

Time as a Key Factor to Lean Management Assessment: A New Approach*

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Abstract

This paper proposes a new model of Lean Management assessment using the time as a key factor. We analyse the literature on the relationship between the management models included in Lean Management (JIT, TQM, TPM, ABC/M and HPWS) and performance. The literature has been classified according to the nature of the elements considered to be crucial for assessing each management model: financial indicators, non-financial or operational indicators, and contextual factors of the company itself or its environment. The results are not conclusive. The aim is to deduce what kinds of indicators and which combination of these are best for assessing the results of Lean Management depending on its implementation phase.

Key words: Lean Management, Performance Measurement, Literature Review.

Objective and methodology

In a rapidly changing and competitive environment, global enterprises face the challenge of being profitable and obtaining competitive advantages in order to maintain their overall market and financial position during the present worldwide economic crisis. Lean Management (LM) is one possible solution, improving product design, productivity and quality to foster global competitiveness (Mefford, 2009). In fact, The Toyota firm, precursor of Lean Management, is the leader of automotive industry in the world (Strategic Direction, 2007).

However, so far, results have been contradictory regarding the implementation of LM. In fact, although the concept of the term LM has been clearly defined with the passing of time, the way to assess it has not (Pilkington and Fitzgerald, 2006). Whereas some firms achieve short-term benefits, others, despite investing in training and adapting their incentive schemes, only achieve improvements in the long term. Ahlström and Karlsson (1996) found that there is even a fall in productivity during the system's first implementation phase. Therefore, there has been a long-standing underlying question about whether applying LM generates in firms the expected benefits and even though affects their market value (Al-Khadash and Feridun, 2006). So it is an important aspect to study in order to justify the huge amount of money needed to implement any management system.

The little empirical research that has been done in the scientific area to show whether the implementation of a management model conditions company profitability has been non-conclusive (Callen *et al.*, 2000; Fullerton and McWatters, 2001; Ahmad *et al.*: 2004; Maiga and Jacobs, 2007) as there are many different ways to assess the results of implementing LM. With specific regard to empirical studies on LM, we have detected that the outcomes resulting from the system's implementation have not been assessed in sufficient detail (Cuatrecasas, 2002; Shah and Ward, 2003; Narasimhan *et al.*, 2006). Fullerton and Wempe (2009) concluded in their recent research that this subject needs further investigation. Broadly-speaking, the final impact of management systems implementation on bottom-line results is no clear. What is more, case research has shown that improvements introduced by lean practices are not properly considered in traditional accounting systems (Young, 1992; Maskell and Baggaley, 2006; Hutchinson, 2007). For this reason, this study proposes a new model of Lean Management assessment using time as the catalyst of the process.

We conducted an exploratory study using a qualitative approach based on a literature review of the relationship between performance and the five management internal practices encompassed in LM: Just in Time (JIT), Total Quality Management (TQM), Total Productive Maintenance (TPM), Activity Based Management (ABM) and High Performance Work System (HPWS). Subsequently we identified the indicators and factors used to assess these practices in order to develop an approach that relates LM to financial performance. The articles reviewed were taken from relevant scientific journals in several areas: Production/Operations Management, Management and Accounting and were identified in the main Management journal databases for the period between the *Womack et al.* (1990) book to the present day using key words related to LM. Given the scope of our research, which includes an analysis of the relationship between LM and financial performance, articles that only considered operational indicators or contextual factors, or that provided no empirical evidence for financial indicators, were ignored. The remaining articles were classified according to two criteria. Firstly, depending on how implementation affected the company's profitability (financial performance): positively or negatively. If no influence was observed, the article was classified as neutral. If the management practice affected some financial indicators positively and others negatively, the article was classified as mixed. The second criterion was the kind of performance indicators considered: financial, non-financial or operational, and the contextual factors of the company itself or its environment. At the end, we try to complement this classification with the time implementation because we consider that it is a key factor.

Assessment of management models included in lean management

The pillars of the LM management system within the company are founded on continual quality improvement, productivity and cost reduction (Cooper and Maskell, 2008). In order to achieve continual improvement, practices derived from Total-Quality-Management (TQM), Just-in-Time (JIT) and Total Productive Maintenance (TPM) (Cua *et al.*, 2001; Powell, 1995) are used. In order to achieve a reduction in costs and improvements in productivity, LM tries to eliminate all activities that do not provide added value (Cuatrecasas, 2002), as a result of which its application involves the indirect adoption of Activity-Based-Costing/Management (ABC/ABM) complementary to its implementation (Cooper, 1996; Boyd *et al.*; 2006; Silvi *et al.*, 2008). Another keystone of LM is the involvement and commitment of people to the company, for which advanced Human Resources practices are implemented (High Performance Work System, HPWS) (Colombo *et al.*, 2007; Way, 2002).

Our initial hypothesis is that the current way of LM is assessed is confused. Some authors have split the assessment of management systems into different operational aspects, such as

the effect implementing LM has on delivery times, quality and costs (De Toni and Tonchia, 1996). Others have exclusively defended the use of non-financial indicators (Fortuin, 1988; Upton, 1998; Bourne et al., 2000). The current trend is to use a measure of performance that combines both the financial and operational angles (Coopers and Maskell, 2008; Wempe and Fullerton, 2009) although the best indicators for use in each case are not known (Nelly et al., 2005). Also, the fact that the measure of accounts-based results are constantly questioned due to their “short term” nature and their “easy manipulation” (Lea and Fredendall, 2002; Koumanakos, 2008), has determined the decision to analyze more just financial indicators of performance. The purpose of this is to compensate for the limitations of accountancy data and comparisons can be made with other indicators (Cannon, 2008) in keeping with the idea that non-financial measures can complement financial indicators (Banker *et al.*, 2004). If contingency theory is also taken as part of the basis (Chenhall, 2003), the best solution would be to use contextual or environmental factors to improve the overall assessment of management systems. However, the impact of contextual factors in results is not clear and need more studies (Germain and Drogé, 1998; Barker and Emery, 2006; Terpend et al, 2008).

In any cases, managers need to know if a new practice will get good results in order to implement it or not. Not all named “best manufacturing practices” produce significant performance effects (Laugen et al, 2005).

The following subsections focus on how the different management practices related to LM have been assessed. Table 1 summarises the content of articles, sorted chronologically. Values are given for each article in the three columns corresponding to each practice (TQM, JIT, ABC/M, or HPWS). There are no columns for TPM since no article that relates that model to financial performance has been found. The three columns of each practice denote the relationship of said practice with the financial performance of the business (FP), the kind of indicators considered (I), and whether contextual factors have been taken into account (CF). Values in FP columns can be P (positive), M (mixed) or N (neutral). Values in columns I can be F (financial) or O (operational). CF columns can indicate ✓ (yes) or ✗ (no).

Table 1 – Articles that analyse the influence of TQM, JIT, ABC/M and HPWS on performance

Article	TQM			JIT			ABC/M			HPWS		
	FP	I	CF	FP	I	CF	FP	I	CF	FP	I	CF
Fitzerald and Erdmann (1992)	P	F	✗									
Sevmour (1993)	P	F	✗									
Inman and Mehra (1993)				P	F,O	✗						
Shetty (1993a)	P	F,O	✗									
Shetty (1993b)	P	F,O	✗									
Adam (1994)	M	F,O	✗									
Billesbach and Haven (1994)				P	F,O	✗						
Maani <i>et al.</i> (1994)	N	F,O	✗									
Chang and Lee (1995)				M	F,O	✗						
Huson and Nanda (1995)				P	F	✗						
Mohrman <i>et al.</i> (1995)	M	F,O	✓									
Pandva and Boyd (1995)				P	F,O	✗						
Powell (1995)	M	F,O	✗									
Balakrishnan <i>et al.</i> (1996)				N	F,O	✓						
Forker <i>et al.</i> (1996)	P	F,O	✗									
Madu <i>et al.</i> (1996)	P	F,O	✓									
Adam <i>et al.</i> (1997)	P	F,O	✗									
Chapman <i>et al.</i> (1997)	N	F,O	✓									
Chenhall (1997)	P	F,O	✓									
Germain and Dröge (1997)				P	F,O	✓						
Grandzol and Gershon (1997)	M	F,O	✓									
Hendriks and Singhal (1997)	P	F	✗									
Ittner and Larcker (1997)	M	F,O	✗									
Lemak <i>et al.</i> (1997)	P	F	✗									
Chang and Cheng (1998)	P	F,O	✗									
Easton and Jarrell (1998)	M	F,O	✗									
Germain and Dröge (1998)				P	F,O	✓						
Nakamura <i>et al.</i> (1998)				N	F,O	✓						
Anderson and Sohal (1999)	P	F,O	✗									
Claycom <i>et al.</i> (1999)				P	F,O	✓						
Lieberman and Demeester (1999)				P	F,O	✗						
Agus and Hassan (2000)	P	F	✗									
Agus <i>et al.</i> (2000)	P	F,O	✗									
Callen <i>et al.</i> (2000)				P	F	✗						

productivity and time, both in the reduction of the operating cycle and in delivery times to customers. Contextual factors are used to explain the influence JIT has on the results in 53% of the articles. This has been a tendency in recent years in keeping with contingency theory. More than half the articles use company size (measured as sales volume or number of employees), JIT implementation time and the use of other additional management systems (such as TQM). There are wide differences between the results obtained. Germain and Drögue (1997), for example, find that size has a negative effect on the adoption of JIT and Chen *et al.* (2005) discover that the effects that felt from the implementation of JIT are conditioned by macroeconomic variables, such as interest rates and inflation.

Assessment of Total Quality Management

The great majority (52% of the articles) of the 53 studies that analyse the relationship between TQM and financial performance find that TQM has a positive bearing on the performance, although the latest of these papers (Hendricks and Singhal, 2001) condition this principle to a firm's intrinsic characteristics, in keeping with contingency theory. On other occasions it is not intrinsic or extrinsic characteristics that condition the impact that TQM has on financial or market results, but the influence of other, intermediate variables. Quality improvement alone may not be enough to change firm's financial performance (Adam *et al.*, 1997; Han *et al.*, 2007). Management leadership, training and the relationship between the employees and the quality of data all affect operating performance from the management of quality to suppliers, product design and the management of the production process (Kaynak, 2003).

In other regards, there is a consensus amongst the literature on the fact that the implementation of total quality management practices has an impact on the operating indicators and that these, in turn, have a direct or indirect effect on performance (Easton and Jarrel, 1998; Lakhal *et al.*, 2006). Where a consensus does not exist, however, is on the type of impact these practices have on performance. Customer-oriented or continual improvement practices thus have a positive impact on the performance, whilst teamwork seems to have a negative effect (Fuentes *et al.*, 2004). The analysis of the bibliographical review between TQM and financial results does not provide conclusive results, either, and this is a controversy that is still unanswered today (Wayhan and Balderson, 2007b). Finally, although there are 35% of the articles that condition the result of TQM to contextual factors, the latest empirical research studies show that the proper implementation of quality improvement practices outweighs all other factors (Sila, 2007).

Assessment of ABM

There is no unanimity between all the studies that relate ABM to performance when it comes to assessing the management system. Over 80% supplement financial indicators with operating indicators, in which the time effect and costs stand out. Only half the studies use contextual factors as determinants of performance when this system is implemented. These determinants vary depending on the degree to which the system is implemented; ie: in companies where ABC/ABM has already been implemented, its use is conditioned by management support and the associated reward system; on the other hand, in companies which are in the first stages of the ABC/ABM implementation process, its use is conditioned by the team that it is being implemented by (Anderson and Young, 1999). Some studies set out a series of variables that condition the improvement of ROI, such as the joint use of ABC and other strategic initiatives, the degree of company diversification, the costs level or the number of transactions that occur within the company (Cagwin and Bouwman, 2002).

According to Anderson and Young (1999), if the management considers that the implementation of ABC/ABM will improve anticipated results, it will not hesitate to develop it. Nevertheless, to be effective it must be adapted to the company's accounting system and its environment (Al-Omiri and Drury, 2007). Traditional methods of recording and assessing

costs are of no use in current times (Dickinson and Lere, 2003) which is why financial indicators are not conclusive when assessing performance, either.

Assessment of Total Productive Maintenance

There are studies that demonstrate that the synergy effects produced between TQM, TPM and JIT lead to better results for firms (Seth and Tripathi, 2006; Cua *et al.*, 2006). In these cases, a positive and significant relationship can be seen between cost reduction, high levels of quality and improvements in performance, in time and service (McKone *et al.*, 2001). There are also studies that analyse the contextual factors that condition the appropriate implementation of a TPM program, such as the application of JIT, TQM, worker involvement, the environment and the influence of the setting (country, sector) (McKone *et al.*, 1999). However, no bibliography has been found that attempts to analyse the direct relationship between TPM and financial performance.

Assessment of High Performance Work System (HPWS)

The empirical evidence obtained to date indicates that the adoption of these practices does not necessarily produce results that cover the cost associated with the use of these systems (Way, 2002). HPWS practices will have one effect or another depending on the company's intrinsic and extrinsic characteristics, although empirical research considers that if there are no changes towards centralisation in company organisation, there will be no positive effects on performance (Colombo *et al.*, 2007). Indeed, the impact that HPWS has on the organisation's results irremissibly requires improvements in human resources as an intermediate step, depending on the sector and company size (Beltrán-Martín *et al.*, 2008). Table 1 shows that all the studies analysed supplement financial indicators with operational indicators and contextual factors.

Assessment of the impact of lm on performance

In the previous sections we have reviewed the diverse impact that the different management systems have on performance when bundled together in LM. We shall now proceed to analyse the various studies that have explicitly researched the relationship between LM implementation and performance.

LM implementation affects not only internal results (a reduction in costs, improvements in quality and productivity, etc.) but extends to the supply chain and suppliers, especially (Wu, 2003). In other words, any assessment of its results has to be very wide-ranging. For this reason, the LM assessment focus will be based exclusively on the use of the three types of indicator used to assess the other management systems linked to Lean Management (financial, operational and contextual indicators). The synergy effect between LM and other management systems, which is not always positive, must be also taken into account. For example, inventory reduction has negative effects until levels stabilise (Meade *et al.*, 2006).

Table 2 summarises papers which analyse the influence that LM has on performance. Said studies provide widely differing findings. Specifically, while 50% of the articles find that the influence of own resources on performance are positive, 50% state that the results of the indicators are mixed, ie: impact on sales growth and performance of shares is not significant (Olsen, 2004). In other regards, among operational indicators, the transition time until LM is fully implemented and the impact of this on results are considered to be essential issues to assess the outcomes of its implementation on results: although the initial assessment might be negative, when some time has passed it might be considered beneficial for the company (Cooper and Maskell, 2008). It should be noted that there is no neutral result if LM is implemented. From the literature review, it is deduced that there is a dearth of studies that consider the influence of contextual factors on LM-derived results (Hines *et al.*, 2004).

Table 2 – Articles that analyse the influence of Lean Management on performance

Article	LEAN MANAGEMENT		
	FP	I	CF
Oliver <i>et al.</i> (1996)	P	F,O	✗
Biscontri and Park (2000)	P	F,O	✓
Lewis (2000)	M	F	✗
Martínez and Pérez (2001)	M	F,O	✗
Soriano and Forrester (2002)	P	F,O	✓
Olsen (2004)	M	F,O	✓
Boyd <i>et al.</i> (2006)	P	F,O	✗
Maskell and Baggaley (2006)	M	F,O	✓
Meade <i>et al.</i> (2006)	M	F,O	✗
Ward and Zhou (2006)	P	F,O	✓
Bayou and Korvin (2008)	P	F,O	✓
Cooper and Maskel (2008)	M	F,O	✗
Koumanakos (2008)	M	F,O	✓
Fullerton and Wempe (2009)	P	F,O	✓

Performance indicators used in the assessment of management systems

With a view to providing the scientific community with a reference framework for the assessment of management systems, we have studied the literature more closely, as it has been grouped, in an attempt to disaggregate the indicators where there is a greater consensus among researchers on empirical papers. The most financial indicators are, in this order: earnings/profits/net income, ROA, sales, ROS and ROI, used to assess TQM and, to a lesser extent, JIT. A wide variety of financial indicators can be used when assessing the Lean Management. The most used indicators are those that are simple and easily found in statements of results, such as profits and sales, especially, in the nineteen-nineties although nowadays the trend is to use the ratios. However, accounting data has certain limitations as earnings management, overall (Koumanakos, 2008; Cooper and Maskell, 2008).

The most used operating¹ indicators to assess management systems in the literature are, in this order: costs, labour productivity, inventory turnover and quality. Once more the articles on TQM use the greatest number and variety of indicators to assess impacts on results. To a lesser extent, articles on JIT and LM also use operating indicators and, in this case, the most used are those linked to employee participation and work, inventory level and quality results. In fact, the bottom line is the manager then (Mizruchi, 1983) and now (Cooper and Maskell, 2008) although there is a statistically significant relationship between operational and financial indicators (Flamholtz and Hua, 2002).

The characteristics of the company and the environment that have to be rigorously controlled to assess a management system are also identified. Firstly, the use of contextual factors to assess management systems is much lower compared to the degree to which operational and, especially, financial indicators are used. The most used factors are company size, years of implementation and sector or company type.

The current trend is to consider the time as a key for both implementation and in the evaluation of any management system (i.a.: Meade *et al.*, 2006; Ward and Zhou, 2006; Benner and Veloso, 2008; Fullerton and Wemper, 2009). In the implementation phase, operational indicators must be used. Then, financial indicators will be used to assess the management system.

Conclusions

The first aspect to be highlighted is the little importance given to assess the results that come from implementing the management systems analysed, considering the large number of

¹ We are classified all operational indicators following Demeter *et al.* (2009)'s classification.

articles published on these management systems up to date. A total of 109 articles were identified as being related to the objective of the article, practically half of them deal with results obtained from the adoption of TQM. Twenty-nine percent of the articles relate JIT to results and twelve percent examine the relationship between LM and performance. It might be said that the assessment of performance for the remaining management systems is a residual topic for researchers.

As far as evolution over time is concerned, it can be deduced from the number of articles published between 1999 and 2004 that it is during this period that the analysis of the impact of management systems on performance peaked. Periods when it is more fashionable to assess a given management system can be also noticed: up to the year 2002 researchers were concerned with assessing TQM, whereas from that date onwards their interest has focused on an assessment of JIT and LM.

With regard to how the management systems impact on financial results, the main conclusion is the empirical evidence does not provide enough consistent results with theoretical forecasts. Nevertheless, there are differences between the management systems analysed: whilst a mostly positive impact on financial results was found for advanced human resource practices (HPWS), only a few papers find the impact positive for LM. It should be highlighted that the JIT system raises more doubts about its implementation, as a large percentage of empirical studies give neutral results. It is also significant that there is no empirical study which demonstrates that implementing a management system leads to negative financial results, even when start-up costs are taken into account. In other regards, only a marginal use has been made of the internal aspects of the firm or of the environmental conditions when assessing management systems. These aspects would define the minimal conditions that should exist for positive results to be achieved with the implementation of a given management system, and a solution could be found through theoretical arguments from contingency theory.

In fact, successful implementation of LM is a complex task (Scherrer-Rathje et al, 2009), overall, its assessment. This means that if it is difficult to assess any management systems, more difficult will be to assess a pool of management systems as LM is. Organizing the performance measures into four groups, related to balance scorecard, could be a way to assess management systems properly although managers prefer “financial measures” (Sousa et al, 2005).

Lastly, we believe that, if used in combination, the three types of most used indicators for these management systems should act as minimum checks for researchers who want to assess any LM-associated management system. And the implementation time is the most important variable to condition the performance measurement in order to pursue a long-term strategy (Engström et al, 1996). This would help to prevent the wide disagreement among findings regarding the impact of the management systems on performance found in the literature. Our future research will be to contrast the new model proposed of LM assessment in the Spanish automotive industry.

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