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Quantity Surveyors in the Shipbuilding Industry

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ABSTRACT

Objective - This study explores the role of quantity surveyors in the procurement of vessels in the Malaysian shipbuilding industry. The study's objectives include defining the quantity surveyors' relevance in the vessels, identifying the skills required of quantity surveyors by shipbuilding companies, and identifying the professional services quantity surveyors can offer to shipbuilding companies.

Methodology/Technique – This study adopts an exploratory research design, mixed-method, sequential data collection, and the simple random sampling technique to select a sample size of 52 shipbuilders out of the 59 shipbuilding companies operating in Sarawak, Malaysia. The qualitative data was obtained through an interview held with the executive director of a large-sized shipbuilding company in Sibu town.

Finding - A questionnaire survey was also carried out among the shipbuilding companies operating in Sibu town. A total of 21 usable questionnaire were received, yielding a 21% response rate. Descriptive statistics were obtained with the use of the Statistical Package for Social Science (SPSS) software. The results show that quantity surveyors are relevant in the shipbuilding industry. It was also found that quantity surveyors are required to be familiar with the shipbuilding design, materials, process, and contract.

Novelty - The results suggest that the essential services that quantity surveyors can provide to the shipbuilding companies are estimating and cost planning. This study compliments the existing literature on shipbuilding and provides a direction for the advancement of the quantity surveying profession.

Type of Paper: Empirical

JEL Classification: O13, O14.

Keywords: Quantity Surveying; Shipbuilding Industry; Shipbuilding Companies; Sarawak; Malaysia.

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1. Introduction

The shipbuilding and ship-repairing industry has been characterized as a heavy industry that plays a vital role in Malaysia's economic activities. The current shipbuilding and ship-repairing companies range from small to medium-sized and spread across Kuching, Sibu, Bintulu, Miri, and Limbang. Their market products span across China, Philippines, Cambodia, Singapore, Thailand, Indonesia, the Middle East, and Australia.

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Out of the 100 shipyards currently in operation across Malaysia, 59 are located in Sarawak. In Sarawak, 5 shipyards are located in Kuching, 40 in Sibu, 1 in Bintulu, 12 in Miri and 1 in Limbang (Hwa & Othman 2016). Compared to other states in Malaysia, most of the shipyards and shipbuilding activities are dominant in Sarawak State. Hence Sarawak State is a significant player in Malaysia's shipbuilding and ship-repairing industry. The dominance of the shipbuilder in Sarawak State persists because 68 shipyards out of the 99 total shipyards operating in Malaysia are located in the eastern region of Malaysia (Suleiman et. al., 2017). The location of Sarawak State on the coastal line is a significant factor that enables the state to be an essential player in Malaysia's Gross National Income (GNI).

Many previous studies have focused on innovation in the shipping company (Tsekouras, Poulis, & Poulis, 2011), cruise ship tourism (Marsh, 2012), and cruise ship workers (Dennett et. al., 2014). Passenger ships and building structures share similar features in terms of their usage and construction materials. Usable areas such as bedrooms, toilets, kitchens and stores can be found in both passenger ships and building structures. Meanwhile, steel works, piping works and welding constitute a large part of passenger ships, similar construction materials and method can also be found in part of the building structures. In the procurement of building structures, quantity surveyors are well known in providing the cost management expertise. However, in the procurement of passenger ships and other types of vessels, the role of quantity surveyors is seldom discussed in literature. Hence, there is a gap in the literature regarding the role and relevance of quantity surveyors in the ship building industry. To narrow the identified research gap in the existing literature, the following three research objectives are the focus of this study:

1. To define the relevance of quantity surveyors in shipbuilding companies.
2. To identify the services quantity surveyors can provide to shipbuilders.
3. To identify the skills required of quantity surveyors in shipbuilding companies.

This paper complements the existing literature in two ways. Firstly, this paper provides new insights on the relevance of the quantity surveying profession in the ship building industry. Secondly, it will identify the role of quantity surveyors in relation to cost management services in the shipbuilding industry. Consequently, an awareness of the opportunities that are available for the quantity surveying profession in the shipbuilding industry will be highlighted. The rest of the paper is organized as follows: A review of the relevant literature is provided in section 2. Section 3 describes the research design, sampling techniques, sample size, procedure for data collection and method of data analysis. Section 4 presents the results of the analysis. Section 5 concludes the paper.

2. Literature Review

Shipbuilding is a global business that spreads across many countries such as China, South Korea, Japan, Philippines, Brazil, Taiwan, Romania, Vietnam, USA, and Malaysia. The services provided by the shipping industry have played an essential role in the economic development of a country due to its links with commercial activities, such as transportation of goods and fishing (Benzaquen, 2017). Shipbuilding is one of the significant activities of the shipping industry. The shipyard involves all sizes of ships ranging from large, medium, and small vessels. These ships will require either repair or maintenance, or both depending on the situation; hence, the shipping industry is also involved in vessel repair or maintenance (Benzaquen, 2017). Literature has shown that there is a link between global maritime traffic or the economic cycle and the demand for shipbuilding (Ferrari et. al., 2018). It is logical to state that global marine traffic can be influenced by the number of goods shipped by a continent. According to the United Nations Conference on Trade and Development (2014), Asia was ranked first with 38% of shipped products, America placed second with 23%, Europe placed third with 18%, Oceania had 11%, and Africa had 9% of the market share.

The shipbuilding industry is diverse and can provide numerous challenging job opportunities in many fields, such as naval architecture, marine engineering, mechanical engineering, electrical engineering, marketing, purchasing, accounting and finance (Chilton, 1977). Similar to the construction industry, shipbuilding has been characterized as a traditionally labour-intensive industry that requires high levels of skilled and craft workforce. According to Chilton (1977), the craft workforce required in shipbuilding includes platers and shipwrights, welders, caulkers and burners, drillers, riveters, and blacksmiths. Also, the skilled workforce consists of shop-fitters, turners, electricians, pipe workers, sheet metal workers, woodworkers, painters, and riggers. The professional services that quantity surveyors provide to clients or contractors during the procurement of residential structures can be extended to shipbuilding due to the similarities shared by passenger ship and residential structures. Hence, the relevance of quantity surveying to the shipbuilding industry lies in the services procurement of the ship. Nevertheless, quantity surveyors are seldom associated with in the ship building industry as revealed in existing literature.

2.1 The Quantity Surveyor

A Quantity Surveyor (QS) is a person trained primarily to be a cost expert. He is trained to keep the project cost within an approved budget. He ensures that the employer obtains value for their money. A quantity surveyor provides professional services such as preliminary cost advice and cost planning, preparation of tender documents, advice on the type of contract and method of obtaining tenders, negotiations with contractors, valuation of work in progress, and settlement of the final account. They may need to collaborate very closely with the architect from sketch to detailed functioning drawing (Seeley, 1997). Based on this role, a quantity surveyor is an important member of the design team. As a building economist, the quantity surveyor advises employers and architects on the probable costs of alternative designs. The quantity surveyor's advice enables effective control of design and construction at all stages within the limit of the predetermined expenditure. A quantity surveyor advises the client on procedures for ordering building and engineering contracts. Other services that a QS provides are the preparation of bills of quantities, negotiation of agreements with contractors, forecasts of final costs, and valuations for payments to the contractor as work proceeds. Further, a QS does measurement and valuation of variations in work during the contract for the preparation and agreement of the contractor's final account (Seeley, 1997).

Historically, the growth of the quantity surveying profession occurred between 1950 and 1980. This period witnessed the preference of bills of quantities as the basis for tender documentation (Cartlidge, 2011). In recent times, the quantity surveying profession has evolved into new areas in order to cover all aspects of procurement, contractual, and project cost management. Consequently, a QS is employed as a consultant, contractor, or subcontractor's QS (Lee et al., 2014). The aspect of quantity surveying practices that can be applied to shipbuilding is classified into two: firstly, the measurement used to determine the quantities of materials needed for the project, and secondly, the estimation utilized to build up the rate for calculating the cost. In construction projects, there is always the need to measure a proposed construction project at various stages from the feasibility stage to the final account. The measurement and building up of rates for every unit of work facilitates the establishment of a budget price, gives a pre-tender estimate, provides a contract tender sum or evaluates the amount to be paid to a contractor (Lee et. al., 2014).

3. Research Methodology

3.1 Research Method and Sample

This research uses exploratory and mixed-method designs. According to Creswell et. al. (2003), exploratory models are appropriate when qualitative data are only the initial exploration to identify variables, constructs, taxonomies, or instruments for quantitative studies. This research adopts a mixed method of data collection. The mixed-method design was chosen because it provides more flexible, integrative, and holistic

investigative techniques which enable the researchers to address a range of complex research questions that may arise (Powell et. al., 2008, p. 306).

The population of this study consists of 59 shipbuilding companies that were fully registered with the Association of Shipbuilders in Sarawak and the Department of Marine. The Marine Department provided only a list containing 40 shipbuilding companies operating in Sibu town. To ensure that the other major towns in Sarawak State were represented, the list of the shipbuilding companies operating in Kuching and Miri was obtained from the Sarawak Shipbuilding Association. Krejcie and Morgan's (1970) criteria were used to determine the appropriate sample size for this research at 95% confidence level. It was found that 52 samples were deemed necessary for the population of 59 shipbuilding companies. Following Sekaran and Bougie's (2013) technique, simple random sampling was used to select the 52 respondents for this study. To test the reliability of this research instrument, the internal consistency was measured by Cronbach's alpha. The reliability was expressed as a coefficient between 0 and 1.00. The higher the coefficient, the more reliable is the test. The most common reliability coefficient is the Cronbach's alpha, which estimates internal consistency by determining how all items on a test are related to all other items and the total test - internal coherence of data. Cronbach's alpha implies that there is a positive relationship of one item with another. The acceptable Cronbach's alpha should be greater than 0.7. The Cronbach's alpha for the relevance of the QS in this research variable exceeded 0.7, indicating the reliability of the instrument used in this research (Carmines & Zeller 1979).

3.2 Data Collection

The data in this research was collected using qualitative and quantitative approaches. The qualitative data was collected through an interview, and the quantitative approach was collected through a questionnaire survey. Following Kirmani and Campbell's (2004) technique, a sequential data collection approach was adopted. Hence, the qualitative data was initially collected through the interview followed by the provision of the questionnaire survey. The data for this study was collected from the shipbuilding companies located and operating in Sarawak State, the eastern region of Malaysia. Sarawak State was chosen because majority of the shipbuilding companies are located there (Zhang et. al., 2011).

Following Leedy and Ormrod's (2001) interview technique, a face-to-face semi-structured interview was conducted with an official of the Sarawak Shipbuilding Association. The interviewee was chosen because of his vast experience in the shipbuilding industry. The interview was held at the respondent's office on 20 March 2019. A total of 21 questions were asked, and the response to each question was written down progressively, beginning with the first to the last question. "Other" or 'any additional information" was asked at the end of every question to enable the interviewee to provide any additional explanation. The interview lasted for about 45 minutes. The semi-structured interview guide was modified into a structured questionnaire and was used for the questionnaire survey (Harrison & Reilly, 2011). Before the data collection, the questionnaire was given to a quantity surveyor consultant to check the questionnaire items. The questionnaire was revised based on the suggestions of the consultant.

The respondents for the survey were executive directors and business managers who were operating in each of the companies and had acquired satisfactory professional experiences to provide the data needed for this study. Postal mail was used to send 52 copies of the questionnaire to the various shipbuilding companies in Miri and Kuching towns. The questionnaire had a cover letter that explained its purpose and assured the respondents that their responses would be treated with utmost confidentiality throughout the research. After 2 weeks, only 8 copies of the questionnaires were received from respondents in Sibu town despite the 2 telephone calls intended to remind the selected respondents in Sibu to complete the copies of questionnaire. Subsequently, 11 copies of the questionnaire were physically distributed to all the shipbuilding companies in Kuching and Miri towns. In all, 27 usable copies of questionnaire were received, yielding a 21% response rate.

4. Results

4.1 Reliability of the Instrument

The reliability of an instrument refers to its ability to produce consistent and stable measurements. Reliability can be seen from 2 factors: reliability (the extent of accuracy) and unreliability (the extent of inaccuracy). To test the reliability of the pilot study, the test employed an internal consistency method measured by Cronbach's alpha. The reliability was expressed as a coefficient between 0 and 1.00. The higher the coefficient the more reliable is the test. The most common reliability coefficient is the Cronbach's alpha which estimates internal consistency by determining how all items on a test relate to all other items and to the total test - internal coherence of data. As the adopted instrument for measurement in this study was a questionnaire consisting of several questionnaire items, the adopted instrument used the internal consistency by Cronbach's coefficient. Cronbach's alpha indicates the positive relationship of one item with another. Acceptable Cronbach's alpha is greater than 0.65. As shown in Table 1. Cronbach's alpha for the relevance of QS variable exceed the minimum acceptable value of 0.65 (alpha = 0.735), indicating the high acceptable value (Carmines and Zeller 1979).

Table 1. Reliability of the Research Instrument

	N of Items	Cronbach's Alpha
Relevance of QS	11	0.735

4.2 Background of the Respondents

Table 2 summarizes the background of the respondents who participated in this study. The respondents consist of executive/managing directors (7.4%), general managers (11.1%), purchasing managers (7.4%) and marketing managers (3.7%). The remaining respondents were engineers, administrative executives and secretaries (70.4). Their work experience in the current company is categorized as follows: less than 10 years (33.3%), between 10 and 15 years (33.3%) and more than 15 years (33.3%). Most of the respondents were females (51.9%). In terms of the companies' owner, 88.9% of the companies were private limited companies compared to sole proprietorship (7.4%) and partnership/joint venture companies (3.7%).

Table 2. Background of the Respondents

	Frequency	Percentage
Position		
Executive/Managing Director	2	7.4
General Manager	3	11.1
Purchasing Manager	2	7.4
Marketing Manager	1	3.7
Others	19	70.4
Working Experience		
Less than 10 Years	8	33.3
10 to 15	8	33.3
More than 50	8	33.3

Gender		
Male	13	48.1
Female	14	51.9
Ownership Type		
Sole proprietorship	2	7.4
Partnership/Joint Venture	1	3.7
Private limited	24	88.9
Operational Location		
Within Sarawak	20	74.1
Borneo Region	1	3.7
Within Malaysia	3	11.1
Others	3	11.1
Company Age		
6-10	1	3.7
11-15	2	7.4
16-20	1	3.7
21-25	6	22.2
26-30	4	14.8
>31	13	48.1
No of Employee		
1-20	5	18.5
21-40	4	14.8
41-60	3	11.1
61-80	4	14.8
81-100	2	7.4
Above 100	9	33.3
Type of Vessel		
Tankers	4	15.4
Passenger ship	4	15.4
Ferry	2	7.7
Boats	7	26.9
Others	9	34.6

4.3 The Relevance of Quantity Surveyors to the Shipbuilding Industry

The first objective of this study is to define the relevance of Quantity Surveyors (QS) in the shipbuilding industry. The relevance of QSs to the shipbuilding industry is shown in Figure 1 and Table 3. The majority of the respondents agreed that QSs are relevant in the shipbuilding industry (mean = 3.96, SD = 1.13). It was also followed by "Progress payments" (mean = 3.93, SD = 0.92), Use of standard form of contract (Mean = 3.85, SD = 0.83), and "Shipbuilder require QS to prepare estimate" (mean = 3.81, SD = 0.88). Most of the respondents did not completely agree that "QS professional fees are based on negotiation" (mean = 2.91, SD = 1.06) and "Employment of QS is on temporary basis" (mean = 2.81, SD = 0.88).

Table 3. Relevance of Quantity Surveyors to the Shipbuilding Companies

	Percentage					Mean	SD
	1	2	3	4	5		
QS is relevant in the shipbuilding industry.	7.4	-	18.5	37.0	37.0	3.96	1.13
Shipbuilders in other countries engage QS.	3.7	3.7	37.0	48.1	7.4	3.52	0.85
Shipbuilders require QS to prepare estimate.	-	3.7	33.3	40.7	22.2	3.81	0.83
A QS is needed throughout the contract.	7.4	-	40.7	33.3	18.5	3.56	1.05
A QS is needed during pre-contract stage.	7.4	-	37.0	44.4	11.1	3.52	0.98
A QS is employed on temporary basis.	11.1	-	14.8	55.6	18.5	2.81	0.88
A QS payment is based on negotiation.	7.4	29.6	25.9	33.3	3.7	2.96	1.06
The contract permits advanced payments.		11.1	37.0	29.6	22.2	3.63	0.97
The contract permits interim valuations.	3.8	-	57.7	26.9	11.5	3.42	0.86
The contract permits progress payments.	-	3.7	33.3	29.6	33.3	3.93	0.92
Ship builders have standard form of contract.	-	-	40.7	29.6	25.9	3.85	0.83

QS Refers to a quantity surveyor

4.4 Knowledge and Skills Required of Quantity Surveyors in the Shipbuilding Companies

As shown in Figure 2 and Table 4, a majority of the respondents agreed that a QSs must know the shipbuilding process (30.8%), read and interpret ship design (26.9%), know how to estimate (19.2%) and know the shipbuilding material (15.4%). Half of the respondents agreed that the main service provided by QSs is approximately estimating (53.8%). The other services that they agreed to were cost planning, preparation of contract documents and preparing a detailed bill of quantity.

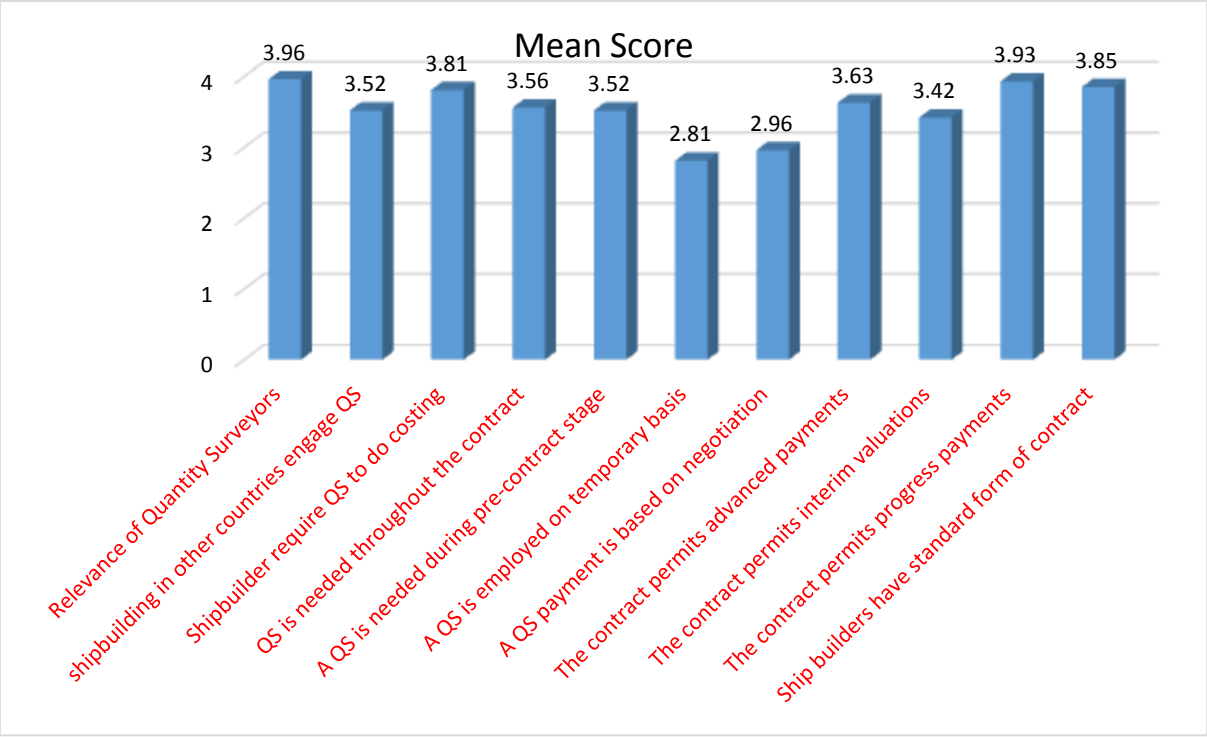

Figure 1. Relevance of QS in Shipbuilding Industry

As shown in Table 4, the procurement methods commonly practised in the shipbuilding industry are design and building (73.0%), and traditional methods (12.0%). The results also show that the type of contract

often used in the shipbuilding industry were cost plus contract (48.0%), lump sum (36.0%) and other contracts (16.0%). Lastly, Figure 3 presents the reasons for not engaging QSs by the shipbuilding companies in Sarawak. The main reason given was that an engineer is capable of providing all of the required services (40.0%). The other given reasons were that the type of vessels that are built do not require QS services (16.0%), they are not able to find a qualified QS (16.0%) and they prefer only working with engineers (16.0%).

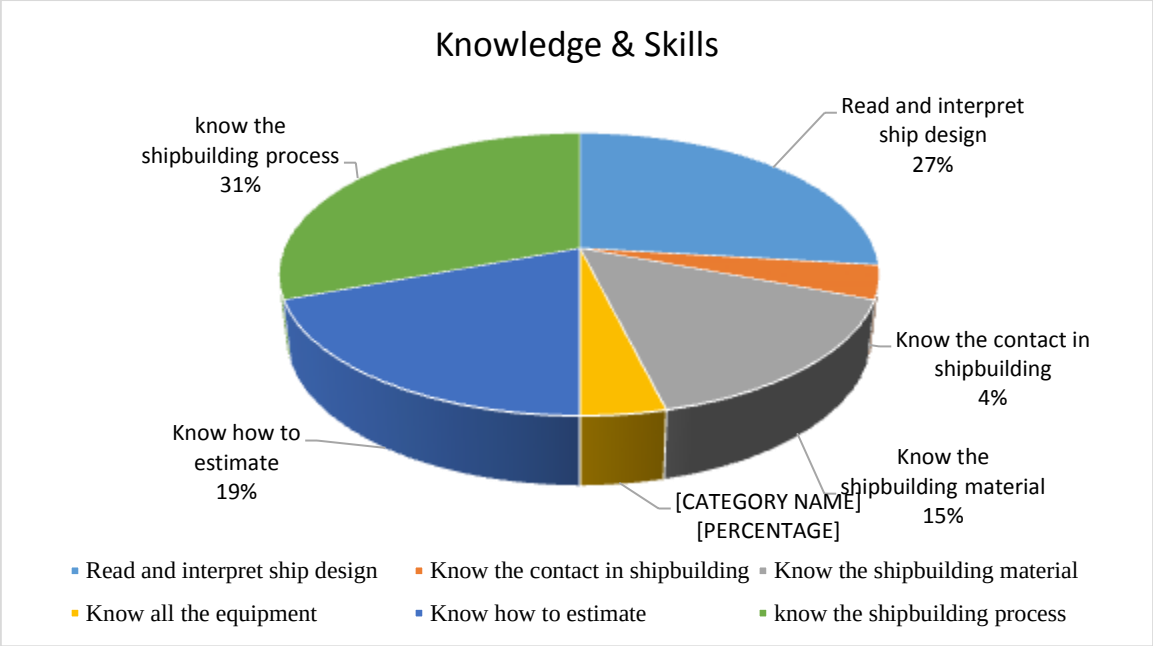

Figure 2. Knowledge and Skills required of Quantity Surveyors.

Table 4. Knowledge and skills required of quantity surveyors in the Shipbuilding Companies.

Items	Frequency	Percentage
Knowledge and skills required by QS		
Read and interpret ship design	7	26.9
Know the contact in shipbuilding	1	3.8
Know the shipbuilding material	4	15.4
Know all the equipment	1	3.8
Know how to estimate	5	19.2
know the shipbuilding process	8	30.8
The services needed from a QS		
Approximately estimating	14	53.8
Preparation of contract document	2	7.7
Cost planning	9	34.6
Detailed bill of quantities	1	3.8
The types of procurement methods in practice		
Traditional methods	3	11.5
Design and build	19	73.1
Others	4	15.4
The types of contract currently in practice		
Cost plus contract	12	48.0
Lump sum contract	9	36.0
Others	4	16.0

Why are Quantity Surveyors not engaged by shipbuilders in Sarawak		
The engineer is capable of providing all the service required	10	40.0
The type of vessel being built does not require the service of a QS	4	16.0
We are just to work with engineer	4	16.0
We do not find the qualify QS having the required skills	4	16.0
Others	3	12.0

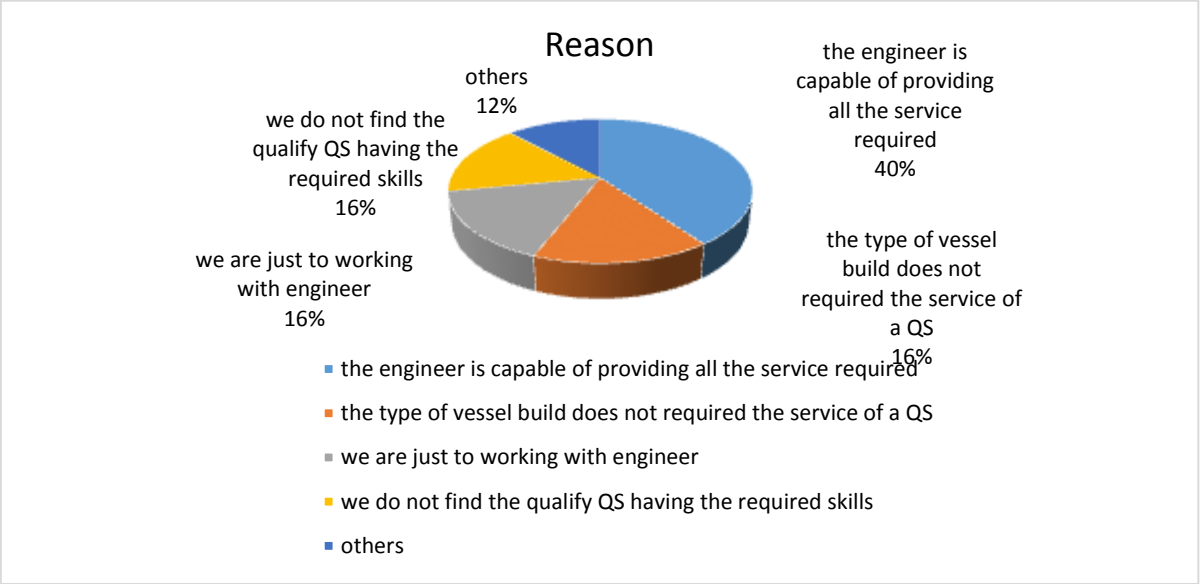

Figure 3. Reasons why some shipbuilding companies don't employ quantity surveyor

Figure 3 presents a summary of the responses from the interview and the result of the questionnaire survey. Table 5 presents the information in both qualitative and quantitative forms of data collection. An additional 'remark' column in the table provides additional information that relates to either the qualitative or quantitative results.

Table 5. Comparison between interview responses and the results of the questionnaire survey

S/N	Items in the Instrument	Interview Response	Questionnaire Survey	Remark
1	Number of shipbuilding companies in Sarawak	72 companies	Not included	68 companies (SBSR 2017 Industry report)
2	Types of vessels mostly built by the shipbuilder in Sarawak	1.Tankers, 2. Ferry, 3. Passenger Boat, 4. Tugboat, 5. Barge, 6. Offshore supply vessel, 7. Landing craft, 8. Crew boat, fishing boat, 9.container ship, 10. Sand dredger	1. Tanker 2. Ferry Passenger Ship 3. Tug Boat 4. Boat 5.Offshore Vessel 6. Work Boat 7. Landing Craft	Boats:26.9% Tanker:15.4% Passenger ship:15.4 Others:34.6%

3	The relevance of QS in the shipbuilding industry	Yes	1. QS is relevant in the shipbuilding industry. 2. Shipbuilding company does engage QS. 3. Shipbuilding companies require the QS to do the costing.	Mean score: 3.96
4	Employment of a quantity surveyor by the interviewee's shipbuilding company	Does not employ a quantity surveyor, the engineer does all the job	-	-
5	What are the reasons for not engaging or employing quantity surveyors by the shipbuilding companies in Sarawak?	Shipbuilding companies in Sarawak do engage QS; however, due to the workload, the engagement may not be as that of big companies.	1. The engineer is capable of providing all the services. 2. The types of vessel being built do not need the service of a QS.	The engineer is capable of providing all the services (40 % of the respondents)
6	List a few countries where QS are engaged or employed by the shipbuilding companies.	1. China, 2. Germany, 3. Japan 4. Korea 5. Holland, 6. Turkey	1. Australia 2. Europe 3. Germany 4. Indonesia 5. Korea 6. Japan 7. Malaysia 8. Singapore 9. United Kingdom	Asian counries (69% of the respondents)
7	Period of employing or engaging a quantity surveyor by the shipbuilding companies	QS is needed throughout the shipbuilding contract period	QS is required throughout the shipbuilding contract period	Mean Score: 3.56
8	Which stage of the shipbuilding contract requires the service of a QS?	QS is needed at the pre-contract stage	QS is required at the pre-contract stage	Mean Score: 3.52
9	What is the type or mode of engagement of a quantity surveyor?	Either temporary or throughout the contract	QS is employed temporarily	Mean Score: 2.81
10	What is the basis for the payment given to the quantity surveyor?	Payments to QS is based on negotiation	Amount to QS is based on negotiation	Mean Score: 2.96
11	What are the knowledge and skills required of a quantity surveyor in the shipbuilding industry?	1. Ability to read and interpret or visualize the ship design or drawings 2. Understand the equipment needed for the shipbuilding 3. Understand the contractual aspect of shipbuilding 4. Knowledge of estimating 5. Knowledge of shipbuilding materials	1. Able to read and interpret ship design. 2. Has the experience of the shipbuilding material. 3. Know all the equipment. 4. Know the shipbuilding process.	1. Knowledge of shipbuilding materials (37.5% of the respondents) 2. Understanding of shipbuilding process (37.5% of the respondents)
12	What are the services required from a QS at the pre-contract stage?	1.Approximate estimating 2. Cost planning 3.Preparation of contract document 4. Detailed bill of quantities	1. Approximately estimate 2. Development of contract document 3. Cost planning	1. Approximate estimating (53.8 % of the respondents) 2. Cost planning (34.6% of the respondents)

13	What are the services required from a QS at the post-contract stage?	Classification surveyor (International Association of Classification Society) conduct the valuation of work done.	-	QS might be required to inspect and conduct internal valuation before the IACS comes
14	The type of procurement method practised by the shipbuilding companies in Sarawak.	1. Traditional 2. Design & Build	1. Traditional methods 2. Design and build	1. Design & Build (73.1% of respondents) 2. Traditional (11.5% of the respondents)
15	The type of contract currently practised by the shipbuilding companies in Sarawak.	Cost-plus contract	1. Cost-plus contract 2. lump sum contract	Cost-plus contract (48 % of the respondents) Lump sum: 36.0
16	There is advance payment in the shipbuilding industry	Yes	Advance payment	Mean Score: 3.63
17	Valuation of work done in the shipbuilding industry.	The shipbuilding contract permits valuation and is made by a classification surveyor from the International Association of Classification Society.	The shipbuilding contract permits the valuation of work done.	Mean Score: 3.42
18	Willingness to train QS students in the shipbuilding companies and welcome students internship.	Concrete used in building the steel used in ships.	-	This is additional information by the interviewee
19	A software similar to BIM has been developed to calculate the quantities of materials required for a ship.	Any design change will automatically be reflected in the amounts.	-	This is additional information provided by the interviewee
20	QS should develop a formula for estimating the cost of the ship.	Require welding and connections and heat resistance.	-	This is additional information provided by the interviewee

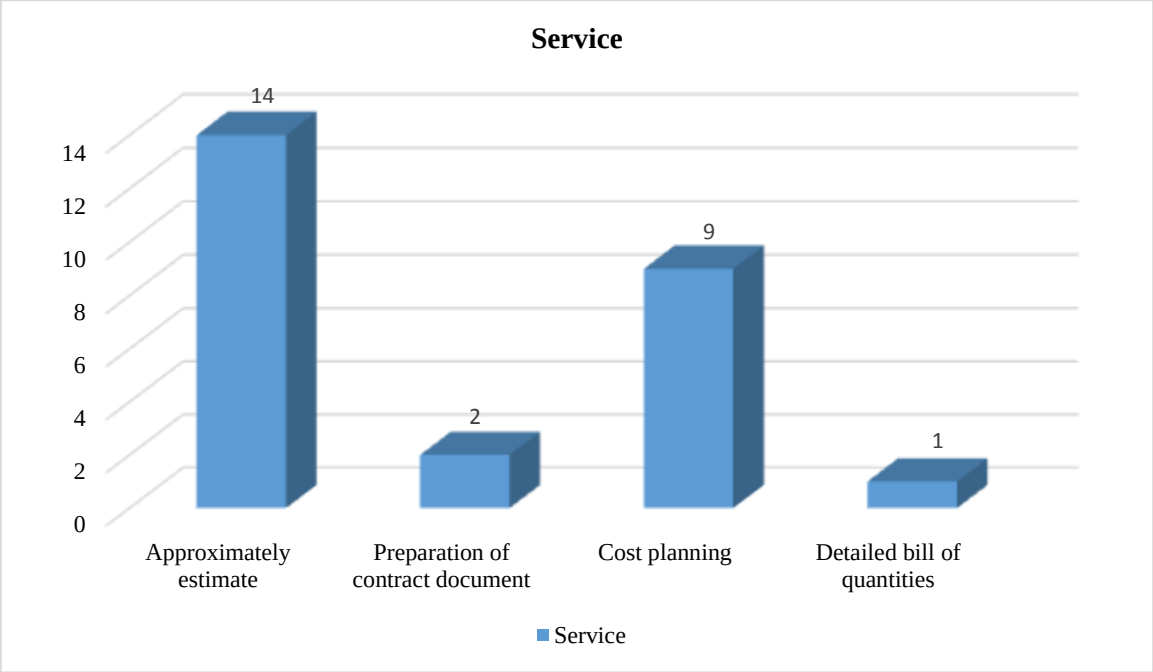

Figure 4: The quantity surveying professional services needed by shipbuilders

Figure 4 depicts the professional services a quantity surveyor can provide to the shipbuilders. As shown in Table 4, more than half of the respondents agree that the main service provided by QS is approximately estimating (53.8%). The other services include cost planning, preparation of contract documents and providing a detailed bill of quantity.

5. Findings

The findings from the interview reveal that though quantity surveying is relevant in the shipbuilding industry, only large-sized shipbuilding companies and cruise ships would require the services of a quantity surveyor. Furthermore, this research identified the reasons most shipbuilding companies in Sarawak do not need the services of a quantity surveyor. The first reason was due to the type of vessels mostly built by the companies. The second reason was that the engineer employed by the shipbuilding companies could provide all the services required to complete the ship without engaging a quantity surveyor. However, as shown by both qualitative and quantitative studies, Australia, Japan, Germany, Korea, Singapore, and the United Kingdom are some of the countries where quantity surveyors are employed in shipbuilding companies.

In relation to the second objective of this research, the findings from the qualitative study reveal that approximate estimating, cost planning, preparation of contract documents, and preparation of bill of quantities were the services that quantity surveyors can offer shipbuilding companies. However, the quantitative results show that approximate estimating and cost planning were the vital services the shipbuilding companies required of the quantity surveyors. This research suggests that the quantity surveyors are needed at the pre-contract stage. The essential services quantity surveyors can offer the shipbuilding companies are approximate estimating, cost planning, and preparing the bill of quantities. The post-contract services are offered by the ship surveyors from the International Association of Classification. However, some shipbuilding companies may have their in-house quantity surveyors that perform a preliminary assessment before the ship surveyors arrive to perform the actual interim valuation.

In relation to the third objective, both qualitative and quantitative studies reveal that the quantity surveyors should be able to interpret ship designs, be familiar with the shipbuilding materials, be able to identify types of equipment, and be able to understand shipbuilding process. In addition, this research found

that most of the shipbuilding companies in Sarawak were willing to accept quantity surveying students for their industrial training. This research found that the shipbuilding companies do make use of software for calculating the quantities of materials needed for a vessel.

6. Discussion

Despite the diverse professionals and craftsmen involved in shipbuilding, the role of quantity surveyors in the procurement and building of a ship has not been widely discussed in past literature. Quantity surveyors have not been recognized as professionals that are relevant to the shipbuilding industry. However, they can provide professional services similar to the building and infrastructural projects. Such services include preparation of preliminary estimates, preparation of bill of quantities, valuation of the ship for progressive payment to the constructor, assessment of variations due to changes in design or specifications by the client, etc. This study discovers that quantity surveying is relevant to the shipbuilding industry; the services required from quantity surveyors by the shipbuilding, though at the pre-contract stage, are similar to the services provided during construction projects. However, past and recent publications on quantity surveying practices have not been relating the practices of quantity surveyors to the shipbuilding industry (Jennings & Betts, 1996; Seeley, 1997; Pheng & Ming, 1997; Matipa et. al., 2009; Cartlidge, 2011; Towey, 2012; Lee et. al., 2014; Olanrewaju, 2016; Ogunsina et. al., 2016; Yogeshwaran et. al., 2018). The findings of this research imply that the scope of services that quantity surveyors provide is not limited to the construction industry. The services can also be applied to the shipbuilding industry. Hence, approximate estimating and cost planning are also needed in the shipbuilding industry. A quantity surveyor must be able to interpret ship designs, be familiar with the shipbuilding materials, equipment, and process if they desire to work in the shipbuilding industry.

7. Conclusion

This research has advanced our understanding of the relevance of quantity surveyors in the shipbuilding industry. It also provides an insight into the knowledge required of quantity surveyors by shipbuilding companies. Further, this research has also expanded our understanding of the professional services that quantity surveyors can offer the shipbuilding companies in the pre-contract stage. The findings of this study have practical implications. Firstly, the findings of this research are beneficial to quantity surveyors and professional institutions such as the Board of Quantity Surveyors Malaysia (BQSM) and the Royal Institution of Surveyors Malaysia (RISM). Hence, this research provides an insight to all the quantity surveying professional bodies on the opportunities available for the quantity surveyors to be involved during the procurement of a passenger ship and other types of vessels. In other words, this research has shown that there are job opportunities for quantity surveyors in the shipbuilding industry.

Secondly, this research has also enlightened shipbuilders on the relevance of quantity surveyors in the ship building industry. Therefore, the scope of the professional services of quantity surveying does extend beyond construction, real estate, infrastructure and oil and gas projects. The similarity between the findings of the interview and survey are a clear reflection of the views among shipbuilders operating in Sarawak, Malaysia. Though a mix method was adopted in this research, conducting a single interview with one of the active shipbuilding company in Sarawak has been considered a major limitation of this research. Future research should conduct multiple interviews with the shipbuilding companies prior to the survey.

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