It is also possible that a firm is pulled into insolvency by the failure of another firm. This "domino theory" may apply if a client becomes insolvent owing large sums of money to the contractor, or if a main contractor fails owing cash to one or more regular subcontractors.

Impact on Performance

Various studies have been carried to find out whether there exist a relationship between performance and retainage in construction contract. The Specialist Engineering Contractors Group (SECG) recently completed a study on retainage. Based on its investigation, SECG (2002) submits "there is no evidence to link the existence of retentions to the elimination of defects or enhanced levels of performance" (SCEG, 2002:6). ASA's 1999 survey reached a similar conclusion. It found that retainage was not a motivating factor in the completion of the work for 80% of its membership, Dennis (2004). Many argue that retainage provides an incentive to delay completion of the work to minimize the contractor's financing cost.

Bond

A bond: can be defined as a promise (in writing) by one party (the surety company) to indemnify another party (the oblige/beneficiary) in the event of default by the obligor/contractor. It is an agreement of irrevocable nature between three parties, the contractor/obligor, and the surety and the obligee and the obligor on the other hand, whereby the surety accepts liability to the obligee in the event of the obligor failing to perform his obligation.

Parties to a Bond

Before a bond is demanded, there are two primary players: the person who gives the contract (obligee/principal) and the person who should fulfill the contract (obligor/contractor).

These two parties reach an agreement which the third party, “a surety”, comes in to guarantee the fulfillment.

I. *The obligee (employer/principal/creditor):* this is the owner who has the benefit on the bond.
II. *The obligor (contractor/debtor)*: is the one who carries out the obligation. He is the executor of the project for which the bond is taken.
III. *The surety*: he guarantee the obligee that the obligor will fulfill his obligations. The surety prepares, signs, seals and delivers the bond to the guaranteed person or company. Where the contractor/obligor fails, the obligee can now recoup from either the contractor and/or the surety.

Types of Retention Bond

According to NSCC (2011), there are two types of retention bond: conditional or default and on demand or unconditional retention bond.

On Demand/Unconditional Retention Bonds:- This, as its title suggests, allows the client to demand payment under the bond without having to prove that a defect is present or that the Contractor is unable or unwilling to correct it. In the case of on demand retention bonds, the surety is usually the contractor’s own bank and the bonded amount is set against the contractor’s borrowing capacity, which will reduce his overdraft limit until such time as it is returned.
Banks may also provide a bond which is on demand but ‘subject to satisfaction of stated conditions’. However, such conditions are likely to fall short of those contained in a conditional bond issued by an insurer.

Beyond checking that the conditions have been met, the bank will not carry out any further investigation to ascertain that the Contractor has defaulted.
The contractor should be extremely cautious about offering on demand bonds as they can be called without good reason and it is the contractor (not his bank) that will be responsible for recovering the money. In making payment to the Client, the bank will also reduce the contractor’s bargaining position.

Conditional Bonds:-In a conditional bond, the liability of employer is conditioning out the prescribed events where in construction cases, commonly the contractor default in committing their works and failure to complete the work on time that had been stipulated in the contracts. Here, comes the right of the employer on the terms of the bonds. If the employer could prove the breach and the loss suffered, the bonds is merely expressed to be activated. But, must be acknowledged that the bonds not absence immediately before the term of ‘default’ determined in detailed. Therefore, in practice, the conditional bond’s is considered as a security for damages which the employer may recover in the action against the contractor.

Generally conditional bonds can be identified by; wording which makes payment under the bond conditional upon the proof of breach of the underlying contract (as opposed to mere notice of a breach) by the contractor; the existence of notice provisions as to the existence of a default or of the intention to claim, as conditions precedent to any call on the bond; the bond being signed by the contractor. Unlike the unconditional bond, the conditional bond depends on the obligations owed by the contractor to the owner under the contract, and the contractor must be a party to it; and the absence of words typically found in unconditional bonds such as: "…on receipt of its first demand in writing…the bank/surety will fulfill its obligations under the bond without any proof or conditions…”

Period of Cover

The period of cover ranges from six(6) months to twelve(12) calendar months in most cases. It is the duration agreed by the surety provider for which he will be held liable for defects in the contractor work. The bond policies are not renewable and can only be extended on special request and

consideration with the payment of agreed extension premium. The policies therefore terminate at their expiry dates.

Premium

This is the amount charged by the surety in providing a retention bond. Generally, in bond policies, premium charged are service charge and the amount charged depends on individual obligor and the type of bond required. In many cases the charge is 1% per annum and the premium is not pro-rated and not refundable.

The Benefits of Using a Retention Bond

Offering a retention bond in place of cash retention can result in substantial cost savings for the Contractor. The money that would have been held in cash retention remains in the cash flow of the Contractor improving its financial position. In addition, the retention bond will normally contain a fixed expiry date so there is no confusion about when the Contractor stand released from his obligations. There is also no chasing for the release of cash retention at the end of the works, NSCC, (2011).

Problems Associated with Cash Retention

The most prevalent form of protection against non-performance on a construction project is cash retention. In a recent survey carried out by the University of Reading on behalf of the Reading Construction Forum, 77% of all projects surveyed used a retention fund.
On average they represent 3% of contract value and cost, in real terms, the loss of interest on the money held which represents approximately 0.2% of the contract value per year of the contract. This is not, however, deemed to be the most significant factor when considering retention funds, and it is clear that main contractors' retention funds are, in the main, an assemblage of sub-contractors' retentions which can present the following problems to the sub-contractor:-

i. Retention money withheld longer than contractual retention period
ii. Retention money not returned in its entirety, or at all, often due to spurious claims against the fund
iii. Main contractor insolvency
iv. Main contractor under-valuation of project swelling retention funds

RESEARCH METHODOLOGY

The study is aimed at making a comparative cost assessment of the cost of cash retention and retention bond. Relevant data required for the research were extracted from record of interim valuation of completed projects and information was also collected from financial institutions such as bank and insurance company. A total number of Twenty (20) projects were sampled for this study. The method of data analysis adopted for the research was “the compounding method” also known as “Amount of ₦1 method” which was used to evaluate cost of cash retention and cost of retention bond, which are equivalent to compound interest loss on cash retained by the client and the cost of providing retention bond respectively. Further analysis was carried out using “T-test analysis” in-order to determine the level of significance of the difference between both costs. Simple percentile was also used to compare both costs.

RESULT AND DISCUSSION

Table 1 reveals the cost of retention for both alternatives, against the limits of retention for the projects sampled in this study. The costs were computed using the compounding method and the difference between both costs are as shown in table 1. The results reveals that the average annual cost

of cash retention and retention bond for the sampled projects are N3.8824 x 10^5 and N1.3897 x 10^5 respectively and the average difference in cost is N2.4927 x 10^5

Table 1: Evaluation of Annual Cost of Retention

S/NO	PROJECT TITLE	LIMIT OF RETENTION (₦)	ANNUAL COST OF CASH RETENTION (₦)	ANNUAL COST OF RETENTION BOND (₦)	DIFFERENCE IN COST (₦)
1	A	86,565,347.85	2,075,115.70	841,000.42	+1,234,115.28
2	B	2,266,089.50	52,781.44	23,490.43	+29,291.01
3	C	10,206,810.86	377,610.36	106,150.83	+271,459.52
4	D	17,182,229.54	660,741.38	178,695.19	+482,046.19
5	E	17,269,994.54	460,030.80	167,505.24	+292,525.56
6	F	26,281,672.80	1,444,671.76	365,338.34	+1,079,333.42
7	G	8,278,894.50	257,152.47	128,059.64	+129,092.83
8	H	3,779,983.78	202,707.18	29,119.15	+173,588.04
9	I	15,282,773.53	474,666.52	239,033.00	+235,633.53
10	J	5,266,685.00	159,797.58	81,466.16	+78,331.42
11	K	23,115,756.27	876,880.64	362,351.42	+514,529.22
12	L	1,789,003.53	50,875.43	18,605.64	+32,269.79
13	M	7,783,460.04	262,006.85	122,828.50	+139,178.35
14	N	1,415,289.05	72,067.62	22,961.65	+49,105.97
15	O	775,488.28	36,993.60	7,903.78	+29,089.82
16	P	1,283,760.51	61,555.12	13,351.11	+48,204.01
17	Q	937,722.80	44,962.93	9,752.32	+35,210.62
18	R	1,249,489.52	63,830.68	20,271.72	+43,558.96
19	S	1,332,539.00	68,512.05	21,619.11	+46,892.94
20	T	1,227,549.00	61,901.47	19,915.75	+41,985.72
AVERAGE COST (₦)		11,664,527.00	388,243.08	138,970.97	+249,272.11

Table 2 shows the result of the T-test carried out in-order to determine the level of significance of the difference between the annual cost of cash retention and the annual cost of retention bond. The result reveals that the value of calculated T (T_{cal} =1.959) for the data is greater than the value of tabulated T (T_{tab} =1.684) and also the probability value (P_{value} =0.014) is less than the cutoff point (C_oP=0.05). This implies that a significant difference exist between the cost of cash retention and the cost of retention bond, hence the null hypothesis was rejected.

Table 2: Test of level of significance

S/N	**Variables**		**Type of model**	**Observation**				**Inferences**
	X_1	X_2		T_{tab}	C_oP	P_{value}	Rmk	Action on hypothesis
1	Annual cost of cash retention	Annual cost of retention bond	Independent samples	1.684	0.05	0.014	SS	Reject H_0

Table 3 shows the relationship between the annual cost of cash retention and the annual cost of retention bond. The results reveals that the annual cost of retention bond is 35.79% of the annual cost

of cash retention. This implies that the substitution of retention bond for cash retention in building contract will lead to the reduction of the cost of retention to the contractor by 64.21%. This finding substantiates the finding of Ahmad and Barnes (1994) which state that cash retention reduces profitability and increases contractors' bankruptcy. It also corresponds with the statement by proponents that cash retention increases project cost and places financial hardship upon contractor and subcontractor.

Table 3: Relationship between Cash Retention and Retention Bond

S/N	RELATIONSHIP	
	Ratio of Retention	Retention of Retention Limit
Annual Cost of retention bond	35.79%	1.19%
Annual Savings on Retention Bond	64.21%	2.14%
Annual Cost of Cash Retention	**100.00%**	**3.33%**

CONCLUSION

Subsequent to the findings of this research, the study therefore concludes that the utilization of retention bond in lieu of cash retention will reduce the cost of retention to the contractor by 64.21%, equivalent to 2.14% of limit of retention, while still maintaining adequate level of security of the clients' money.

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DESIGNERS APPROACH IN MANAGING LEGAL DESIGN RISKS IN MALAYSIA

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Abstract

Design risk is one of various risk elements in a construction works. Exploring the understanding of Malaysian professional designers on design related risks, risk management, laws related to the management of such risks as well as the sufficiency of existing laws to the effect is the objective of the research. Quantitative research method was applied, where questionnaire survey was adopted to collect data from professional designers, consist of professional architects and engineers. The data were then analysed using SPSS software. The finding reveals that the respondents were in consensus in certain areas, such as the importance to understand the law, but were in mix of opinion with regards to some area such as the branches of law regulating their duty. It is concluded that, understanding of professional designers on design risks, risk management and the laws can be further improved.

Keywords: *Risk Management, Design Works, Legal, Malaysia*

INTRODUCTION

The construction industry is statistically one of the most hazardous industries in many countries (Gangolells, Casals, Forcada, Roca and Fuertes, 2010). One of the major risks in construction is the design risks, such as on design quality and communication framework (Dey, 2009). Risks may appear as a result of the competitiveness of the industry itself. While competing for business, it is not uncommon for designers to come with new and noble design. It must be noted that, while innovation may be applauded, there are risks associated with it. The common law has laid down a basic principle with regards to new and noble design. In *Turner v Garland and Christopher* (1853), Hudson's Building Contracts, 4th Edition, Vol. 2, page 1, a designer was asked to prepare plans for the erection of model lodging houses, using new patent concrete roofing which was cheaper than the alternatives available. The patent concrete roofing was not a success and had to be replaced. The owner claimed in negligence from the designer but the judge told the jury that, although failure in an ordinary building was evidence of want of competent skill, yet if, out of the ordinary course, a designer is employed in some novel concept in which he has no experience and which has not the test of experience, failure may be consistent with skill. Accordingly, this research is meant to explore the understanding of design risks by professional designer (architects and engineers), with emphasize on the role of Malaysian law towards better design risks management practice. The professional designer is limited to architect and engineer

PROBLEM STATEMENT

Design errors are a major factor in landslide and building failures in Malaysia. Gue, Liew and Tan (2006) have conducted 49 cases studies on building failures and landslides in Malaysia. According to them, the occurrence of building failures and landslide cases in Malaysia were due to the following factors:

Table 1 : Factors of landslide and building failures

Factors	No of Incidents	Percentage
Design error	29	60%
Design and construction	10	20%
Construction error	4	8%
Geology factors	3	6%
Maintenance	3	6%
TOTAL	49	100%

Gue, Liew and Tan (2006) concluded that common mistakes involving consultants in engineering project includes:

1) Inadequate engineering assessments for engineering design, such as evaluation of long term settlement and fill compression problems, long term slope stability at cut ground, negative downdrag on piles at filled ground and request for necessary subsurface investigation.
2) Mistakes or errors in the design without thorough checking and reviewing process.
3) Improper engineering specifications, which are not specifically tailored for the project.
4) Fails to highlight to the client or coordinate with other design engineers, who will take over the site for subsequent engineering design, such as the performance of the platform.
5) Fails to provide professional advice to the non-professional client on their commercial decisions, which has design implications subsequently.
6) Does not seek input for specialist works, which is beyond the field of his or her expertise. The civil and structural consultants only emphasize on the structural design.

Therefore, based on the above findings, it is obvious that design errors are the important risk factor to be managed. The issue is why design errors are the main factor for failure? Do the designers fail to understand the risks involved in their works? Is there any means for such matter to be improved?

It is important for the professional designers to be fully aware of the risks involved in their work. This research is meant to look at risks related to professional designers and design works, and how the law can improve the management of such risks. The role of the law in improving matters related to design risks by professional designers is in line with the suggestion by Gue and Wong (2008) on the role of policies and legislations in design risk management.

In particular, this research is meant to look at the risks associated with professional designer (architect and engineer) and design works, within the purview of the traditional procurement method, with reference be made to standard form of contract available in Malaysia (Pertubuhan Arkitek Malaysia (PAM) 2006 Form of Building Contract and Institutions of Engineers Malaysia (IEM) Standard Form of Contract).

The Malaysian construction industry is widely dominated by the traditional structure of contracting. Under the traditional procurement system, three distinctive parties are involved, namely the employer, consultant and contractor (Rosli, Ismail et. al, 2006). The traditional structure of contracting formed the backbone of the existing Malaysian building contract, such as the Pertubuhan Arkitek Malaysia (PAM) Form of Building Contract by Pertubuhan Arkitek Malaysia (PAM), Institutions of Engineers Malaysia (IEM) Conditions of Contract for Works Mainly of Civil Engineering Construction by Institution of Engineers Malaysia (IEM), the CIBD Standard Form of

Contract for Building Works (2000 edition) by Construction Industry Development Board and the PWD Forms by Jabatan Kerja Raya (Public Works Department).

The selection of PAM 2006 Form and the IEM Conditions of Contract as basic reference in reflecting the traditional method of contracting in Malaysia is based on the fact that both contract forms has been widely used throughout Malaysia. In addition to this, the selection of PAM 2006 Form and IEM Conditions of Contract is due to the fact that the both forms have been sanctioned by the respective professional bodies of architect and engineer in Malaysia.

AIM AND OBJECTIVES

The aim of this study is to explore the level of understanding of professional designers on design risks, risk management and the laws relevant in managing design related risks in Malaysia.

Malaysian legal provisions and the management of risks related to professional designers and design works

With reference to the role of law in establishing a framework for risk management practice, it can be looked from various angles.

Firstly, the role of law with regard to risk management is related to allocation of risk to the most appropriate parties to manage it. Accordingly, the parties with the highest capability will be able to manage the risk more sufficiently. According to Bunni (2003), the allocation should be based on a sound appraisal of the interplay between the parties and the risks. The most appropriate method may be to allocate the risks on the basis of control over their occurrence and the effect they cause when they eventuate. In the words of Edwards (1995), the responsibility for indemnifying the consequences of a risk event resulting from the activities of one of the contracting parties should ideally rest with the party who has control over that risk, such as:

a) If the actions of client's staff, negligent or otherwise, result in damage to works being undertaken by a contractor, then that should be a risk indemnified by the client.
b) If a contractor's employee or equipment damages a client's property, then those costs should be borne by the contractor.

In practice, it is usually best commercial policy that responsibility for such risks should rest with the party best able to manage them, such as the party with the relevant insurance cover. The actual sharing of risk, indemnities and provisions for supporting insurances will be determined by the wording of the relevant contract documents. For other areas of risk not caused by the actions of either party, standard forms of contract usually share the risk between them. Edwards (1995) further elaborate that risky activities can be transferred by:

a) Contracts, subcontracts: such as having risky work undertaken by others. Residual vicarious liability by a principal for certain action of a subcontractor may remain, like the removal of support from adjacent land, the escape of fire or dangerous substances.
b) Property, vehicle, machinery leases: such as the transfer of the repair/maintenance responsibility.

Transfer of financial consequences of risk, can be summarised as follows:

a) Indemnities: agreements to pay costs of losses to property, damages for liability.
b) 'Hold harmless' agreements: types of indemnity dealing with legal liability claims.
c) Sureties: agreements by a third party within the framework of the main contract between the two parties to pay money in the event of non-performance by one of those main parties.
d) Bonds: agreements to pay money if quality or fitness for purpose are not met.
e) Guarantees: agreements to provide recompense for inadequate products or services. This is a separate contract wholly outside the main contract.
f) Insurances
g) Liquidated damages: agreement to provide recompense for the effects of delay.

Secondly, the law may directly impose certain duties and obligations upon the architect. The duties imposed by the law may well consist of requirement to exercise the basic element of risk management, consisting of risk identification, risk analysis and risk response. This is true based on the wordings of Yang Berhormat Dato' Fong Chan Onn in his opening remarks during a dialogue session between the Minister of Human Resource and the Chief Executive Officer of Construction Company in Malaysia on 7th March 2006:

"Department of Occupational Safety and Health (DOSH) is in the final stage of introducing a new set of regulations, which will require employers to manage safety and health at work sites systematically. One of the main elements in the regulations is the requirement for employers to conduct hazards identification, risk assessment and risk control at the construction sites."

The construction industry has suffered through a decade of poor design and construction performance (CFMA, 2006; Simonson, 2006; Flores and Chase, 2005). Designers have been criticised for not being accountable to deliver designs on time, minimising construction change orders, and not giving contractors adequate design directives (CFMA, 2006; Chang, 2002; Rubin, 2004). Some construction industry participants have identified the professional designers as a major source of risk and inefficiency in the design-bid-build process resulting in the current poor delivery of construction services (Chang and Chiu, 2005; HC&O Editor, 2004).

In order to understand the perspective of risks related to design works, specifically in relation to professional designers and design, we have to look at the definition of risk. Risk is the potential for loss or gain: quantitative, qualitative, or both (Richardson, 2010). According to Raquib (2002), risk means uncertainty concerning the occurrences of losses and the term 'risk management' means scientific management having many effective tools to minimize, eliminate or control risk factors to protect human lives, businesses and properties.

Managing risks is one of the most important tasks for the construction industry as it affects the project outcomes (Dey, 2009). To avoid the occurrence of possible events that may jeopardize the project, it is important to manage the risk properly. It is achievable through risk management procedures. In addition, risk management is essential in ensuring that the project can be completed successfully. A project is considered successful when it is completed within budget, ahead of schedule, and meets or beats the objectives set out by the owner. And achieving those goals usually means that the project team was able to counteract, minimize, or eliminate risk (Adibi, 2007).

According to Amran, Rosli and Mohd Hassan (2009), risk management refers to the methods and processes used by organizations to manage risks (or seize opportunities) related to the achievement of their objectives. A risk management framework typically involves a few processes. Firstly, there is the careful identification, measurement, and assessment of risk types and contingencies that a company might face. Secondly, it involves the formulation of a response model or strategic action to tackle the risks (both threats and opportunities). This includes determining capacity for bearing risk, risk reduction or mitigation procedures and other strategies to benefit from the impact of the potential risk. Finally, it requires the monitoring and checking of the implementation of all the actions planned as proposed by the response model (Lajili and Zeghal, 2005). By identifying and proactively addressing risks and opportunities, the company protects and creates value for their stakeholders, including owners, employees, customers, regulators, and society overall (Amran et al., 2009). In general, risk management techniques can be classified into three different stages which include risk identification, risk analysis and risk response (Wood and Ellis, 2003).

METHODOLOGY

For the purpose of understanding the general perceptions of the critical issues related to the research problem, registered architects and engineers in Malaysia were selected as respondents for the questionnaire survey. The questionnaire was sent to 300 registered architects and 300 registered engineers in Malaysia. The list of respondents was obtained from the Pertubuhan Arkitek Malaysia (PAM) and Institute of Engineers Malaysia (IEM) registry. This is in line with the research objective, namely to gather the exploratory data from professional designers as one group on the problem statement. This will indicate the general overview of the problem statement involving professional

designers as a whole. Accordingly, there is no need to separate the data from respective sampling group.

With reference to the traditional procurement route and standard form of contract, the Malaysian PAM 1998 Form of Building Contract was selected as major reference in the questionnaire for architect respondents, since PAM forms has been widely used throughout Malaysia since 1969. In addition to this the selection of PAM 1998 Form is due to the fact that the Form has been sanctioned by the Pertubuhan Arkitek Malaysia (PAM), the Malaysian professional body of registered architect.

In addition to this, even though PAM 2006 was considered to be the replacement for PAM 1998, it was submitted that the structure and flow remains substantially unchanged from PAM 1998 (See Lian, 2010). The structure of the PAM 2006 Form remains in the form of traditional procurement system. Therefore, it is submitted that risks emanating from the structure of traditional procurement system underlying both PAM Forms remains the same.

With reference to engineers, the IEM Conditions of Contract for Works Mainly of Civil Engineering Construction was used for questionnaire survey questions drafted for engineer respondents. Accordingly, engineers can also be made lead designer, especially in projects where architect is not required. Examples for such projects are infrastructure projects such as bridges and dams. In line with the recognized role of an engineer, the engineer was also named qualified Principal Submitting Person under requirement of CCC (Certificate of Completion and Compliance) introduced by the government to replace the Certificate of Fitness for Occupation (CFO) previously issued by the local authority.

Questionnaire design

The questionnaire survey was drafted with four main constructs. The main constructs of the questionnaire are:

- Respondents **understanding** of design related risks
- Respondents **understanding** of risk management
- Respondents **understanding** of the law with regard to design risks management
- **Sufficiency** of the law

The first question is a general question on the respondent's experience, while the last 18 questions dealt with the research topic and were divided into 4 parts. All questions except the first one are in close-ended form, which requires the respondents to tick the appropriate boxes. The usage of this approach is intended to gather factual responses and to facilitate the respondents in answering the questionnaire, with the hope will increase the response rate.

The process on sending the questionnaire survey took nine (9) months to be completed, due to poor response rate. It has to be conducted in two rounds, as the replies were very low. The first round was conducted during the first four (4) months. Merely 21 architects and 33 engineers responded. As a result, the researcher has to conduct another round of questionnaire survey sending to improve the response rate, which requires another five (5) months. Within the period of 9 months, due reminder has been sent via reminder cards, emails and phone calls. Albeit two rounds of questionnaire survey being conducted and the sending of due reminders, merely 49 architects respondents and 65 engineer respondents replied.

All collected information from the survey were checked and verified for their correctness. Data cleaning was carried out by checking the frequency and descriptive statistics as well as coding and data entry. The cleaned data were then analyzed to obtain frequency, statistical descriptive analysis and variance, carried out using SPSS 120.

RESULTS AND DISCUSSION

The purpose of this question is to gather the respondents experience practicing as an architect or engineer in term of years.

Table 2: Respondent Experience

	Year group	Architect		Engineer	
		Number	Percentage	Number	Percentage
1)	Less than 10 years	9	18%	11	17%
2)	More than 10 years	38	78%	53	82%
3)	Missing	2	4%	1	1%
	Total	49	100%	65	100%

From Table 2, seventy eight percent (78%) of the architect respondents consist of architects with experience of more than 10 years. Merely 9 respondents out of 49 or eighteen percent (18%) are architects with experience of 10 years and below. There are 2 missing data, or two percent of the total architect respondents. With reference to engineer respondents, 53 respondents or eighty two percent (82%) are having experience of more than 10 years. Out of 65 respondents, 11 or seventeen percent (17%) makes of the group of 1-10 years of experience. Accordingly, it is submitted that as a whole, the replies received are from experienced professional designers, as only eighteen percent (18%) of the architect respondents and seventeen percent (17%) of the engineer respondents were having less than 10 years of experience. In other words, seventy eight percent (78%) of the respondents architect and eighty two percent (82%) of engineer respondents are having more than 10 years of experience.

Part A: Risk Related To Designer and Design Works

Risk in Design

This question is aiming at identifying the general perception of the respondents on risks, especially risks related to design works. Ninety three percent (93%) of the respondents agreed that there are risks related to design works. Merely six percent (6%) were off the opinion that there is no risk related to design. It is submitted that majority of respondents agreed that there are risks related to design.

Effect of Risk

The aim of this question is to determine whether the respondents understand that risks involved in their works have significant impact on the project. Kashiwagi, Sullivan, Kashiwagi, Chong, and Pauli (2006) submitted that risks in construction can affect the proper performance of the project, in term of time, quality and cost.

Table 3: Respondent Understanding on Effect of Risks

Total Respondents	Effect of Risk	Replies	Percentage (%)	Missing	Percentage (%)
114	Time	109	96	5	4
114	Cost	109	96	5	4
114	Quality	104	91	10	9

Table 3 indicated that ninety six percent (96%) agreed on the impact over time of completion, ninety six percent (96%) agreed on the risks effect over cost of project and ninety one percent (91%) agreed on impact of risk over quality. The replies gave an indication that the respondents understood the effect of risks over the project, in particular with regards to quality factor, time of completion and cost of project. The understandings of the respondents reflect the importance for the risks to be properly managed.

Sources of Risk

This question aims to gather the understanding of the respondents on the sources of risks. Risks in construction, in particular risks related to professional designers and design works can be originated from

1) The Standard Form of Contract (Taylor, 2000)

2) Execution of specific duties of the designer (Duncan, 1995)

3) Various stages involved in the traditional procurement route (as illustrated by Murdoch and Hughes, 1996).

The replies will give indications on the understanding of the respondents over sources of risks.

Table 4: Sources of Risks

Total Respondents	Sources of Risk	Agreed	Percentage (%)	Unsure	Percentage (%)	Disagreed	Percentage (%)	Missing	Percentage (%)
114	Building Contract	82	72	11	10	20	18	1	1
114	Traditional Procurement System	84	74	16	14	13	11	1	1

Table 4 shows that the sources of risks listed to be evaluated by the respondents consist of the building contract, which include the Memorandum of Engagement/Agreement and Codes of Professional Conduct as well as risks emanating from the traditional procurement system. The respondents' replies on this matter can be summarized as follows:

Building contract

As part of the sources of risk, the building contract, which is read together with the Memorandum of Engagement/Agreement and Codes of Professional Conduct, was viewed by the respondents as follow. Seventy two percent (72%) of the respondents agreed that building contract as the sources of risks. Ten percent (10%) were unsure while eighteen percent (18%) disagreed.

Traditional Procurement System

Another source of risks viewed by the respondents is risks emanating from the traditional Procurement System. Accordingly, seventy four percent (74%) of the respondents agreed that risks can be the result of the traditional procurement structure, fourteen percent (14%) were unsure on this and eleven percent (11%) disagreed. The purpose of this question is to understand the respondents' perception over sources of risks. From the replies, it can be seen that mix of opinion existed among the respondents. Replies from the respondents indicated that the percentage of more than seventy percent agreed on sources of risks, while the rest of the respondents were unsure or disagreed on sources of risks listed. Giving the importance to understand the sources as a measure to manage the risk, the total percentage of more than twenty percent of respondents who was not sure or disagreed on building contract and traditional procurement as sources of risk is alarming.

Part B: Design Risk and Risk Management

Elements of Risk Management Practice

This question was drafted with the purpose of getting the respondents perception on stages required for efficient risk management practice.

Table 5: Element of Risk Management

Total Respondents	Element of Risk Management	Agreed	Percentage (%)	Unsure	Percentage (%)	Disagreed	Percentage (%)	Missing	Percentage (%)
114	Risk Identification	110	96	-	-	2	2	2	2
114	Risk Analysis	100	88	6	5	6	5	2	2
114	Risk Response	98	86	12	11	2	2	2	2

Table 5 shows that the respondents seem to agree that risk identification as an important risk management practice. Ninety six percent (96%) of the respondents agreed that risk identification is part of risk management practice. Two percent (2%) disagreed on risk identification as part of risk management. There were two (2) missing replies on this point, representing two percent (2%) of the total respondents. Eighty eight percent (88%) of the respondents agreed that risk analysis is an important risk management element. Five percent (5%) were unsure and another five percent (5%) disagreed. On this particular point, there were two (2) missing replies.

Eighty six percent (86%) of the respondents agreed that risk response as part of risk management stage, eleven percent (11%) were unsure and two percent (2%) disagreed. There were two (2) missing replies for risk response as part of risk management stage. Overall analysis of the respondents perception on risk management stages indicates that majority of the respondents (more than eighty six percent (86%) of the respondents) manage to identify the stages involved.

The respondents were asked about various methods available in risk response. List of ways to respond to risk were listed. The objective of this question is to gather the understanding of the respondents on various risks response strategies.

Risk Response Method

Table 6: Risk Response Method

Total Respondents	Element of Risk Management	Agreed	Percentage (%)	Unsure	Percentage (%)	Disagreed	Percentage (%)	Missing	Percentage (%)
114	Risk Avoidance	92	81	8	7	12	11	2	2
114	Risk Reducement	103	90	4	4	2	2	5	4
114	Risk Transfer	48	42	39	34	22	19	5	4
114	Risk Absorbance	38	33	42	37	29	25	5	4

Table 6 shows that eighty one percent (81%) of the respondents agreed that risk avoidance as part of risk response strategy. Seven percent (7%) were unsure and eleven percent (11%) disagreed. There were two (2) missing replies. Ninety percent (90%) of the respondents agreed that one of the ways pertaining to risk response is by risk reducement, four percent (4%) were unsure and two percent (2%) disagreed. On this point, there were five (5) missing replies.

With reference to risk transfer/allocation, only forty two percent (42%) of the respondents agreed that part of risk response strategy is by risk transfer. Thirty four percent (34%) were unsure and nineteen percent (19%) disagreed. Five (5) missing replies on risk transfer. Thirty three percent (33%) of the respondents agreed that risk absorbance is a part of risk response, thirty seven percent (37%) were unsure and twenty five (25%) disagreed. On risk absorbance, there were five (5) missing replies.

It was submitted by Mills (2001) that the most efficient response to risk is by allocating the risk to other parties who are in the best position to accept it. This question was drafted with the aim of getting the data from the respondents, whether they understand the importance and bearings of risk allocation.

Table 7: Risk Allocation as the Most Efficient Risk Response Strategy and risk allocation through contract

Total Respondents	Risk Response Method	Agreed	Percentage (%)	Unsure	Percentage (%)	Disagreed	Percentage (%)	Missing	Percentage (%)
114	Risk Allocation	64	56	26	23	22	19	2	2
114	Risk Allocation through Contract	64	56	28	25	18	16	4	4

Table 7 shows that fifty six percent (56%) of the respondents agreed that risk allocation to party that is in the best position to accept it is an efficient risk response, twenty three percent (23%) were unsure and nineteen percent (19%) disagreed. There were two (2) missing replies on this particular point. The above findings indicate that the respondents were unclear on the importance of risk allocation. This is evidenced from the mix replies, where the figures split between those who agreed and those who unsure or disagreed are substantive. Having the contention by Mills (2001) on risk allocation as the most efficient risk response strategy, the respondents misunderstanding on this matter is a deep concern.

The findings indicated that the respondents did not really grasp the function of the contract in allocating the risks involved to the most appropriate party to handle it. Accordingly, fifty six percent (56%) of the respondents agreed with this point, while twenty five percent (25%) were unsure. Sixteen percent (16%) of the respondents disagreed. The above finding is in line with the earlier findings on the respondents' perception over risk allocation. Accordingly, the respondents were having major split of opinion on risk allocation as the most efficient risk management strategy, particularly via the application of the contractual provisions.

Mitigating Risk by Fulfilling Standard Required

General duties of professional designers can be traced down from list prepared by Duncan (1995) and duties originated from the standard form of contract as illustrated by Taylor (2000). According to the law, the duties have to be performed up to the reasonable standards before the designers can be absolved from liabilities as stated in *Bolam v Friern Hospital Management Committee* [1957] 1 WLR 582. In *Bolam's* case, standard duty to be performed by a designer is

measured with the performance of other designers with the same capacity. The question to be asked is whether other designers will act similar with the action of the designer is question. The replies will provide the researcher with data on the respondents understanding over areas requiring them to properly execute their duties.

Table 8: Respondents Understanding On Areas of Drawings Needed To Be Performed According To Required Standard

Total Respondents	Aspect of drawings and specifications to be performed according to standards required	Agreed	Percentage (%)	Unsure	Percentage (%)	Disagreed	Percentage (%)	Missing	Percentage (%)
114	Meet the client's requirement	98	86	6	5	8	7	2	2
114	Define the scope of works completely	105	92	4	4	3	3	2	2
114	Comply with the Rules and regulations stipulated	101	89	8	7	3	3	2	2
114	Respect the project cost limit or budget	90	79	4	4	15	13	5	4
114	Are sufficient for tender purposes and unambiguous	95	83	6	5	11	10	2	2
114	Are practical and buildable	94	82	9	8	9	8	2	2
114	Are completed in the stated contract period	89	78	9	8	14	12	2	2
114	Ensure a safe working environment during and after construction	99	87	11	10	2	2	2	2

Table 8 shows that most of the respondents agreed that the aspects of drawings and specifications listed have to be performed in accordance to the required standard, as a measure to absolve the designers from liability. In general, seventy eight percent (78%) and more of the respondents confirmed the areas listed as important to be properly executed in accordance to the required standard.

Part C: Risks under the Standard Form of Contract

According to Taylor (2000), risks in construction, which includes risks related to professional designers and design works can be the outcome of the Standard Form of Contract. Accordingly, this section is meant to deal with the respondents perception on risks related to the standard form available in the Malaysian construction industry, in particular PAM 1998 Form and BEM Form 2000 Edition. It must be noted that, the contract provisions on designers requires it to be read together with Memorandum of Engagement and Codes of Professional Conduct in providing a complete structure for architect and engineer. As such, the respondents' opinions on both texts were also solicited, together with the Standard Form.

Designers Responsibility Outlined by the Contract

This question is meant to gather the opinion of the respondents on the outlining of designers duty by the contract. The data will enable the researcher to understand the perceptions of the respondents on the sufficiency of the contract in outlining their responsibilities.

Table 9: Sufficiency of The Contract in Outlining the Designer's Responsibility

Total Respondents	Sufficiency in outlining the designers' responsibility	Good	Percentage (%)	Average	Percentage (%)	Poor	Percentage (%)	Missing	Percentage (%)
114	Standard Form of Building Contract	85	75	18	16	8	7	3	3
114	Memorandum of Engagement/Agreement	71	62	34	30	6	5	3	3
114	Codes of Professional Conduct	76	67	29	25	6	5	3	3

Table 9 shows that generally the respondents gave split opinion on the effectiveness of the contracts in outlining the responsibilities. While many evaluated the contracts as good, quite a number ranked the contracts as average. By taking into consideration the replies that evaluated the contract as average/poor, it is submitted that there is a room for improvement, in relation to the contract document. With reference to this, it is important to understand the reason why some of the respondents regarded that the contract as average/poor in outlining the responsibility of a designer.

Risk Management by Proper Performance of the Contract Provisions

In this question, the respondents were asked to evaluate the contracts in term of proper performance of its provisions and efficient risk management practice. The replies will indicate whether proper performance of the contracts provisions is sufficient in avoiding risk occurrence, from the perspective of the respondents.

Table 10: Respondents Perception on Proper Performance of Contract Provision as Sufficient Risk Management Practice

Total Respondents	Proper performance of the contracts provides sufficiently for risk management	Good	Percentage (%)	Average	Percentage (%)	Poor	Percentage (%)	Missing	Percentage (%)
114	Building Contract	61	54	35	31	13	11	5	4
114	Memorandum of Engagement/Agreement	54	47	38	33	17	15	5	4
114	Codes of Professional Conduct	62	54	34	30	11	10	7	6

Replies gathered shows that the respondents were having mix opinion on the point that performance of the contracts provision will provides sufficiently for managing risks. The percentages of respondents ranked it as good which consist of around half of the total replies. The rest split between average and poor. As such, for this percentage, merely executing the duties outlined by the contract provisions is not sufficient enough.

Protection against Risk under the Contract

The respondents were asked to give their opinion on the sufficiency of the contracts, in providing protections against risks related to professional designers and design works. The data will show the respondents opinion on the protection available to them under the contract.

Table 11: Respondents Perception on the Sufficiency of the Contract in Providing Protection against Risks

Total Respondents	Sufficiency of the contracts, in providing protections against risks	Good	Percentage (%)	Average	Percentage (%)	Poor	Percentage (%)	Missing	Percentage (%)
114	Building Contract	45	39	44	39	20	18	5	4
114	Memorandum of Engagement/Agreement	39	34	50	44	22	19	3	3
114	Codes of Professional Conduct	41	36	45	39	23	20	5	4

The respondents were having mix opinion on the sufficiency of the contract, Memorandum of Engagement/Agreement and Codes of Professional Conduct in providing the necessary protections. Less than half of the total respondents ranked the contracts as good, while the rest consider it as average or poor. Accordingly, if the level of protection by the contract, Memorandum of Engagement/Agreement and Codes of Professional Conduct is not sufficient, the designers will have to take additional steps in protecting their works from risks.

Part D: Legal Framework on Design Risk Management

According to Raquib (2002), risk management is an area, which may be effectively thought of in the formulation of law and establishment of legal framework. Within this perspective, this section of the questionnaire survey is aiming at gathering information from the respondents on their understanding on the existing legal provisions, corresponding to efficient risk management measures of risks related to professional designers and design works.

Understanding the Law as Part of Risk Management

This question requires the respondents to indicate their opinion on the importance to understand the laws, as understanding of the laws is part risk management practice. Respondents' replies on this question will give a better picture on their perceptions over the importance to understand the law.

Table 12: Understanding the Law as Part of Risk Management and Branches of Law Regulating Designers' Duty

Total Respondents	Understanding the Law as Part of Risk Management	Agreed	Percentage (%)	Unsure	Percentage (%)	Disagreed	Percentage (%)	Missing	Percentage (%)
114	Law as part of risk management	106	93	4	4	-	-	4	4
114	Contract Law	90	79	18	16	2	2	4	4
114	Law of Tort	70	61	34	30	4	4	6	5
114	Statutory Provisions	88	77	18	16	2	2	6	5

Table 12 shows that ninety three percent (93%) of the respondents agreed that it is important to understand the law, while four percent (4%) were unsure. Majority of the respondents perceived that it is important to understand the law, as part of risk management strategy. Ninety percent (90%) of the respondents agreed that their duties are regulated by the contract followed by law of contract and statutory provisions. The respondents seem to have split opinion on the branches of laws regulating their duties. Both respondents group were in mix opinion, especially on law of tort. Sixty one percent (61%) of the respondents agreed on tort as part of laws regulating their duties. This is alarming as law of tort plays an important role in regulating the designers' duties and liabilities.

Discussion on findings

It is important for the designer to understand and properly manage the risks related to their works. Risks resulted from the execution of the designers duty can be traced to the contractual terms, duties imposed upon the designers by the law of tort and statutory duty. In addition to the above, the structure of traditional procurement system also resulted into the possibility of risks occurrence. The traditional procurement arrangement consists of three different entities, namely the client, the contractor and the designer. Proper communication and coordination between the parties is essential in ensuring proper performance of the project. For instance, the client will have to convey completely the details required from the designer during briefing stage to ensure that sufficient design scheme can be prepared by the designer. Incomplete design by the designer as a result of insufficient information given by the client will increase the risks in relation to the design itself.

Accordingly, risk occurrence can bring catastrophic effect in various ways, such as financial disaster, damages to property and personal, even fatality. As such, it is submitted that it is critical for the designer to fully understand the risks and manage it properly to avoid its occurrence. Considering the effect of risks related to design works, it is important to have it properly managed. Professional designers need to better understand the risk and the importance of risk management. Risk management can be implemented out of the designer's own initiative, or by some other means, such as through legal provisions with risk management role incorporated in its implementation.

CONCLUSION

It was found that issues related to the identification of risks, its factors, risk management and its importance, understanding of the respondents on the laws, issues related to building contract on professional designers and the availability of proper legal provisions were identified as key points to be further explored. It was found that not even half of the total respondents evaluated the existing laws as imposing sufficient duties on the designer to observe basic risk management practice. Based on this perception, it is submitted that the law in general can be further improved to accommodate the needs in implementing the basic risk management duties to be observed by the designers. The perception of the respondents on the role of existing laws in risk allocation does not signify the importance of risk allocation through the application of law in Malaysia.

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