A WAY FORWARD FOR IMPLEMENTING JUST-IN-TIME TECHNIQUES WITHIN THE LIBYAN OIL AND GAS INDUSTRIES

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الملخص

تناولت هذه الورقة التحقق من مستوى التطبيق الفعلي لتقنيات الإنتاج الآني، أو ما يعرف أحيانا بالإنتاج في الوقت المحدد، في مجال الصناعة الليبية للنفط والغاز باعتبارها تقنيات تستخدم للضبط والتحكم في مجالات التصنيع، وتهدف الدراسة إلى اقتراح ما يلزم لإمكانية تنفيذ هذا النظام وبما يضمن النجاح والفعالية في مستوى أداء هذه الصناعة. اعتمدت هذه الدراسة على المسح الميداني باستخدام استمارة استبيان مركزة وعدد من المقابلات الشخصية.

تمثلت المساهمة العلمية لهذه الدراسة في تقديم فكرة من أرض الواقع على مدى فهم ودراية عينة هذه الدراسة لكافة التقنيات التي تم التطرق لها في هذا المسح الميداني. وبناءً على ما تم جمعه وتحليله من معلومات، خلصت النتائج إلى أن معظم الشركات الليبية العاملة في مجال صناعة النفط والغاز لا توجد بها الاستراتيجيات الواضحة تجاه كثير من المجالات التي اعتبرت ذات أهمية كبيره لنجاح تطبيق تقنيات الإنتاج الآني.

أشارت الدراسة أيضاً إلى مستوى القصور الواضح في كافة المجالات التي تم تخصيصها بهذا المسح الميداني، حيث إتضح بشكل جلي ما يجب على متخذي القرار في هذه الشركات أن يتخذوه من إجراءات سريعة إذا ما أرادوا الولوج في تطبيق هذه التقنيات بكل نجاح وفعالية. ولهذا يعتبر ما تم استخلاصه من نتائج خلال هذه الدراسة من الأهمية بمكان لأي نجاح مستقبلي للشركات العاملة في مجال النفط والغاز ولكافة الشركات الصناعية والإنتاجية بشكل عام.

ABSTRACT

This paper investigates the current implementation status of Just-In-Time (JIT) technique as a production planning and quality enhancement technique within the Libyan Oil and Gas industry, thereby suggesting a way forward for implementing a complete and effective JIT system within this industry. A survey methodology has been applied in this research using an intensive questionnaire and one-to-one interviews. It makes a contribution by providing an insight into what extent the JIT technique is understood and implemented within this surveyed industry. Based on the analysis, the results show that the management body within the surveyed industry does not have a clear strategy towards most of the areas that are considered as being crucial in any successful implementation of the JIT technique, in addition the implementation levels of the JIT technique was found to be at modest levels.

The paper also identified limitations within the investigated areas, and pointed to areas where the management body within the area of Libyan Oil and Gas industry should take immediate actions in order to achieve an effective and successful implementation of JIT systems within their companies. This is an important finding for the future success of the surveyed industry and for all the Libyan manufacturing and production companies in general.

KEYWORDS: Implementation Level; Libyan Oil and Gas Industry; Just-In-Time; Survey.

INTRODUCTION

Libya was relatively poor until the discovery of oil and natural gas during the 60's of the last centenary. Since then, the country has turned to industrialisation by engaging in petroleum processing. The other manufacturing industries in Libya are small, lightly capitalised, and devoted primarily to the processing of local agricultural products, textiles, building materials, and basic consumer items, and handicraft products, which include carpets and rugs, silver, glassware, and leather goods [1-3]. Libya is committed to develop its capabilities to produce goods that meet the quality requirements of the present local and global markets, which could be achieved through implementing the most appropriate technology available [4-6].

This situation forced many companies within the country to improve their performance to ensure good positions in both national and international marketplaces [7]. This desired goal could be achieved by continuously improving their processes and operations, reducing costs, and increasing the capacity of their outputs with a satisfactory and acceptable price. These challenges compelled these companies to change beyond the old traditional manufacturing planning and control systems, and implement a new way for operating their businesses operations towards continuous improvements, with a serious focus on the companies' internal and external customers [1, 8-10].

To achieve these aims, production and quality techniques such as JIT systems could be used as an effective production management system that can help companies provide a dramatic increase in customer satisfaction [11-13]. Many authors [1-2; 14-16] identify the top management as the most important factor in achieving a successful and effective implementation of related production and quality techniques such as JIT, where the full acceptance of these techniques by the senior managers is crucial to empower teams and individuals to overcome the barriers in the implementation processes throughout the entire company [17-18].

This paper investigates the current implementation status of the implementation levels of JIT techniques within the Oil and Gas industry in Libya, thereby, suggesting a way forward with the aim of improving its path on the road to achieving World Class Manufacturing (WCM) status.

AN OVERVIEW OF JIT

JIT is a management *pull* system, used for planning and controlling of operations that are carried out for producing and supplying the requested products and services at the right time are needed, at the right place, and at the exact desired quantities [1]. The

distinctive feature of JIT system is to eliminate all types of waste, which could be achieved by organising the entire activities throughout the productions' system [19-20]. JIT systems work continuously to improve the processes throughout the entire supply chain within the company [21].

JIT focuses on the complete elimination of waste, which is defined as anything that does not add any value to the services and products [9]. In addition, modern manufacturing and production companies consider the successful implementation of JIT system as a key factor for minimising inventory and maximising the quality of their products and services [22]. This could be achieved through setting well-organised networks for manufacturing and transporting the right ordered items exactly at the right time with the right quantities, establishing a long-term relationship with suppliers in order to maintain regulated shipments to minimise ordering cost, and to ensure enough amounts as needed to avoid paying holding costs [1, 15]. For all successful companies, certainly claiming to be WCM, the implementation of JIT techniques is essential to their success in the recent global competitive marketplace [1-3].

DATA COLLECTION

The data were collected through a developed survey questionnaire, which was pre-tested prior to its final distribution to targeted respondents. As a first step of distributing the questionnaire, a formal letter was sent to all the targeted companies, containing a general idea about the survey and its expected contribution in developing the Libyan Oil & Gas industry. Then a total of 100 hard copies were distributed to the targeted respondents. Each copy was accompanied with another letter from the author providing the reasons for conducting this survey. In addition, contact details were provided in a case of any inquiries or clarifications. Out of the 100 copies sent, a total of 62 copies were returned with the full-completed questionnaires, giving a response rate of 62%.

Complementary to the questionnaire survey, a couple of meetings were carried out between the author and senior managers working within the targeted companies. During these meetings, information related to the surveyed industry was provided and site visits to four correspondent companies were additionally carried out in order to gather more knowledge about the working environment within this industry.

DATA ANALYSIS AND DISCUSSION

As a first step of analysing the gathered data, a reliability test was conducted for the entire questionnaire. The calculated value of Cronbach's Alpha was found to be 0.86. According to Pallant [23], Alpha Coefficient of 0.70 or above is considered adequate for the reliability of the entire questionnaire. Therefore, in this study 0.86 gives strong evidence that the questionnaire responses were reliable.

The approximate total number of employees within the surveyed companies is summarised and illustrated on Figure (1). The figure shows that about 50% of the respondent companies have an approximate total number of more than 1000 employees. Although this industry should be highly automated, they are still running their business operations using a large number of work force. The analysis also shows that the size of the respondent companies based on their annual turnover are large with respect of their annual turnover of more than 10 Million Libyan Dinners.

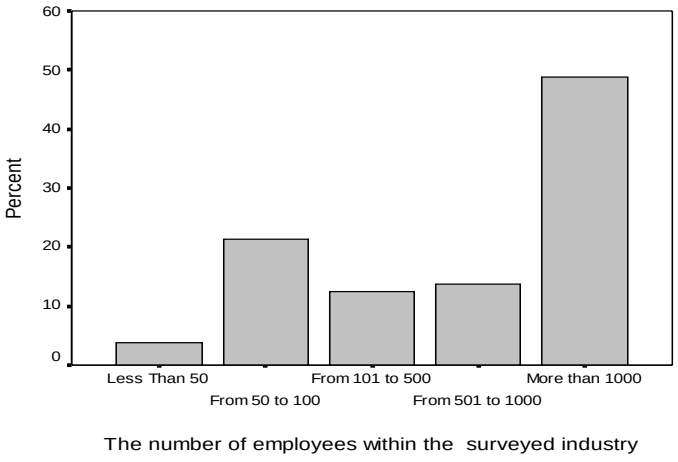

Figure 1: The approximate number of employees within the surveyed companies

The findings also show about 13% of the participants preferred not to mention their annual turnover. This result reflects the previous findings, which shows that the participant companies are large with respect to the number of their employees. However, in fact this result indicates that these companies are still depending on large number of the employees for running their businesses and not paying much attention on working towards moving to automation and or applying the latest automated machinery and computerised techniques.

The managerial level of the respondents is shown on Figure (2), showing that about 43% of the respondents are from the middle management level, and about 46% are from the lower management level. The directors and the general managers of the surveyed companies show a modest sign of participation for this survey. This poor situation could be a result of the heavy duties as this situation is very common within such managerial levels in Libya. It was clearly realised throughout the one-to-one interviews, which were carried out during this survey. Another reason may cause this situation is these top managers are depending on their middle and lower managers to cope with such things as they are more involved in their companies' strategic business operations and activities.

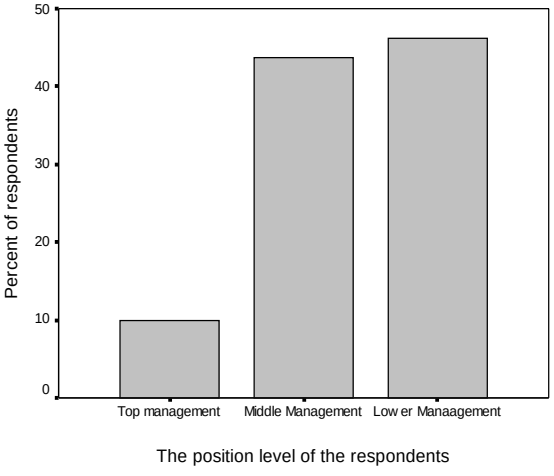

Figure 2: The managerial positions of the respondents

JIT IMPLEMENTATION LEVELS

A summary analysis of the implementation status of JIT techniques within the surveyed industry shows that about 72% of the surveyed companies did not show any sign of implementing the full JIT systems within their companies, whereas a range of about 28% from all the surveyed companies could not identify whether they had implemented JIT system or not, preferring to give an answer of *Do Not Know*.

Surprisingly, The Libyan Oil and Gas industry, which considered to be the largest industry in the country did not show any positive sign of implementing a full JIT system. These findings reflect problems and difficulties that the Libyan Oil and Gas industry are suffering from as reported on the World Report [24]. This report indicated that most of the Libyan industries are running with only 50% capacity utilisation, giving main reasons for that as the ageing of production lines, which are in need of renovation, replacement and maintenance. However, this survey has identified other additional factors, which are contributing to this low capacity utilisation.

REASONS FOR NOT IMPLEMENTING JIT PRACTICES

The reasons being pointed by the respondents as an obstacle for not implementing JIT techniques within the surveyed industry are shown in Table (1).

Table 1: The reasons for not implementing JIT system

Reasons for not implementing JIT practices	(%)
Lack of top management support	14
Lack of interest within the organisation	07
The implementation requires formal approval	21
JIT does not fit well with the company	16
The company is not familiar with JIT	42
JIT is too expensive to implement	00.0
JIT is too complex to implement	00.0

The table shows that the three most important reasons for not implementing JIT techniques as given by the respondents are: unfamiliarity with JIT practices with about 43% of respondents, lack of the top management support, and JIT does not fit well with their companies and the need for a formal approval for about 21% of the respondents. Surprisingly, there is no mention of either the cost or the complexity of implementing JIT techniques. One would have expected these two points to be raised as concerns for not implementing JIT techniques.

TOP MANAGEMENT'S COMMITMENTS TOWARDS JIT IMPLEMENTATION

The management commitments applied towards JIT implementation was investigated within all the surveyed companies. The analysed data is presented in Table (2), showing that apart from the commitment to increasing customer satisfaction, the commitments is very modest throughout the entire strategic levels, and not exceeding 22% at the most in holding clear visionary goals for JIT.

In general, the management commitment towards implementing JIT techniques is very poor within the oil and Gas industry as half of the investigated categories were found to be at *Zero* level. This result reflects the wide lack of knowledge about JIT techniques and other related issues throughout the entire strategic levels as a quite large per cent rate of the respondents could not indicate a straight answer either with positive or negative, preferring to answer with *Do Not Know*.

Table 2: The management's commitment towards implementing JIT

The category of the top management commitments	Commitment Levels (%)		
	Yes	No	Do Not Know
Committed to implementing JIT	06	22	72
Hold clear visionary goals for JIT	22	06	72
Shared vision of fulfilling total JIT implementation with all the employees	00	66	34
Developed a detailed implementation plan for JIT	00	50	50
Identified the necessary Champions for implementing the JIT programme	00	61	39
Ensured the necessary resources to implement JIT	11	38	51
Ensured a clear definition of JIT to all the employees	00	66	34
Committed to increase the customer satisfaction	66	00	34

Although 66% of the respondents indicated that their companies are committed to increasing customer satisfaction, it is very difficult to believe how that could be achieved successfully without full effective commitments from the management body to implement the JIT practices as well as all the other related issues, which definitely leads to effective implementation of JIT system and achieving all the desired benefits beyond this implementation.

THE CURRENT IMPLEMENTATION STATUS OF JIT KEY-ELEMENTS

Further investigation was applied to indicate the levels of implementing each of the JIT key elements. The findings is presented in Table 3, showing that majority of the surveyed companies are focussing on implementing preventative maintenance programmes, followed by 83% of the respondents classifying their companies as implementers of programmes to implement multifunctional skills training programmes. The companies pointed themselves as implementers of programmes for eliminating the waste are in the range of 72%, whereas the programmes for reducing set-up times are found to be with a mean value of about 50%. Apart from this, all the other investigated JIT key-elements are implemented in modest levels.

However, when investigating in details the extent of implementing these key-elements, the results showed that the implementations are in the range from *Low* to *Acceptable* levels. This indicates that even there is a modest implementation levels of some JIT elements; it is clear that these companies are practicing these key-elements without knowledge that they are belong to JIT system, reflecting the previous results.

Table 3: The implementation levels of the investigated JIT elements

Investigated JIT key element	Implementation status (%)		
	Yes	No	Do Not Know
Implemented any programmes to eliminate waste	72	12	16
Implemented any programmes for Continuous Improvement	06.	78	16
Implemented any programmes to reduce set-up times	50	22	27
Implemented any programmes for Group Technology	17	50.	33
Implemented levelled/mixed scheduling programmes	44	29	27
Used Kanban cards as a production control system	12	61	27
Implemented multifunctional skills training programmes	83	11	06
Implemented Total Quality Management programmes	38	44	18
Implemented any Quality Circle programmes	38	38	24
Implemented any Preventative Maintenance programmes	94	00	06

THE IMPLEMENTATION LEVELS OF EACH JIT KEY-ELEMENT

The implementation status of the JIT key elements was investigated in detail, and was broken down into sub-elements in order to investigate the actual implementation status of each of these key-elements. The calculated mean values of all these sub-elements within the surveyed industry are shown in Tables (4 to 13). Table (4) shows the extent of the implementation levels of eliminating the waste within the surveyed companies.

Table 4: Extent of the implementation status of eliminating the waste (Scale 0 to 6)

The company implemented any programmes to eliminate the waste	Mean Value
Eliminated the waste due to over production	2.61
Eliminated the waste by reducing the queues and the waiting times	**3.72**
Planned and controlled the operations avoiding any extra operations	2.61
Eliminated the waste due to delay of materials before processing	3.44
Eliminated the waste due to unnecessary transportation and conveyance of materials	2.72
Eliminated the waste by reducing the inventory materials	2.78
Eliminated the waste by producing ZERO defects	2.44
Eliminated the waste due to proper utilisation of the employees	2.94
Overall mean	***2.91***

It is found that the category of eliminated the waste by reducing queues and waiting times shows the highest mean value with 3.72 (from a maximum of 6). The overall mean of the extent implementation of eliminating the waste has a mean value of 2.91, which indicates to a *low* implementation level of this key-element within this industry

Table 5: The extent of the implementation status of the QC

The company implemented any Quality Circle programmes	Mean Value
The employees have the decision-making authority to stop the production line	1.72
The employees been organised into self-directed teams	1.94
The employees been able to identify their operations' problems	**2.67**
The employees suggested improvement programmes	2.61
The employees participated in decision-making process	1.78
The employees met to discuss their common problems	1.94
Overall mean	***2.11***

The extent of the implementation levels of the Quality Circle (QC) programmes is shown in Table 5. The table shows that the highest average mean value is for the category of the employees been able to identify their operations' problems, which has a mean value of 2.67.

Beyond this basic point of knowledge, there is an aspect of QC which has been implemented, indicating an overall mean of implementing all the sub-elements of the QC programmes by 2.11, which also stands at the *low* level.

Table 6: The extent of the implementation status of the continuous improvement programmes

The company implemented any programmes for Continuous Improvement	Mean Value
The top management responded to the feedback from the employees on JIT	1.44
Ensuring training programmes for the management body on JIT	1.94
Ensuring training programmes to the administrative staff on JIT	1.83
Designing the training programmes considering the variety of the employees' learning needs	2.83
Ensuring training programming to the machine operators	3.67
Carrying out research and development to improve the products	2.61
Encouraging a continuous improvement culture within the working environment	2.83
Focusing on the requirements of their customers in designing your products and services	3.28
Using team-based approaches to problem solving	2.89
The programmes been implemented in the Marketing function	2.28
The programmes been implemented in the Design function	2.33
The programmes been implemented in the Production/Manufacturing function	3.22
The programmes been implemented in the Purchasing function	2.89
The programmes been implemented in the Finance function	3.00
The programmes been implemented in the Production Shop Floor function	2.11
The programmes been implemented in the Materials Handling Control function	2.94
The programmes been implemented in the Quality Control function	3.44
The programmes been implemented in the Preventative Maintenance function	3.83
The programmes been implemented in the Shipping function	3.17
Overall mean	***2.76***

Table (6), summarised the data of the implementation extent of implementing programmes for continuous improvement within the surveyed companies. The findings show an overall mean value of 2.76, which indicates a low implementation level, giving its highest level at implementing preventative maintenance function programmes, which stands at the Acceptable level with an average value of 3.83. The extent of the levels of implementing multi-skilled training programmes is also investigated and the findings are summarised in Table (7).

Table 7: the extent of the implementation status of the multifunctional skills training programmes

The company implemented a multifunctional skills training programme	Mean Value
The employees receive cross-training programmes	4.11
The employees qualified to perform several different tasks	3.78
The employees qualified to train and/or be trained for their duties	3.72
The employees able to rework the non-conforming items by their own	3.78
The employees inspect the produced items	3.94
The employees maintain the inventory and production control	4.17
The employees qualified to set-up their equipment and tools	4.44
The employees able to execute the minor maintenance needed for their equipment and machines	4.61
Overall mean	***3.99***

The table shows an overall mean value of 3.99 (out of 6), which gives an indication that this implementation extent is within the *Acceptable* level. In addition, it shows that all the sub-elements do not differ much from each other in their implementation extent as most of them stand at the *Acceptable* range.

The highest mean value is in the category of the employees are able to execute the minor maintenance needed for their equipment and machines, which has the average mean of 4.61. This mean value indicates a high level of implementing the multi-skilled training programmes within this industry.

The programmes implemented to reduce the set-up times have been investigated in order to assess the extent of this implementation. The results are summarised in Table (8). The table indicates low implementation levels of reducing the set-up times within the surveyed companies. The overall mean value of the investigated sub-elements is 2.85, which stands at its highest level for training the operators to handle and monitor items and materials with a mean value of 3.61, which is still at a low level of implementation.

Table (9) shows the findings from investigating the extent implementation levels of the Group Technology (GT) programmes. It shows no sign of implementation of this key-element within this industry as the overall mean stands at the none implementation level with a mean value of 1.35. The results show the highest value of 1.94 within the category of familiarity with the product flow analysis, which is at the Very Low implementation level. This is to be expected from the mass production industry such as Oil and Gas, and the non-implementation of GT here should not be taken as a negative point.

Table 8: The extent of the implementation status of reducing the set-up times programmes

The company implemented any programmes to reduce set-up times	Mean Value
All the employees trained for set-up time reduction process	2.28
The employees trained to perform the set-up of their machines on time	3.39
The operators trained for mounting and handling items and materials	3.44
The operators trained to use the set-up tools	3.61
The operators trained to understand and use the set-up drawings	3.39
The operators have sufficient knowledge about their machines set-ups	3.50
The operators have enough skills in improving set-up times	3.11
The set-up time reduction programmes involving a multifunctional team approach	2.78
The relevant teams aware of clear definition of the set-up times	3.00
The relevant teams aware of the distinction between internal and external set-up activities	2.72
The teams converted the internal activities to external ones by re-examining their true functions	1.89
The teams changed as many internal activities to external activities as possible	1.83
The teams actually performed the external activities as external activities	2.94
The teams videotape the changeover and review for opportunities for improvements	2.72
The teams reduce the time needed to perform internal activities by using quick disconnects	2.17
Overall mean	***2.85***

Table 9: The extent of the implementation status of the GT programmes

The company implemented any programmes for Group Technology	Mean Value
The company is familiar with Group Technology/JIT Cells	1.06
The company is familiar with OPITZ system	1.11
The company is familiar with Product Flow Analysis	**1.94**
The company is familiar with Part Families Concept	1.33
The company formed Part Families	1.17
The company formed JIT cells based on Part Families	1.28
The company groups the similar parts within one place to use same facilities	1.61
Overall mean	***1.35***

The levelled/mixed scheduling programmes as a key element of JIT system has been investigated in detail and the findings are shown in Table (10). The table shows an overall mean value of 3.14, which stands at an *Acceptable* implementation levels whereas using the electronic data exchange system between all the departments stands at the lowest implementation levels with a mean value of 1.67. Again very low values indicating that the management body within this industry has a long way to achieving JIT production and quality control system.

The results of investigating the implementation levels of Kanban cards/signals as a production control system are shown in Table (10). The table shows very low implementation levels of the Kanban programmes. The overall mean value is 1.90. The highest mean value of the investigated sub-elements is 2.44 for the category of suppliers are allowed to supply the materials directly to the workstations. This result is reflected by the findings shown in Table (10), as both Levelled/Mixed Scheduling and Kanban are inter-related.

Table 10: The extent of the implementation status of the levelled/mixed scheduling programmes

The company implemented levelled/mixed scheduling programmes	Mean Value
The company schedules production plan to produce the same amount of products on a daily basis	3.28
The company schedules production plan to produce regular variety of products on a daily basis	3.22
The company schedules production plan according to the delivery time	3.67
The company considers the cycle time while scheduling your production plan	3.61
The company modifies the production schedule regularly	3.44
The total production of all products varies more than 15% on a day-to-day basis	1.67
The company uses electronic data exchange between all the departments	3.06
Overall mean	***3.14***

Table 11: The extent of the implementation status of using Kanban as a production control system

The company used Kanban cards/signals as a production control system	Mean Value
The company controls the supply of the materials between the workstations by supplying exactly the needed amount of materials	2.17
The operators rely on Kanban as a source of information for production and transportation	1.50
The company uses containers attached with kanban to transfer the items between workstations	1.39
The company produces exactly the quantity of production that is ordered	2.11
The company uses Kanban system in ordering and delivering the materials	1.33
The suppliers allowed to supply the materials directly to the workstations	2.44
The flow of materials completely controlled by the demand side	2.33
Overall mean	***1.90***

The implementation status of the preventative maintenance programmes stands at, surprisingly, *High levels* with an overall mean of 4.78. The summarised results are shown in Table (12). The table also shows a highest mean value of 5.22 when investigating the extent of scheduling the planned preventative maintenance programmes by the involved managers. The results continued in this table are encouraging, pointing to the fact that when a sub-element of JIT system has been focused upon, it has been done to *High* levels.

Finally, Table (13) shows the detailed investigation results of the implementation levels of the TQM programmes within the investigated industry. It shows no sign of implementation of TQM within the surveyed industry. The category, which has been implemented with a mean value of 2.00 (*Low Level*), is the implementation of the ISO9000 systems or equivalent.

Table 12: The extent of the implementation level of the preventative maintenance

The company implemented any preventative maintenance programmes	Mean Value
The company has any Preventative Maintenance System	4.61
The company keeps records of preventative maintenance schedules	5.17
The company schedules the planned preventative maintenance	5.22
The preventative maintenance activities scheduled with the main production programme	4.83
The managers track preventative maintenance programmes	5.00
The maintenance department take the needed actions on time	4.72
The company keeps records of individuals performing major overhauls	4.67
The operators trained by preventative maintenance people	4.11
The company keeps records of breakdown frequencies	4.72
The company keeps records of the repair times	4.50
Overall mean	***4.78***

Table 13: The extent of the implementation level of the TQM programmes

The company implemented Total Quality Management programmes	Mean Value
Implemented any of ISO9000 systems or equivalent	2.00
Implemented Statistical Process Control (SPC)	1.00
Implemented Quality Function Deployment (QFD)	0.71
Implemented Failure Mode and Effect Analysis (FMEA)	0.83
Implemented Experimentation (Taguchi) methods	0.83
Overall mean	***1.07***

CONCLUSIONS

This study investigates the implementation status of the JIT techniques within the Libyan Oil & Gas industry. It makes a contribution by providing an insight into what extent this technique being implemented within this industry. The commitments as well as the emphasis levels of the management body within this industry were widely investigated in order to demonstrate the actual status of the applied strategies. On the basis of the survey analysis and the response from the related senior managers, the shortcoming and limitations throughout the applied policies were clearly identified, showing that the implementation levels of JIT techniques within the Oil & Gas industry in Libya is still modest and in most cases in very low levels.

In addition, the paper has identified some problems and difficulties that the decision-makers within the industrial environment might face towards implementing JIT systems. The senior management body within the surveyed industry should pay more attention through applying a clear strategy towards most of the areas that are considered as being crucial in any successful implementation of the JIT techniques. So, to successfully implement JIT system within the Libyan Oil & Gas industry, the first and most important task would be to educate the top managers on the benefits of JIT systems. Only then should other implementation tasks be considered.

Furthermore, an increased attention should be paid towards generating improved management commitments in JIT implementation process, and taking the full responsibility to encourage all the involved individuals to take part in the task. Generally, the training and ongoing education programmes are essential to achieve an effective implementation of JIT systems and should be provided to all the related parts and departments at all levels throughout the entire companies. Ensuring high levels of understanding of the whole JIT implementation process to all the involved teams certainly will lead to a complete implementation of JIT as a manufacturing and quality planning & control system, thereby moving the Libyan Oil & Gas industry towards WCM levels.

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