

# A MODERATING ROLE OF THE SUSTAINABILITY IN LEAN PRODUCTION SYSTEMS: A LONGITUDINAL CASE STUDY ANALYSIS

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## ABSTRACT

**Purpose** – The purpose of this paper is to explore the extent to which principles of lean product development are applied to product design and engineering at production systems in Italian medium sized firms. “Lean thinking”, with its focus on the elimination of waste for the improvement of flow, and on continuous improvement has profoundly influenced many aspects of manufacturing, (Womack and Jones, 1996; León and Farris, 2011). The effectiveness improvements to be gained from a lean approach to manufacturing processes will, however, be limited by the development and engineering of the product. Much of the literature and research on lean product development (LPD) has looked at individual aspects for improvement of product design and development (PD&D) processes. This study inserts itself in the literature that compares the efficiency of individual performance evaluation.

With the problems associated with over-emphasising process control, ambidexterity appreciates a need to engage in exploratory learning to adequately adapt to environmental changes. Koskinen and Vanharanta (2002) for example, suggest that purposeful learning through explicit knowledge learnt through books and databases, and tacit knowledge gained through experience, may be particularly important in the initial stages of exploratory learning. Argyris (1977) similarly suggest that exploratory learning aids in ensuring that organisations address the needs of the customer more effectively rather than simply operating more efficiently. However, over expenditure on exploratory learning can result in the pursuit of flexibility at the expense of short-term profitability (Miles et al., 1978). To address this, it is necessary for firms to develop appropriate organisational processes and dynamic capabilities that support adaptation at a rate that reflects their operating environment (Eisenhardt and Martin, 2000). From a dynamic capabilities perspective, Anand et al. (2009) stated that without appropriate resources allocated to breakthrough process innovations, firms may have difficulties in sustaining improvements. In this study we give specific attention to project-level processes, emphasising the impact of the operating environment of each firm. Depending on a particular business environment, the ability of firms to engage in process innovation can have dramatic effects on firm performance, compared to firms with greater emphasis on cost based competition (Levinthal and March, 1993).

**Design/methodology/approach** – Drawing on reviews of both operations and strategic management literature, the paper employs a case study methodology to unpack critical aspects of operational business process improvement within a lean production process systems.

This study uses a longitudinal case study (action research - AR), which combines qualitative and quantitative analyses. Survey, interview and observational data form the basis for an adaptation of

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lean product development system (LPDS) (Reinersten, 2007; Pullan et al., 2013) to the medium sized firms that produce industrial plant machineries. Observations over time, documents such as contracts, joint agreements, meeting agendas and minutes, personal conversations, and in-depth interviews were mainly used, with quantitative measurement of operational performance. Rather than taking the conventional semi-structured interviewing approach, the case study adopted an “active interviews” approach. Traditional approaches may view interviews as a neutral means of extracting information. Active interviewing, on the other hand, views interviewing as a meaning-making conversation, and so active in the sense that a two way conversation is unavoidably interactional and constructive. Thus, active interviewing is a joint process of knowledge creation between the interviewer and interviewee, rather than a unilateral process of information extraction on the part of the interviewer (Matthews et al., 2014).

**Findings** – The benefits of applying lean thinking to PD&D, such as achievement of higher productivity and design quality with less development time and less engineering effort have been widely provided in the literature (Bicheno and Holweg, 2009; León and Farris, 2011). The study offers additional empirical support for production competence theory. This work outline that although firms may be technically capable and even though firms may be able to develop new products, they may not be able to make use of them in an efficient manner.

The complete solution to eliminate waste and improve the existing system is provided, as well as the ordering process solution in the form of service level models. The results of the study proved ‘manufacturing management approach coordination’ to be a consistent approach in reducing inventory, reducing the safety stock at the buyer’s facility, improving the forecasts, lowering the product delivery lead-times, and establishing an information system throughout the three tiers of the supply chain.

**Originality/value** – The paper offers a novel approach to operationalize production competence.

In addition to offering general support for the thinking behind existing theory of production competence, this article makes important theoretical contributions. Recognizing the nature of production competence it offers an overview about the lean production managerial choices. The study on lean production managerial choices (about this theme) was previously used in case study based articles. To the best of our knowledge, this paper represents the appreciable application of the the know production managerial philosophy (lean production) to investigate the relationship between production competence and business performance.

Finally, the present study supports the critique (Vickery et al., 1994) on (some of the) existing production competence theory (Cleveland et al., 1989; Safizadeh et al., 2000; Schoenherr and Narasimhan, 2012), namely that the association between production competence and performance is assessed using operational measures together with or instead of business performance measures.

The importance of the lean production (o thinking) analysis approach adopted in this study avoids the major drawbacks of previous production competence studies and offers an appropriate method to assess the impact of production competence on business performance.

**Practical implications** – The purpose of this paper is to seek remedy to two major flaws of the production competence literature, which concern: the way the production competence construct is operationalized and the way its effects on performance are measured. Using a longitudinal case

study analysis, the study shows that the importance performance matrix is a useful tool for decision makers to assess and improve their company's manufacturing strategy: it indicates how to prioritize between improvement efforts to positively contribute to business performance.

### **Future research and limitations**

Limitations of the study include the fact that the maturity assessment rating approach is new to the research field, and contains the possibility of rater error and bias. However, the application of multiple raters and variation analysis addresses this issue to some extent. The study also does not measure longitudinal performance of ERP systems, nor accounts for differences in organization scope of ERP deployment, global reach, or implementation duration. All of these factors are important and could be included in future studies of ERP impacts.

A number of potential avenues for future research exist. One approach would be explore the longitudinal relationship between ERP system usage, operational maturity of the productive processes, and operational outcomes (cost savings, financial returns, share price, etc.).

Another research initiative would be to explore why other ERP vendors fail to generate the results found in our research for large vendors. An analysis of small to mid-size company supply management results based on ERP adoption may point to other forms of positive outcomes than the sample of firms we used in the 'sample case' that has been analysed.

**Keywords:** Action research, Production competence, Lean, Business process reengineering (BPR), Business performance

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