Unit Transportation Cost Index for Decommissioning Offshore Platforms in Malaysia

by

Nurul Suhara binti Abd Rahim @ Rusling

Dissertation submitted in partial fulfilment of
the requirements for the
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(Civil Engineering)

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CERTIFICATION OF APPROVAL

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Approved by,

____
(Dr. Noor Amila Wan Abdullah Zawawi)

UNIVERSITI TEKNOLOGI PETRONAS

TRONOH, PERAK

January 2014

CERTIFICATION OF ORIGINALITY

This is to certify that I am responsible for the work submitted in this project, that the original work is my own except as specified in the references and acknowledgements, and that the original work contained herein have not been undertaken or done by unspecified sources or persons.

NURUL SUHARA BINTI ABD RAHIM @ RUSLING

ABSTRACT

Decommissioning of offshore installations presents a major liability due to the complexity in a sensitive environment as well as the huge sum of money involve in its operations. Therefore, an appropriate cost planning of decommissioning is needed. This study is aimed at developing a site specific unit cost index pertaining to year of decommissioning offshore platform. In particular, this study will focus on the transportation aspect of decommissioning of offshore platform because it contribute high percentage in cost of decommissioning. Laspeyres index formulas were used to compute a series of years from 2009 to 2013 for unit transportation cost index. With a series of cost index, the rate of inflation for the transportation were predicted based on the previous data. Analysis and interpretation on the price level is discussed in this report. The inflationary trend is used to project the upcoming price level. In conclusion, cost index is very useful in planning the decommissioning of offshore platform installation and more importantly it also helps in producing reliable cost estimation. For future research, it is recommended to have a series of inflationary trend on transportation for at least more than 10 years to obtain accurate projection of price level. In addition, this research study can initiate another set of unit cost index for different cost element for decommissioning such as equipment. It has also been recommended that, further research should be conducted to establish cost index for the whole platform.

Keywords: Cost index; decommissioning; inflation rate; offshore; transportation

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Abbreviations and Nomenclature

BLS	Bureau of Labor Statistic
CPI	Consumer Price Index
DSV	Diving Support Vessels
GDP	Gross Domestic Product
HLV	Heavy Lift Vessel
IMO	International Maritime Organization
POCS	Pacific Outer Continental Shelf
UNCLOS	United Nations Convention on the Law of the Seas
PETRONAS	Petroliam Nasional Berhad
PPI	Producer Price Index

CHAPTER 1:

INTRODUCTION

1.1 BACKGROUND

According to the article of Study Assesses Asia-Pacific Offshore Decommissioning Costs in the Oil and Gas Journal, Malaysia has about 249 offshore installations dotted around in the region of Peninsular Malaysia, Sarawak and Sabah. However, about 48% of 249 platforms have exceeded their 25 years life and out of these figures only three have been decommissioning. Based on this trend, the offshore decommissioning activity will gradually increase as the number of the existing offshore platform approach its design life. An Offshore platform installation is said to be due for decommissioning when the cost of operation of oil and gas outstrips the income that coming from the production of hydrocarbons and henceforth, the offshore installation exists as liability instead of asset. There is responsibility to return the ocean in the same conditions after the end of production of hydrocarbons.

The current situation shows that decommissioning of offshore platform is seen to be one of the biggest challenges and presents a great liability to the operator such as PETRONAS because of the complexity of the technical activities involve. Thus, it is vital to develop an accurate and proper cost estimation of decommissioning activity right from the planning phase. A detail cost estimation is needed for every technical decommissioning activity which begins with the pre-environment studies until the post monitoring. The cost of decommissioning can be divided into three major parts which are transportation, manpower and equipment. Based on the previous decommissioning activities, it shows that lots of transportation are needed such as derrick barge, cargo barge, diving support vessel (DSV) and many others. Seeing that the cost transportation is one of the main attributes contributing the decommissioning of offshore installations than manpower and equipment, indirectly it could affect the cost estimation of decommissioning of offshore installations. As such it is essential to have a further study on how this transportation cost could inflate and affect the cost estimate in order to have an accurate estimation for decommissioning of offshore platforms.

1.2 PROBLEM STATEMENT

Globally, decommissioning of offshore installation has been considered to be one of the biggest challenges facing the oil and gas industry, seeing that about 48% of 249 offshore platforms in Malaysia exceeding 25 years design life, decommissioning of oil and gas facilities are set to boom. These offshore platforms present a major liability instead of asset. Hence, a proper decommissioning plan and cost estimation must be presented in order to develop quality cost estimates for an economical of decommissioning operations so as to give value for money (VFM). Previously, decommissioning of offshore installations in Malaysia did not attempt an accurate cost estimate due to the vast task where a specific evaluation, risk and environmental assessment and cost analysis for each offshore installations are required to be done. As an alternative, a rough cost estimate have been performed based on available decommissioning of offshore installation cost data from the nearer decommissioning site and modified to generate an estimated mean cost. The rough estimation may cause estimates to deviate due to the uncertainties of the decommissioning operation because every offshore installation is exclusive.

As decommissioning market is relatively fresh in Malaysia, the cost to decommission an offshore platform could inflate for other platforms. Hence, developing a site specific unit cost index could achieve a reasonable degree of accuracy in the cost estimation. In most of the main stages of decommissioning operation such as structural removal and site clearance, transportation is seen to be one of the attributes that affect the cost estimate as compare to manpower and equipment. However, no specific unit cost index has been establish for decommissioning in transportation. Therefore, unit transportation cost index shall be designed to compare how this unit, taken as a whole, differs in time periods and how this unit can change the rate of inflation towards the transportation for decommissioning offshore platform.

1.3 OBJECTIVES OF STUDY

The objectives of the study are:

i. To evaluate relevant basis and assumptions in cost index development

ii. To develop site specific unit transportation cost index pertaining to the year of decommissioning offshore platform

iii. To establish rate of inflation for transportation pertaining to the year of decommissioning offshore platform

Therefore, at the end of this project, the predetermined objectives are expected to be achieved within the given scope and time frame as per next discussion.

1.4 SCOPE OF STUDY

This study will cover only on the transportation hire rate for marine vessel. Three types of transportation are taken in order to develop unit transportation cost index which are DSV and Derrick Barge of 1000MT and 2000MT. Due to the minimum number of platforms that have been decommissioned, rate of transportation at Sarawak waters for commissioning offshore platform is used as an alternatives. In order to study on the inflationary trend of the transportation rate, different time intervals will be the variable in establish the unit transportation cost index. For this research study, the rate of transportation is taken from 2009 up to 2013. There are few techniques to develop a unit cost index. Thus, for this research purposes only one technique used which is Laspeyres Index Formula.

1.5 RELEVENCY AND FEASIBILITY OF THE PROJECT

The study on the unit transportation cost index for decommissioning of offshore installation in Malaysia has its own significant towards the oil and gas industry in Malaysia as it is said that the decommissioning market is set to boom in this region. The author aim to establish the unit transportation cost index in order to study the inflationary trend for future cost estimation in decommissioning offshore platforms. The unit transportation cost index, helps engineers or financial accountants for cost planning of decommissioning activities. Moreover, unit cost index is widely used for contract. With predetermined cost index, it helps in identify the escalation factor to the contract price. In addition, cost index also helps in comparing the costs in different geographical locations and time intervals. Hence, it is important to establish unit transportation cost index for cost-effective purposes.

CHAPTER 2:

LITERATURE REVIEW

2.1 DECOMMISSIONING OF OFFSHORE PLATFORMS

Oil and gas production is now past its peak, which means that many operators are facing up to tough questions over how and when to remove platforms when they reach the end of their useful life (Jamieson, 2013). Conceptually, decommissioning of offshore platforms is necessary when the cost to operate a structure such as maintenance, operating personnel, and transportation exceed the production's income. Hence, the offshore platforms become a liability instead of asset. Shown in the Figure 2.1 illustrated the theory of how the marginal cost exceeding the marginal profit and hence necessitates the decommissioning of offshore platforms. However, some operator of oil and gas industry keeps on continuing the production of the hydrocarbons until the last drop by enhancing the oil recovery. Somehow, this offshore platforms need to be decommissioned when it reach the life design.

In addition, other factors why decommissioning activities are carried out on offshore platforms that have reach their design life is because of the current international treaties and conventions. According to Twomey (2010), reported that, there are three main international conventions or treaties that affect the decommissioning of offshore platforms; United Nations Convention on the Law of the Seas (UNCLOS), London (Dumping) Convention and International Maritime Organization (IMO). All of these treaties or conventions stressed that an offshore platforms are required to be removed after it have reached its design life and ocean must be free from any oil and gas related debris. Studied had made the idle offshore platforms to be permanently removed and the wells need to be plugged to avoid damages caused by the environmental factors for instance the hurricane and other disaster. Consequently, the cost for the damaged offshore platforms and wells will be higher and cost 10 to 15 times the actual cost of decommissioning of offshore platforms also it leads to the environmental problems.

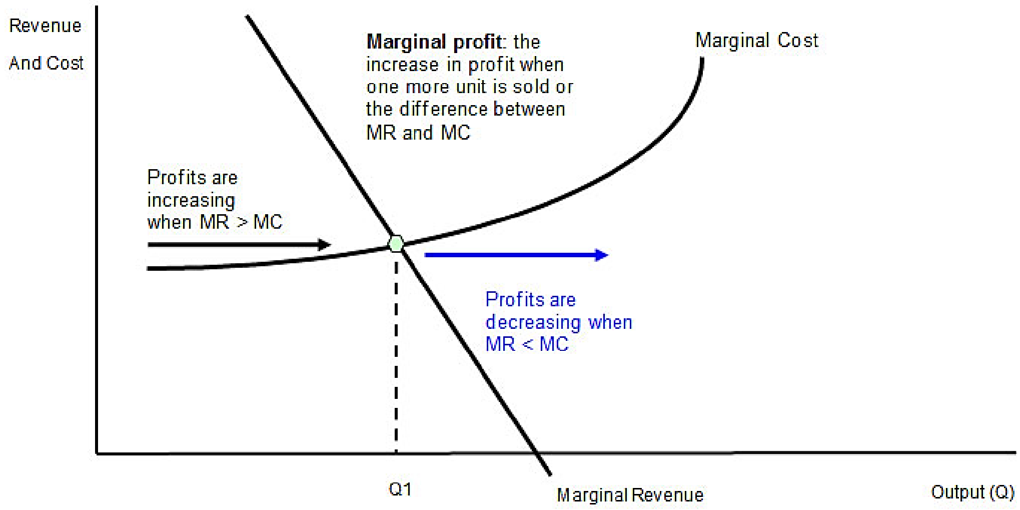

Figure 2. 1 Concept of Marginal Cost and Marginal Profit (Riley, 2012)

Curtis et al (2001) have provided a guideline to identify decommissioning of offshore platforms processes. Fundamentally, the vital operations of decommissioning are identified and presented in a logical sequence. Then, the utilization of equipment for dismantling, lifting and transporting are included in the decommissioning offshore platforms processes. Specifically, the process of the decommissioning offshore platforms comprises of 10 steps (shown in the Figure 2.2). It starts with the engineering and planning and ends with site clearance.

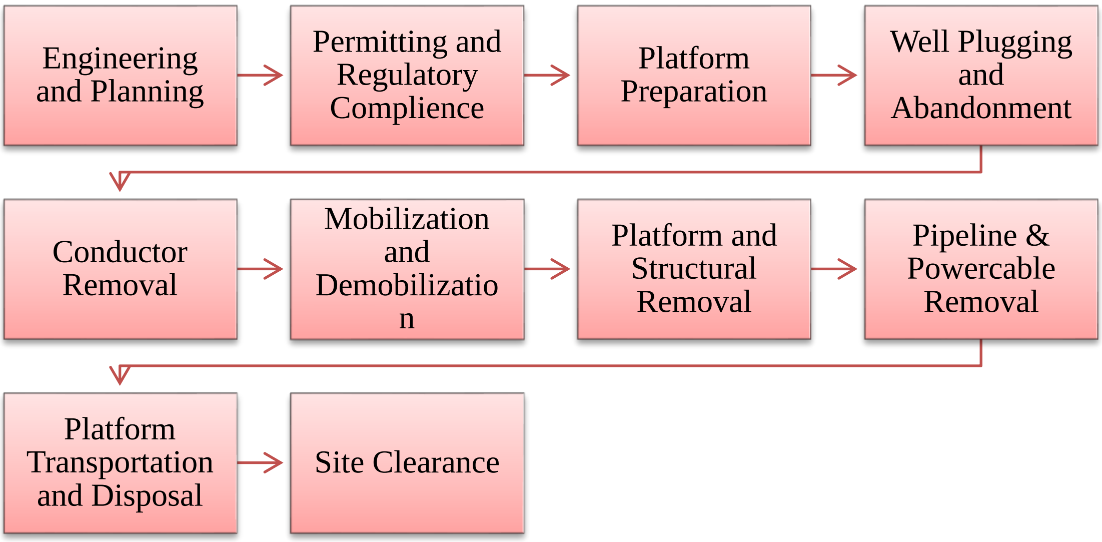

Figure 2. 2 Decommissioning Offshore Platform Process

During decommissioning process, the most important stage is the platform removal stage. It is the core of the decommissioning process because during this stage the topsides and the jacket are removed. According to Kaiser et al (2003), derrick barge and cargo barge are needed to transport the jacket and taken to the shore or to another location of sea to be used as an artificial reef site while the topsides modules need to be returned to shore for refurbish, recycling or use as scrap. The topsides modules are removed by the reverse installation method and then placed on the cargo barges. After that, the cargo barges will transport the topsides module to the nearest scrap yard for further process such as recycling, refurbishment or scrap. Similarly goes to the jacket where the jacket severed into section and removed. Then this jacket sections are transported to the scrap yard. Derrick barge selection is determined by the water depth in which the derrick barge can safely operate the lift capacity of the cranes and market availability (Kaiser, 2006). Maximum load weight of structure during the operation is estimated to determine the minimum derrick barge required. The size and weight of the offshore platform relates with the water depth. As the water depth increases, the jacket and deck weight increase. Consequently, the size of derrick barge required in removal operations is increasing. Thus, to determine the size of derrick barge, engineers estimate with the aid of the physical characteristics and blueprint specifications of the structure.

Figure 2. 3 Removal of Jacket Platform

Figure 2. 4 Transportation of Topside to Scrapping Yard

Before the decommissioning process starts, the heavy lift vessel (HLV) with the anchor handling tugs will be mobilized from the original of its location to the offshore platforms location. In addition, the certain capacity of cargo barge also will be mobilize from the fabrication yard concurrently before the platform removal stage start. The steel pads also known as load spreader is equipped in the cargo barge at fabrication yard before it mobilizes. The steel pads is used to support the point load coming from the topsides and also the jacket section. During the decommissioning offshore platforms process, the dive boats with the diver is assembles at the location of decommissioning along with the support vessels. According to Gebauer, et.al, (2004), the utilization of the local crew boats and workboats is used up, until the maximum extent practicable. This is due to the reason of saving the time constraint of the decommissioning process besides to save the cost of mobilization/demobilization of vessels.

Figure 2. 5 Net Trawling Technique for Site Clearance

After all the components of offshore platform are decommissioned, now it comes to the last stage of decommissioning of offshore installation which is the site clearance and verification. In this stage, all the oil and gas related debris that has amassed on the seafloor and the vicinity of the offshore installation are removed. Then the site is verified to ensure that the site is free of any potential obstruction. There is an assortment of technique that may be used on the site clearance and verification stage operations. Clearance may be performed with diver surveys, sweep assemblies and heavy duty trawl nets, electromagnetic and grappling devices, dredging buckets, or a combination of techniques (Pulsipher, 1996 and Manago & Williamson, 1997). Different salvage approaches or a combination of approaches for the site clearance and verification may be required because different site has different conditions depending on numerous factors. Indirectly, all of different salvage techniques to clear and verify the ocean required transportation such as the net trawler boat and the surface support vessel that carries the crane or equipment. To conclude that, transportation is one of the main attributes in the core stage of decommissioning of offshore platform as it is one of the mediums of the decommissioning to occur.

2.2 COST OF DECOMMISSIONING OFFSHORE PLATFORMS

Cost estimation is a significant aspect of business and it is usually present in support of liability assessment, alternatives and divestiture opportunities. Considering the fact that, decommissioning of offshore platforms presents a major liability to the operator, an accurate cost estimate must be prepared in order to minimize the cost of decommissioning operations. As every offshore platform is exclusive and to estimate the cost of decommissioning offshore platforms there are several considerations that must be taken into account. It requires a specific evaluation, risk and environmental assessment, and cost analysis for each offshore platforms to perform the accurate cost estimate. This would be a vast task to achieve. An approximate cost estimation of decommissioning offshore platforms can be prepared based on each step of the decommissioning offshore platforms process that calculated separately.

According to the Gebauer, et al., (2004), compilation of detailed and updated information on the offshore platforms is essential in developing the cost estimates of decommissioning offshore platforms. It includes the detailed such as water depth, depth of productive interval, number of wells, number and weight of conductors, number of modules and weight of platform decks, depth and weight of platform jacket, location and size of pipelines, and locations of power cables. All of these data predetermined the cost for each step of decommissioning process earlier. To obtain such detailed data, many analysis need to be done before the activity starts. Thus, the cost estimation of decommissioning did not attempt above mentioned approach. Instead, most of cost estimate prepared are only rough estimation based on several assumptions. According to Twomey (2010), the rough cost estimation can be prepared based on the available decommissioning data from previous decommissioning offshore platforms activity. To generate an approximate mean cost per tonne of the structure, the operator modified some of the worldwide decommissioning database. Hence, many major factors are negligible due to the vast task to have a proper and accurate cost estimate. Moreover, the operator lacks of studies on the specific cost specific cost estimation in the decommissioning world of offshore platform. Addition to the point, due to the unfavourable of the ocean environment, offshore decommissioning operation is identified to have more uncertainties and costly than onshore operation.

In decommissioning of offshore platforms at the area of Pacific Outer Continental Shelf (POCS), the decommissioning scenario assumes that the offshore platforms will be completely removed and the materials transported to shore will either recycling, refurbishment or disposal. Other assumptions that taken into account are such the method of reverse platforms using the HLV will be used to remove platform and about two to six offshore platforms will be decommissioned in a single project using HLV mobilized from nearest area such as Gulf of Mexico, North Sea or Asia. In addition, the pipelines and power cables are assumed left in place. A number of factors determined the time and cost to perform decommissioning activities. Basically only significant factors that describe the essential elements of the process are identified.

Jamieson (2013) outlined five key findings of the future decommissioning cost estimates for the North Sea offshore platforms. One of the key findings that the total weight of facilities removed contribute the high percentage of cost of decommissioning. The total cost is unrelated to the neither the location nor the water depth but it was by how much material will be decommissioned. Another important factor that he highlighted is the disconnection and removal of offshore platforms should be the main focus to minimize the cost. The removal method has influence on cost decommissioning for instance the cost for single lift of topsides much more economy than multi lift. Similarly in the Pacific OCS region, variation of other factors can influence the decommissioning cost. For instance the factors of location, complexity of the offshore platforms, water depth and weight of the structure removal method, transportation and disposal options. Although water depth and weight are key variables in determining the decommissioning costs for any particular activity, other factors may have significant impact on the decommissioning cost (Gebauer, et al., 2004). For instance, a well with deviation greater than 60 degrees will cost higher for the plugging and abandoning well compare to the well with no deviation.

According to Kaiser (2006), there are three main stages of decommissioning process that need to take into consideration in order to estimate the cost functions.

These three main stages comprise the process of well plugging and abandonment, platform removal, and site clearance. A detailed studied has made by the Prosev Offshore (2010) regarding the cost contributed in each of decommissioning process. Shown in the Figure 2.6 is the chart of breakdown categories of the decommissioning cost percentages prepared by this company. From the chart, it observes that the most contributed process of decommissioning offshore platforms is the platform removal which comprises the jacket and topsides removal then it followed by the mobilization/demobilization of derrick barge, well plugging and abandonment and conductor removal. Besides that, Oil & Gas UK (2012) identified the decommissioning market according to the different of decommissioning process. In the chart shown in the Figure 2.7 it can be seen that cost for the jacket and topside removal also the well plugging and abandonment cover about partial of the total decommissioning costs. From these three different sources of decommissioning cost studies, it concludes that the vital process in decommissioning offshore platforms that contribute about half of the total cost are in between the well plugging and abandonment stage up until the platform removal.

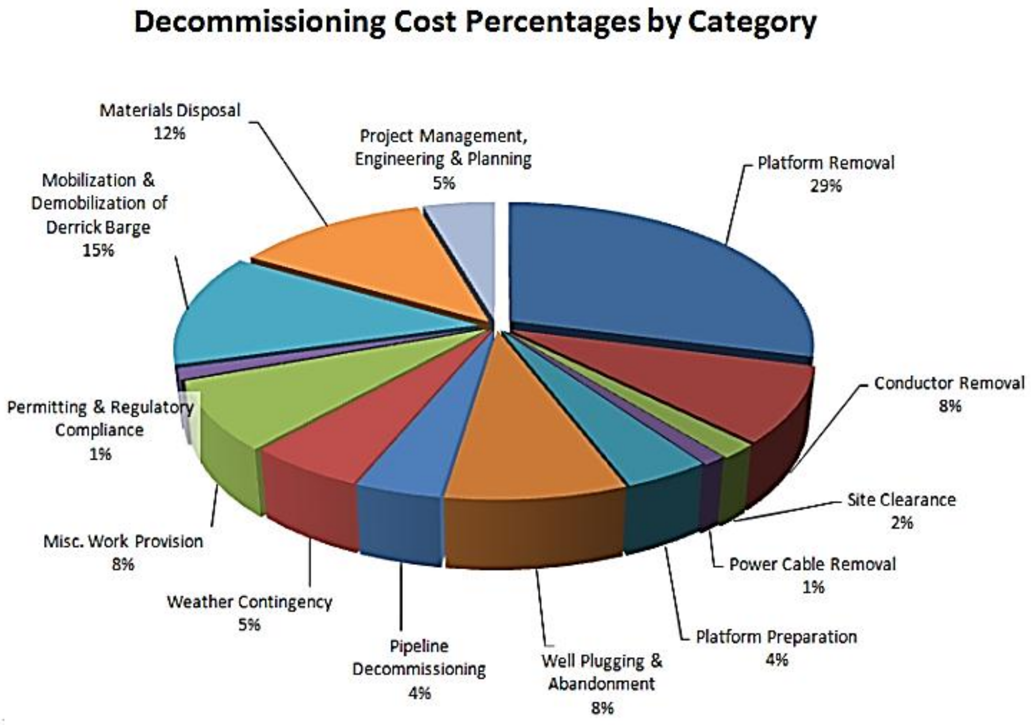

Figure 2. 6 Decommissioning Cost Percentages by Category (Proserve Offshore, 2010)

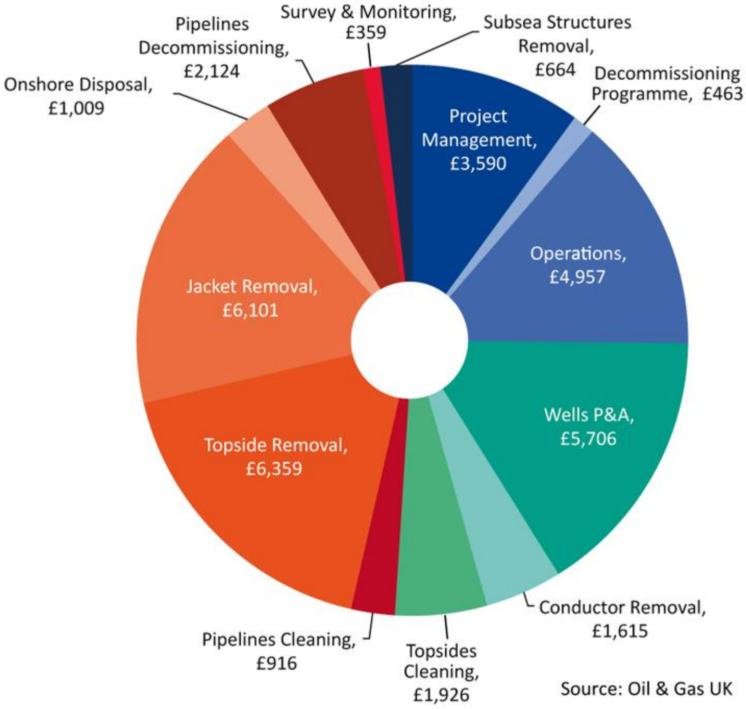

Figure 2. 7 Decommissioning Market by Activity (Oil & Gas UK, 2012)

Prior to the decommissioning process discussed, it shows that how the transportation seem to be the main attributes of the decommissioning process. According to the Proserv Offshore (2012), 15% from the total cost of decommissioning is covered by the cost of mobilization and demobilization of derrick barge and it ranks as the second important stage of the decommissioning process. Mobilization and demobilization costs cover the transit time required to bring a HLV to the project site and return the HLV to its point of origin (Gebauer, et al., 2004). It also includes the cost for other types of transportation such as diving support vessel, material barge, crane barges and trawling boat. Distance to shore is an important characteristic since it determines the time and cost for mobilization/demobilization, offloading and transport, and service cost (Kaiser, 2006). Throughout the lifting operation during the structural removal, a sequence of activities is identified to each discrete operation. Firstly, the HLV is mobilized to the site and anchored. The crane on the vessel is used to lift module to the cargo barge. There will be a few multi-support vessel and barge on stand-by if there any unpredictable incidents occur. After that, the barge is transported to the shore for next process. Finally, the HLV is demobilized from the site to its point of origin.

According to Razak (2012), decommissioning of offshore platform assumed to be merged into larger projects. Hence, the cost of HLV mobilization and demobilization could be shared. It is helpful to include activities such as transportation and mobilization/demobilization within each of the respective operations rather than collating them into separate operations (Curtis et al, 2001). Despite the fact that transportation is seen to be the important in cost estimation, however there is no specific study on the cost of transportation and lack of study on the factor that could change the cost of estimate that caused by the transportation.

On the other hand, one of the other factors affecting the cost estimate of decommissioning of offshore platform is the distance from the fabrication yard or origin of the vessels to the location of offshore platforms. The location where the job of clearance and verification of the seafloor is done influence the mobilization/demobilization. Eventually, it will affect the cost of the transportation for the trawling boat or vessel to arrive at the site. Water depth is often a primary variable in offshore construction activities since increasing water depth requires the size of the vessel to increase, reducing the operational flexibility and increasing the cost of the operation (Kaiser& Martin, 2008).

In a nut shell, it is regarded that the transportation is one of the most important aspects in most of the decommissioning stage. However, there is no such fixed measurement of the rate on inflation in the transportation industry in offshore especially in Malaysia. In this study, a unit transportation cost index needs to be established to help the engineer or financial accountant to compare how the costs, taken as whole, differ between geographical locations and time intervals. Moreover, the cost index can help in the decommissioning plans and cost estimation.

To measure the price associated with the group of commodities in absolute terms; only the price for one commodity can be measured in absolute terms (Sahu, 2013). In this statement, it concludes most of variable of economic are measured in absolute term and in this study which is transportation can be measured by the cost index to help in comparison of costs in differ geographical locations and time interval. According to Sahu (2013), there are three main cost indices that are widely used. Firstly is the consumer price index (CPI) which evaluates the average retail prices paid for the services. Secondly is the implicit price deflator, also known as gross domestic product (GDP) that includes the prices of all services in the calculation of the current output of services in the country. Lastly, the third measure of the inflation rate is producer price index (PPI). All of these three types of cost index, only one will be predetermined in order to the establishing of unit transportation cost index for offshore decommissioning. According to the Bureau of Labour Statistic (2011) by the United Stated of Department of Labour, the PPI measures the average changes in prices received by domestic producers for their output.

From the literature reading of decommissioning of offshore installation operations, it shows about more than 50% of the activities required transportation in order to execute the decommissioning. Hence, it shall be the major factor that influences the cost estimation in decommissioning of offshore installation as most of the project decommissioning provides the rough cost estimate by modifying the decommissioning available data from previous activities. Unit transportation cost index must be established to help the cost estimation for transportation vary with the geographical locations and time interval.

CHAPTER 3:

RESEARCH METHODOLOGY

3.1 INTRODUCTION

The main objective of this chapter is to describe the methodology used for this research paper. Main problem and objectives outlined in the first chapter of this report will be elaborated further in this chapter. The author starts with the research methodology and project activities involved in order to achieve the objectives stated earlier in this report. In addition, this chapter will elaborate the technique used to develop the unit transportation cost index. Lastly, the key milestone and Gantt chart are provided in the end of this chapter.

3.1.2 RESEARCH PROBLEM

Decommissioning offshore platforms would definitely exist as liability to the operator instead of asset. Therefore, it is important to plan the decommissioning beforehand to minimize the cost of decommissioning. Previous decommissioning activities in Malaysia did not attempt an accurate cost estimate due to the vast task such as specific evaluation, risk assessment and cost analysis. In addition, based on analysis made by the author, it is found that the percentage of transportation contributed in cost estimate is higher compared to manpower and equipment. Therefore, the goal of this research is to develop unit transportation cost index to help in the cost planning and to evaluate the trend of inflationary.

3.1.3 RESEARCH OBJECTIVES

The objectives of this study are:

a) *To evaluate relevant basis and assumption in cost index development*

There are few methods widely used in developing unit cost index. The most conventional used by the economist to develop are Laspeyres and Paasche. Both method are similar except that Paasche tend to underestimates inflation because it uses current period quantities. Hence, as the aim of this paper to study on the inflationary trend, thus Laspeyres index formula is used. The methodology will further explained in this chapter

b) *To develop site specific unit transportation cost index pertaining to the year of decommissioning offshore platform*

A series of unit transportation cost index is developed for five consecutive years; 2009, 2010, 2011, 2012 and 2013. Hence, transportation rate of selected marine vessels; derrick barge 1000MT, derrick barge 2000MT, and DSV were collected for five consecutive years to develop the unit transportation cost index. The Laspeyres index formula then was used to develop the unit transportation cost index.

c) *To establish rate of inflation for transportation pertaining to the year of decommissioning offshore platform*

In order to address the last objective of this paper, the inflationary trend of transportation rate for decommissioning offshore platform will be establish once the both objectives mentioned above is achieved. The trend of rate of inflation will be used to project the price level for the next year to ease the cost planning of decommissioning for offshore platforms.

3.2 RESEARCH METHODOLOGY AND PROJECT ACTIVITIES

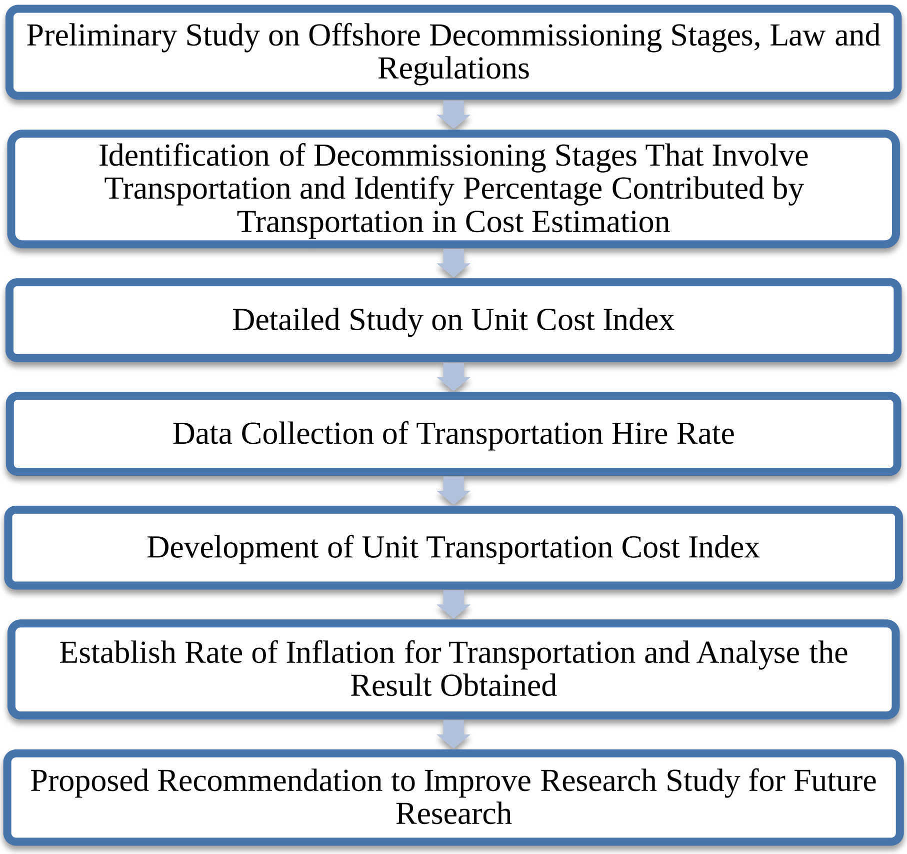

Figure 3. 1 Research Methodology in This Study

To accomplish the study on Unit Transportation Cost Index for Offshore Decommissioning, problem statements and objectives are predetermined at first. A logical sequence of methodology (Figure 3.1) is established to ensure the final result could be obtained in the given time frame. Before the author starts, a literature review on the decommissioning process, law and regulation and also the cost index is done in order to well understand the research study. Then, data is collected from and unit transportation index is calculated. A series of unit transportation cost index is used to establish the trend of inflation rate. In the end of this paper, the author recommend mitigation measure to improve the research study for future assessment.

3.3 LASPEYRES FORMULA TO DEVELOP UNIT COST INDEX

Many approaches can be done in order to compute the cost index. Major approach widely used by the economist are such Laspeyres index, Paasche index, Fisher Ideal index and Tornqvist index. Each of the method has different purposes. In this paper, the intention of developing unit transportation cost index is to answer on how the transportation sector would cost in the decommissioning offshore platforms for the next period relatively to the earlier period. In other words to study the trend of inflations toward the transportation for decommissioning offshore platform. Thus in this paper, the Laspeyres index method will be used in developing the cost index because it could estimate the inflation rate by assuming that the expenses is still distributed in the same way. In other words, it assume that the price level would be slightly similar to the previous price level. Whilst, the Paashce index tend to underestimates inflation.

Laspeyres Index is also known as a “base-weighted” or “fixed-weighted” index because the price increases are weighted by the quantities in the base period. It is commonly used in measuring the change in cost purchasing the same basket of goods and services in the current period as was purchased in specified base period (Statistics New Zealand, n.d). Following equations shows the Laspeyres index formula to understand further on how it can calculate to establish the result for this research study.

$$L_t = \frac{\sum_{j}^{n} p_{jt} q_{j0}}{\sum_{j}^{n} p_{j0} q_{j0}} \qquad \text{...} (1)$$

Where;

p_{jt} = price of goods/services in the current year
p_{j0} = price of goods/services in base year
q_{j0} = quantities of the goods/services in base year

3.4 INFLATIONARY

According to the website of Rate Inflation (2013) inflationary or in simple terms can be defined as the increase in price or the purchasing power of money. Practically, the economist calculate the inflation rate by recording the prices of goods or services over the years or simply known as cost index. The cost index on its own does not give the inflation rate but it can be used to calculate the inflation rate.

In earlier discussion, Laspeyres index formula is used in developing the unit transportation cost index due to its functional that can estimate the rate of inflation. Once the unit transportation cost index is calculated, the rate on inflation will be establish by take a base year and then determine the percentage rate changes of those prices over the years. The calculation of inflation rate between any two years can be simply place in the percentage rate change formula as show in the equation below.

$$\text{Inflation Rate}_{\text{F-I}} = \frac{F - I}{I} \times 100 \quad \text{...} \ (2)$$

The *F* is the value of index in the succeeding year and *I* is the value of index for the preceding year.

3.5 DATA SOURCES AND COLLECTION METHOD

The basic starting point for sampling for the establishment of cost index transportation in the decommissioning sector must has an individually designed and tailored sample. First of all, a frame that includes all the establishments classified in the offshore transportation of decommissioning is constructed in the selecting a sample. Due to limited data, rate of transportation for commissioning offshore platform is used.

After compiled the list of price forming units, the list may be stratified by variables appropriate for the transportation of offshore decommissioning. The criterion for identifying the sampling strata is whether price trends may be different for different values of a variable. The sampling strata for the transportation of decommissioning offshore platforms for instance the distance for mobilization/demobilization, capacity of derrick barge, number of days operation and equipment. Hence, the author has set the limitation of the sampling strata.

First, the types of transportation used to develop unit transportation cost index are Derrick barge and DSV. Then, this vessel is narrow down to only 1000MT and 2000MT of Derrick barge and 1600MT of DSV. Later, five consecutive of transportation hire rate is used to obtain the result. All of the data is obtained from the operator which is PETRONAS. Above data sources and collection method is taken from the conventional cost index development set by the Bureau of Labour Statistic (BLS). In this paper, the development of unit cost index will adapt this conventional method in order to get the result.

3.6 KEY MILESTONE AND GANTT CHART

Table 3. 1 Gantt chart and Key Milestone

		FYP 1														FYP 2														
No.	Activities Detail/Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	Selection of Project Title																													
2	Preliminary Research Work																													
3	-understand the project background																													
4	-problem identification																													
5	-establishment of objective																													
6	-literature review																													
7	Evaluate Methodology Cost Index Development																													
8	Submission of Extended Proposal						•																							
9	Further Research of Methodology Cost Index Development																													
10	Proposal Defence									•																				
11	Detailed Analysis on Transportation and Cost Index																													
12	Submission of Interim Draft Report													•																
13	Submission of Interim Report														•															
14	Evaluate the Appropriate Cost Index Development																													
15	Analysis of the Data Source																													
16	Calculation of Unit Transportation Cost Index																													
17	Result Analysis																													
18	Submission of Progress Report																						•							
19	Validity of the Unit Transportation Cost Index																													
20	Purpose Recommendation for Future Works																													
21	Pre-SEDEX																									•				
22	Submission of Draft Report																										•			
23	Submission of Dissertation (soft bound)																											•		
24	Submission of Technical Paper																											•		
25	Oral Presentation																												•	
26	Submission of Project Dissertation (hard bound)																													•

• *key milestone*

3.7 TOOLS REQUIRED

Table 3. 2 Software and Tools Required

SOFTWARE	DESCRIPTION
Microsoft Office (Word, Excel, PowerPoint)	For documentation and presentation purposes

Table 3.2 shows the software required at this point of preliminary research stage. Microsoft Office Word and Microsoft Office Excel are used for documentation and extended proposal writing while Microsoft Office PowerPoint Presentation is used for progress update during weekly meeting session and would be used to analyse the data collected.

3.8 SUMMARY

This chapter has presented the methodology used in this research. Research methodology and project activities were summarize in the Figure 3.1. Formula on developing unit transportation cost index were discussed in this chapter where the Laspeyres index formula is used. The methodology of establishing inflationary also was explained in this chapter. In addition, the data sources and collection of data was included. Lastly, this chapter also outlined key milestone, Gantt chart and tools required throughout the research study is conducted. From the methodology discussed in this chapter, the result and recommendation will be discussed and analyse in the following chapter.

CHAPTER 4:

RESULT AND DISCUSSION

4.1 INTRODUCTION

This chapter presents the rate of transportation for three different type of vessels together with the calculation of unit transportation cost index. The result will be further discussed and interpreted by developing and examined the trend of inflation rate of transportation. In the last clause of this chapter, the author illustrated the recommendations required to improve the finding of this research work.

4.2 DATA OBTAINED

Due to the limitation of data on rate of the transportation for decommissioning, as an alternative the rate of transportation for commissioning is used for this research purposes. Three type of marine vessels were considered to compare and develop the unit transportation cost index; Derrick Barge for 1000MT and 2000MT, and DSV. In order to develop the unit cost index, minimum of three consecutive year of transportation rate are needed. For this research paper, five years of transportation rate were obtained from the operator. The rate of these three marine vessels as summarized in the table below and the trend of transportation as per illustrated in Figure 4.1.

Table 4. 1 Transportation Hire Rate

Type of Transportation	**Criteria**	**Year**				
		2013 (RM mil)	**2012 (RM mil)**	**2011 (RM mil)**	**2010 (RM mil)**	**2009 (RM mil)**
Derrick Barge	1000MT	1.165	1.165	1.109	0.943	0.933
	2000MT	1.388	1.388	1.322	1.259	1.250
DSV	1600MT	0.732	0.732	0.697	0.664	0.578

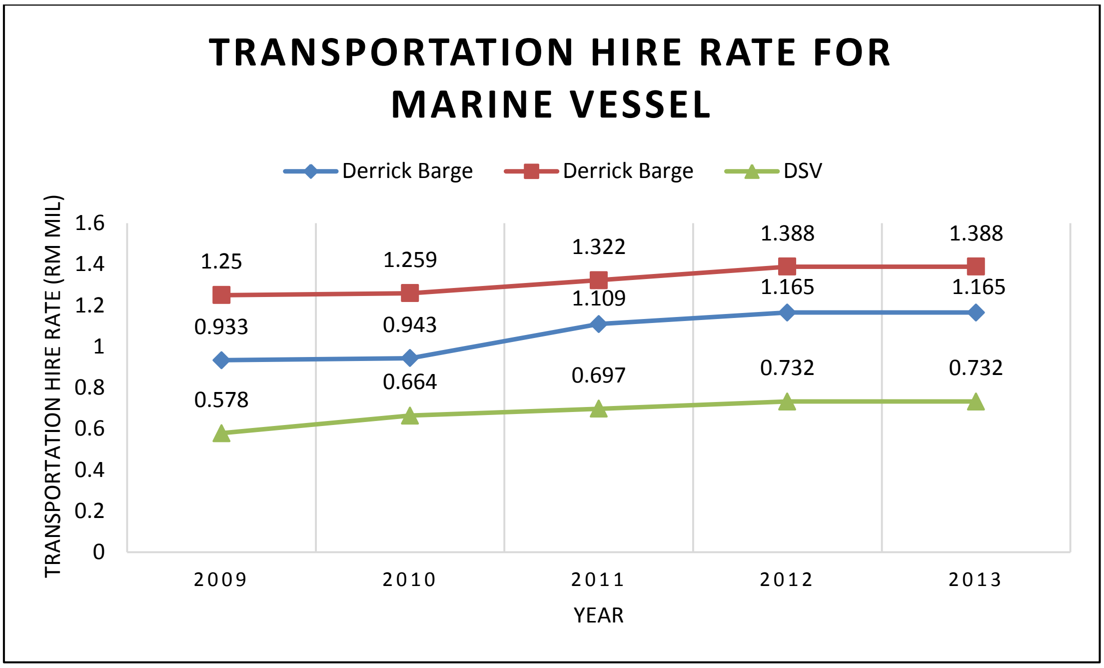

Figure 4. 1 Transportation Hire Rate for Marine Vessels

4.3 DEVELOPMENT OF UNIT TRANSPORTATION COST INDEX AND INFLATION RATE

For this study, unit transportation cost index for five respective years and trend of inflationary were established.

4.3.1 Laspeyres Index Calculation

Based on the data available, year 2009 served as the base year. Formally, the calculation is written as shown below;

$$L_t = \frac{\sum_{j}^{n} p_{jt} q_{j0}}{\sum_{j}^{n} p_{j0} q_{j0}}$$

The subscript "*j0*" and "*jt*" refers to the base year value and current year value of transportation, *j* respectively.

4.3.1.1 Calculate the Base Year Value of the Index

$$L_{\text{base year}} = \frac{\sum \{Q_{transportation}(2009) \times P_{transportation}(2009)\}}{\sum \{Q_{transportation}(2009) \times P_{transportation}(2009)\}}$$

$$L_{\text{base year}} = \frac{\sum \{1000 \times 0.933 + 2000 \times 1.250 + 1600 \times 0.578\}}{\sum \{1000 \times 0.933 + 2000 \times 1.250 + 1600 \times 0.578\}}$$

$$L_{\text{base year}} = \frac{4357.8}{4357.8}$$

$$L_{\text{base year}} = 1.00$$

The value is multiplied by 100. Thus, the base year value of the index will always be equal to 100.

$$\text{Index Value}_{\text{base year}} = 1.00 \times 100$$
$$= 100$$

4.3.1.2 Calculation of Index Value for the Subsequent Year

<u>Value index for 2010</u>

$$L_{2010} = \frac{\sum \left\{ Q_{transportation}(2010) \times P_{transportation}(2010) \right\}}{\sum \left\{ Q_{transportation}(2009) \times P_{transportation}(2009) \right\}}$$

$$L_{2010} = \frac{\sum \left\{ 1000 \times 0.943 + 2000 \times 1.259 + 1600 \times 0.664 \right\}}{\sum \left\{ 1000 \times 0.933 + 2000 \times 1.250 + 1600 \times 0.578 \right\}}$$

$$L_{2010} = \frac{4523.4}{4357.8}$$

$$L_{2010} = 1.03$$

The prices for 2010 have been substitute into the numerator. The quantities are fixed in the base year. The index value for 2010 as follows.

$$\text{Index Value }_{2010} = 1.03 \times 100$$
$$= 103$$

<u>Value index for 2011</u>

$$L_{2011} = \frac{\sum \left\{ Q_{transportation}(2011) \times P_{transportation}(2011) \right\}}{\sum \left\{ Q_{transportation}(2009) \times P_{transportation}(2009) \right\}}$$

$$L_{2011} = \frac{\sum \left\{ 1000 \times 1.109 + 2000 \times 1.322 + 1600 \times 0.697 \right\}}{\sum \left\{ 1000 \times 0.933 + 2000 \times 1.250 + 1600 \times 0.578 \right\}}$$

$$L_{2011} = \frac{4868.2}{4357.8}$$

$$L_{2011} = 1.12$$

$$\text{Index Value }_{2011} = 1.12 \times 100$$
$$= 112$$

Value index for 2012

$$L_{2012} = \frac{\sum \left\{ Q_{transportation}(2012) \times P_{transportation}(2012) \right\}}{\sum \left\{ Q_{transportation}(2009) \times P_{transportation}(2009) \right\}}$$

$$L_{2012} = \frac{\sum \left\{ 1000 \times 1.165 + 2000 \times 1.388 + 1600 \times 0.732 \right\}}{\sum \left\{ 1000 \times 0.933 + 2000 \times 1.250 + 1600 \times 0.578 \right\}}$$

$$L_{2012} = \frac{5112.2}{4357.8}$$

$$L_{2012} = 1.17$$

$$\text{Index Value}_{\ 2012} = 1.17 \times 100$$
$$= 117$$

Value index for 2013

$$L_{2013} = \frac{\sum \left\{ Q_{transportation}(2013) \times P_{transportation}(2013) \right\}}{\sum \left\{ Q_{transportation}(2009) \times P_{transportation}(2009) \right\}}$$

$$L_{2013} = \frac{\sum \left\{ 1000 \times 1.165 + 2000 \times 1.388 + 1600 \times 0.732 \right\}}{\sum \left\{ 1000 \times 0.933 + 2000 \times 1.250 + 1600 \times 0.578 \right\}}$$

$$L_{2013} = \frac{5112.2}{4357.8}$$

$$L_{2013} = 1.17$$

$$\text{Index Value}_{\ 2013} = 1.17 \times 100$$
$$= 117$$

4.3.2 Rate of Inflation

From the result obtained, the rate of inflation has been be established. To calculate the rate of inflation between any two years, simply calculate the percentage change between the index values. As shown in the calculation below, four inflation rate of transportation were established for 2009 to 2013.

$$\begin{aligned}
\text{Inflation Rate}_{2009\text{-}2010} &= \frac{103-100}{100}\times 100 \\
&= 3.00\% \\
\text{Inflation Rate}_{2010\text{-}2011} &= \frac{112-103}{103}\times 100 \\
&= 8.74\% \\
\text{Inflation Rate}_{2011\text{-}2012} &= \frac{117-112}{112}\times 100 \\
&= 4.46\% \\
\text{Inflation Rate}_{2012\text{-}2013} &= \frac{117-117}{117}\times 100 \\
&= 0\%
\end{aligned}$$

Summarized in the table below is the unit transportation cost index and the trend of inflation rate. The trend can be illustrated as shown in the Figure 4.2.

Table 4. 2 Index Value and Inflation Rate

Year	Index Value	Inflation Rate (%)
2009	100	-
2010	103	3.00
2011	112	8.74
2012	117	4.46
2013	117	0.00

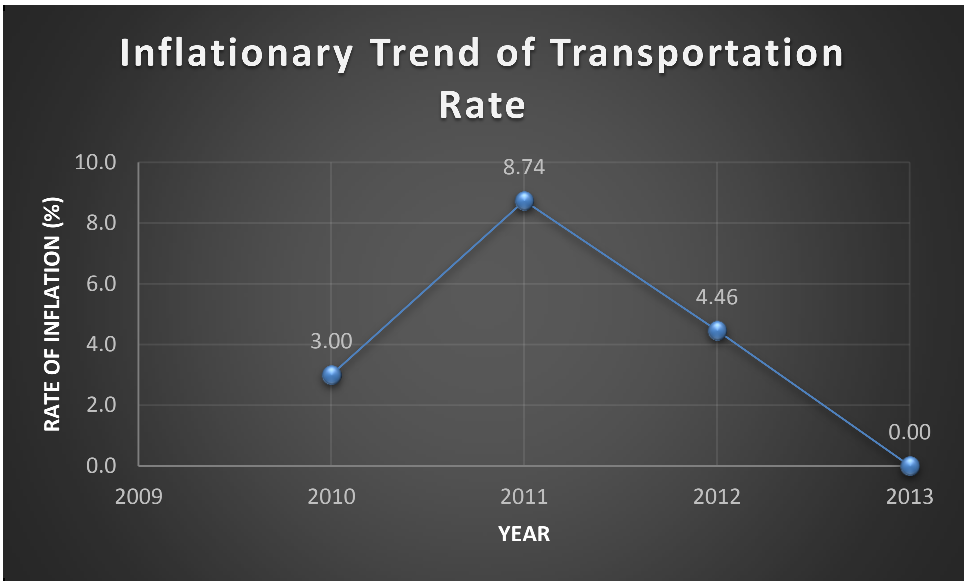

Figure 4. 2 Trend of Rate of Inflation (2009-2013)

4.4 DISCUSSION

Inflation is defined as a persistent increase in the general price level of goods and services in an economy over a period of time. It is called inflation when the price level increases from one year to the next. Note that, from the trend illustrated in Figure 4.2, inflation increased to highest rate from 2010 to 2011 and decreased between 2011 and 2012. However, during the year 2013, no inflation was observed as the rate of inflation drops to 0.00%. For 2009, no inflationary was calculated as it is used as base year in calculating the cost index.

Decreasing in rate of inflation also known as disinflation occurred due to the slowdown in the rate at which prices increase. Disinflation occurred in 2012 and it continues to disinflation until the inflation rate is zero at 2013. According to the economist, when disinflation continues there will be probability of deflationary period. Normally, it happened after a period of higher inflation. However, during disinflation the price level for transportation is still actually rising at slower rate than during low inflation even if prominent prices for instance oil and fuel are falling. Therefore, with the trend of inflation rate, the cost estimation can be determine accurately.

From the inflationary trend, the historical cost of transportation can be projected to estimate the possible cost for the next year. This can be done by averaging the available rate of inflation to obtain the escalation percentage. As shown in the calculation below is the percentage of escalation for the transportation hire rate. In the Table 4.3 summarize of the possible price level for transportation based on the escalation percentage obtained.

$$\text{Percentage Escalation} = \pm\left(\frac{3.00+8.74+4.46+0.00}{4}\right)\times 100$$
$$= \pm 4.05\%$$

Table 4. 3 Estimated Price Level of Transportation Rate for 2014

Type of Transportation	2013 (RM mil)	2014 (RM mil)	
		+4.05%	**-4.05%**
Derrick barge 1000MT	1.165	1.212	1.118
Derrick barge 2000MT	1.388	1.444	1.332
DSV	0.732	0.762	0.702

To validate the result obtained, the author compare the trend of rate of inflation with different country. As shown in the Figure 4.3, the trend of inflation for another two different country are same as the one established by the author. From observation of the chart, it shows that the rate of inflation increase from 2010 to 2011 and decrease gradually from 2011 and 2013.

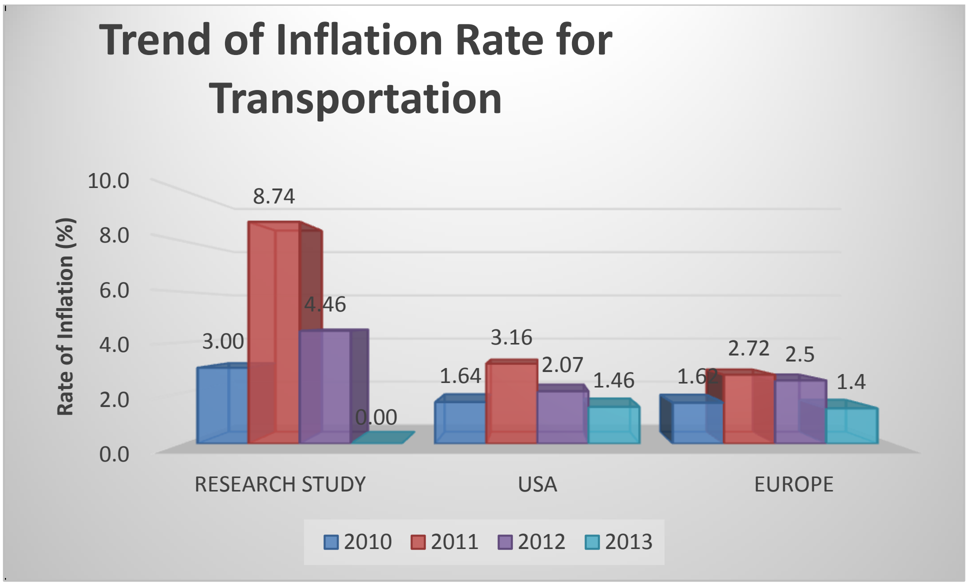

Figure 4. 3 Trend of Inflation Rate for Transportation

4.5 RECOMMENDATION ON INFLATIONARY TREND

The inflationary trend can be studied if the data available is sufficient enough. For instance, a series of cost index needed for more than five years to establish the inflationary trend and study how the price level can be escalated from previous rate of inflation. The prediction of inflation can be project to the subsequent year by used the method of moving average. As an example, the Figure 4.2 illustrate the rate of inflation of ten years for different types of commodity. From the observation, it shows the pattern of the graph is same for the time interval of January 1996 to July 1999 with the pattern of January 2002 to July2005. Therefore, the probability of the occurrence for the pattern to repeat is higher. Thus, it is important to study on the trend of inflation rate in order to project the price level of subsequent year. Consequently, it ease to estimate the cost for decommissioning.

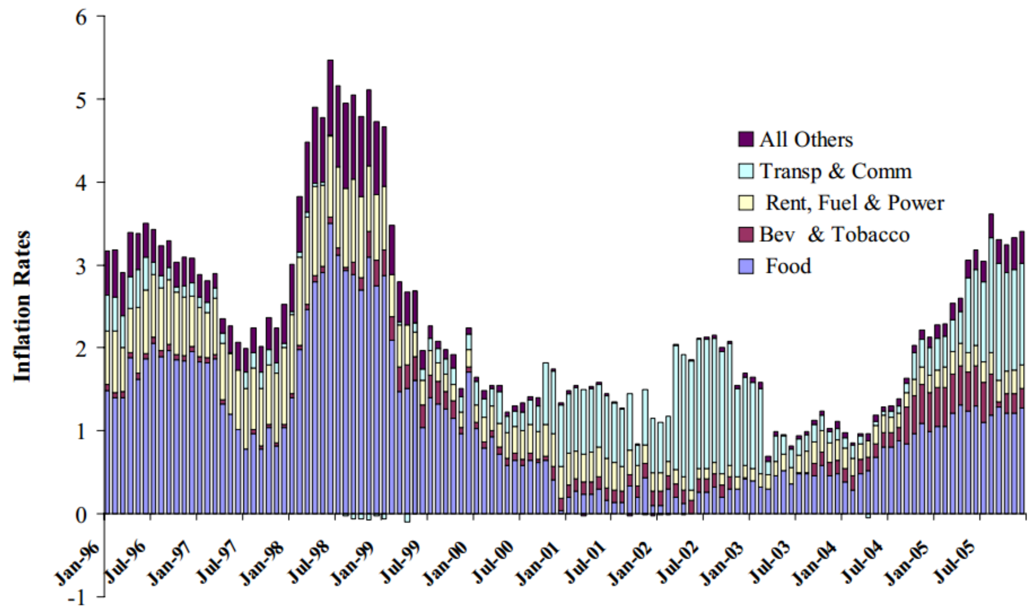

Figure 4. 4 Monthly Evaluation of Headline Inflation

4.6 SUMMARY

This chapter has presented the unit transportation cost index by using the Laspeyres index formula. Besides that, the inflationary trend was established based on the calculated cost index. In addition, the author recommend mitigation measures to improve the research study. Hence, the objectives of this research study has been achieved.

CHAPTER 5:

CONCLUSION

5.1 INTRODUCTION

This chapter presents conclusions of the research that includes recap problem statement, objectives, methodology and result obtained. At the end of this chapter, the recommendations for future research proposed by the author will be discussed.

5.2 CONCLUSIONS

Offshore installation is said to be liability instead of asset when the cost to operating the oil and gas facility exceed the revenue of the hydrocarbons production. Hence, there is responsibility to return the condition of the sea as it was before. In Malaysia, the number of platforms approaching to the end of their design life are gradually increase from year to year. Hence, it would be a huge task for the operator to start planning the decommissioning activity especially regarding to the cost planning. An accurate cost estimate must be ready beforehand. Preliminary study on the cost elements has been conducted and it shows that, transportation contributes the most in the cost of decommissioning.

For this research, the author aimed at developing site specific unit cost index for transportation in order to help in cost planning of the decommissioning activity. As per mentioned earlier, it is due to the fact that, the percentage contribution by the transportation in the cost of decommissioning is higher than the cost for manpower and equipment. With a series of cost index, the rate of inflation for the transportation has been computed based on the previous data. Laspeyres index formula was used throughout this research to establish the unit transportation cost index. From the result obtained, it shows that the disinflation occurred after 2011 to 2013. From the economic point of view when disinflation occur and continue until the inflation rate becomes zero, it can lead to a general decrease in price level. However, this is true due to the limited inflationary trend as in this research only five years of cost index is obtained. Therefore, with sufficient data of transportation rate, a trend of inflationary can be obtained and the price level can be predicted by projecting the previous inflationary trend.

In conclusion, all objectives of this study were achieved. The results obtained provided a trend of inflationary in order to project the price level in future. Due to the limited data available, the author has recommended a mitigation measure proposed in Chapter Four to improve the result. This research paper can be extended the whole platform for instance a development of cost index for overall decommissioning activity can be constructed.

5.2 RECOMMENDATION ON CORRELATION OF OTHER FACTORS

According to study made by Proserv Offshore (2010), compilation of information on inflationary trends related to offshore construction can be as based line to recommend or develop an appropriate index to apply to the decommissioning costs. For instance, the rates of marine vessels and overall offshore construction prices create a strong correlation. Hence, it is a good indicator of offshore construction prices used in developing inflation rate for decommissioning activities. Besides that, the transportation rate is always related to the price of fuel. Therefore, the inflation rate of oil need to be study in order to obtained an accurate result. A review of the various rates such as transportation rate, equipment rate and manpower rate can give a wide range of variation by category. From this variation, a detail study need to be done in order to relate an inflationary trend for decommissioning activities. Another suggestion is that, besides establishing a decommissioning cost index, a specific cost index can be establish for every cost element such as equipment, decommissioned steel, etc.

5.3 SUMMARY

This chapter has presented conclusion including recaps from previous chapters. The author examined the decommissioning cost element and identified the problems and defined the objectives of the research study. Unit transportation cost index was established and the trend of inflationary was developed. Analysis was made based on the result obtained and recommendation was proposed to improve the research study.

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