Soft Investment: Lean versus Traditional Plants

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ABSTRACT

Lean production comprises a set of different tools geared towards the elimination of all operations that do not add value to a product, service or process, thereby increasing the value of each activity and removing all that is not required. An essential part of lean production is training and education. Training and educating the workforce (what we refer here as "soft investment") will create the necessary conditions to engage and involve employees in improvement activities, so are indispensable in the implementation of lean production. The aim of this study was to explore and contrast the relationship between "soft investments" in lean firms and "soft investments" in traditional firms, by set of hypotheses tests. Data, both quantitative and qualitative, were collected through a survey in conjunction with short structured interviews and planned visits to several organisations. Two questionnaires were administered at two different levels of the organisations: one to the CEO or general managers and the other to the operations managers with the objective of evaluating the relationship between "soft investment" and the implementation of lean production. More than 30 firms in the tableware industry of the UK completed the questionnaires. The information collected allowed an analysis of the given hypotheses and the results and conclusions of the study shown that organisations that use lean manufacturing invest significantly more in training the labour force than those that do not.

1. INTRODUCTION

This study investigated the application of lean production techniques in the UK ceramics industry of North Staffordshire. This craft-based industry represents a major manufacturing sector in the UK and it depends heavily on export markets, the majority of which are composed of tableware products. Although the sector is still a major employer in North Staffordshire, it is estimated that more than 44 per cent of jobs have been lost in the last 25 years [1-6]. Closures, downsizing and restructuring have taken place in many ceramic firms, mainly in response to changes in market demands, increasing foreign competition and the introduction of new technology.

Lean manufacturing pursues simultaneous improvements in all aspects that drive the elimination of waste. This is usually achieved through projects that change the physical organisation of work, logistical and production control throughout the entire supply chain; the way the human effort is applied not only in production activity but also in the support activities. Lean manufacturing was developed first in Japan by the instigators of the Toyota production system: Taiichi Ohno, Shingeo Shingo, Eijy Toyoda among others. The lean manufacturing system has been defined as a philosophy founded on different principles, see [7].

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Researchers from MIT, theoreticians of the new manufacturing paradigm called lean production, conducted an international investigation of the automotive industry and differences in productivity entitled the International Motor Vehicle Program (IMVP), costing $5M. The MIT academics argued that this system would change the organization of production, and that its adoption was absolutely necessary in US and European industries to remain competitive in world markets.

Since the publication of the lean production thesis [8], the interest in this concept has grown and evolved considerably. The diffusion of information regarding the lean concept can be obtained in key books and articles, which are often quoted by academics since the lean movement was founded. Among these references it is important to mention the contribution of Womack's books: The Machine that Changed the World (1990); Lean Thinking: Banish Waste and Create Wealth in your Corporation (2003); Lean Solutions: How Companies and Customers Can Create Value and Wealth Together (2005). Other key books include those published by Shigeo Shingo [9] and Taiichi Ohno [10], and the paper published by Spears and Bowen [11]. The lean concept has many appeals for the practitioner via just-in-time management, and the integration via computer-aided processes to the areas of design, factory management, supply and distribution, see [12]. Womack and Jones [13] argue that lean production can be applied to any organisation or economic activity. They also argue that lean production provides a way of generating sources of employment instead of destroying the same on behalf of efficiency and that managers have turned 'mean' instead of 'lean' as a consequence of not employing the system correctly or simply employing it piecemeal. Lean production is a long term approach and not a panacea to sort out competitive problems in the short run [8]. Therefore, lean manufacturing is best viewed strategically as a formidable weapon in increasingly competitive markets [14]. Theoretically and critically lean production also appeals to academics. It represents a natural progression from Fordist mass production, although there has also been a debate on the extent to which it represents a new paradigm [15], [16]. After years of 'downsizing' and 're-engineering', managers needed to look for a model that would allow them to engender continuous and successful growth.

2. EDUCATION AND TRAINING – THE LEAN CONTEXT

The elements of lean production are evident through different industrial sectors, but the rate of change is dramatically different and the specific results can vary from firm to firm [17]. Despite this interest, nonetheless, we really do not know the boundaries of this lean production system. Therefore, there is a need to conduct more research in this important area. Since the introduction of this production system [8] this has been the topic of more research in operations management. In terms of its implementation, McClure [18] indicates that lean production may find a subtle form of resistance. However, this could be prevailed over by the training of employees in preliminary steps. Grieves [19] argues that people have a dominant role in the implementation of lean production, stressing the need of training and educating the workforce. In addition, Slack et al [20] argue that, under a lean perspective, training is a key factor when improving and implementing processes.

Bigelow [21] defines training as "formal instructions sessions to provide employees with knowledge, skills, competence and expertise in specific subject matters or job functions". Bigelow [21] also argues that in some cases, companies retrain employees several times without finding out the root cause of employee's inability to learn or comply with the requirements.

New technological innovation requires employee training. Warren et al [22] indicate that fast and single fire technology has been incorporated into the tile industry since 1990. However, the sanitaryware and tableware sectors delayed in considering such installations. It is in this instance where employee training plays an important and crucial role. Day et al [22] indicate that mass production has dominated this industry for many years, where manual labour, semi-skilled workers and predominantly unskilled labour were the typical scenario. Day et al [22] also stressed that under the new flexible specialisation environment (a lean characteristic), core and periphery workers, multi-skilled artisans and semi-skilled operatives were linked by a chain of sub-contractors. Again, here training plays an extremely important role.

Soft investment is an infrastructural factor, which could be associated with the concept of leanness, see [7]. This is the proposition compared in this research. In so doing this study increases the knowledge about lean production. Moreover, under the methodological point of view and due to the fact that there are no similar studies in relation to the existing correlation between soft investment and the implementation of lean production, this study offers opportunities to develop new perspectives. According to Buhler [23], training the workforce is a key challenge and it is necessary to be reconsidered by managers in order to combat global competition. May [24] argues that people must learn in order to develop knowledge, which will empower the workforce to become independent goal seekers, leanness while developing deeper problem solving skills and critical thinking capabilities, which are key

characteristics of the lean principle of multifunctional teams. Needy [25] indicates that companies claim that people are their greatest assets, however, many of them fail to assess skill standards which need to be developed. In line with this argument, Smith et al [26] stress that the implementation of new management practices in industrialised countries has had a significant impact in employee training.

3. METHODOLOGY

The research methodology followed in this study is based on the formulation and test of two hypotheses. These examine the existing relationship between the two components that conceptualise leanness (managerial commitment towards lean production and real changes made towards the lean direction) and the soft investment, which is assumed to be an infrastructural factor associated with these two components. Hence the following hypotheses were developed:

H1: Firms that have made in tandem investment in the supporting manufacturing infrastructure, SMI – (measured by the degree of commitment – DOC) and real changes towards the lean direction (measured by the degree of leanness – DOL) have also made investment to train their personnel (measured by the variable Investment in People – INVESTP), see [7].

H2: firms that have made in tandem manufacturing structural investments – ISM (measured by the degree of commitment – DOC) and real changes towards the lean direction (measured by DOL) have also trained their production managers (measured by the variable managerial skills – MSKILLS).

The two hypotheses formulated, and presented above, for this investigation are summarized in table 1.

Table 1: Research methodology summary

Variables	DOC	DOL	INVESTP	MSKILLS
Hypothesis 1 (H1)	+	+	+	N/A
Hypothesis 2 (H2)	+	+	N/A	+
Tool	Questionnaire 2	Questionnaire 1		
Respondent	Top Management (CEO/President)	Operations and Production Managers		

3.1. RESEARCH TOOL – SURVEY STUDY

The main research tool used in this study of the tableware industry was a survey questionnaire. As the model and methodology of this study have already been explained in detail, see [7] and [27], it will simply be summarized here. It is prescribed that this survey, in adapted format, can be deployed for data collection in future studies testing the leanness of manufacturing firms. This survey was also supplemented with structured short interviews, external and internal secondary data and plant observation to increase familiarity with the tableware industry and triangulate any results derived for the study for validation purposes. The aim in deploying this survey was to examine the relationship between the main components of the Karlsson and Ahlstrom conceptual framework, see [28] for a reference on this framework, the adoption of lean production principles and managerial commitment to lean production. Because the relevant data were not available in secondary form, primary data collected was necessary. The data generated also enabled the investigation and testing of a number of other different research hypotheses.

For the purpose of this paper, the unit of analysis is the firm. The information was obtained from two levels of the organisation: the production and operations managers, and top management (CEO/president). A different questionnaire was used especially designed for each level. Questionnaire no. 1 was directed at production and operations managers and was used to measure the degree of adoption of the principles that comprise lean production. Questionnaire no. 2 was directed at top managers and was used to measure the degree of commitment of top management towards the adoption of the lean system. Both questionnaires were completed in the presence of the researchers. The two questionnaires measured different variables, consequently, they were analysed independently. A short structured interview was performed on the operations managers with the objective of obtaining more

information about the firms and the managers. Additionally, 14 planned visits were conducted. The objective was to observe the production process in more detail. The population was defined as the firms of the sector with 35 or more employees, included in the list provided by 'Business Link Staffordshire' under the title 'vitreous china table/kitchen products'. A list of 45 companies having these characteristics were acquired from this title sector. The basic assumption of this study was that firms surveyed should have a minimum of 35 employees in order for the new paradigm to be viable. The fundamental reason for this assumption is that a typical process in this industry has six stages: 1. Preparation of the clay, 2. Moulding, 3. Drying, 4. Firing, 5. Decorating, Fixing & Refiring, 6. Packing. If at least 5 workers are assigned to each stage this will add up to a total of 30 employees for manufacturing. Additionally, a minimum of 5 administration staff are needed which adds up to 35.

North Staffordshire County is traditionally known as the heart of the tableware industry in the UK as most of the 'potteries' and largest firms are located there. Three experts from CERAM Plc, previously called 'British Ceramic Research Institute', reviewed the list previously provided by the 'Business Link Staffordshire'. They excluded firms that had disappeared or gone bankrupt, sister companies and other sectors that were wrongly included in the list (e.g. refractories and miscellaneous products). They also included some firms that were not in the list but in their opinion were relevant for the study. The new reviewed list comprised 36 firms. These firms were contacted and 33 agreed to participate. All firms completed both questionnaires (with the exception of only one general manager who decided not to participate). The rate of response was higher than 90 per cent, which is exceptionally high compared to similar research conducted in other similar industries, see [29].

4. STUDY RESULTS

4.1. HYPOTHESIS 1 (H1)

To test H1 a correlation analysis was performed. This hypothesis assessed the relationship between the degree of managerial commitment towards lean production (DOC) and degree of adoption of lean systems (DOL) in relation to the investment in people (INVESP), see table 1. In a previous study, the taxonomy of the firm that comprises this industrial sector was performed by a cluster analysis, see [7].

Since the variables DOC and DOL comprise the concept of leanness, they were both correlated with INVESTP. Table 2 shows the results of this analysis. As can be observed, factors DOL and DOC present a high correlation ($p<0.01$) indicating that lean production was implemented. Also, the same variables are correlated with INVESTP ($p<0.05$). However, when executing a one-way ANOVA the means were found not to be significantly higher in lean plants than in traditional plants. Out of this analysis we can infer that if we make soft investments in lean plants, however, not sufficient enough to have a significant difference. Nonetheless, H1 was accepted.

Table 2. Pearson correlation matrix between factors DOL, DOC and response INVP (N=32)

Factor	DOL	DOC	INVESTP
DOL	-	.520 (**)	0.350 (*)
DOC		-	0.333 (*)
INVESTP			

(*) $p < 0.05$; (**) $p < 0.01$

4.2. HYPOTHESIS 2 (H2)

To test H2 a correlation analysis was performed. This hypothesis assessed the existing relationship between the degree of managerial commitment towards lean production (DOC) and the degree of adoption of the lean system (DOL) in relation to the training of the operations managers, which was measured by the factor managerial skills (MSKILLS). The variables DOC and DOL comprised the operationalisation of lean production so investigated the correlation between managerial skills and both of them. Table 3 shows the results of this analysis.

As can be observed in Table 3, the factors DOL and DOC presented a high correlation ($p<0.01$) between them, which indicated that lean production had been implemented. Also, it can be observed that DOL and DOC are highly

correlated ($p<0.01$) with MSKILLS. Then, one-way ANOVA was performed followed by Tukey's HSD procedure. ANOVA showed that there are significantly high effects between ($F2, 27=15.506000$) for this variable. Tukey's HSD procedure has shown that MSKILLS factor in lean firms are significantly higher than those of the same variable in traditional firms, which means that lean firms have managers with better managerial skills than traditional firms. Moreover, lean firms also have better managerial skills than firms in transition. This analysis indicates that managerial skills are a key factor in implementing the lean operations paradigm. In this study, when we talk about managerial skills we included the educational level, his/her managerial experience, training in last 5 years and managerial competencies. The managers' attitude and interest towards this research project in addition to the level of cooperation towards this study was included in this measurement. It could be observed that in addition of his/her level of experience, training, and skills, managers of this firm had a positive attitude and genuine interest in this investigation in contrast to those managers in traditional firms. This is in line with what Weiss [30] argues regarding that the attitude and interpersonal relations are as, or more, important than the capability and ability. These results provided support for H2, which was accepted.

Table 3. Pearson correlation matrix between factors DOL, DOC and response MSKILLS (N=33)

Variable	DOL	DOC	MSKILLS
DOL	-	.520 (**)	0.548 (**)
DOC		-	0.588 (**)
MSKILLS			

(*) $p < 0.05$; (**) $p < 0.01$

5. CONCLUSIONS

Based upon the results of this investigation, it can be concluded that firms that have made higher soft investment are the lean ones. Therefore, H1 and H2 were accepted and shown that there is a correlation between the concept of leanness and soft investment. These results also are consistent with Buhler's [23] results, who argues that soft investments tend to be a critical element in successful firms. As it can be seen, training is an extremely important issue when implementing lean manufacturing. Due to insufficient empirical evidence, future research is needed to clarify the existing relationship between soft investment in firms and the implementation of lean production found in this study.

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