The Effect of Technology Transfer on Human Recourse Development in Oil and Gas Industry

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Abstract In this era of globalization, technology transfer is a vehicle for bridging the gap in knowledge, ideas and innovations from one part of the world to the other. Technology transfer cut across industries, organizations and governments. This paper examines the impact of technology transfer in the oil and gas sector of the Libyan economy between 1996-2010. This period was categorized into three epochs closed economy (1996-2001), transition economy (2002-2004) and open economy period (2005-2010). Both quantitative and qualitative approaches were adopted in investigating the impact technology transfer had on the general economy during this period. The quantitative approach involved the use of times series data of some key economic indicators in the oil and gas industry while the qualitative approach was based on focus group discussions and interview of some major stakeholders in the oil and gas industry. Special package for social science statistics (SPSS software) was used to analyze the quantitative data while NVivo9 software was used for analyzing the qualitative data. The findings of the study showed that technology transfer had both negative and positive impact on the oil and gas industry and some other sectors of the national economy during the three epochs. During the closed economy, production output and revenue generation from the sale of crude oil at the international market dropped. Government capital expenditure as revealed from the study was equally affected as a result of the drop in production output. Similarly, findings from the study revealed that there was a drop in the generation of power due to lack of spare parts and expansion of the existing plants. However, the positive impact was that local engineers and technicians were brought in to some key positions which hitherto were under the dominance of foreign expatriates. The positive and negative impact of technology transfer as revealed from the findings formed the basis upon which the study built a Bi-Dimensional impact theory (BDIT). The BDIT as propounded by study serves as a pivot upon which the impact of technology transfer could be assessed in any sphere of the national economy.

Keywords Technology Transfer, Human Resource Development, Oil and Gas Industry

1. Introduction

Libyan oil and gas industry is the life wire of the Afro-Arab economy. With the discovery of oil in 1959, the largely desert nation of sparsely populated human settlements depends on foreign technology to extract the natural resource for export and local consumption. Technologically, the industry is operated by subsidiaries of multinational companies and technology transfer licenses. The impact of technology transfer in the oil and gas sector on the national economy needs to be established for policy making and practice. Thus, transfer of knowledge has been a subject of considerable interest to researchers and policy makers due to the close relationship between knowledge transfer and economic growth.

The objective of this research is to measure the level of technology transfer during the era of closed and open economies[1]. It could be argued that foreign expatriates (technical operatives working in Libya) have prerequisite knowledge that they may transfer to the local technicians and engineers to enhance their skills. Western oriented technology and knowledge may not be transferred wholly to the context of a developing country like Libya. An example of such knowledge is the technical skills in oil exploration and production. The truth of the matter is mostly viewed from the perspective of their values and other factors that impact such policies including the government policy. Therefore, the main concern of this study is not what “ought” to happen but what “actually” happened in the Libyan oil companies[2]. The study focuses on the empirical evidence collected from Libyan oil companies. This research also addresses the appropriateness and effectiveness of knowledge transfer in the context of Libyan oil companies. This study adopts a mix qualitative approach to examine empirically evidence of knowledge transfer in seven arms of the Libyan oil and gas industry, by analysing the information collected from the case study[3]. The results of the study

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could indicate the effectiveness of knowledge transfer in this sector especially, the technical crew involved in production and exploration. Human resource practices appear to be transferable at the micro level; however, some adaptation of technical skill is necessary at the behavioural or micro level[4]. Most of the technology and knowledge in use in this sector, which originated from the West, have assisted in increasing oil output. The main issue which needs to be addressed in this research is the impact of technology transfer on human resource development.

2. Technology Transfer in Human Resource Development

2.1. Technology Transfer

Technology transfer is the process of sharing skills, knowledge, technologies, methods among governments and other institutions. This ensures that scientific and technological developments are accessible to a wider range of users, who can then further develop and exploit the technology into new products, processes, applications, materials or services[5]. Technology transfer is closely related to (and may arguably be considered a subset of) knowledge transfer. Oil and gas industry is globalizing its products and operations due to its sophistication and universal needs. On the other hand, technology brokers are people who discover how to bridge the disparate worlds and apply scientific concepts or processes to new situations or circumstances[6]. Related terms, used almost synonymously, include “technology valorisation” and “technology commercialization”. While, conceptually, the practice has been utilized for many years; (in ancient times, Archimedes was notable for applying science to practical problems)[7], whereas the present-day volume of research, combined with high-profile failures at Xerox PARC and elsewhere, has led to a focus on the process itself.

2.2. Transfer Process

Many companies, universities and governmental organizations now have an "Office of Technology Transfer" (also known as "Tech Transfer" or "TechXfer") dedicated to identifying research, which has potential commercial interest and strategies for how to exploit it[8]. For instance, a research result may be of scientific and commercial interest, but patents are normally only issued for practical processes; and so someone, not necessarily the researchers, must come up with a specific practical process. Another consideration is commercial value; for example, there are many ways to accomplish nuclear fusion, those of commercial value are the ones that generate more energy than they require operating.

Moreover, technology transfer offices may work on behalf of research institutions, governments and even large multi-nationals. Where start-ups and spinouts are the clients, commercial fees are sometimes waived in lieu of an equity stake in the business[9]. Because of the potential complexity of the technology transfer process, technology transfer organizations are often multidisciplinary, including economists, engineers, lawyers, marketers and scientists. The dynamics of the technology transfer process has attracted attention in its own right, and there are several dedicated societies and journals.

2.3. Transfer Instrument

When many people think of the oil and natural gas industry, they hardly think of “high-tech.” In fact, they probably think of an old-fashioned, dirty industry using technology from decades ago. Most people do not realize how outdated these images are[10]. The oil and gas industry has advanced in its operation long ago, and in fact, the industry is one of the few in the world where you never actually “see” the product from the well to the refinery and to the gas tank of your vehicle. Petroleum products are safely and efficiently produced and transported in a totally enclosed environment.

2.4. Human Resource Development

The most important interface in technology transfer is human resources; therefore, the key point in technology transfer is how to transform human resources into an idea of interface. The development of human resources in technology transfer could be conducted in two ways[11] (Hong, 994: 17-21):

i. From a macrocosmic point of view, the training is done through project-based learning;

ii. From a microcosmic point of view, the training is done through self-development.

Self-development is still indispensable to project-based learning. To conduct the technology transfer into technology exchange, the technology receiver has to organize a learning group to learn the ideas and methods of the technology provider. Without systematic learning, the receiver will find himself actually benefiting nothing from technology transfer. Generally, of the two ways of training, project-based learning is more systematic for training. This involves[12] (Hong, 1994):

i. Confrontation: At this stage, some people may reject new technology because the apparent shortcomings associated with the original technology.

ii. Problem Identification: The functions of the original technology are reviewed in terms of its effectiveness and efficiency.

iii. Design of new functions: The functions of the new system are either integrated into those of the original system or replaced.

iv. Simulation: The effectiveness of technology transfer is appraised, and the standards of similar technology are set.

Moreover, the trainees in technology transfer have a different task at each of the five stages. They must[13] (Hong, 1994):
i. Collect directly and indirectly relevant information (such as space requirements and supply of materials) and classify the collected information during the confrontation stage;

ii. Develop mechanical and applicable information during the problem identification stage;

iii. Arrange out the functions and operating logics of each part of new technology during the designing stage of new operating approaches of function;

iv. Make a structural analysis of the mechanism of the operation system during the simulation stage;

v. Stress the assembly and maintenance of the functions of the operating system, and examine the possibility of simplification during the evaluation stage.

From a microcosmic point of view, at each stage of technology transfer, the trainee can accomplish the transfer of “idea interface” only by self-development. In other words, each stage has its own approach and key points[14]:

3. Proposed Model/Framework

This part is concerned with the analytical framework which is the functional relationship existing between the "technology transfer" as the dependent variable and its economic and social variables as the explanatory variables. The multiple regression model is being adopted to describe how the dependent variable Y is related to the explanatory variables, x1, and an error term, e, as follows:

\[ Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_p x_p + \epsilon \]  

(1)

In which, 'Y' is a dependent variable and 'p' denotes the number of explanatory variables, \( x_1, x_2, x_3, \ldots x_p \) are explanatory variables, \( \beta_0, \beta_1, \beta_2, \ldots \beta_p \) are the parameters, and \( \epsilon \) is a random variable (error term)[15] (Anderson, Sweeney and Williams, 1999).

![Figure 1. Conceptual Model of Technology Transfer in Oil and Gas Sector](image)

4. Result

The human development index (HDI) as could be seen from the figures recorded negative percent increment from the beginning of the sanction until 2008 when it started appreciating a little bit. In fact, the highest increment of 3.38% was recorded in 2010. What this suggests therefore is that HDI during those years the nation was under sanction dropped.

<table>
<thead>
<tr>
<th>Year</th>
<th>HDI</th>
<th>% Increment</th>
</tr>
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<tbody>
<tr>
<td>1996</td>
<td>76.741</td>
<td>-</td>
</tr>
<tr>
<td>1997</td>
<td>77.408</td>
<td>-0.87</td>
</tr>
<tr>
<td>1998</td>
<td>78.075</td>
<td>-0.86</td>
</tr>
<tr>
<td>1999</td>
<td>78.742</td>
<td>-0.85</td>
</tr>
<tr>
<td>2000</td>
<td>79.409</td>
<td>-0.85</td>
</tr>
<tr>
<td>2001</td>
<td>77.8933</td>
<td>1.91</td>
</tr>
<tr>
<td>2002</td>
<td>79.8795</td>
<td>-2.55</td>
</tr>
<tr>
<td>2003</td>
<td>81.5919</td>
<td>-2.14</td>
</tr>
<tr>
<td>2004</td>
<td>82.7528</td>
<td>-1.42</td>
</tr>
<tr>
<td>2005</td>
<td>83.2132</td>
<td>-0.56</td>
</tr>
<tr>
<td>2006</td>
<td>85.2449</td>
<td>-2.44</td>
</tr>
<tr>
<td>2007</td>
<td>87.4225</td>
<td>-2.55</td>
</tr>
<tr>
<td>2008</td>
<td>85.7876</td>
<td>1.87</td>
</tr>
<tr>
<td>2009</td>
<td>84.9463</td>
<td>0.98</td>
</tr>
<tr>
<td>2010</td>
<td>82.0732</td>
<td>3.38</td>
</tr>
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Mean = 81.412009  Median = 81.591864  STD = 3.4103062

5. Conclusions and Future Work

In this paper, we have presented the effect of technology transfer in human development in oil and gas industries. The use of statistical model allows us to obtain good results in the analysing the effect of technology transfer in oil and gas industries to ease the process of transferring knowledge and expertise to local engineers. As future work; we will extend the research in order to obtain better result in the process of determining how technology transfer can effect human development

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REFERENCES


