

Identification of Critical Success Factors of Collaborative Product Development

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ABSTRACT

In today's global market, competition between firms is high, and customers are constantly demanding technically more advanced products. To fulfill the requirements of customers and rapid growth of global market, organizations have to execute further research in the field of product development in order to achieve the desired goal. Collaborative product development (CPD) has emerged as a new way of business which results in high quality, low cost of products with shorter time to market and hence a powerful source of competitive advantages for the success of an organization. Collaborative product development (CPD) may be defined as two or more partners joining complementary resource and experience with mutual aims to find out the desired goals in the form of new improved product. CPD has a current system approach which results in high quality and low cost products within minimum possible time. In this paper, various critical success factors affecting the successful CPD have been identified from the previous literature work. From, extensive literature review, it has been revealed that critical factors like trust, communication, partner selection, leadership, supplier selection, fairness, cooperation, experience, knowledge transfer, group learning etc. affects this collaborative product development (CPD) process.

Keywords: Collaborative product development (CPD), critical success factors.

INTRODUCTION:

The rapid growth of the global market drives organizations to invest further in product development (PD) in order to maintain a competitive advantage (Owens and Cooper 2001). Collaborative product development (CPD) has emerged as a new way of business, increasing efficiency and effectiveness in product development. Collaborative product development may be defined as two or more partners joining complementary resource and experience with mutual aims, in order to design or develop a new or improved product. However, the complex nature and uncertain environment which surround PD, lead organizations towards collaboration in order to share risks, reduce costs and time-to-market, improve quality and benefit from complementary knowledge and competence throughout the PD process (Littler et al. 1995, Noori and Lee 2004). Collaborative product development (CPD) is a current business approach towards increasing cooperation between different groups for introducing new and innovative designs to market. Thirty eight percent of the formal agreements worldwide are motivated by joint PD and the number increases to 64% when eventual production and/or marketing of the products are also included (Noori and Lee 2004).

The real source of sustainable competitive advantage develops with the ability to become involved and create value in innovation and improvement processes within inter-company collaborations (Chapman and Corso 2005). However, Yeh et al. (2009) state that even though utilization of appropriate tools and techniques in the process of PD can assist firms in achieving better performance in launching new products, in practice many useful tools and techniques are not utilized effectively. The collaborative product development process has been focus of much attention in academia and industry for good reason; accurate product development constitutes the success of manufacturers (e.g. May et al. 2006; Schilling et al. 1998). Between 1982 and 1997, the success rate of new products introduced to the market had stabilized at 59 percent with no concomitant increase since (Griffin, 1997). Furthermore, companies who are showing the best success rates of product acceptance are using multiple product development strategies simultaneously (Griffin, 1997). These trends have prompted a new surge of research on how to optimize the new product development processes. Up until now, the role of collaborative product development in the apparel industry has been one of predicting the needs of the consumer and responding with novel and well executed products with little to no consumer involvement (Hines et al.2007). Various definitions of CPD are given by different authors who are given below:

*Cooperative relationship between firms aimed at innovation and the development of new products (Lawton-Smith et al.1991).

*CPD is ‘any activity where two (or more) partners contribute differential resources and know how to agree complementary aims in order to design and develop a new or improved product’ (Dodgson 1993).

*Continued and parallel responsibility of different design disciplines and lifecycle functions for product and process specifications and their translation into a product that satisfies the customer but does not presuppose one single organization (Mi et al. 2005).

*Collaborative product development (CPD) is a widely accepted modern business strategy which results in high quality, low cost products with shorter time to market and hence a powerful source of competitive advantage (Mathrani, Mathrani, & Liu, 2011).

*Two or more partners joining complementary resource and experience with mutual aim, in order to design or develop a new or improved product.(Gulcin et at. 2012).

Figure 1 describes the potential overlap points and individual characteristics of each process of CPD. Collaboration may include only one phase of PD as well as the whole process from conceptual design to product launch. For proper collaboration in PD proper goal alignment, process, structure, method, information alignments are prime necessities. Product development is starting from conceptual design and ended at product launch. Product development, prototype and manufacturing are the intermediate stages in product development.

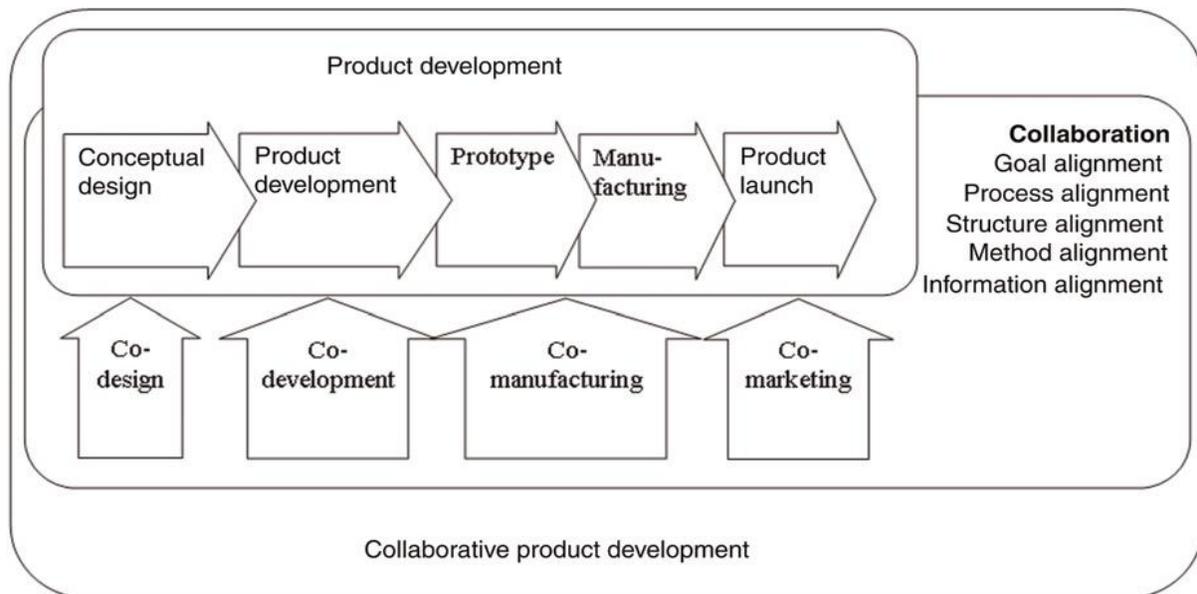


Figure1. Collaboration in PD.((Gulcin et al; 2012)

Various limitations of collaborative product development through literature review are lack of interest exists for studies concentration on long term collaboration, wrong partner selection, wrong supplier selection, lack of resources, improper coordination between manufacturer and supplier, lack of trust. The objective of this paper is to identify various critical success factors affecting the collaborative product development (CPD).

LITERATURE REVIEW:

The term “collaborative product development” has been introduced from a long time. Since then, various researchers have embraced and expanded this concept. To fulfill the requirements of customers and rapid growth of global market, organizations have to execute further research in the field of product development in order to achieve the desired goal. Collaborative product development (CPD) has emerged as a new way of business, increasing efficiency and effectiveness in product development. For this purpose, the study is focused on research of various authors which are explained below:

Christian et al. (2001) have focused on the success factors of cooperative ventures in innovation and production systems. The objectives can be summarized as: determination of different success factors and classification of the success factors in a management model of cooperative ventures. **Sosa et al. (2002)** have recognized that communication process is a key element to improve product development performance through various communication medium like telephone, email etc. Sosa has developed a model that allows us to formulate several hypotheses about how these factors influence both communication frequency and media choice. **Ludwig Bstieler (2006)** has examined the trust formation in new product development partnerships and effect of trust on performance. Bstieler has thinks that trust is modeled as an outcome of communication behavior, shared problem-solving, perceived fairness, the existence of conflicts during the development project, and partner egoism.

David et al. (2006) have examined that cultural and leadership variables associated with corporate social responsibility values that managers apply to their decision-making. In this longitudinal study, David analyze data from 561 firms located in 15 countries on five continents to illustrate how the cultural dimensions of institutional collectivism and power distance predict social responsibility values on the part of top management team members. **Sofi (2007)** has thought that the increasing complexity of products and systems has forced new processes, methods and tools for managing the development of products. Sofi also forced the development complex organization and diverse relationship among functions and peoples with in product develop organization. The main purpose of Sofi facilitates the efficient execution of CPD projects in manufacturing industries. **Qiu et al. (2008)** have concentrated on idea that Collaborative Product Development (CPD) is an advanced paradigm for product development, which focuses on facilitating the business collaboration across organizational boundaries.

Danielle Twardy (2008) has prepared a report which describes the results of a study into the partner selection processes companies use to select their alliance partners who is responsible and accountable for the various phases in the partner selection process? **Silva et al. (2009)** have identified that collaborative product development (CPD) is a current business approach towards increasing cooperation between different groups for introducing new and innovative designs to market. Silvas have research to investigate the use of information and communication technology (ICT) in collaborative product development activities and its impact on the process outcomes. **Wang et al. (2011)** have worked on to construct a product development model through using knowledge management system. Wang model aims to help the design engineers and their upstream and downstream partners in the supply chains to develop products synchronously and simultaneously through the computer supported cooperative work (CSCW) tools. **Anyanitha et al. (2012)** have efforts to provide a potential framework for analyzing knowledge transfer in CPD through social network analysis (SNA). Survey is used to describe how the supplier and buyer worked together to transfer knowledge for developing product in practice. The results show that communication and transfer of knowledge are important success factor in CPD.

IDENTIFICATION OF CRITICAL SUCCESS FACTORS OF CPD:

Through literature review, various critical success factors of CPD are identified. The main critical success factor of CPD are given below-

- Trust
- Communication
- Fairness
- Leadership
- cooperation
- Supplier selection
- Experience
- Knowledge transfer and innovation
- Group learning
- Partner selection

Trust: Trust is the main critical success factor in collaborative product development. Trust plays an important role to find the predetermined goal of an organization. As a part of team's self direction, it is trust that enables the team to engage in open debate and decision making as compare to individual members of team. Trust is the main factor in formation of vertical new product development partnerships and its effect on partnership efficiency and project performance. A vertical partnership is defined as a collaborative and interim working relationship between a manufacturer and a customer or a supplier partner involved in the conception, testing, production, or marketing of a new product, i.e., a project-based collaboration (Anderson and Narus, 1990). This type of interorganizational arrangement provides companies with many of the same benefits of vertical integration without the investment required for vertically integrated units. Trust is usually defined as the willingness to accept vulnerability based upon positive expectations of the intentions or behavior of another within a particular context, i.e., in interdependent and risky situations. Trust enables us to tolerate uncertainty through an expectation that a trusted person will work or agree to reduce our sense of vulnerability to unpredicted contingencies and increase our confidence that others will act proactively in any case where the need to adapt to unforeseen contingencies arises.

Trust is not a special tool or technique which helps in collaborative product development. It is an outcome of gradual and consistent effort over time. In essence, there is strong agreement that trust is an obvious and central element of any type of relationship. Most of the research on interorganisational trust has focused on the context of sales management or distribution channels, i.e., between a manufacturer and a dealer or a manufacturer and a retailer) trust is a strong critical success factor for achieving coordination and cooperation. Trust also used as a mechanism to reduce search costs when seeking trustworthy partners. Trust factor plays an important role when two companies want to share their technologies. Trust helps in making a strong relationship in b/w two or more persons or organizations.

Communication: Communication is a medium to exchange their thoughts. Communication process in product development organizations has been recognized as a key element to improve product development performance. It is particularly interesting to study information exchanges in geographically distributed product development teams because of the highly interdependent nature of design organizations. Communication is the exchange of information between parties. Much of the information exchanged in partnerships is marketing, technical, or production information that has competitive or strategic relevance. At the same time, development-related knowledge may be very detailed and hard to codify and articulate, as it was acquired through a process of learning and a strong determinant of trust development. Research on new product development has emphasized the importance of meaningful and timely information exchange to resolve disputes or align perceptions and expectations, thus fostering a trust formation. Likewise, the personnel involved in successful partnerships extensively exchanged substantive information to ensure that key component designs were coordinated with overall product requirements (Littler, Leverick, and Bruce, 1995).

Collaboration is dependent on communication between individuals. To have collaboration, in the easiest form, communication and exchange of information is needed. To exchange knowledge, a higher level of collaboration is needed depending on how distributed the collaboration is, different means of communication is needed. Means of communication, thus collaboration, may for instance be in its simplest, but very efficient form, face-to-face meetings, moreover, telephone, fax, e-mail, video conferencing, the Internet, Intranets, Extranets, online workspaces etc (Sosa et al. 2002).

Communication is defined as Boundary people who transfer information between groups and organizations. The communication can be improved through training and social activities. The decision-making is the heart of administration, and that the administrative process is a decisional process. Coordination and communication are central to the decision-making process, and decisions are dependent on each other. Organizational decisions are based on assumptions, incomplete information, few alternatives, and conflicting demands. Group behavior needs adoption of decisions and coordination. There has to be coordination of the organization itself, and coordination of the members in the organization. Moreover, each activity has to be coordinated. Much information is circulated in an organization. Information is transferred between teams, functions, machines, and so on. The success of a company is dependent on how well product design information is managed and communicated. .

Fairness: Fairness is also the important critical success factor of CPD. Fairness enhances job satisfaction and organizational commitment. Fairness of decision-making procedures has been argued to affect the attitudes, behavior, and decision-making quality of organizational members (Kim and Mauborgne 1998).Unfairness in top management decisions during CPD may lead to reduced product quality, longer time to market, and new product performance. Fairness helps individuals manage uncertain environments by providing information.

Partner selection: Partner Selection is also the important critical success factor of collaborative product development. Before partner selection, it is necessary to define the objective of that organization. Standardized governance of partner selection is critical factor in CPD. It is necessary for the organization to clarify who is to be responsible, accountable, consulted, informed in each partnering phase. The growth of organization depends upon the right partner selection. For this purpose, it is important to develop a partner selection process including steps, criteria, tool and success factor which are important for growth of organization. A thorough standard partner selection process may therefore help to avoid selecting the wrong partner. Accordingly, when selecting a partner companies should at least deal with each other's culture, trust, strategy etc. Not all companies have an adequate partner selection process. Companies may include many steps in their partner selection process. Theoretically, the most elaborate partner selection process may involve no less than 16 steps. Naturally, few companies will use all these steps. This research project identified the steps they do use most often which are development of a partner selection team, Identify partnering needs of your company, Identify partnering opportunity, Define company's objectives for alliance, Identify partner selection criteria, Create long list of prospective partners, Orientating Meeting prospective partners, Determine short list of prospective partners, Screening of short listed partners against defined criteria, Beauty contest, Ranking of prospects, Final choice of partner, Negotiating alliance with prospected partner, Organizing social event selected partner, Writing legal agreements, Joint writing of the business plan.

Knowledge transfer and innovation: Knowledge transfer is also important critical success factor of CPD. Without sharing their knowledge among other persons of organizations, organizations cannot find out their predetermined goal. Knowledge management includes five dimensions that should be taken into account when analyzing knowledge transfer in CPD:

- (1) The setting of knowledge transfer.
- (2) Level of dissemination.
- (3) The scope of knowledge.
- (4) The degree of abstraction and generalization.
- (5) The degree of articulation or embodiment.

The first dimension concerns the setting (routes, directions) of knowledge transfer. The second dimension of knowledge is its level of dissemination. Depending on the specific culture of the organization, emphasis can be placed on sharing knowledge and fostering learning at different levels: from individuals, to groups, to the organization as a whole or even the inter-organizational system. The third dimension is the scope of knowledge. This scope can range from component knowledge, which refers to the mastering of specialist skills and technologies and their embodiment into components, to architectural knowledge, which refers to how components and skills are integrated and linked together into a coherent whole (Henderson and Clark, 1990). A fourth dimension of knowledge concerns the degree of abstraction and generalization (scope of applicability to different situation). The fifth and final dimension is the degree of articulation or embodiment. In order to facilitate knowledge transfer and to prevent its drain, organizations can embody knowledge in vehicles such as design solutions (e.g. components and architectures), standard methodologies and procedures, or organizational structure and routines. Such embodied knowledge is more easily transferable.

Cooperation: Cooperation is important critical success factor in CPD. Cooperation may be defined as Collaboration between two or more independent organization with no financial or legal connection in order to improve their overall performance. Strategic and operational aspects have to be taken into account during cooperation. Cooperation success consists of

- The achievement of the original objectives;
- The revenues for the cooperation partners as a whole;
- Organizational learning (gaining experience and knowledge); and
- Subjective personal feelings.

Cooperation process is affected five factors which are Initiation, Partner Selection, Setup, Realization, Termination or relaunch

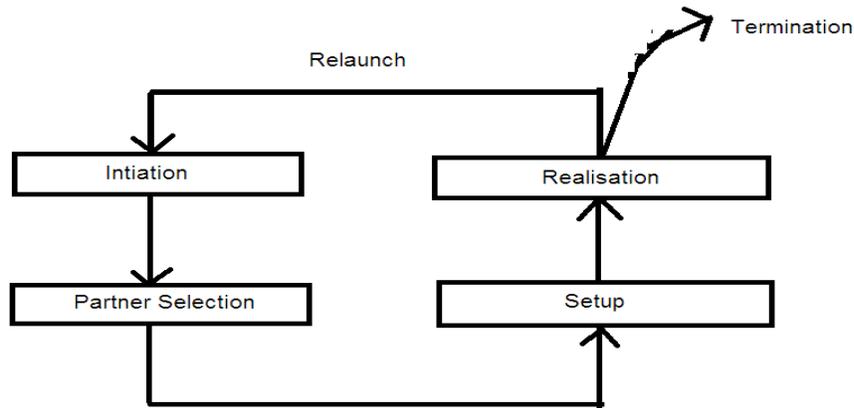


Figure 2: Cooperation Process

Leadership: Leadership can be defined as one's ability to get other to willingly follow. Leadership involves a relationship between an individual (leader) and one or more followers based on leader behaviors. Every organization needs leaders for collaborative product development at every level. Key behaviors commonly associated with visionary leadership include:

1. Providing a sense of mission or purpose based on opportunities and constraints in the larger environment.
2. Showing determination when accomplishing goals or change, including acting decisively.
3. Questioning assumptions

Some qualities of leader for collaborative product development are Integrity, Dedication, Honest Creativity, Fairness, Openness, and Manageability.

Group Learning: Group Learning is also the important critical success factor of CPD. Group learning increases productivity. Group learning activities represent that team member gain more experience and knowledge from different sources. Leadership skills may be the key to stimulate Group learning. Group learning may become stationary after the performance goal is achieved. Group learning is key drivers of team productivity and time efficiency. Group learning helps in decreasing project duration time. Motivation may be also the key to stimulate Group learning.

Experience: Experience plays an important role in CPD. By using their experiences, collaborative product development becomes easy. Many problems related to CPD can be solved by their previous experience in that field.

Table 1: (References of success factors of CPD)

Success Factor	Sources
Trust	Barnes et al. (2006), Bstieler (2006), Sako (1992), Lam and Chin (2005), Shah and Swaminathan (2008), Chin al. (2008)
Communication	Littler et al. (1995), Bstieler (2006), Qiang et al. (2001), Lam and Chin (2005), Sosa et al. (2002), Chin et al. (2008)
Partner selection	Littler et al. (1995), Emden et al. (2006), Glaister and Buckley (1997) and Fraser et al. (2003)
Knowledge transfer	Chin et al. (2008), Anyanitha et al., (2012)
Cooperation	Christian et al., (2001)
Experience	Littler et al. (1995) and Hou et al. (2006)
Leadership	Barnes et al. (2006) and Chin et al. (2008)
Group learning	Barnes et al. (2006), Marxt and Link (2002) and Chin et al. (2008)
Fairness	Littler et al. (1995), Bstieler (2006) and Shah and Swaminathan (2008)

CONCLUSION

Collaborative product development (CPD) is emerged as a new way of business, increasing efficiency and effectiveness in product development. The collaborative product development process is focus of much attention in academia and industry for good reason; accurate product development constitutes the success of manufacturers. In this modern age, the customer's demands are continuously increases. In today's global market, competition between firms is high, and customers are constantly demanding technically more advanced products. To fulfill the requirements of customers and rapid growth of global market, organizations have to execute further research in the field of product development in order to achieve the desired goal. For this reason, collaborative product development (CPD) is introduced. Through literature review, various critical success factors like trust, communication, partner selection, fairness, and cooperation etc of CPD are identified. The success of collaborative product development (CPD) depends upon these success factors. From these success factors, some factors are more important than other for collaborative product development. To fulfill the requirements of customers and rapid growth of global market, organizations are executing further research in the field of product development in order to achieve the desired goal.

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