

Drilling Rigs and Their Role in Logistics and Supply Chain Management (SCM) for Optimization of Drilling Industry through Reducing Waiting Time of Drilling Rigs

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Abstract— Performing the drilling operation and repairing the productive and injecting wells and implementing all associated technical services is one of the major components of exploration and production activities for oil and gas reservoirs in dry lands and continental shelf and it is the start point of oil industry and the key for winning the reservoirs and the most important link of upstream field chain of oil industry. The sparkle of drilling industry in Iran was the successive drilling of the first oil well in Masjed Soleyman. During about a century lifetime, this industry have been experienced various fluctuations including economic, political and social evolutions. Competitive based-oil industry is continually looking for cost reduction. Direct effect of oil market prosperity on drilling industry causes various challenges for it in the form of providing rig and its equipment, providing required materials for drilling operation, providing skillful personnel, capability of contractors for engineering services and finally, managing technical activities.

Index Terms— Drilling Rigs, Logistics, Supply Chain Management (SCM), Waiting Time, Oil Wells, Optimization, Drilling Operation, Repairing and Completion, Drilling Industry

1 INTRODUCTION

Although waiting time for drilling rig for logistics and Supply Chain Management (SCM) is a normal issue, reducing waiting time for logistics and Supply Chain Management (SCM) is inevitable necessity; since providing the drilling rigs is very costly for companies and increasing the waiting time for logistics and Supply Chain Management (SCM) should not be led to non-optimum operation of rigs [1-8].

The problems induced by human shortcomings and weaknesses can be solved by improving skillful personnel [9, 10]. In addition, client must minimize the transferring time of drilling equipment for logistics and Supply Chain Management (SCM) by accurate planning and engineering of drilling operation and at the other hand, the planning should be performed so that the companies which provide services would always be available as one of the affecting factors on waiting time of drilling equipment for logistics and Supply Chain Management (SCM) [11, 13, 15, and 17]. Contractor can reduce waiting time of drilling equipment for logistics and Supply Chain Management (SCM) by paying more attention to material and services affairs (which unfortunately, the waiting time for logistics and Supply Chain Management (SCM) related to these affairs are considerable) and repairing affairs [12]. Meanwhile, waiting time for logistics and Supply Chain Management (SCM) can be effectively reduced by using technology, espe-

cially in offshore drilling equipment [11-21].

Next to these factors, there are various issues that affect waiting time of drilling rigs for logistics and Supply Chain Management (SCM) such as clearing the geological ambiguities and simulating a reliable static model in order to optimize drilling plan, updating the drilling rigs, providing materials with good quality, improving the cooperation between client and contractor and paying more attention to selecting the contractors, general policies of Ministry of Oil and integrating the drilling operation [22, 23].

In this regard, waiting time of drilling rigs for logistics and Supply Chain Management (SCM) are defined and effective factors on waiting time for logistics and Supply Chain Management (SCM) are categorized into obvious and hidden times for logistics and Supply Chain Management (SCM) and the statistics related to waiting time of drilling rigs for logistics and Supply Chain Management (SCM) are presented for contractors (North Drilling National Company and National Iranian Drilling Company) and clients (National Iranian South Oil Company, Iranian Offshore Oil Company, and Iranian Central Oil Fields Company). Considering the mentioned statistics, it is possible to list waiting times of drilling rigs for logistics and Supply Chain Management (SCM) operated by National Iranian Drilling Company during 9 months of 2008, 2009 and 2010 categorized for clients, contractors and both, as shown in Figure (1) [1-14].

The most important effective factors on waiting time of drilling rigs for logistics and Supply Chain Management (SCM) categorized as obvious time are repairing, transferring and installation of rig, providing materials and etc. while the

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factors categorized as hidden time for logistics and Supply Chain Management (SCM) are inappropriate use of drill bit, lack of load application and optimum drill rotation for various geological structures, inappropriate use of additives for producing mud or cement and etc. All of these factors were defined in detail [24-37]. Now, the effects of above mentioned factors on the performance of clients and contractors of drilling operation are separately evaluated in order to analyze the effect of each factor on the time for logistics and Supply Chain Management (SCM) loss for rigs operated by National Iranian Drilling Company [38-53].

2 WAITING TIME OF DRILLING RIGS IN CONTRACTOR FOR LOGISTICS AND SUPPLY CHAIN MANAGEMENT (SCM)

In 2008, regarding the effect of each factor represented in Figure (1), waiting of contractor (National Iranian Drilling Company) is about 1.38 rig-years. Among the factors, the waiting times for logistics and Supply Chain Management (SCM) related to top drive, mud pump and material are the most important ones in creating the waiting time of contractor for logistics and Supply Chain Management (SCM) in the year. Waiting of contractor in 2009 is about 1.21 rig-years. In this year, jarring operation, wash pipe, stand pipe and draw-works are the most important effective factors on waiting times of contractor for logistics and Supply Chain Management (SCM). Figure (1) shows that in 2008 and 2009, distribution of effective factors on waiting times of drilling rigs for logistics and Supply Chain Management (SCM) are changed; so that in 2009, other waiting such as wrench, coiled tubing, Vrane and trailer are added and some parameters such as power source, mud pump and blowout preventer (BOP) are removed. Regarding the contribution of each effective factor on waiting of contractor in 2010, waiting time of active and under-operation drilling rigs for logistics and Supply Chain Management (SCM) is about 1.44 rig-years. Motor, top drive and mud pump (similar to 2008) are the most important effective factors on waiting time of drilling rigs for logistics and Supply Chain Management (SCM) in this year.

3 WAITING TIME OF DRILLING RIGS IN CLIENTS FOR LOGISTICS AND SUPPLY CHAIN MANAGEMENT (SCM)

Regarding the difference between working field of clients and contractors, the factors leading to time loss for logistics and Supply Chain Management (SCM) in various drilling operations sometimes have differences in these two different companies. Therefore, it seems that it is the best to separately evaluate the effective parameters on waiting times for logistics and Supply Chain Management (SCM) in clients. In 2008, waiting time of drilling rigs for logistics and Supply Chain Management (SCM) in clients (Iranian Central Oil Fields Company, National Iranian South Oil Company, Iranian Offshore Oil Company and Pars Oil and Gas Company) is about 1.6 rig-years. Among the factors, the waiting times for logistics and Supply Chain Management (SCM) related to provid-

ing mud material for barge, crane, planning issue, coiled tubing and fire line are the most important ones.

In 2009, waiting time for logistics and Supply Chain Management (SCM) related to on-time providing the budget, services providing companies, planning issue, down-hole motors and miscellaneous factors are the most important effective factors on waiting times of drilling for logistics and Supply Chain Management (SCM). In the year, the contributions of clients in waiting time of rigs for logistics and Supply Chain Management (SCM) are about 2.37 rig-years.

In 2010, waiting time of active and under-operation drilling rigs of National Iranian Drilling Company for logistics and Supply Chain Management (SCM) is about 2 rig-years for clients. Miscellaneous factors, logging services, down-hole motors and planning issue are the most important effective factors on time losses of drilling for logistics and Supply Chain Management (SCM) in the year. As can be seen in Figure (1), during 2008 to 2010, some factors such as planning issue and down-hole motors are among the important and repeated problems.

Considering these factors as well as effective factors on waiting times of drilling rigs for logistics and Supply Chain Management (SCM) in contractors, it is possible to summarize the obvious and hidden factors as case studies:

(a) Obvious Factors:

- 1- Possible events (improvement, pipe clogging, fishing to and washing out)
- 2- Waiting due to decision making in changing the plan
- 3- Waiting for materials
- 4- Repairing related to constituents of drilling equipment
- 5- Unexpected events related to drilling equipment during operation (such as fault and gas packet)
- 6- Natural disasters (flood, storm, earthquake, etc.)

(b) Hidden Factors:

- 1- Inferior consumer product
- 2- Lack of on-time reconstruction of drilling equipment
- 3- Lack of enough education and weakness in well and drilling equipment management

Generally, there are numerous steps such as well drilling, customary tests, cementation, well completion, well circulation process, logging, repairing, etc. Performing these steps finally lead to drilling of oil and gas wells. However, waiting times for logistics and Supply Chain Management (SCM) are arisen due to various reasons. To better understanding of the waiting times for logistics and Supply Chain Management (SCM) happened during various operations of oil and gas well drilling, a real example of the distribution of these times for logistics and Supply Chain Management (SCM) for a real sample well is represented in Figure (1). As can be seen, waiting time for logistics and Supply Chain Management (SCM) for this well is about 380 hours which is about 11% of total time for logistics and Supply Chain Management (SCM) consumed for well drilling; it seems to be considerable.



Fig. 1. Drilling rigs and their role in logistics and supply chain management (SCM) [1–14].

4 EFFECT OF WASTED TIME ON INCREASING THE COSTS OF DRILLING OPERATION FOR LOGISTICS AND SUPPLY CHAIN MANAGEMENT (SCM)

Generally, wasted times during drilling operation for logistics and Supply Chain Management (SCM) is one of the problems that arise during drilling of oil and gas wells and in other words, it is inevitable; however, it is necessary to minimize the wasted time for logistics and Supply Chain Management (SCM) as it increases the cost of operation. In this regard, it is better for more deep understanding about the losses induced by wasted time for logistics and Supply Chain Management (SCM) in drilling of oil and gas well to mention the effect of obvious and hidden factors on increasing the costs and waiting times of drilling equipment for logistics and Supply Chain Management (SCM) during drilling a sample well.

In a sample well, the average daily cost of drilling equipment is estimated at about 25000\$. The required time for logistics and Supply Chain Management (SCM) for drilling and completing the well is estimated at about 87 days while this is increases up to 142 days in real. Therefore, by subtracting the mentioned times, waiting time of drilling rig for logistics and Supply Chain Management (SCM) for the sample well is 55 days. The contributions of obvious and hidden waiting times for logistics and Supply Chain Management (SCM) are 16 and 39 days, respectively, which considering daily cost of rig, the additional cost induced by obvious and hidden waiting times for logistics and Supply Chain Management (SCM) is 1375000\$. This is shown the importance of waiting times of drilling rigs for logistics and Supply Chain Management (SCM) in imparting financial losses to the project.

5 CONCLUSION

The following results are obtained toward reducing the waiting times of drilling rigs for logistics and Supply Chain Management (SCM): Representing suitable drilling plans based on accurate geological-reservoir studies and planning for reducing hidden waiting times for logistics and Supply Chain Management (SCM). Trying for preventing or reducing human errors by on-time and effective education. Implementing the reconstruction plans of drilling equipment. On-time provid-

ing of material with high quality. Using new technologies for drilling equipment and the required operational and technical services. Learning for personnel in international scientific schools and passing technical courses and enhancing the qualitative level in various fields according to long time plans towards the improvement of drilling operation and reaching to the considered goals. Accurate and continuous periodic management of construction process and testing of the internal produced elements according to the international standards (intelligently support for national producers). Motivating the academic elites for to stay in the country and orienting them towards the qualitative and scientific improving of oil industry. Cooperating with credible international companies for using their technical and engineering experiences.

6 FUTURE STUDIES, STRATEGIES AND USEFUL SUGGESTIONS

Increasing the cooperation between applicant unit and contractor for transferring the experiences and improving the drilling operation. Codifying appropriate process for purchasing the ordered materials in companies who work in oil industry with supportive approach for national producers along with international ones. Accurate selecting of appropriate contractor for drilling operation and companies who are providing services by the client and careful supervising by the client. Logical and planned development of privatization process of active drilling companies.

7 SHORT BIOGRAPHY AND OUTLOOK

Capt. Hooshang Zamanifard is currently Master of Science (M.Sc.) student in Maritime Engineering-Transportation, Department of Maritime Engineering, Amirkabir University of Technology (Tehran Polytechnic), Bandarabbas Campus, Bandarabbas, Hormozgan Province, Iran. He received his B.Sc. degree in Nautical Science (Deck Officer) from Marine College of Oil Industry University, before eventually becoming a ship's pilot at the Iranian Offshore Oil Company (IOOC) in 1990 at the age of 28 years old. After 26 years career, which began as a junior pilot in oil terminals up to his present senior position (Assistant Harbor Master). Capt. Hooshang Zamanifard backed to university classroom, where he was accepted by a high level university through all over country M.Sc. entrance exam with the grade of 10th person among nearly over 60000 applicants. Along with his duty in IOOC, he is preparing (research) in Maritime Transportation, under subject of Supply Chain Management (SCM), focus on role of Mobile Offshore Drilling Unit (MODU) in Offshore Industry, for his M.Sc. thesis. It should be noted that he possesses two sons. Captain, is currently an official employee of National Iranian Oil Company and also M.Sc. student as well. He is interested to sport and also loves the dog; however he cannot keep a dog as he is living with his wife and family in a super luxury apartment in North of Tehran.



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