A Study of Critical Success Factors and Prioritization by Using Analysis Hierarchical Process in Lean Manufacturing Implementation for Thai SMEs

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Abstract – This study identifies and prioritizes critical success factors (CSF) based on the implementation of Lean Manufacturing for Thai SMEs. After review of International research papers, 12 CSFs were selected and categorized into four resource types from the lens of Resource-Based View (RBV) Theory. These are Organizational, Technology, Human and Financial Resources. Interviews and surveys with Lean experts experienced in SME consultation were carried out to answer the proposed research questions. Analytical Hierarchy Process (AHP) is then applied to prioritize the relative importance of the CSFs. The results show that “Technology resource” is the most important to enhance implementation of Lean in SME organizations. This indicates the knowledge of production technology is a prime key to support process improvement according to Lean methodology. This study contributes to the existing body of knowledge by evaluating and prioritizing CSFs reflecting by grounded theory and expected outcomes at firm level from experts’ experience.

Keywords – Analytical Hierarchy Process (AHP), Lean manufacturing, Resource-Based View

I. INTRODUCTION

Small and Medium Enterprises (SMEs) are importance economic foundation of the country. It make production, employment, income and development of the country competitiveness. Operation strategy as introduction in Thai Industry in order to level up manufacturing performance. Lean is one of prime strategy encouraged among Thai SMEs. Lean manufacturing takes a holistic and multidimensional systems approach towards understanding and providing solutions for reducing waste, and thus develops close links between quality, cost, delivery, customer satisfactions and continual improvement. By implementing Lean, organizations could achieve breakthrough process improvement with a dramatic impact not only on financial benefits but also customer satisfaction and production capability.

While Lean has made a substantial impact on industry, academic research in this area is lacking, particularly research regarding what makes a successful Lean implementation for SMEs. The main purpose of this study is to identify and prioritize factors for successful Lean implementation by employing the Analytic Hierarchy Process (AHP) approach. This method allows us to define those success factors in a hierarchical structure of factors, evaluate factors in pairs, and quantify the relative importance of each factor to the successful implementation. Critical Success Factors resulting from a number of publications are reviewed and selected Preference data from selected experts involved in consulting Lean for Thai SMEs in many years are utilized in this study to identify and prioritize the significant CSFs. The following section provides relevant literature in the field and identifies the factors for successful implementation of Lean. A detailed discussion on research methodology is given in below section, while data analysis and findings are shown in Section 4. Finally, managerial implications are discussed in the conclusion section.

II. LITERATURE REVIEW

A. Analytical Hierarchy Process (AHP) Methodology

In order to ascertain the management of SMEs to understand on factors that affect the successful Lean implementation at firm level, this study conducted an in-depth research in the Thai electronics components manufacturing industry using the AHP approach. AHP is a decision-making approach which integrates simultaneously qualitative and quantitative information for prioritizing alternatives when multiple criteria must be considered. According to Saaty [1], a decision making approach should have the following characteristics: be simple in structure, be adaptable to both group and individual decision making environments, and be natural to human intuition and general thinking.

The modeling process of AHP involves four steps [2]:
1) Assessment of success factors in Lean implementation,
2) Structuring the problem as a hierarchy and building the AHP model,
3) Collection and compilation of experts’ opinions and application of the prioritization procedure, and
4) Determination of critical factors through the synthesis of normalized priority weights.

B. Resources to achieve implementation of Lean manufacturing in SMEs

The basic concept of RBV is that firms are collections of resources that are: (a) valuable to the firm; (b) rare to come by; (c) imperfectly mobile and not imitable by competitors; and (d) not substitutable [3]. The efficiently and effectively resources utilization leads the firms to enhance their organizational capabilities. Resources, in addition, consist of a bundle of potential services, whereas capabilities are intangible bundles of skills and accumulated knowledge exercised through organizational routines [4-6]. Applicability of RBV theory in developing the firm’s capability has been explained by

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the idea of how firms can achieve sustainable competitive advantages by using firm-specific resources. To apply RBV theory in explaining implementation of Lean manufacturing, the resources could be considered as CSFs. What resources play important roles in enhancing success of implementing Lean in environment of Thai SMEs. The CSFs from literatures are arranged into four resources [7] views as follow in Table I and Fig.1:

1) Organization resource (strong leadership and commitment, clear vision and target deployment, project management, and continuous improvement culture),
2) Human resource (empowerment, training and skill building, internal expert, and external consultant),
3) Technology resource (production technology support, and Lean technique knowledge), and
4) Financial resource (financial support for Lean project, and reward).

<table>
<thead>
<tr>
<th>Type of Resource</th>
<th>Critical Factors</th>
<th>Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organization Resource:</td>
<td>Strong Leadership and Commitment</td>
<td>[8-18]</td>
</tr>
<tr>
<td></td>
<td>Clear Vision and Target Deployment</td>
<td>[10,12-16,19]</td>
</tr>
<tr>
<td></td>
<td>Project Management</td>
<td>[8-9,11,13-14,18]</td>
</tr>
<tr>
<td></td>
<td>Continuous Improvement Culture</td>
<td>[8-11,14,18-19]</td>
</tr>
<tr>
<td>Human Resource:</td>
<td>Empowerment</td>
<td>[10,13,17]</td>
</tr>
<tr>
<td></td>
<td>Training and Skill Building</td>
<td>[8-9,11,13-14,18-19]</td>
</tr>
<tr>
<td></td>
<td>Internal Expert</td>
<td>[9,11-12,14-15,18]</td>
</tr>
<tr>
<td></td>
<td>External Consultant</td>
<td>[9,11,14]</td>
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**TABLE I**

CRITICAL SUCCESS FACTORS OF LEAN IMPLEMENTATION: RESOURCE-BASED VIEW PERSPECTIVE

**III. METHODOLOGY**

A combination of research methodology approaches has been employed in this research project. This comprises literature review and specialist interview. The literature review conducted extensively at the initial stages of this research to settle the CSFs for implementing Lean in Thai SMEs. These are categorized based on RBV perspectives. A survey was carried out among Lean experts who have been consultants for Thai SMEs. Most of them have more than 5 years experiences for training Lean Manufacturing topic and implement at shop-floor level. The data were processed in order to give interpreting priority of CSFs using the AHP technique selected because of the following reasons:

- It is an appropriate tool for determining priority of CSFs with respect to different dimensions,
- This technique does not involve statistics or probability theory, thus giving the user a better sense of reality, and
- It is the well established methodology to evaluate important factors in other research focus on operation strategy such as total quality management implementation, and Six-Sigma™ [7,20]

In this study, the structured questionnaire was developed for the eight experts to provide the important score for each CSF. It should be noted that these evaluation score is come from the specifically view point for Thai SMEs not for general firms.

**IV. RESULTS**

Numerical evaluation was carried out in two levels. Firstly, four resources are compared to determination of important weights to prioritize the significant resources for implementation of Lean Manufacturing. In next level, among CSFs are evaluated to determine of important weights on each CSFs. Fig.2. Show the weight calculated by AHP based model for each of resources categories. The top two highest weights are “Technology Resource” and “Organizational Resource”, which are 0.364 and 0.232 respectively.