SUPPLIER INVOLVEMENT IN COLLABORATIVE PRODUCT DEVELOPMENT PROCESS

Shabnam Hajizamanali, Chai Kah Hin
Industrial and Systems Department, Faculty of Engineering,
NUS, 10 Kent Vale Crescent,
Singapore 119260, Singapore
Email: g0500722@nus.edu.sg, iseckh@nus.edu.sg

ABSTRACT
The need for supplier involvement in new product development process is going to be more intensive due to the increasing technology advances, product and technology complexity and the fast growth of international trade in today's competitive markets. Therefore, firms have increased their collaboration with their suppliers in order to develop new products more effectively. However, this strategy influences the product development projects performance. Brown and Eisenhardt's review on the previous studies in this research area reveals that though different factors and relations have been studied in supplier involvement in product development, the interactions among these factors are still incomprehensive [1]. Moreover, Takeishi has proposed an integrative framework for supplier involvement in product development in automobile industry [2]. In his framework, not only does he investigate automaker's "internal capabilities" but also he includes "external coordination", and their combined effect on component design quality as one of the main development performances. However, there are still some relationships among the OEM (Original Equipment Manufacturer) and its suppliers which have not been described clearly yet. This article concentrates on the three important factors which affect inter-firm product management process. These factors are (1) communication between OEM and its suppliers, (2) integrated problem solving, and (3) OEM's degree of knowledge about the outsourced components. In addition, we investigate how these factors influence product development project performance criteria in terms of product quality, development time, and product innovation.

KEY WORDS
Collaborative Product Development, Information Exchange, Knowledge

1. Introduction

Technology advances, product and technology complexity and the fast growth of international trade intensify the need for supplier involvement in NPD (New Product Development) [3], [4]. However, managing supplier involvement in product development has known to be quite difficult [5], [6]. There are just few studies presenting an integrative model of collaborative product development process. While Takeishi (2002) has argued about the manufacturer's knowledge, joint problem-solving pattern and communication in the information processing part of his model, he has not clearly studied the interaction and effect of these factors on the collaborative product development performance [7]. This study tries to focus on this research gap.

2. Supplier Involvement in Collaborative Product Development Process

Organizations are information processing systems which have access to limited resources to reduce the ambiguity and uncertainty of the information they acquire [8]. Similarly, product development process is a transforming system which receives a set of data as inputs (e.g., customer needs, market demands, product strategy, technology requirements, manufacturing and production constraints), analyze and refine them to a set of outputs (e.g., product specifications, product design, production plan, and product prototype) [9], [10], [11]. Therefore, collaborative development often deals with information sharing and information processing. However, information processing is usually influenced by uncertainty and equivocality during decision making procedure and project progress [12].

Moreover, product development process can be considered as a kind of communication web in which information and solutions are exchanged through problem-solving cycles to decrease ambiguity and information deficit which can also be considered as equivocality and uncertainty [13], [1], and [14].

Supplier involvement in product development is the extent to which a buyer organization shares responsibility with a supplier organization for the development and design of the subsystems or components of a new product [1], [15]. Previous studies investigated some factors affecting product development performance in the collaborative process [1], [16]. It is shown that supplier involvement in product development process varies on the basis of the time span of their involvement in the project, the extent of their involvement in the development or design work, the significance of their roles in the process, buyer-supplier information exchange, and the quantity and complexity of technical interfaces between the buyer and its suppliers [17], [18], [19], [20], [15]. However, there is not much literature with a comprehensive model to explain the interactions among different elements of collaborative product development process.

3. Hypothesis Development

a. Routine Communication Intensity

The importance of good and close communication between supplier and manufacturer is well-known. Routine communication deals with coordinative information in order to reduce task uncertainty and organize product development activities in collaborative projects [6]. When information about the content and status of the project is exchanged frequently, it is more likely that all project members get informed about the most up-to-date status of the project and apply it to their work when relevant [21]. This can enhance the product quality because of reduced rework and at the same time decreasing the number of time delays which may happen during the process due to lack of required information. This leads us to argue that:

H1: The intensity of routine communication between NPD team and suppliers has a positive relationship with product quality in product development projects with supplier involvement.

H2: The intensity of routine communication between NPD team and suppliers has a negative relationship with development time in product development projects with supplier involvement.

b. Joint Problem-Solving Pattern in CPD Process

Since the collaborative development team members often deal with "imprecise information" and unforeseeable problems during the process, frequent problem-solving oriented interactions facilitate problem definition or reaching a consensus on the solution of a problem [14]. This improves the compliance of final product with the expected and desired specifications in the collaborative process. Therefore:

H3: The intensity of problem-solving oriented interactions between NPD team and suppliers is positively associated with product quality in product development projects with supplier involvement.

Moreover, problem solving strategy in NPD process involves cross-functional development teams from the early stages of product development in order to reduce ambiguity and to increase product development effectiveness [13]. Effective involvement of suppliers in problem-solving from the early stages of the process improves flexible response in problem solving, and adequate expertise to solve the product design and process problems.

H4: The early involvement of mutual problem-solving techniques between NPD team and suppliers is positively associated with product quality in product development projects with supplier involvement.

H5: The early involvement of mutual problem-solving techniques between NPD team and suppliers is negatively associated with development lead-time in product development projects with supplier involvement.

c. Knowledge and Product Development Project Performance

Collaboration with suppliers provides buyers the opportunity to access knowledge, expertise and skills to improve compatibility, to increase the speed of development process, and to reduce product development risks and investments [22], [23], [24]. On the other hand, buyers who rely heavily on suppliers' engineering capability may lose negotiation power with their suppliers and become vulnerable by losing their engineering expertise [13], [7]. Therefore, if buyers do not have access to the appropriate knowledge, they would not be able to evaluate the suppliers' products and capabilities and they cannot negotiate with them properly to come to any consensus when it is required during the process [25].
Accordingly, we put forward the following propositions:

H6.1: The higher the OEM's degree of knowledge about the outsourced components is, the more effective is the intensive communication for improving the development lead-time.

H6.2: The higher the OEM's degree of knowledge about the outsourced components is, the more effective is the

intensive joint problem-solving for improving the development lead-time.

H6.3: The higher the OEM's degree of knowledge about the outsourced components is, the more effective is the intensive joint problem-solving for improving the product quality.

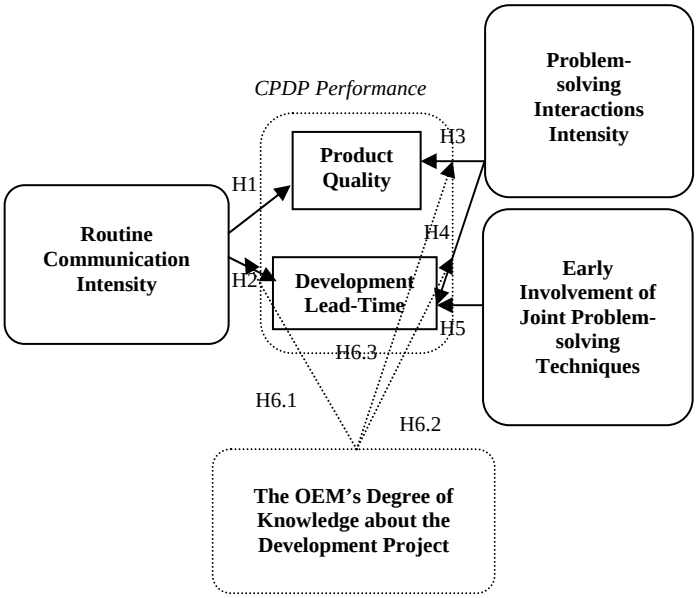

Figure 1: The Proposed Model

4. Conclusion

Responding to the lack of a comprehensive model on different interactions among the main elements in the collaborative product development process, this research introduces some propositions supported by literature to explain Takeshi's initial model for the process. Focusing on information processing sections of the model, we have identified the main factors and argued how the factors may interact and affect the collaborative product development project performance.

Our framework has several meaningful implications. Firstly, it helps buyers to manage their relationship with their suppliers in order to improve the performance of the collaborative development project. Secondly, it provides a systematic view for the practitioners to consider how they can apply their knowledge in different stages of the collaboration regarding the industry dynamics and product architecture. Thirdly, it differentiates between intensity and stage of the involvement of problem-solving activities in the process. In other words, it claims that in order to improve collaborative development performance, both early and intensive involvement of problem-solving activities are necessary.

These propositions will be tested through a survey in Singapore considering the dynamics of the industry the projects belong to and the degree of product modurality.

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