Reducing Time and Cost of New Product Development in SMEs by E-Collaboration Through Project Management Approach

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One of the most serious bottlenecks in many small and medium enterprises (SMEs) is the time required for new product development. Most SME manufacturing companies have realized that they cannot compete, unless they shorten product development cycle times. At the same time, the rapid evolution of Web-based technologies and knowledge of project management has revolutionized the product development process. Through the literature review and real world insights, this paper proposes a conceptual model and a series of hypotheses. The model integrates departments of design, planning, production and procurement in the company via project management with electronic collaboration (E-collaboration) in order to shorten the time and reduce the cost of new product development. Incorporation of design, planning, production and procurement are the four factors in the improvement of the product development process. In order to validate the research model, we collected data from the interview with the group of project managers of SME by using an internet survey.

Keywords: E-Collaboration, Project Management, SMEs, New Product Development,

1. INTRODUCTION

Previous studies have shown that one of the problems in small and medium sized enterprises (SMEs) is the excessive time that is needed for new product development. As the global competitive pressure increases and product life cycle grows shorter, SMEs have to shorten their product development cycles.1,2 The time for a new production is usually longer and more expensive than initially estimated. Then the companies cannot catch-up to their customers. Therefore, SMEs cannot remain competitive in the global market. Large firms have implemented new technologies to reduce the production time, and can work in different markets.2 SMEs, however, cannot enter the global market, unless they meet the needs of their customers.3

In this context, the authors propose that integration of different departments in one company is important for reducing time and cost in new product development. One way to integrate information is working under a web. Qureshi4 has proven that the use of electronic collaboration (E-collaboration) technologies is essential for supporting projects, and it fosters new types of collective works with advanced collaboration technologies.4 In addition, project management is an integral part of human evolution, and has been considered in many sciences.5 Furthermore, “project management is becoming a key strategy for managing organizational change in contemporary organizations, with corporations, government, academia and other organizations recognizing the value of common project approaches and of educated employees for the execution of projects.”6

The objective of this study is to reduce new product introduction time and cost by establishing a relationship between a project manager and different departments of the company by E-collaboration. The main factors to be considered are department of design, department of planning, department of procurement and department of production. Researchers have discussed these items separately. In this study, these factors are combined to create and evaluate a new model.

This paper is structured as follows: Section 1 presents the purpose of the study and defines its research objectives. Section 2 is the review of prior literature on reducing the time and cost of a new product. We introduce the methodology in Section 3. Section 4 describes the theoretical foundations and the conceptual model. Section 5 is the conclusion.
2. RELATED STUDIES

For better understanding, the authors define some key terms related to this study:

- **Project management**: According to QueenFish et al. Project management is "the manner of implementation of expertise, paraphernalia, knowledge and modus operandi to an extensive range of activities for the fulfillment of prerequisite of the specific project."

- **E-Collaboration**: Cai et al. defined "E-Collaboration is collaboration among different individuals to accomplish a joint task using electronic technologies."

- **SMEs**: According to Alebrahim et al. "There are many accepted definitions of SMEs in addition the classifications vary from one country to another. Different countries accept dissimilar criteria such as employment, sales or investment for defining small and medium enterprises. In the absence of a definitive classification, a consensus has developed around the European Commission (EC) criteria for SME classification, this definition adopts a quantitative approach emphasizing "tangible" criteria, employee numbers (Fewer than 250 employees), turnover (Less than 50 million) and balance sheet statistics (Less than 45 million)."

- **New product**: According to Hohenegger et al., "new product development (NPD) is a business process for developing new products for a company, whether it is an upgrade of an existing product or a new concept. It includes all activities from the development of an idea or concept for a product, to the realization of the product during the production stage and its introduction into a market place."

Other researchers have already discussed the phases that this paper considers for reducing time and cost. In order to reach the objectives of the study and evaluate the conceptual model in new product development, two of the four phases are used. These phases are planning, product, and procurement.

2.1. Design Stage

In order to identify the most influential design factors in a new product, Zhou1 has proposed a Web-based collaborative tool between designers and engineers in different departments, which will reduce the amount of reworking and shorten the product development cycle. Roemer22 found that if the design of production is synchronized with manufacturing, less time will be required for production. Furthermore, Selvaraj23 has suggested that one of the ways to reduce time and cost is design for manufacturing and assembly. Further, Roberts24 has defined the service assembly environment (SAE) including the design phase of a product which is important for improving product time. In addition, Lien25 has illustrated that modular component parts for designing a product can improve the time to market of new product. Chong26 has proven that the implementation of CAD technology also improves product development performance. Finally, Vinod27 has found that the design by CAD is useful for product development and reducing time and cost in the pump industry.

2.2. Planning Stage

In this stage, Xiao-Jiao28 has illustrated that four steps are involved in defining a project, identifying a critical chain, setting buffers and constructing the project plan which is important to set lead-time. Hebert, John29 has proven by combining software project for planning like Microsoft project and traditional programming concurrently, the time and cost of construction projects decrease.

2.3. Production Stage

Xiao30 has designed a Web-based information management system in the production line for rapid and integrated product development. Bashir31 has shown a design of the development time for hydroelectric generators. Chuen32 has illustrated that the supplier's integration is important for reducing new product time, increasing cost and improving quality. However, Griffin33 found that cross-functional teams are important for development cycle time.

3. METHODOLOGY

The literature review revealed that the long time required for a new product is a problem in firms. Four departments are influential in reducing new product time. This paper adopts a theoretical-conceptual research, and proposed that if these three departments (design, procurement, planning and production) work together through project management, the time for a new product will decrease.

The development of this model was based on empirical experience and interviews with 50 project managers in SMEs in Iran. Information on the respondent organizations is presented in Table 1.

<table>
<thead>
<tr>
<th>Characteristics of the sample</th>
<th>Percentage of sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function</td>
<td></td>
</tr>
<tr>
<td>Project manager/coordinator</td>
<td>30</td>
</tr>
<tr>
<td>Project manager/deputy manager</td>
<td>10</td>
</tr>
<tr>
<td>Project manager/consultant</td>
<td>15</td>
</tr>
<tr>
<td>Project manager/senior advisor</td>
<td>5</td>
</tr>
<tr>
<td>Project manager/general manager</td>
<td>10</td>
</tr>
<tr>
<td>Education level</td>
<td></td>
</tr>
<tr>
<td>PhD's degree</td>
<td>6</td>
</tr>
<tr>
<td>Master's degree</td>
<td>47</td>
</tr>
<tr>
<td>Bachelor's degree</td>
<td>45</td>
</tr>
<tr>
<td>Project management experience</td>
<td></td>
</tr>
<tr>
<td>More than 20 years</td>
<td>40</td>
</tr>
<tr>
<td>15-20 years</td>
<td>30</td>
</tr>
<tr>
<td>10-15 years</td>
<td>15</td>
</tr>
<tr>
<td>Less than 10 years</td>
<td>10</td>
</tr>
<tr>
<td>Less than 5 years</td>
<td>5</td>
</tr>
<tr>
<td>Membership in a professional association</td>
<td>80</td>
</tr>
<tr>
<td>No</td>
<td>20</td>
</tr>
<tr>
<td>Specification domain</td>
<td></td>
</tr>
<tr>
<td>Engineering</td>
<td>70</td>
</tr>
<tr>
<td>Business</td>
<td>25</td>
</tr>
<tr>
<td>Other</td>
<td>5</td>
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<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>32</td>
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<tr>
<td>Male</td>
<td>68</td>
</tr>
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</table>
The interview was done by video and voice chat, video conferencing and PC calls. "As electronic surveys allow the communication of more information, they support a better interaction between the researchers and the respondents, and they contribute to a better quality of information, to a faster response cycle and to a reduction in research costs." Table II shows the number of sample in the different tools to interview.

4. THEORETICAL FOUNDATIONS AND CONCEPTUAL MODEL

As indicated by the review of the literature, it is almost universally accepted that the long time that is needed for new product is a serious problem for SMEs. However, an examination of the interdisciplinary literature identifies four departments that affect the completion of projects in terms on time and within the budget: design, planning, production and procurement. The effects of these four departments have been studied separately under several theoretical perspectives in recent years. No studies, however, used these four stages together.

To understand the importance of coordinating these sections with the project manager, we interviewed 50 project managers in Iran. The approach was similar to that used by Refs. [7, 29].

The majority of project managers we interviewed stated that the lack of coordination between the related departments in production is major problem in reducing time and cost. Our interviews led us to the conclusion that the long time for new products resulted from a lack of coordinating mechanisms.

The companies interviewed were in the electronics industry. The purpose of these interviews was to understand the companies' process for collaboration among four departments into product and process development and to elicit insights into how they had overcome barriers along the way.

Using the information from these case studies, we developed a conceptual model that characterized the major activities required for interdepartmental collaboration in new product development. However, the answers to the two major questions that emerged from our case studies remained elusive: I. Are all four of these departments efficient? II. What is the relationship between these four departments and project management for development time?

Our case studies suggested that companies that had reduced time for new products, had better interdepartmental collaboration. Four critical elements of this process are captured in the explanatory model (Fig. 1) and supported by prior research. 11-13, 15, 25

4.1. Project Manager

The first four hypotheses represented in the theoretical model (Fig. 1) describe the relationship between the project manager and its four antecedents. The fifth hypothesis relates the project manager to firm-level performance outcomes.

4.1.1. Hypothesis 1: Department of Design

The department of design needs a collaborative design team of employees possessing complementary skills to realize the design concept and to finish the project. 10, 11-13 We hypothesize:

H 1: The communication between a designer in the department of design and project manager is essential before starting the production.

4.1.2. Hypothesis 2: Department of Production

According to this section of production, many workers with different skills are working. Tools and equipments should be
Operational. In this section only the product managers are directly involved in a hypothetical model. This section has been noted by many researchers in the past.\textsuperscript{15,16,17,18,19} We hypothesize:

- **H3.** Coordination between product manager and project manager is necessary for improving time of new production before the start of production.

4.1.3. Hypothesis 3: Department of Procurement

The procurement manager prepares the equipment for the project; supplies are produced domestically or abroad. This section has value, in the opinion of some authors.\textsuperscript{15,16,17,18,19} We hypothesize:

- **H3.** Procurement manager has to report to the project manager about preparing equipment before starting a project.

4.1.4. Hypothesis 4: Department of Planning

The department of planning must have a project plan, analyze major risk factors, employ critical path analysis, and use Gantt charts.\textsuperscript{20} Planning enables a project plan to use more organized monitoring and better observation. Better observation permits the detection and discouragement of losing. Better observation also permits the identification and prevention of the disorganization that constitutes poor focus.\textsuperscript{21} One of the factors of success in project management is accurate planning.\textsuperscript{22} Hence we hypothesize that the control project manager does the planning for the project in the company.\textsuperscript{15,16,17,18,19}

- **H4.** The project manager has to know about the product plan and then the control project manager must report to a project manager before arriving at the project in the late state of product.

4.1.5. Hypothesis 5: Performance Outcomes

A project was successful if it was completed within its budget, within its initial scheduled time frame, and if the product performed as it was designed to Ref. [33]. We hypothesize:

- **H5.** Time (H5a) and cost (H5b) for manufacturing of new product will be reduced with E-collaboration among different parts of companies.

5. CONCLUSION

Since this study is part of an ongoing research, and it is not fully completed, conclusions should be drawn with care. However, some concluding points deserve attention. First, the literature has established that new product development takes a long time, especially in SME. Second, the conceptual model reflects the need for collaboration between departments of design, planning, procurement, and production in a company through project management via E-collaboration. Future studies should consider these points. A detailed analysis of the conjoined application of the topics that compose each dimension in the operation dimension also seems to be important. In addition, an analysis of how the integration of all these elements occurs, with methods to optimize it would improve the understanding of a process as complex as new product development. Consequently, incorporation of these four factors: design, planning, production, and procurement are going to open a guideline for the future researchers towards effective improvement in terms of time and cost for a new product introduction.

References and Notes


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