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Assessing the mediating role of lean manufacturing practices in the relationship between TQM practices and operational performance

Hana Arrfou M [*], Amlus M.H., Jusoh M.S.

University Malaysia Perlis

Abstract: Achieving high operational performance has been considered as the best way to compete, survive, and gain market share in the hyper competitive market. To do so, companies need to enhance and build its lean manufacturing practices which represent the main antecedents of operational performance. In response to the aforementioned issue, this study aims to investigate the effect of TQM as an effective organizational philosophy that enhances operational performance and lean manufacturing practices, and in turn, operational performance. To this end, a primary data is collected from the manufacturing companies in Jordan. Then, data is analyzed through Partial Least Square PLS-SEM technique. The obtained results support all the formulated hypotheses.

Key words: TQM practices; Lean manufacturing practices; Operational performance; Partial least square PLS

1. Introduction

Over the last several decades, firms have implemented practices to get lower production costs, increase throughput, and provide high-quality products on time for their customers (Fullerton, McWatters and Fawson, 2003). These practices describe lean manufacturing practices (LMPs), which focus on the systematic elimination of waste from an organization's operations through a set of synergistic work practices, to produce products and services at the rate of demand (Habidin and Yusof, 2013). Lean manufacturing practices, although widely discussed, still cause considerable confusion among both academics and in practice (Saleeshya and Raghuram, 2012).

Although the relationship between lean manufacturing practices and different aspects of organization's performance has been assessed by several studies, literature concerning the relationship is still limited (Yang and Dobrzykowski, 2014). This lack of the studies is what underlies the intention behind the present study to examine this relationship empirically and provide some insight that will contribute to reduce the mentioned literature gap.

Among the most popular strategies and approaches that have been adopted to enhance many aspects of operational performance, TQM practices have been confirmed by researchers to be a very important strategy in helping organizations to create and sustain their competitive advantage (Jaca and Psomas, 2015). However, studies dedicated to the examination of how TQM practices enhance organizational practices, particularly lean manufacturing practices are still few and far between. Thus, this study attempts to examine the effect of TQM practices on lean manufacturing practices.

Besides, this study tries to provide some light on manufacturing companies in Jordan by determining the role of TQM practices in developing their lean manufacturing practices which in turn, reflect on their operational performance. To this end, this study was carried out involving all manufacturing companies in Jordan as they are more suitable for their resources and capabilities compared to their smaller counterparts (The World Bank: Jordan Economic Monitor: Growth through Innovation, 2016).

1.2 operational performances of Jordanian manufacturing industries

The manufacturing sector in Jordan is the most important sector in terms of its contribution to the GDP at constant basic prices. Relative to other sectors, the manufacturing sector has been increasing from 26% to 29.9% during the period of 2011–2015. As shown in Fig. 1, this sector has been playing a very important role in boosting growth in Jordan over the last few years and therefore, it is important to focus on the manufacturing sector.

As shown in Fig. 2, during 2015, the output of the manufacturing industry increased by a moderate rate of 1.7 percent over the last year. However, manufacturing prices decreased by 13.3 percent. The end result is that the proceeds of sales decreased by 11.8 per cent (Fanek, 2015). This is a dramatic decrease that cannot only reduce industrial profits, but can also reverse the expected profits into definite losses. Consequently the industry cannot survive for a long time (Alafi, 2014).

[*] Corresponding Author.

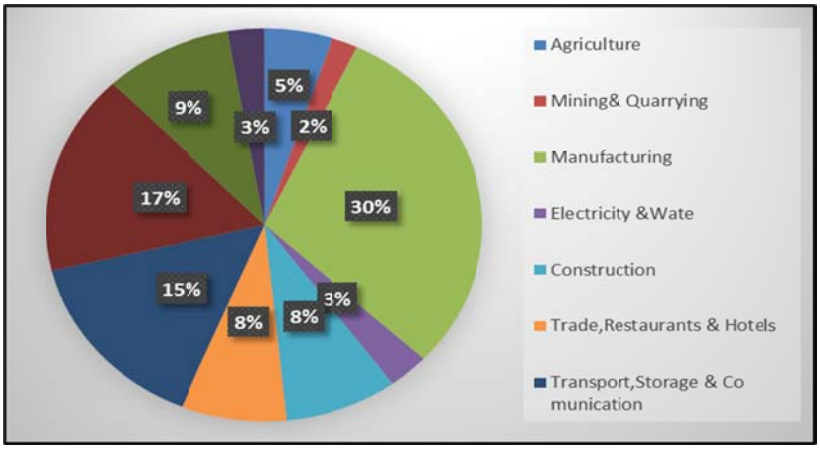


Fig. 1: Economic sectors to GDP at constant basic prices, 2011–2015/ The World Bank: Jordan Economic Monitor

Fig. 2: Manufactures' output/ prices and proceeds of sales: The World Bank: Jordan Economic Monitor

Jordanian manufacturing industries are not ready to meet the competition of foreign products, neither in quality nor in pricing (Zu'bi, 2015). Especially if such products are imported from countries that provide electricity and fuel at symbolic prices, such as the Gulf states, from a country that subsidizes exports through the exchange rate, such as Turkey, from countries that enjoy the benefits of large-scale production and low cost, such as China and other Far Eastern countries, or from more advanced industrial countries in Europe and America (Fanek, 2015; Zu'bi et al., 2015).

According to the previous figures, and under these hard circumstances, it can be concluded that despite adopting several policy initiatives and support from institutions to help Jordan become an operations-led economy, the occurrence of operational performance is still low in Jordan compared to what should have been based on its level of development. This fact encourages this study to investigate, determine and provide some insight that can help to enhance the operational performance of Jordanian manufacturing industries.

2. Literature review

Lean manufacturing practices which focusses on the systematic elimination of waste from an organization's operations through a set of synergistic work practices, to produce products and services at the rate of demand (Habidin and Yusof, 2013). Waste can be regarded as any activity that does not add value for the customer, such as overproduction, waiting time, excess inventory, and unused employee creativity, among others (Yang et al., 2011). Lean manufacturing practices involve a fundamental paradigm shift from traditional batch and queue mass production to single piece flow pull production, minimizing the time spent on non-value-added operations by positioning tools and materials as close as possible to the point of assembly (Foo et al., 2015).

To successfully apply lean manufacturing, it is necessary to understand the customer requirements; only then can a company develop the value stream map and identify those non-value added activities that are increasing the cost of producing the good or service based on the customer's perspective (Kocakülâh et al., 2008). Also, it is of high importance for companies to understand that lean manufacturing happens in a set of interrelated dimensions, where concepts and initiatives support each other to continuously identify and reduce waste (Turesky and Connell, 2010). The authors also argued this multidimensional effort can be seen in companies which apply several techniques and tools. These techniques can include value stream mapping and work standardization to reduce waste in labor use.

Building on the previous discussion, this study uses lean manufacturing practices to explain it is effect on the relationship between TQM practices and operational performance. Applying TQM in a successful way requires several practices (e.g., leadership, customer focus, people management, process management, supplier management)

(Mohammed et al.,, 2012). Implementing those practices in the organization leads to generate several capabilities within the organization. For example, leadership to achieve quality performance provides an environment that encourages the trust and cooperation among the employees, which in turn, lead to knowledge flow across the organization, and is the pre-requisite for the success of any management activity (Ju et al., 2006; Mohammed et al., 2012). Furthermore, customer focus orientation supports the organization with the necessary feedback regarding the customers' attitudes, preferences, and complaints. These kinds of information help the organization to improve its implement the lean manufacturing practices, in order to build good relationship with the customers, and facilitates its ability to solve and deal with customers' complaints to achieve customer satisfaction (Yunoh and Ali, 2015). Studies conducted on the past literatures shows that the main goal of TQM is to fulfill the needs of consumers. Therefore, the implementation of TQM can be considered as a failure if value added service cannot be provided to the customers consistently (Ooi et al., 2009).

On the other side, TQM practices focus on developing people's skills and capacities through the engagement of employees in several kinds of training programs (Jones and Grimshaw, 2012), which provides the organization with skillful sales-force, and, skillful marketing team in general (Jones and Grimshaw, 2012). In addition, emphasizing TQM on managing process and continuous improvement in all organizational aspects help to improve the process of making marketing decision, pricing, promotion activities, distribution. To this end, the data related to improving the processes along with the previous success and failure stories have been recorded and reported to the relevant section (Mohammed et al., 2012). Suppliers are one of the success factors especially for manufacturing companies. Therefore, establishing good relationship with the suppliers is one of the principles that TQM asserts on. This kind of relationship provides the necessary knowledge that helps to make right purchasing decision, develop the negotiation skills of the marketing team, and enhance the database with knowledge that relate to the suppliers in the industrial market. According to the previous discussion the following hypothesis is formulated:

H1: There is a positive relationship between TQM practices and lean manufacturing practices.

On the other hand, Implementation of manufacturing practices can enable plants to react quickly to changes in customer demand, and thereby carry lower levels of inventory, improve cost efficiencies, increase the flexibility of production facilities through use of planning and scheduling software, and improve overall plant productivity (Banker et al., 2006). Investments in JIT and flexible manufacturing practices help to reduce setup times that permit shorter production runs, thereby allowing for more efficient inventory control as well as lower product defect rates (Hendricks and Singhal, 2008).

Despite the conceptual attention paid to lean manufacturing practices, researchers have paid less attention to the empirical investigation of its relationship to firm performance (Dora, Kumar, Van Goubergen et al., 2013). Furthermore, lean manufacturing is comprised a wide variety of tools and techniques to find root causes of problem, eliminate wastes and streamline the business processes. In a nutshell, lean manufacturing practices can have a significant impact on the operational performance of companies. "Operational performance" is defined as the changes happening in the operational metrics after the implementation of lean manufacturing practices in an organization (Martínez Sánchez and Pérez Pérez, 2011). Thus, based on the aforementioned statements the following hypothesis is introduced:

H2: There is a positive relationship between lean manufacturing practices and operational performance.

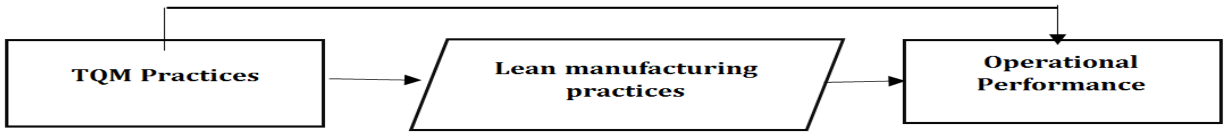
Regarding the relationship between TQM practices and operational performance, although a review of literature reveals that there is inconclusive finding among the previous studies, this study supports the argument that TQM practices influence operational performance. For example, Chang et al. (2011) studied TQM practices in Taiwan's manufacturing firms. They found a significant causal relationship between quality dimensions (i.e., customer satisfaction, employment satisfaction, and employee service quality) and operational performances. Furthermore, Wheelen and Hunger (2011) investigated the relationship between quality implementation and operational performance and discovered that TQM leads to higher operational performance, which indicates efficiency, cost-effectiveness, and higher perceived high level of quality. In a similar research in the Netherlands, Zhang et al. (2012) reached a similar conclusion. The authors revealed that quality implementations have a positive impact on product quality and TQM has much better effects on the overall business performance than ISO 9000. Using a case study conducted in the region of Murcia, Spain, Costa and Martinez Lorente (2014) also concluded that TQM improves many aspects of performance. From the previous discussion the following hypothesis is introduced:

H3: There is a positive relationship between TQM practices and operational performance.

As discussed earlier, it can be concluded that applying TQM practices provide the organization with distinctive lean manufacturing practices, which in turn, lead to enhancement of its operational performance (Mohammed et al., 2012). In addition, building on the previous assumptions which meet the mediating relationship criteria, it can be concluded that lean manufacturing practices play a mediating role in the relationship between TQM practices and operational performance. Therefore, the following hypothesis is introduced:

H4: Lean manufacturing practices mediates the relationship between TQM practices and operational performance.

Consequently, the following framework is introduced:



3. Research methods

3.1. Sample and data collection

For the purpose of examining the conceptual model of this study, the data is collected from manufacturing companies listed in Ministry of Industry and Trade Jordan (MITJ) (2016). For the justification mentioned earlier, all companies have been chosen for this study, because the number of Jordanian manufacturing industries is limited in 95 companies. A survey research method is adopted to collect the data, where the instrument is adopted from the previous studies.

By using on-line survey approach, a total of 39 items was administrated randomly to 95 manufacturing companies. The unit of analysis of this study was represented by the operations mangers, as the researchers are convinced that those managers have knowledge regarding the issue under study. Out of 219 (as a number of the operations mangers) distributed questionnaires, 169 usable questionnaires were returned, representing a response rate of 77.2 %.

3.2. Data analysis

To evaluate the present model, Partial Least Square (PLS) analysis and Structural Equation Modeling (SEM) techniques was adopted. PLS-SEM path modeling was adopted for several reasons; first of all, the model of the present study includes formative construct (e.g., lean manufacturing practices), and, unlike CB-SEM approach, PLS-SEM has the ability to run formative constructs. Second, PLS-SEM is a nonparametric technique and, consequently, does not assume normality of data. Third, PLS-SEM does not require a large sample size as CBSEM approach, and, since the sample size of the current study is considered small, PLS-SEM is a more suitable approach. Therefore, Smart PLS version 3.0.M3 was employed to examine the measurement of structural model.

As mentioned in the previous paragraph, this study has one formative construct represented by lean manufacturing practices. Unlike the reflective construct, the formative construct does not suppose that the measures are all caused by a single underlying construct. Rather, it supposes that the measures all have an impact on (or cause) a single construct. That is, the direction of causality flows from the indicators to the latent construct, and the indicators, as a group, jointly determines the conceptual and empirical meaning of the construct (Jarvis et al., 2003). Consequently, the processes to evaluate formative construct are quite different from those that evaluate reflective constructs. The assessment of formative constructs and reflective constructs are separately discussed in the following sections.

3.2.1. Formative construct

Lean manufacturing pracctices is formative first order construct, which consists of the cause-effect relationship between the manifest variables and the latent variable (Jarvis et al., 2003). Therefore, internal consistency reliability is not an appropriate standard for evaluating the adequacy of the measures in formative models (Jarvis et al., 2003; Mathieson et al., 1996). Instead, evaluating formative constructs require i) the assessment of the indicator/manifest relevance (weight); ii) the evaluation of the indicators significance (external validity); and iii) the determination of the multicollinearity of indicators. The weight of the formative construct is shown in Table 1 below:

Table 1: Items' weight of lean manufacturing practices construct (formative construct)

LMPs construct	Items Weight	T-Value
LMPs1 -> LMPs	-0.022	0.148
LMPs 2 -> LMPs	0.277*	1.691
LMPs 3 -> LMPs	0.162	0.763
LMPs 4 -> LMPs	0.403**	2.181
LMPs 5 -> LMPs	0.320**	1.986
LMPs 6 -> LMPs	0.267*	1.600
** p < 0.05, * p < 0.01		

Table 1 above shows that out of six items belonging to lean manufacturing practices, four were significant and contribute to lean manufacturing practices; although there were two items which were found to be non-significant, formative indicators should never be discarded simply on the basis of statistical outcomes (Henseler et al., 2009). Such actions may substantially change the content of the formative index (Jarvis et al., 2003). Consequently, the researcher should keep both significant and insignificant formative indicators in the measurement model as long as they are conceptually justified. As the items of lean manufacturing practices have been adopted from previous studies, this study is going to keep these insignificant indicators in the measurement model of the current framework.

A concern with formative construct is the potential of multicollinearity among the items, which could produce unstable estimates (Mathwick et al., 2001). Accordingly, collinearity test is employed. Hair, Anderson, Tatham and Black's (2010) procedure was followed. As defined in the multivariate literature, tolerance measure is the amount of the variance of the variable that is not explained by other variables. Similarly, VIF is the inverse of tolerance value. According to Hair et al. (2010), tolerance values should be higher than 0.1, while VIF values should be lower than 10. Table 2 indicates the multicollinearity result.

Table 2: Collinearity analyses of formative construct LMPs

lean manufacturing practices	Collinearity Statistics	
	Tolerance	VIF
LMPs 1	.366	2.734
LMPs 2	.321	3.120
LMPs 3	.366	2.729
LMPs 4	.338	2.957
LMPs 5	.339	2.948
LMPs 6	.320	3.020

Table 2 above shows that all tolerance values were higher than 0.1 and the VIF values were lower than 10 indicating that all values meet the cut-off threshold for tolerance and VIF, which implies that the issue of multicollinearity was not a serious issue (Hair et al., 2010).

To evaluate the formative construct completely, external validity has to be assessed. As mentioned earlier, internal consistency examinations (e.g., Cronbach's alpha) are not appropriate for formative indicators. Several authors instead suggested testing the external validity of a formatively measured construct (Diamantopoulos et al., 2008; Jarvis et al., 2003). Diamantopoulos et al. (2008) stated that formative indicators should be correlated indicators of other constructs. Therefore, the external validity was examined by evaluating the relationship between lean manufacturing practices and other endogenous construct operational performance which has a theoretical relationship. As shown in Table 3 below, the correlation between LMPs and OP was significant which leads confidently to conclude that the formative construct of this study is valid and reliable.

Table 3: The correlation of LMPs and OP

Constructs	Correlation	Standard Error	T - value	P- value
LMPs -> OP	0.60483	0.057106	10.5914	0.000

3.2.2. Reflective construct

The other constructs are reflective. Therefore, evaluating the measurement model need to go through processes to test the indicators reliability, convergent validity, and average variance extracted AVE, cross loading, and discriminate validity. The main goal from these steps is to assess the internal consistency of the reflective indicators. Since TQM construct has high level order (first order and second order) the evaluating processes will be into two levels also. According Fornell and Larcker (1981); Hair et al. (2011); and Henseler et al. (2009), the values of Cronbach's alpha and composite reliability should be higher than 0.70, while the values of AVE should be higher than 0.50. Furthermore, Henseler at al. (2009) and Hair et al. (2011) recommend that the indicators' cross loading should be higher than 0.70. For discriminant validity test two condition should be met: a) the correlations values of the indicators with its latent variables should be higher than the correlation with other constructs, b) the square root of AVE of the construct should be higher than correlation with another constructs (Fornell and Larcker, 1981) (Table 4-6).

Table 4: CFA of First order construct

Construct	Items	Internal reliability Cronbach's alpha	Convergent validity Factor Loading	Construct Composite reliability	Items AVE
TQM	LMC1 LMC3 LMC4 LMC5 LMC6	0.901	0.818 0.838 0.767 0.910 0.897	0.927	0.718
	CF1 CF2	0.912	0.813 0.889	0.935	0.718

	CF3 CF4 CF6		0.891 0.900 0.808		
	PEM1 PEM2 PEM3 PEM4 PEM5 PEM6	0.919	0.814 0.898 0.868 0.849 0.838 0.791	0.937	0.712
	PRM1 PRM2 PRM3 PRM4 PRM5	0.915	0.863 0.889 0.867 0.846 0.854	0.936	0.746
	SQM1 SQM2 SQM4 SQM5 SQM6	0.871	0.722 0.841 0.890 0.829 0.780	0.907	0.663
OP	IP1 IP2 IP3 IP4 IP5 IP6 IP7 IP8	0.927	0.819 0.878 0.814 0.809 0.779 0.831 0.732 0.839	0.940	0.662

Table 5: Cross loading of the first order of TQM construct

	CF	IP	LMC	PEM	PRM	SQM
CF1	0.801	0.339	0.695	0.557	0.560	0.560
CF2	0.879	0.483	0.629	0.646	0.704	0.595
CF3	0.885	0.539	0.695	0.696	0.721	0.678
CF4	0.894	0.426	0.694	0.692	0.730	0.688
CF5	0.679	0.289	0.498	0.527	0.545	0.480
CF6	0.804	0.363	0.651	0.634	0.654	0.639
OP 1	0.338	0.819	0.350	0.454	0.408	0.427
OP 2	0.404	0.878	0.438	0.503	0.484	0.501
OP 3	0.342	0.814	0.378	0.517	0.482	0.455
OP 4	0.392	0.809	0.389	0.433	0.451	0.413
OP 5	0.415	0.779	0.349	0.429	0.474	0.459
OP 6	0.391	0.831	0.334	0.442	0.445	0.516
OP 7	0.458	0.472	0.732	0.329	0.465	0.489
OP 8	0.495	0.839	0.500	0.519	0.587	0.560
LMC1	0.639	0.351	0.807	0.494	0.500	0.538
LMC2	0.418	0.272	0.649	0.272	0.463	0.355
LMC3	0.660	0.361	0.852	0.531	0.557	0.561
LMC4	0.536	0.392	0.769	0.379	0.467	0.462
LMC5	0.769	0.456	0.894	0.710	0.711	0.644
LMC6	0.718	0.452	0.876	0.629	0.605	0.621
PEM1	0.633	0.444	0.543	0.814	0.671	0.629
PEM2	0.637	0.498	0.547	0.898	0.720	0.628
PEM3	0.726	0.572	0.521	0.628	0.868	0.721
PEM4	0.574	0.721	0.640	0.849	0.571	0.546
PEM5	0.705	0.509	0.594	0.838	0.753	0.649
PEM6	0.553	0.438	0.498	0.791	0.609	0.578
PRM1	0.675	0.559	0.623	0.731	0.863	0.713
PRM2	0.728	0.479	0.573	0.690	0.889	0.675
PRM3	0.675	0.427	0.542	0.702	0.867	0.604
PRM4	0.658	0.496	0.521	0.671	0.846	0.566
PRM5	0.688	0.578	0.630	0.730	0.854	0.673
SQM1	0.550	0.450	0.563	0.473	0.557	0.738
SQM2	0.500	0.413	0.527	0.470	0.534	0.690
SQM3	0.342	0.326	0.340	0.367	0.356	0.613
SQM4	0.600	0.482	0.565	0.583	0.482	0.853
SQM5	0.667	0.478	0.597	0.621	0.695	0.859
SQM6	0.592	0.421	0.508	0.550	0.572	0.795
SQM7	0.590	0.457	0.510	0.635	0.640	0.754

Table 6: Fornell-Larcker criterion (discriminant validity) (first order of TQM construct)

Construct	Square root of AVE	OP	CF	LMC	PEM	PRM	SQM
OP	0.814	1					
CF	0.861	0.502	1				
LMC	0.848	0.477	0.789	1			
PEM	0.844	0.580	0.751	0.659	1		
PRM	0.864	0.589	0.785	0.678	0.816	1	
SQM	0.814	0.574	0.725	0.665	0.708	0.751	1

Reviewing the above result indicates that all values of Cronbach's alpha and composite reliability exceed the threshold of 0.70, and the same conclusion was reached with the AVE test as the values exceed the cut-off values of 0.50. As the statistics results show in the previous Tables, all values of cross loading and discriminant test meet the recommended values where cross loadings of all indicators go beyond the recommended value 0.70, and, Fornell-Larcker criterion for discriminant validity indicates that all square roots of AVE values of the latent constructs were higher than correlation values with other constructs. Thus, it can be concluded that all reflective constructs showed an adequate measurement model. Given this result, the hypotheses could be tested through the examination of the structural model which is discussed in the coming section.

4. Structural model

Before examining the hypotheses, the predictive relevance of the model is tested. The quality of the structural model can be assessed by R^2 which shows the variance in the endogenous variable that is explained by the exogenous variables. The R^2 value is assessed based on assessment criterion suggested by Cohen (1988), where 0.26 is considered as substantial, 0.13 moderate, and 0.02 weak.

An additional criterion to evaluate the quality of the model is through the use of Blindfolding procedure to assess the model's capability to predict (Hair et al., 2011). According to Henseler et al. (2009), blindfolding procedure is only applied to endogenous latent variable that has formative measurement model. The predictive relevance Q^2 comes in two forms which are cross-validated redundancy and cross-validated communality (Hair et al., 2011). Hair et al. (2011) recommended using the cross-validated redundancy where the use of PLS-SEM is required to estimate both the structural model and the measurement model for data prediction. Therefore, cross-validated redundancy is perfectly suitable for the PLS-SEM approach. The cross-validated redundancy measure value (i.e., Q^2) should be higher than zero; otherwise, it indicates a lack of predictive relevance (Fornell and Cha, 1994; Henseler et al., 2009). The following Table shows the prediction relevance of the model (Table 7).

Table 7: Prediction relevance of the model

Endogenous	R square	Cross-Validated Redundancy
OP	0.453	0.297

As reported in the above Table 7, R^2 was found to be 0.453 indicating that TQM and LMPs can account for 45% of the variance in the innovation performance. According to Henseler et al. (2009), if a particular inner path model structures only partially explain endogenous latent variables by only a few (e.g., one or two), it is acceptable to consider exogenous latent variables with a moderate R^2. Referring to Cohen (1988) criterion, R^2 of this study is considered substantial indicating the power of TQM and LMPs in explaining the operational performance. Regarding the Q^2 value, as shown in Table 7 above, the cross-redundancy value was found to be (0.297) more than zero. This result supports the claim that the model has an adequate prediction quality.

Having established the validity and the reliability of the measurement model, this paves the way to move to the next step which is testing the hypothesized relationship by running PLS algorithm and Bootstrapping algorithm in Smart PLS 2.0. As shown in Table 8.

Table 8: Hypothesis testing result

Hypotheses	path coefficient	Standard Error	T-Value	P-value	Decision
H1: TQM -> LMPs	0.631	0.066	9.581	0.000	Supported
H2: LMPs -> OP	0.327	0.091	3.584	0.000	Supported
H3: TQM -> OP	0.413	0.093	4.453	0.000	Supported
H4: TQM -> LMPs -> OP	0.207	0.066	3.12	0.001	Supported

4.1. Mediating effect

To figure out the mediating role of LMPs in the relationship between TQM and OP, Baron and Kenny's (1986) criteria are followed. According to Baron and Kenny (1986), the following conditions have to be met to be able to claim that there is mediating relationship:

a. The predictor TQM has to significantly influence the mediator LMPs (H1);

b. The mediator LMPs has to significantly impact the criterion variable OP (H2); and

c. The predictor TQM has to significantly influence the criterion variable OP without the mediator influence.

Bootstrapping technique was used to determine the mediating relationship; accordingly, the result support the mediating effect of LMPs in the relationship between TQM and OP (β= 0.207, t= 3.12, p<0.001) (H4) as shown in Table 8. After excluding the mediating variable, the direct relationship between TQM and operational performance was tested and a significant relationship was found between TQM and OP (β= 0.625, t= 10.071, p<0.001). By comparing the path value between TQM and OP in the two cases (e.g., with mediating effect and without mediating effect) it was found that the path value, although still significant, is reduced when the mediating variable LMPs, was introduced to this relationship. Thus, LMPs is established as a partial mediator in this relationship. To estimate the size of indirect effect of TQM on OP through LMPs, the present study used the Variance Accounted For (VAF) values, which represent the ration of the indirect effect to the total effect. The VAF value indicates that 33.4% of the total effect of TQM on OP is explained by indirect effect (LMPs) as shown in the following equation.

$$\text{VAF} = \frac{a \times b}{a \times b + c} = \frac{0.631 \times 0.327}{0.631 \times 0.327 + 0.413} = \mathbf{0.334}$$

4.2. Goodness of fit (GoF) of the model

In contrast to CBSEM approach, PLS-SEM has only one measure of goodness of fit which was defined by Tenenhaus, Vinzi, Chatelin and Lauro (2005) as the global fit measure (GoF). This measure is the geometric mean of the average variance extracted and the average R^2 for the endogenous variables. GoF is calculated by the following formula:

GOF= $\sqrt{R^2 \times \text{Average Communality (AVE)}} = 0.749$

According to Wetzels, Odekerken-Schröder and Oppen (2009) criterion, the outcome demonstrated that the model's goodness of fit measure is large and adequate for global PLS model validity, where Wetzels et al. (2009) suggested that small =0.1, medium =0.25 and large =0.36.

5. Discussion and conclusions

Maintaining and enhancing operational performance has been considered as the key engine to achieve competitive advantage, gain market share and customer loyalty (Greene, 2015). Recently, the tendency of most of the studies concerned with operations management is the investigation of factors that can be the antecedences of high operational performance. However, the past studies somehow ignored the effect of the lean manufacturing practices. Thus, there is lack of studies that examine the effect of lean manufacturing practices on operational performance. Consequently, this study is one of the studies that aim to answer the question: how can organizations enhance their operational performance? To this end, the study introduces the framework through which the effect of TQM practices and lean manufacturing practices on the operational performance was examined. Therefore, the main purpose of this study is to explore the following point.

First, examining the effect of integration of TQM and lean manufacturing practices on operational performance is the main goal of this study. To achieve this goal, the relationship between TQM practice and lean manufacturing practices was examined. The finding shows that TQM practices have a positive and significant effect on lean manufacturing practices of the organization (β = 0.631, t = 9.581, p > 0.001). This result is compatible with previous studies (Shah and Ward, 2003; Arumugam et al., 2006; Yang et al., 2011), and provides additional evidence of the importance of TQM practice to the organizations.

Second, the relationship between lean manufacturing practices and operational performance also has been examined. The outcome indicated that lean manufacturing practices contribute significantly to enhance the operational performance (β = 0.327, t = 3.584, p > 0.001).

Furthermore, the direct relationship between TQM practices and operational performance was examined. The obtained result indicates that there is a positive and significant relationship between TQM practices and operational performance (β = 0.413, t = 4.453, p > 0.001). This result is similar to that obtained by Lambert and Cooper (2000) and is consistent with Cousins and Menguc (2006) and Flynn, Huo and Zhao (2010) conclusion, where they confirmed that TQM is not only a tool to improve quality, it is also provides a suitable environment that reinforces operational performance.

Finally, having established the relationship among TQM practices, lean manufacturing practices and operational performance, the partial mediating role of lean manufacturing practices in the relationship between TQM practices and operational performance was also established as significant (β = 0.207, t = 3.12, p > 0.001). Moreover, the outcome indicates that 33% of the total effect of TQM practices on operational performance is explained through lean manufacturing practices.

The implications of this study are presented by providing the evidence that companies aiming to be innovative need to continuously enhance and build their lean manufacturing practices. Additionally, through the findings of this study, it can be advised that managers should adopt and apply quality practices within their companies, as it was confirmed that TQM practices provide an environment that help and pave the way to develop and build the lean manufacturing practices. This study also highlights that lean manufacturing lead to superior operational performance. Therefore, managers of companies should give more attention and allocate necessary resources to build and enhance these kinds of practices.

References

Alafi, k.k. (2014). The effect of purchasing strategies on manufacturing performance: the case of Qualifying Industrial Zones in Jordan. *Interdisciplinary Journal of Contemporary Research in Business*, 6(2).

Arumugam, V., Ooi, K. B., and Fong, T. C. (2008). TQM practices and quality management performance: An investigation of their relationship using data from ISO 9001: 2000 firms in Malaysia. *The TQM Journal*, *20*(6), 636-650.

Banker, R. D., Bardhan, I. R., Chang, H., and Lin, S. (2006). Plant information systems, manufacturing capabilities, and plant performance. *MIS quarterly*, 315-337.

Baron, R. M., and Kenny, D. a. (1986). The moderator-mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. Journal of personality and social psychology, 51(6), 1173–82.

Chang, S. J., Hsiao, H. C., Huang, L. H., and Chang, H. (2011). Taiwan quality indicator project and hospital productivity growth. *Omega*, *39*(1), 14-22.

Cohen, J. (1988). Statistical power analysis for the behavioral sciences (2nd ed.). Hillsdale, Lawrence Erlbaum Associates, NJ.

Costa, M. M., and Lorente, A. R. M. (2004). ISO 9000 as a tool for TQM: a Spanish case study. *The Quality Management Journal*, *11*(4), 20.

Cousins, P. D., and Menguc, B. (2006). The implications of socialization and integration in supply chain management. *Journal of operations management*,*24*(5), 604-620.

Diamantopoulos, A., Riefler, P., and Roth, K. P. (2008). Advancing formative measurement models. Journal of Business Research, 61(12), 1203–1218.

Dora, M., Kumar, M., Van Goubergen, D., Molnar, A., and Gellynck, X. (2013). Food quality management system: Reviewing assessment strategies and a feasibility study for European food small and medium-sized enterprises.*Food control*, *31*(2), 607-616.

Fanek, F. (2015). Jordanian Manufacturing sector under pressure http://www.jordantimes.com/opinion/fahed-fanek/manufacturing-sector-under-pressure#sthash.iMYA8eeO.dpuf . Retrieved 26 August 2015.

Flynn, B. B., Huo, B., and Zhao, X. (2010). The impact of supply chain integration on performance: A contingency and configuration approach.*Journal of operations management*, *28*(1), 58-71.

Foo, W.S., Ang, E.L., Rajamony, B., and Lee, C.C. (2015). Lean Manufacturing Implementation and Sustenance in Malaysian Manufacturing Industry: Challenges and Issues. *Australian Journal of Basic and Applied Sciences*, 9(12), 25-30.

Fornell, C., and Cha, J. (1994). Partial least squares. *Advanced methods of marketing research*, *407*, 52-78.

Fornell, C., and Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement Error. Journal of Marketing Research, 18(Feb), 39–50.

Fullerton, R. R., McWatters, C. S., and Fawson, C. (2003). An examination of the relationships between JIT and financial performance. *Journal of Operations Management*, *21*(4), 383-404.

Greene, C. (2015). 4 Keys to Unlocking Operational Performance. Articles/business-performance-management. Access on line [4.June.2015]: http://www.bpminstitute.org/resources/articles/4-keys-unlocking-operational-performance.

Habidin, N. F., and Yusof, S. R. (2013). Critical success factors of Lean Six Sigma for the Malaysian automotive industry. International Journal of Lean Six Sigma, 4(1), 60-82.

Hair, J. F., Anderson, R. E., Tatham, R. L., and Black, W. C. (2010). Multivariate Data Analysis (7th Ed.). Prentice Hall, USA.

Hair, J. F., Ringle, C. M., and Sarstedt, M. (2011). PLS-SEM: Indeed a Silver Bullet. The Journal of Marketing Theory and Practice, 19(2), 139–152.

Hendricks, K. B., and Singhal, V. R. (2008). The effect of supply chain disruptions on shareholder value. *Total Quality Management*, *19*(7-8), 777-791.

Henseler, J., Ringle, C. M., and Sinkovics, R. R. (2009). The use of Partial Least Squares Path Modeling in International Marketing. Advances in International Marketing, 20, 277–319.

Hong, P., Ga (Mark) Yang, M., and D. Dobrzykowski, D. (2014). Strategic customer service orientation, lean manufacturing practices and performance outcomes: An empirical study. *Journal of Service Management*, *25*(5), 699-723.

Jaca, C., and Psomas, E. (2015). Total quality management practices and performance outcomes in Spanish service companies. Total Quality Management and Business Excellence.

Jarvis, C. B., Mackenzie, S. B., and Podsakoff, P. M. (2003). Critical Review and of Construct Indicators and Measurement Model Marketing in Misspecification. Journal of Consumer Research, 30(September), 199–217.

Jones, B., and Grimshaw, D. (2012). Training and skills to improve innovation in firms (pp. 1–38). Manchester.

Ju, T. L., Lin, B., Lin, C., and Kuo, H. J. (2006). TQM critical factors and KM value chain activities. *Total Quality Management and Business Excellence*,*17*(3), 373-393.

Kocakülâh, M. C., Brown, J. F. and Thomson, J. W. (2008) Lean Manufacturing Principles And Their Application. *Journal of Cost Management*. 16-27.

Lambert, D. M., and Cooper, M. C. (2000). Issues in supply chain management. *Industrial marketing management*, *29*(1), 65-83.

Martínez Sánchez, A., and Pérez Pérez, M. (2011). Lean indicators and manufacturing strategies. *International Journal of Operations and Production Management*, *21*(11), 1433-1452.

Mathieson, K., Peacock, E., and Chin, W. W. (1996). Extending the Technology Acceptance Model: The Influence of Perceived User Resources. WP 96 – 18, Faculty of Management, University of Calgary.

Mathwick, C., Malhotra, N., and Rigdon, E. (2001). Experiential value: conceptualization, measurment and application in the catalog and internet shopping envirnment. Journal Retailing, 77, 9–16.

Ministry of Industry and Trade Jordan http://www.mit.gov.jo/tabid/36/default.aspx

Mohammed Yusr, M., Mohd Mokhtar, S. S., and Othman, A. R. (2014). The effect of TQM practices on technological innovation capabilities: applying on Malaysian manufacturing sector. *International Journal for Quality Research*, *8*(2).

Ooi, K. B., Teh, P. L., and Yee-Loong Chong, A. (2009). Developing an integrated model of TQM and HRM on KM activities. *Management Research News*, *32*(5), 477-490.

Saleeshya, P. G., Raghuram, P., and Vamsi, N. (2012). Lean manufacturing practices in textile industries–a case study. International Journal of Collaborative Enterprise, 3(1), 18-37.

Shah, R., and Ward, P. T. (2003). Lean manufacturing: context, practice bundles, and performance. *Journal of operations management*, *21*(2), 129-149.

Tenenhaus, M., Vinzi, V. E., Chatelin, Y.-M., and Lauro, C. (2005). PLS path modeling. Computational Statistics and Data Analysis, 48(1), 159–205

The World Bank: Jordan Economic Monitor: Growth through Innovation. (2016). (pp. 1–126).

Turesky, E. F., and Connell, P. (2010). Off the rails: understanding the derailment of a lean manufacturing initiative. *Organization Management Journal*, *7*(2), 110-132.

Wetzels, M., Odekerken-Schröder, G., and Oppen, C. van. (2009). Using PLS P Ath Modeling For Assessing Hierarchical Construct Models : Guidelines and Empirical. MIS Quarterly Vol., 33(1), 177–195.

Wheelen, T. L., and Hunger, J. D. (2011). *Concepts in strategic management and business policy*. Pearson Education India.

Yang, M. G. M., Hong, P., and Modi, S. B. (2011). Impact of lean manufacturing and environmental management on business performance: An empirical study of manufacturing firms. *International Journal of Production Economics*, *129*(2), 251-261.

Yunoh, M. N. M., and Ali, K. A. M. (2015). Total Quality Management Approach for Malaysian SMEs: Conceptual Framework. *International Journal of Business and Social Science*, *6*(1).

Zhang, L., Wang, S., Li, F., Wang, H., Wang, L., and Tan, W. (2012). A few measures for ensuring supply chain quality. *International Journal of Production Research*, *49*(1), 87-97.

Zu'bi, M. F., Tarawneh, E., Abdallah, A. B., and Fidawi, M. A. (2015). Investigating Supply Chain Integration Effects on Environmental Performance in the Jordanian Food Industry. *American Journal of Operations Research*, *5*(04), 247.

Zu'bi, M. F. (2015). Examining the Impact of Lean Practices on Flexibility Performance: The Moderating Effect of Environmental Dynamism *Engineering Management Research*, *4*(2), 54.