Hama Kareem et al., *Cogent Engineering* (2017), 4: 1386853
https://doi.org/10.1080/23311916.2017.1386853

cogent engineering

PRODUCTION & MANUFACTURING | RESEARCH ARTICLE

Critical issues in lean manufacturing programs: A case study in Kurdish iron & steel factories

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Received: 07 August 2017
Accepted: 26 September 2017
First Published: 05 October 2017

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Reviewing editor:
Tao Peng, Zhejiang University, China

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Abstract: The main idea of lean manufacturing is actually simple and means relentlessly work on eliminating waste from the manufacturing process. However, after implementing these systems, many organizations find it difficult to achieve the desired results of them. Thus, the lean manufacturing remains an important area of research. For the importance of what was presented, this paper tries to investigate the critical issues affecting the success of implementing lean manufacturing programs in the iron and steel factories in the Kurdistan Region of Iraq. To achieve this end, the mixed methods represented in a questionnaire survey and semi-structured interviews to collect the data in the framework of the case study were chosen. The questionnaire instrument already has been tested. The results of the study revealed that the importance of management commitment and allocate resources, ethical train the workforce and ethical instructions as the critical success issues of lean implementation. Based on the findings, the organization managements are recommended to provide financial and moral support to employees to enable a successful implementation of lean manufacturing aimed at obtaining the desired results of them.

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PUBLIC INTEREST STATEMENT

The main idea of lean manufacturing is actually simple and means working relentlessly on eliminating waste from the manufacturing process. Therefore, this paper tried to investigate the critical issues affecting the success of implementing lean manufacturing programs in the iron and steel industries. However, the findings of the study revealed that in addition to reducing the waste as a result of the proper implementation of the lean manufacturing, the implementation of these systems, in turn, can also play a great role in improving uptime of operating equipment toward the positive dynamic of many business issues in business organizations such as enhancing customer satisfaction due to production schedules ready from customer shipment commitments as well as decreased quantitative safety risks and the costly heath losses.

Subjects: Industrial Engineering & Manufacturing; Production Systems; Manufacturing Engineering; Engineering Productivity; Business, Management and Accounting; Industry & Industrial Studies

Keywords: critical success issues; lean manufacturing; Kurdistan/Iraq

1. Introduction

With today's global economy, the changing circumstances and the growing demands on the part of the customers, increased pace of competition and organizations' ability to innovate and improve have made most industrial organizations think about improving their financial situation by improving their profits without increasing the sale price of their products. This can only be done by minimizing the manufacturing cost of products by increasing the productivity and reducing losses during production (Habib, Wang, & Bejhem, 2008). Therefore, the industrial organizations realized the need for proper use (efficient and effective) of resources for each production facility and systems in a way that overcomes the manufacturing obstacles (Nachiappan & Anantharaman, 2006). Thus, these organizations tried to adopt several strategies to confront this challenge, including the lean manufacturing strategy (Bayat & Dadashzadeh, 2017).

Lean is a combined set of principles, practices, tools, and techniques with an aim to improve quality, delivery, cost, and customer satisfaction by eliminating three main sources of loss: variability, waste, and inflexibility (Drew, McCallum, & Roggenhofer, 2016). Further, lean is a continuous improvement philosophy which is synonymous with Kaizen or the Toyota Production System (Dennis, 2016). The history of lean management or lean manufacturing is traced back to the early years of Toyota and the development of the Toyota Production System after Japan's defeat in WWII, when the company was looking for a means to compete with the US car industry by developing and implementing a range of low-cost improvements within their business (Black, 2008). In brief, lean management seeks to implement business processes that achieve high quality, safety and worker morale, whilst reducing cost and shortening lead times. This in itself is not unique to Japan. What sets lean management apart, and makes it particularly effective, is that it has at its core a laser-sharp focus on the elimination of all waste from all processes (Graupp & Wrona, 2016; Rich, Bateman, Esain, Massey, & Samuel, 2006).

However, Hoyte and Greenwood (2007) stated that the continuing increase in demand for adopting lean strategies is difficult, acknowledging the fact that lean implementation may fail. Thus, most business organizations need to examine and evaluate the role of a series of critical issues in successfully implementing lean manufacturing, which is a major task in any process or program implementation. Although many researchers such as (Bayat & Dadashzadeh, 2017; Laureani & Antony, 2012; Wickramasinghe & Wickramasinghe, 2011; Worley & Doolen, 2014) have pointed out that many issues play an important role in the implementation of lean manufacturing, most of these issues that the researchers focused on concerned organizational issues and their role in the implementation of lean manufacturing. Nevertheless, the current study highlighted the other set of critical issues which can play an effective role in the proper implementation of lean manufacturing at the business organizations, including the factories working in the field of iron and steel industry in the Kurdistan region of Iraq. These issues will be investigated in deep detail in the literature review section along with the proposed hypothesis.

2. Regional background & characteristics of the Kurdish iron & steel factories

In 2003, the Iraqi central government and the Kurdistan regional government launched a broad program of reconstruction and development for all sectors in the region to improve the economic situation and living conditions after the fall of the previous regime. This program needed huge amounts of structural materials, particularly the iron (Al Moussawi & Al Jubouri, 2012), which made the iron and steel industry one of the strategic industries due to its relationship with the direct developmental process undertaken in industrial, agricultural and construction sectors (Mohammed, 2006). In addition to the fact that the iron and steel industry in the region has several advantages

that help in their development and the most important of them: abundant oil and natural gas in large quantities, which is the most important sources of energy. As well as, providing the capital necessary for the development and establishment of such industries in the region, and also the abundance of the assistance raw materials, like limestone (Hamoudi, 2011). Accordingly, all these advantages led to the improvement of iron and steel industry in Iraq in general and in the Kurdistan region in particular.

In the light of the preceding overview, the current study tackled two iron & steel plants in Kurdistan region of Iraq. The names of these factories will not be mentioned in the current study based on the request of the human resources department of these plants. Thus, the first factory is located 7 kilometres from the Bazian area and approximately 40 kilometres west of Sulaymaniyah, which occupies the second biggest city of the Kurdistan region in Iraq. This plant is constructed on an area of one million m^2 with a with a production capacity of 1.25 million tons of finished products (iron and steel) at the beginnings of 2014. While the second plant is situated thirty kilometres from the east of Sulaimaniyah. It is constructed on an area of Seven hundred thousand m^2 with a production capacity of 1 million tons of finished products (iron and steel) at the beginning of 2010. What is more, these two factories belong to the private sector and implement lean manufacturing program in their production processes. They also share broadly similar characteristics in terms of operating in a continuous production mode based on mass production. Moreover, they produce specific types of iron and steel exemplified by: (1) Reinforcement steel such as (High tensile steel & Mild Steel) which is usually used in the construction of residential projects. (2) Ductile cast iron in form of pipes, which is used for drinking water and sewage lines and oil well pumps. (3) Steel such as Mild steel used in general purpose engineering material like (nuts, bolts, and screws) (4) High Carbon Steel used in cutting tools, and ball bearings as well as stainless steel which is used in cutlery and kitchen equipment.

3. Literature review and hypothesis development

The concept of lean manufacturing originated in Japan after the Second World War, when the Japanese manufacturers were faced with vast shortages of material, financial support, and human resources and they realized they could not afford the huge investment required to build facilities similar to those in the United States (Saleeshya, Raghuram, & Vamsi, 2012; Womack & Jones, 2010; Womack, Jones, & Roos, 1990). This concept, originally developed by Toyota, evolved as Toyota Production System (TPS) being a model for companies looking to eliminate or reduce wastes (Fujimoto, 1999; Pavnaskar, Gershenson, & Jambekar, 2003; Ward & Sobek II, 2014) by focusing on pinpointing the major sources of waste and then using tools such as JIT, production smoothing, setup reduction and others to eliminate the waste (Abdulmalek & Rajgopal, 2007; Weiss, Jackson, English, & Stevenson, 2017). The term Lean Manufacturing was coined by the research team of Massachusetts Institute of Technology (MIT) that studied the Japanese automotive industries and compared them with other country's automotive manufacturing performance in the late 1980's and the early 1990's (Begam, Swamynathan, & Sekkizhar, 2014; Bourque, 2013). The results of the study, published as a book, "The Machine that changed the world" (Womack et al., 1990), revealed that the industries implementing LM concepts had superior productivity, quality and responsiveness. It is now widely recognized that organizations that master lean manufacturing methods have significant cost and quality advantages over those that still practice traditional mass production (Forbes & Ahmed, 2010).

The goal of lean manufacturing is to minimize waste in human effort, inventory, time to market and manufacturing space to become highly responsive to customer demand while producing world class products of the most efficient and economical model (Dennis, 2016; Seth & Gupta, 2005). The benefits of lean manufacturing are evident in factories across the world. The industrial firms report improved product quality, reductions in cycle time, reduced work in progress, improved on-time deliveries, improved net income, decreased costs, improved utilization of labour, reduction in inventories, quicker return on inventory investment, higher levels of production, increased flexibility, improved space utilization, reduction in tool investment, a better utilization of machinery stronger job focus and better skills enhancement (Panizzolo, Garengo, Sharma, & Gore, 2012; Pavnaskar et al., 2003; Shah & Ward, 2003).

Thus, in the pursuit of manufacturing perfection, organizations had to apply the lean, a journey that is never ending, but full of rewards (Teeuwen, 2010). With the decision of an organization to initiate the lean process comes the challenge of bringing about the change in the thought process of their employees and environmental culture (Poksinska, 2010). This is because lean is a way of working towards the elimination of waste, thus a transition of behaviour and methodology that may be deeply rooted within an organization is required. When an organization chooses to go lean, it also stirs the entire system (Pandey, 2015).

According to Al-Balushi et al. (2014), lean is a process reengineering philosophy composed of strategic guiding principles and a set of tools at the operational level. Lean is a system which requires less time, less human effort, less cost, less space, resulting in fewer injuries and fewer mistakes, enabling an organization to accomplish more by doing these things better. Dorota Rymaszewska (2014) stated that lean is to be understood as a management system which brings the best results in a long-term perspective. As in the short term, too strong profit orientation may be demonstrated. What is more, lean approach does not have to be efficient in all its applications. Further, Karim and Arif-Uz-Zaman (2013) point out that the lean process is an integrated socio-technical system whose main objective is to eliminate waste by concurrently reducing or minimizing supplier, customer and internal variability. Lean philosophy seeks to reduce waste anywhere in the company, optimize core resources and establish a corporate culture dedicated to identifying and continuously fostering customer satisfaction.

Bayat and Dadashzadeh (2017) referred that the introducing lean manufacturing in any type of industry has a straightforward impact on manufacturing processes. Today, people have a different perspective on manufacturing processes. They understand that the value of a product is defined from the customer's point of view, not from an internal manufacturing point of view. Lean manufacturing focuses on the elimination of wastes from the organization. Waste is defined as anything that does not add value to the product. On the other hand, Hoyte and Greenwood (2007) argued that the continuing increase in demand for adopting lean strategies is difficult, acknowledging the fact that lean implementation may fail. In the light of the above discussion, once the level of implementation of lean manufacturing is successfully pursued by the business organizations, including the business organizations in Iraq, especially those working in the field of iron and steel industry in the Kurdistan region of Iraq, they will eventually gain fruitful results to improve their competitiveness and financial situation. However, these organizations need to take into account the role of many critical issues to meet a successful implementation of lean manufacturing, including the issues that addressed in the current study represented in: autonomy and empowerment, ethical training programs, ethical instructions and commands and management commitment and allocate resources.

As for autonomy and empowerment, in successful organizations, both management and employees need to be in harmony by developing an environment of trust and cooperation. The improvement process must be recognized as benefiting both the company and the employees. The ultimate responsibility for success or failure in achieving the desired goals rests with the management. Employees can accept the concept of teamwork, cooperation and empowerment if management provides leadership, security of employment and reasonable compensation (Ahuja, 2009; Robinson & Ginder, 1995). Thus, researchers (Haddad & Jaaron, 2012; Robinson & Ginder, 1995) highlight that the major roadblock in successful implementation of lean manufacturing that lead to improvement in production effectiveness is the reluctance of management to empower employees. Ahuja and Khamba (2008) also share the same viewpoint that the rigid bureaucratic structures of the organizations are impeding empowerment of the employees.

Similarly, many researchers are of the view that employees are the major cornerstone in the implementation of modern systems (lean manufacturing systems) that could enhance the efficiency of an organization and its competitiveness, and without their involvement in the process of the implementation, these techniques would be rendered ineffective (Ahuja & Khamba, 2008; Haroun & Duffuaa, 2009; Rolfsen & Langeland, 2012). Thus, all of this means that employee empowerment

and involvement in the implementation process are crucial and management needs to understand this fact if they want to reap the benefits of successful implementation of these systems (lean manufacturing systems); on the other hand, the lack of employee involvement in the overall implementation can lead either to their failure or partial implementation of these systems (Suzuki, 1994). Based on the above discussion, the following hypothesis has been formulated.

H1: Autonomy/empowerment would have a strong role in implementing lean manufacturing programs.

Panneerselvam (2012) highlights the role of correct training and ethics in effective functioning of the functional departments of an organization and overall improvements in the results through the provision of correct information and their development. He is of the view that to meet the changing requirements, it is necessary to provide correct training and necessary instructions to employees. He further stresses that the training requirements of the employees are to be determined and managed by the top management of the organization. Similar views have also been expressed by Robinson and Ginder (1995) who also highlight the role of correct training and retraining of employees with a view to developing their knowledge and information for successful implementation of the tasks of the lean manufacturing.

Therefore, it requires awareness and follow-up in training programs by officials to determine if the information provided to the employees is correct and sufficient for the purpose of implementing of tasks assigned to them as required for achieving the desired results. However, Sims (1992) has highlighted that the lack of follow up in the training programs is the ethical dilemma faced by many organizations. Furthermore, Hayes and Pisano (1994) note that the low awareness and follow-up in ethical training programs leads to negative consequences for the organization. Similar views have also been expressed by many researchers, that partial or unsuccessful implementation of techniques of lean manufacturing is caused by employees' resistance, lack of training and ethical education and lack of follow up by the officials in the organization (Maier, Milling, & Hasenpusch, 1998; McKone, Schroeder, & Cua, 2001; Westphal, Gulati, & Shortell, 1997). The purpose behind training and retraining of employees is to develop multi skills that could help them work more diligently, enthusiastically, independently and responsibly (Enaghani, Arashpour, & Karimi, 2009; Paropate, Jachak, & Hatwalne, 2011; Venkatesh, 2007). This requires officials to closely monitor and follow-up on the training programs that help to improve the organizational capabilities by enhancing the problem solving skills of its employees and enabling learning across various functional areas (McKone et al., 2001). This helps employees' to identify the root causes of a problem that could help them solve it without delaying and stopping production (Sahu, Batham, & Bangar, 2012). The above discussion leads us to the following hypothesis.

H2: Ethical training programs would have a strong role in implementing lean manufacturing programs.

The third issue which is important in the successful implementation of lean manufacturing in organizations is ethical instructions and commands. Sometimes employees are subject to the pressures of work, including pressure from some managers in the organization, that can be represented in the control of the managers on the behaviour and performance of employees, which would have a negative effect on the efficiency of the implementing lean manufacturing systems, as employees are asked to do certain tasks that are not according to the training they are provided (Kumar, Kumar Soni, & Agnihotri, 2014). This, in turn, can lead employees to work under the laws, regulations and instructions issued by some of the officials according to that commensurate with their personal interests in the organization, which in turn makes the employee carry a load he/she cannot avoid or escape (Idris, 2001; Wagel, 1990). Consequently, employee performance for tasks would be unseemly and unethical, thus reflecting negatively on the success of organizations to achieve the desired goals (Kumar et al., 2014).

Trevino and Nelson (2010) further confirm some of the immoral positions in the organization, when some of the employees are subjected to the pressures of the so-called ethical instructions and commands at work. For example, an employee may be asked to purchase items or equipment based on manager's quick approval without going into the details of whether or not the equipment or item is necessary for the organization. Situations such as these can put the employee in a difficult position, which can be exposed either directly or indirectly, and that, in turn, could put the employee under pressure of his immediate supervisor, which can cost him stability of his job or profession in the future (Cooper, 2001).

Therefore, many researchers confirm that for the successful implementation of lean manufacturing for improving the level of productivity and attaining competitive advantage, organizations should: (1) Issue rules and instructions and standardized procedures, and all employees should abide by them literally and ethically during their performance of the tasks entrusted to them. (2) Fight wrong behaviors, which can be established by many immoral attitudes in the organization (Aspinwall & Elgharib, 2013; Kumar et al., 2014; Rolfsen & Langeland, 2012). The above discussion leads us to the following hypothesis.

H3: Ethical instructions and commands would have a strong role in implementing lean manufacturing programs.

The last issue that is also important in the appropriate implementation of lean manufacturing in organizations includes management commitment and resource allocation. It is beyond question that practitioners think that managerial commitment is the most important success factor irrespective of differences in plant size, corporation, location and other factors (Bayat & Dadashzadeh, 2017). But it is not enough to just "lead from the office;" the managers must also participate personally on the shop floor. This involves ongoing communication, listening to suggestions and questions from employees, and explaining why lean means change for the better (Punnakitikashem, Buavaraporn, & Chen, 2013).

Allocating the necessary resources to assist implementation of lean manufacturing is also critical for success. It is difficult for organizations to turn lean without coaching and supporting local "lean team," or a distributed task force in the organisation. It is also necessary to dedicate a budget for the transformation (Radnor & Bucci, 2011; Sayer & Williams, 2012). Reward and recognition schemes can be effective in the early stages, but managers should take care when designing reward and recognition schemes because the effects of such schemes seem particularly sensitive to differences in cultural traits (Bayat & Dadashzadeh, 2017). Based on the above discussion following hypothesis has been formulated.

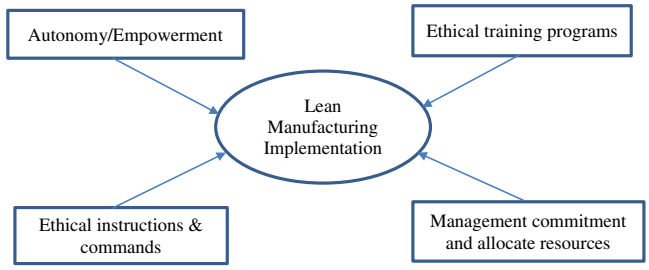
H4: Management commitment and allocate resources would have a strong role in implementing lean manufacturing programs.

4. Methodology of study

The present study is descriptive in nature, aiming to explore the role of a set of critical issues in the proper implementation of lean manufacturing in the field of the iron and steel industry, which has not been studied in any previous researches. In light of the foregoing, the study model Figure 1 was as follows.

Based on the sampling table provided by Krejcie and Morgan (1970), the sample size for a population of 847 is 265 respondents in two iron and steel plants under study in Kurdistan region/Iraq. Thus, based on strata and proportional representation condition of stratified sampling, the sample for each iron and steel factory was 147 and 119, respectively. It is worth noting that the names of these factories will not be mentioned in the current study. This is at the request of the human resources department of these plants, which in turn supplied the researchers the number of the participants (Population). These participants included various grades.

Figure 1. Study model.



Research design helps the researcher to operationalize variables, collect and analyse data and find a solution to the problem of research (Sekaran & Bougie, 2016). As noted earlier, the current study aimed to explore and understand the role of the set of the critical issues in the proper implementation of lean manufacturing in two iron and steel plants in Kurdistan region/Iraq. Therefore, a mix method approach using both quantitative and qualitative methods (survey questionnaire and interviews concurrently) to collect data within the case study framework was selected, which would help in making the results more valid and reliable. The pilot study was conducted to check the validity and reliability of the survey questionnaire.

A self-administered questionnaire was designed for the study. The questionnaire consisted of three sections. Section one comprised of items measuring critical issues. There were twelve items measuring four dimensions of critical issues, which are: autonomy/empowerment (manager-subordinate relationship); ethical training programs, ethical instructions and commands and management commitment and allocate resources. The items measuring the four dimensions have been taken from the studies of Wickramasinghe and Wickramasinghe (2011), Laureani and Antony (2012), Punnakitikashem et al. (2013), Worley and Doolen (2014) and Bayat and Dadashzadeh (2017) and these items have been measured on a 5-point Likert scale using level of agreement or disagreement.

The second section of the questionnaire consisted of items measuring the implementation of lean manufacturing in terms of the safety of the work environment and ease of access to the necessary equipment and the procedures of disposing wastes and employee sufficiency and their training, and other items that can reflect the perceptions of the employees regarding the implementation of lean manufacturing in their factories. These dimensions have been measured through twelve items taken from the studies of Rich et al. (2006), Black (2008), Sayer and Williams (2012), Worley and Doolen (2014), Dennis (2016) and Bayat and Dadashzadeh (2017). These items were also rated on a 5-point Likert scale using level of agreement or disagreement. The third section of this survey comprised the demographic details of the respondents like gender, age, fieldwork experience and education level.

The data collected was analyzed using factor analysis for validity and reliability. Once reliability and validity were ascertained, Pearson correlation was determined to find out the association of the variables of the study. For investigating the impact, multiple regression analysis was done. Before applying regression analysis, assumptions pertaining to regression were satisfied. The reliability of the instrument was found to be 0.854 (critical issues) and for implementation of lean manufacturing (0.793). Reliability using Cronbach's alpha indicated that the instrument was reliable as all the alpha values were found to be above 0.70. The factor analysis indicated that the instrument was valid as all the items were found to have more than 0.40 factor loadings and were retained.

Initially, the survey questionnaires were distributed through the human resource department of each selected factory. For final data collection, permission was taken from each of the respective factory through personal visitations. The managers of the human resources departments of the two plants facilitated the survey data collection. Survey questionnaires were distributed to the sample of 265 respondents using proportional sampling method under stratified sampling technique. The questionnaires collected reached 221; however, 18 questionnaires were not properly filled, thereby

they were discarded. Thus, the final sample that was taken into consideration for data analysis was 203, indicating a response rate of 76.6%.

Moreover, the semi-structured interviews along with the survey questionnaire were conducted in the current study for the purpose of obtaining a clearer understanding of the role of the set of critical issues addressed in the current study in terms of the proper implementation of lean manufacturing in the field of the iron and steel industry. These interviews helped the researcher to have more in-depth knowledge and information about the implementation of lean manufacturing, as well as the role that could be played by the set of critical issues in the implementation of these techniques in the selected iron and steel factories. The researcher focused on the middle management of three departments (Production, Maintenance, and Human resources) of the selected iron and steel factories. The respondents for semi-structured interviews were selected through purposive sampling technique. The criteria chosen for selecting the interview respondents in the iron and steel factories under study were as follows:

- Position as a head of the department in factory,
- Possessed information, knowledge and experience regarding the implementation of lean manufacturing,
- Possessed authority and power in decision-making at the departmental level, and
- Directly involved in the implementation of lean manufacturing.

Thus, all the interviewees' voices were recorded and transcriptions were made for the identification of themes. The transcriptions were also shown to the respondents for verification and to afford respondents the opportunity to either add or delete something from the transcription. All of the respondents certified the transcriptions. This step was necessary as it validated the interview process and transcriptions.

5. Results and discussion

The present section highlights the results of the survey questionnaire and the statistical techniques that were used to test the hypotheses, along with the findings of semi-structured interviews. It is worth mentioning that the semi-structured interviews were analysed using content analysis approach. This was done to obtain more knowledge and in-depth information about the influence brought to bear by the set of critical issues in the implementation of lean manufacturing in two selected iron and steel plants in Kurdistan region/Iraq.

5.1. Profile of respondents

This section displays a brief account of the respondents' profiles. Simple frequency counts were used to distribute the respondents according to the following demographic characteristics: gender, age, fieldwork experience and education level. Profile of respondents is shown in Table 1.

Table 1 shows that the gender of employees' expressed in percentage of males and females were 78.81 and 21.19%, respectively. This distribution is a realistic reflection of reality of employees in most service and industrial sectors in Kurdistan region/Iraq. As for Age, the above table reveals that the participants aged less than 25 years, between 25 and 34 years, 35 and 45 years, and 45 + years were (30.0%), (35.5%), (25.1%) and (9.4%), respectively. Hence, these percentages show that most of the individuals participating in the survey were young people who enjoy vitality and good response for contemporary systems such as the implementation of lean manufacturing. Field work experience displays that the most of the respondents were employed in their current organizations for more than 5 years but less than 10 years (37.4%), followed by less than 5 years (26.6%), between 11 and 15 years (20.7%), and more than 15 years' experience (15.3%). These findings show that the majority of the respondents have had good work experience in the field of implementation of new systems such as lean manufacturing, and are thereby able to show their ability and reap the desired results from the implementation of these systems, including a large improvement the asset

Table 1. Respondents background (*N* = 203)

Respondents background							
Gender		**Age**		**Field work experience**		**Education level**	
Items	***N* (%)**	**Items**	***N* (%)**	**Items**	***N* (%)**	**Items**	***N* (%)**
Male	160 (78.81)	Under 25 years	61 (30.0)	<5 years	54 (26.6)	High school graduate	33 (16.3)
Female	43 (21.19)	25–34 years	72 (35.5)	5–10 years	76 (37.4)	Diploma degree	61 (30.0)
		35–45 years	51 (25.1)	11–15 years	42 (20.7)	Bachelor degree	104 (51.2)
		Over 45 years	19 (9.4)	>15 years	31 (15.3)	Advanced degree	5 (2.5)

performance, quality and, most importantly, improving productivity. As for the education level, as declared in the above table, most of the employees held a bachelor's degree (51.2%), diploma degree (30.0%), were high school graduates (16.3%), and advanced degree of the education level (2.5%). These results indicate that majority of the employees have a good level of education, which combined with the fact that most of them are young people, suggests that they have the ability to generate all that is good and new by way of ideas and meaningful programs that make the implementation of lean manufacturing problem-free in their factories.

5.2. Pearson correlation analysis for variables

Pearson Correlation was carried out to build the association between the set of critical issues and the implementation of lean manufacturing. Pearson correlation examines the significant association between variables (Sekaran & Bougie, 2016). The correlation findings were pointed out in Table 2.

Pearson correlation results were found to be significant for all variables of the study. The results indicated that ethical training program had a significant positive and strong relationship with the implementation of lean manufacturing ($r = 0.571$, $p < 0.01$). Similarly, the ethical instructions & commands, management commitment & allocate resources and autonomy/empowerment (manager-subordinate relationship) were found to have a moderately strong and positive association with the implementation of lean manufacturing ($r = 0.495$, $r = 0.468$, $r = 0.449$), respectively. Autonomy/empowerment (manager-subordinate relationship) was found to have a strong positive association with the ethical training program and management commitment & allocate resources ($r = 0.573$, $r = 0.513$) and the moderately strong and positive association with ethical instructions & commands ($r = 0.495$, $p < 0.01$). As for ethical training program, it was found to have a strong positive association with management commitment & allocate resources and ethical instructions & commands

Table 2. Critical issues and lean manufacturing implementation correlation matrix

	A/E (MSR)	**ETP**	**EIC**	**MCAR**	**Implementation of lean manufacturing**
Autonomy/empowerment (Manager–subordinate relationship)	1				
Ethical training program	0.573**	1			
Ethical instructions & commands	0.495**	0.539**	1		
Management commitment & allocate resources	0.513**	0.584**	0.549**	1	
Implementation of lean manufacturing	0.449**	0.571**	0.495**	0.468**	1

**Correlation is significant at the 0.01 level (2-tailed).

($r = 0.584$, $r = 0.539$). It was also found that ethical instructions & commands demonstrated a strong positive association with management commitment & allocate resources ($r = 0.549$, $p < 0.01$). Once association was established between variables, regression analysis using linear and multiple regression technique was conducted. The results of regression analysis are shown in the following sections of the current study.

5.3. Regression analysis for critical issues and lean manufacturing implementation

To check the influence of the critical issues on lean manufacturing implementation, the multiple regression analysis was performed for the four dimensions of critical issues and implementation of lean manufacturing. The regression has been performed to make sure which of the issues are most influential in the implementation of lean manufacturing in the two factories under study. Table 3 reveals the results of the multiple regression analysis.

The regression results indicate that the management commitment & allocate resources, ethical training and ethical instructions and commands are most influential issues in the effective implementation of lean manufacturing. The result further indicates that the manager-subordinate relationship is having an insignificant influence on the implementation of lean manufacturing.

With regard to the good regression result of the management commitment & allocate resources, the previous researchers have referred that the managerial commitment is the most important success issue irrespective of differences in plant size, corporation, location and other issues. It is not enough to lead from the office, but managers must also participate personally in shop floor (Punnakitikashem et al., 2013). As well, the allocation of necessary resources by organizations' management to assist implementation of lean manufacturing is also critical for success. It is difficult for organizations to turn lean without coaching and supporting local "lean team," or a distributed task force in the organisation. It is also necessary to dedicate a budget for the transformation (Radnor & Bucci, 2011; Sayer & Williams, 2012).

Moreover, the researchers have highlighted that correct and informed training and retraining programs are crucial for the effective implementation of lean manufacturing (Panneerselvam, 2012; Robinson & Ginder, 1995). Lean manufacturing requires continuous training of employees. If the employees are not trained properly, lean manufacturing implementation would be faulty (Maier et al., 1998; McKone et al., 2001; Westphal et al., 1997). Thus, organizations adopting lean manufacturing program should engage in proper and detailed training and retraining of their employees on a continuous basis. These training programs would develop the skills and knowledge base of the employees so that they could take informed decisions when necessary (Paropate et al., 2011; Venkatesh, 2007).

Another important issue that influences the effective implementation of lean manufacturing is the ethical instructions and commands. Instructions issued by the management are sometimes the cause of ineffective implementation (Kumar et al., 2014). It has been reported that managers to

Table 3. Multiple simultaneous regression analysis for dimensions of CI -imp model

Model	*R*	R^2	Adj. R^2	*F*	Sig.	β	*t*	*p*
	0.597	0.356	0.367	23.821	0.000			
Autonomy/Empowerment (Manager-Subordinate Relationship)						0.073	1.329	0.191
Ethical Training Program						0.162	4.556	0.000
Ethical Instructions & Commands						0.174	3.539	0.000
Management Commitment & Allocate Resources						0.189	3.268	0.000

Predictors: (Constant), Management Commitment & Allocate Resources, Ethical Instructions and Commands, Ethical Training Program, Autonomy/Empowerment (Manager-Subordinate Relationship).

Dependent Variable: Implementation of lean manufacturing.

reduce the cost cut corners or acquire equipment that is not needed just to utilize the budget. This is especially true in public organizations, where managers use allocated budgets on unnecessary items to show their efficiency in budget utilization. Similarly, managers also put undue pressure on employees to comply with instructions that may result in a loss for the organization (Trevino & Nelson, 2010). The researchers also point out that managers give instructions to employees that are not according to the training provided to the employees (Ahuja & Khamba, 2008; Mullins, 2007). Thus, ethical instructions and commands play an important role in the effective implementation of lean manufacturing in organizations.

As for autonomy/empowerment (Manager-Subordinate Relationship), the previous researchers have pointed out that due to traditional management practices, managers are reluctant to empower employees (Ahuja & Khamba, 2008; Haddad & Jaaron, 2012; Robinson & Ginder, 1995). Employees are the vital component of the effective implementation of modern systems like lean manufacturing. If the employees are not empowered, the lean manufacturing benefits could not be obtained by the organizations. Thus, involving employees and obtaining their opinions is the crucial step in the effective implementation of lean manufacturing.

Thus, the regression analysis for the model of critical issues—implementation of the lean manufacturing—indicates that its findings support all hypothesises which were mentioned in the literature review section with regard to the dimensions of the critical issues that are addressed in the present study; therefore, these hypothesises were accepted.

As for the finding of semi-structured interviews, it was revealed that all respondents stated that the critical issues represented in autonomy and empowerment, ethical training programs, ethical instructions and commands and the management commitment and allocate resources have a clear role in the lean manufacturing implementation and the occurrence of a difference in the levels of their implementation in the two iron and steel plants under study. For example, one of the respondents stated that “These issues have a direct impact on the level of performance of employees involved in the implementation of the tasks of lean manufacturing. But the severity of the impact of these issues on the performance of employees varies from one employee to another and from time to time, which leads to the occurrence of a difference in the levels of implementing the tasks of lean manufacturing in the factory”.

6. Conclusion

Organizations pursue policies and strategies to gain competitive advantage against their competitors. To overcome cost problems and production quality, many organizations, including the factories covered in this study, adopt lean manufacturing programs. However, many of these organizations, especially in developing countries face obstacles and challenges in the effective and successful implementation of these programs. Organizations facing issues regarding successful implementation normally involve the moral dilemmas that are directly related to staff performance in the implementation of lean manufacturing programs.

Confirming the foregoing, the results of the current study showed that the successful implementation of lean manufacturing programs can bring many benefits to factory management under study and their employees alike. This is in terms of a large improvement in the safety of the work environment, asset performance, quality, productivity and most important financial performance towards achieving the desired competitive advantage for these industrial organizations. However, the study findings confirmed that the successful implementation of lean manufacturing programs and achieving the above benefits depends on the capacities of human resources (employees) that affect the successful implementation of these programs in the organization. Therefore, the industrial organizations should be aware that it is the employee who operates the machine and the employee who maintains it. If employees are not involved or given empowerment in the implementation of lean manufacturing programs, these organizations cannot gather the benefits these programs are supposed to provide.

Funding
The authors received no direct funding for this research.

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Citation information
Cite this article as: Critical issues in lean manufacturing programs: A case study in Kurdish iron & steel factories, Jamal Ahmed Hama Kareem, Pirshing Salih Mohamad Al Askari & Farooq Hussain Muhammad, *Cogent Engineering* (2017), 4: 1386853.

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Cogent Engineering **(ISSN: 2331-1916) is published by Cogent OA, part of Taylor & Francis Group.**