Development and Consequences of Cross Functional Team Performance in the Concurrent Engineering Context: An Integrated Framework

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Cross functional team performance is critical for the success of any concurrent engineering initiative. Despite the widespread acknowledgment of the importance of the potential development and consequences of cross functional team performance in a concurrent engineering context is relatively unexplored in operations management literature. To this end we examined the interrelationships between team socialization, communication performance, coordination, cross functional team performance, new product cycle development time and overall organizational performance. It is proposed that coordination and communication performance will have positive and curvilinear impact on cross functional team performance. In addition, cross functional team performance will have positive influence on reduction in new product development cycle time and new product cycle time is indirectly associated with organizational performance. Potential implications for managers are discussed and conclusion presented.

INTRODUCTION

Concurrent engineering practice (CE) has been identified in the literature as one of the many techniques used to achieve product innovation and competitive advantage in terms of reduction of delivery time and reduced cost (Turino, 1992; Shina, 1991; Loch & Terwiesch, 1998; Prasad, 2000 a,b; Balasubramanian, 2001; Trygg, 1993; Jarvis, 1999; Baer & Frese, 2003). Despite the fact that the area of CE is gaining popularity, researchers have limited themselves to operational issues in CE and have not focused specifically on the development of various dimensions of CE practices. Formation of crossfunctional teams is the most important dimension of CE practice (Durst & Kabel, 2001;Paashuis & Boer, 1997; Koufteros, Vonderembse & Doll, 2001). The success of any CE initiative depends on the effective functioning of the cross functional teams(Koufteros et al., 2001). To this end researchers have only investigated the factors impacting the development of cross functional teams in an isolated manner. For instance as documented in literature critical factors impacting the performance of cross functional team include: socialization, communication performance and coordination(Ainamo, 2007; Branson, Feng-Shun, Chung-Hsien & Fang, 2011; Cousins & Mengue, 2006; Bhuiyan, Thomson & Gerwin, 2006; Dworkin, Goldstein & Drozdenko, 2006; Kratzer, Leenders & Engelen, 2006; Goparaju, Ayesha, & Sanghamitra, 2011; Peters & Fletchers, 2004; Politis, 2003; Katz &Tushman, 1981). Despite the recognition of the importance of such factors, the extent to which these factors impact the cross functional teams in a unified context and help organizations to increase the effectiveness of the operations has received little attention from researchers. Furthermore the interrelationships between these factors have largely gone unnoticed.

Also it is widely known in literature that cross functional team performance is associated with reduction in product development cycle time and organizational performance (Sivasubramaniam, Liebowitz & Lackman, 2012; Ittner & Larcker, 1997). Despite this the simultaneous relationships between cross functional team performance, product development cycle time and organizational performance have not been investigated in a unified context. It is important to study these relationships as the investigation of these relationships will help organizations achieve a sustained competitive advantage by positioning resources carefully.

Based on the above, the study posits the following questions:

RQ1: What is the relationship between socialization, communication performance, coordination and cross functional team performance?
RQ 2: Is there a direct relationship between cross functional team performance, reduction in cycle time in new product development and organizational performance?

The study is of paramount importance to academicians and practitioners as the proposed framework is expected to uncover many relationships that are of interest to managers. To the best of our knowledge this is the first framework specifically exploring the interrelationship between team socialization, communication performance, coordination, cross functional team performance, reduction in product development cycle time, and organizational performance in a unified organizational context. Furthermore as pointed out by operations management researchers despite the growing importance of CE practices, there is still a need to understand the factors which contribute toward the development of dimensions of CE practices (Koufteros et al., 2001). On a micro level one of the key contributions of the current study is to offer additional insights into the relationships between team communication, coordination and socialization. This research can be viewed as adding to literature on team communication by providing a more exhaustive framework by including intending outcome variables such as organizational performance. This is important considering the need for research at more sophisticated levels as documented by different researchers (Peters & Fletcher, 2004; Mohr & Nevin, 1990).

LITERATURE REVIEW

Socialization

Socialization involves building personal bonds, attachments and problem solving (Cousins & Menguc, 2006; Gupta & Govindrajan, 2000). Socialization helps in establishing effective communication avenues and improving interpersonal communication (Gupta & Govindrajan, 2000; Claes, Hiel, Smets, & Luca, 2006.). Socialization literature argues that improving ties between team members can improve the performance (Cousins & Menguc, 2006). Organizations implement socialization with the view of mentoring employees or firms (Feledman & Bolino, 1999). Commonly used dimensions of socialization include anticipatory socialization, accommodation and role management (Dworkin, Drozdenko & Goldstein, 2006).

Communication Performance

Communication is important for success of any cross functional team. The communication performance refers to the frequency and quality of information shared between team members (Ancona & Caldwell, 1992; Peters & Fletcher, 2004). One of the major benefits of effective communication performance is effective knowledge sharing. For instance, members of the team communicate and share knowledge through effective communication helping in generation of new ideas which leads to competitive advantage (Desouza, Chattaraj & Kraft, 2003; Gupta, Iyer & Aronson, 2000; Wiig, 1997; Jones, Herschel & Moesel, 2003).

Coordination

The role of coordination is widely emphasized in management literature (Ernest, Verlin, & Jared, 2006; Simatupang, Wright & Sridharan, 2002; Dyer & Singh, 1998; Stank, Crum & Arango, 1999). Coordination in teams is important to achieve execution task. Coordination amongst different team members is important to achieve optimality in production, planning and distribution (Peters & Fletcher, 2004; Weber, 2006). In addition it helps in achieving team member cooperation which facilitates team performance. For the purpose of the study we adopt the conceptualization presented by Cheng (1980) and use it in a team context. Coordination represents the extent to which the interdependent parts of a team function according to the needs and requirements of the team(Cheng, 1980).

Crossfunctional Team Performance, New Product Development Cycle Time and Organizational Performance

CE practices involve formation of cross functional teams (Celtek & Kaynak, 1999; Swink, Sandvig & Mabert, 1996a, 1996b; Harrell, Emanuel & Kroll., 1995; Sapuan, 2005; Durst & Kabel, 2001; Henke, Krachenber & Lyons, 1993). The cross functional team performance is associated with performance issues of teams such as cost savings, exceeding customer expectation, quality of work accomplished and meeting time line in projects(Ancona & Caldwell, 1992; Banker, Field, Schroeder & Sinha, 1996; Oertig & Buergi, 2006). The benefits of cross functional teams include significant reduction in development cycle time, product life cycle cost and engineering changes (Kumar. V, Fantazy, Kumar. U. & Boyle, 2006). As companies focus on achieving high quality, fast product innovation and improved customer satisfaction, team performance becomes critical to realize the above mentioned goals (Banker et al.,1996).

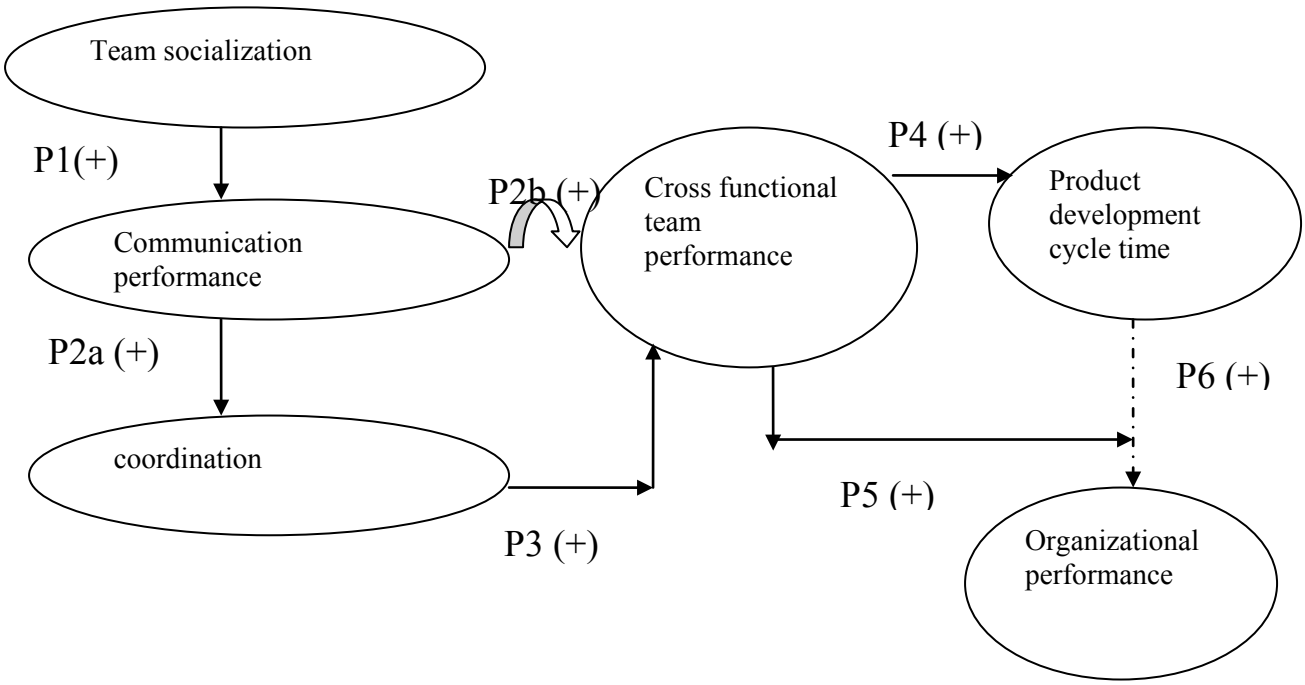
More often than not the way organizations manage their time in production, introduction of new product to market and innovations are important dimensions leading to competitive advantage (Stalk, 1988). In terms of strategy, time is also viewed synonymous with money, quality and innovation (Stalk, 1988). New product development cycle time becomes extremely important as organization strives to launch product early in the market. If the product is launched early in the market as compared to other competitors, the firm has an advantage to learn from customer responses (Brown & Lattin, 1994). Other benefits identified in bringing the products quicker to market include extended sales life of the product and increase in market share (Pawar, Menon & Reidel, 1994).

Organizational performance deals with the capability of the firm to accomplish its goals effectively and efficiently using resources(Daft, 2000). Organizational performance is associated with measures such as market shares and financial performance measures such as return of investment(Hansen & Wernerfelt, 1989; McGurie, Sundren, A & Schneeweis, 1988; Buzzel, Gale, & Sultan, 1975; Frazer & Howell,1983 Kirpalani & Shapiro,1973).

THE RESEARCH MODEL AND PROPOSITIONS

The Figure 1 represents the research model and following subsection explores relationship between different constructs such as, team socialization, communication performance, coordination, cross functional team performance , product development cycle time and their relation to organizational performance. The next section presents the formation of propositions.

FIGURE 1
INTERRELATIONSHIP BETWEEN TEAM SOCIALIZATION, COMMUNICATION PERFORMANCE, COORDINATION, CROSSFUNCTIONAL TEAM PERFORMANCE, PRODUCT DEVELOPMENT CYCLE TIME AND ORGANIZATIONAL PERFORMANCE



Team Socialization, Communication Performance, Coordination, Cross Functional Team Performance

When cross functional teams are formed team socialization will help in effective communication and information sharing. Effective communication and information retrieval from previous projects leads to enhanced organizational learning (Shrivastava, 1994). Also an atmosphere of cohesion is created and reliable ties and bonds are formed because of socialization (Cousins & Menguc, 2006). This further promotes communication performance. Increasing frequency of communication in terms of interactivity on either members of the teams were found to be responsible for improving sense of belongingness in teams (Rafaeli & Sudweeks, 1996). When there is a sense of belongingness in teams, coordination of teams can be improved (Peters & Fletchers, 2004).

The impact of training and coordination has been shown to improve team performance in medical groups (Tschan, et al., 2006). Teams irrespective of size have been shown to perform well if effective coordination exists between team members (Weber, 2006). In operations management context particularly just-in- time domain, presence of coordination is essential for success of supplier and manufacturer team performance (Chee & Johansen, 2006). Coordination is essential from a concurrent engineering perspective as members from different areas provide different expertise which leads to innovation and improved performance. Based on the above arguments we posit that:

Proposition 1. Team socialization has a positive impact on communication performance
Proposition 2a. Communication performance has positive impact on coordination
Proposition 3. Coordination is positively related to cross functional team performance

Communication Performance and Cross Functional Team Performance

The different agents which influence the CE domain include: talents, teams, techniques, time and tools (Prasad, 2001). Personnel from different areas such engineering, marketing, logistics, and production unite during product design and development to form cross functional teams. Exchanging ideas and thoughts across teams, taking responsibility for quality and productivity, development of employee skills during team orientations and enhancing knowledge about organization are integral to team participation (Gustafson & Kleiner, 1994). For the cross functional team to succeed it is important that avenues are opened for effective communication and knowledge sharing (Mohamed, Stankosky & Murray., 2004). It has been empirically shown that communication and problem solving between teams is significantly linked with financial and non-financial team performance (Politis, 2003). Research has been divided in acknowledging the impact of communication on team performance. Higher communication between team members leads to improved team performance (Katz & Tushman, 1981). In addition, it has also been shown that higher communication may not always lead to better performance (Patrashkova, McComb, Green, & Compton, 2003). Too much communication or too little communication has caused fluctuations in team performance (Patrashkova & McComb, 2004). The above arguments lead us to:

> *Proposition 2b. Communication performance is curvilinearly related with team performance*

Concurrent Engineering Team Performance and Product Development Cycle Time

Organizations today are implementing techniques for integration of process, and product design. It has been mentioned that faster new product development can have significant impact on economic rewards. Introduction of product early to market helps company extend the products life cycle, develop cost advantages and set premium pricing (Karagozoglu & Brown, 1993).

Product development life cycle is important for organizations. In addition, cross functional team performance has been shown to be one of the enablers of product development cycle time (Ittner & Larcker, 1997; Denison, Hart & Kahn, 1996). The performance of the cross functional team is found important to analyze different problems arising during product development cycle. Product development has been benefited by the formation of cross functional teams (Hitt, Hoskisson & Nixon, 1993). Different individuals possessing expert knowledge in different fields share information and improve the efficiency of the design process (Brown & Eisenhardt, 1995; Clark & Fujimoto, 1989). It has also been empirically shown that organizational decisions are implemented well if cross functional teams perform in a cooperative manner (Laughlin, 1978). Some of the factors associated with reduced product development cycle time include formation of cross functional teams and increased dedication of team workers (Zirger & Hartley, 1996). Team building is considered important for improving the cycle time. For the purpose of detection of errors early in the project cycle, minimization of communication bottlenecks, and detecting design errors (Blackburn, 1991). What differentiates work teams from individuals is the level of synergy achieved in the work teams (Menon, Chowdhary & Lukas, 2002). Thus accordingly we posit that:
Proposition 4. Cross functional team performance has a positive influence on reduction in product development cycle time.

Product Development Cycle Time and Organizational Performance

In order to be competitive the technology firms such as consumer electronics, personal computer industries, and pharmaceutical firms need to minimize the product development cycle. The proliferation of products to the market results in shrinkage of maturity stage. This further means that pressure increases on a firm to compete against a new entrant (Carrillo & Franza, 2004). Higher profitability is caused because of shorter product development cycle. This further leads to enhancement of productivity and minimization of production runs and overhead costs (Menon et al., 2002). Financial performance improves as production cycle time reduces. Short product cycle time is also associated with minimization of inventory and working capital (Menon et al., 2002). Dramatic reduction in profits are caused if the firm is late in launching products in the market, thereby leading to reduction in overall performance

(Wheelwright & Clark, 1992). It has been shown empirically that product development cycle time is associated to organizational performance. However, this association is through mediators such as use of cross functional teams, use of advanced manufacturing technologies and quality (Ittner & Larcker, 1997). Evidence of influence of team cross functionality amongst other factors such as team independence and product complexity is present on software product development time. Setting explicit goals, overlapping development activities contribute to reduction in product development time which is linked to reduced cycle times (Zirger & Hartley, 1996; Griffin, 1997). The product development cycle is related to commercial success (Griffin, 2002). Accordingly, we posit the following:

Proposition 5. Cross functional team performance positively moderates the effect of reduction of product cycle time on organizational performance.
Proposition 6. New product cycle time is indirectly associated with organizational performance.

DISCUSSION AND IMPLICATIONS OF THE STUDY

The main aim of the study was to identify the interrelationship between, socialization, communication performance, coordination, cross functional team performance and their impact on product development cycle time and organizational performance. An integrative framework is provided. The model will serve to analyze relationships which give valuable insights. The purpose will be accomplished by testing the hypothesized model in future. The implications of the possible results are discussed next.

The study offers potentially several implications for managers. In the CE context the positive association of team socialization with communication performance will further motivate managers to inculcate socialization early in the formation of teams to achieve optimum results. Managers can further organize team meetings, invest in team bonding and relationship and obtain benefits from socialization of teams. The support of the proposition that communication performance has a positive influence on coordination will further consolidate the importance of effective communication promoting information sharing amongst team members. This will further enhance the effective sharing of information and knowledge. The role of managers becomes important to further enhance communication performance. Specifically managers need to further facilitate communication between team members and offer support mechanisms to further enhance communication performance. Communication can be seen as enabler of knowledge sharing. This research further emphasizes the view that role of communication and the amount of information shared becomes important from team performance context. Extremely high or low information can result in deviation in team performance (Patrashkova & McComb, 2004). Particularly in a cross functional environment it becomes important for the managers to pay careful attention to how our embedded beliefs and values and needs may manifest differently in behavior(Rod, 2012). Furthermore managers should promote mentoring channels within the cross functional teams to further help support communication channels between members from different backgrounds. In addition if managers promote and applaud employees for their communication quality this feeling of performing well may lead to a general enthusiasm and maintenance of effective communication patterns thereby enhancing cross functional team performance.

The support of proposition that there is positive association between cross functional team performance and reduction in product development cycle will further substantiate the importance of team performance from an overarching organizational perspective. Product life cycle has been identified as a basic fuel for industries (Brockhoff, 1967). Reduction of cycle time is one of the criteria's along with others such as higher quality, lower cost to assess process improvement (Harter, Krishnan & Slaughter, 2000). Given the importance of cross functional team performance in a product development cycle time context it is important for managers to promote teambuilding as they are known to enhance cross functional team performance(Majchrzak, More, & Faraj, 2012). Also managers can further promote self-directed teams. As has been mentioned in the literature this tends to maximize the contribution of the team members and enhance performance (Kauffeld, 2006). Furthermore empowerment of team members

can also be provided constantly. Empowerment and self-direction will further promote ownership and development of each individual's capabilities.

Support for proposition that the relationship between reduction in cycle time and organizational performance is moderated by cross functional team performance will further strengthen the view that reduction in cycle time is one of the many other dimensions which will enhance the performance of organization. This will further support the fact that having faster production cycle time along with other factors such as sales growth, high accounting returns is extremely important in order to enhance performance of the organization.

CONCLUSION, LIMITATIONS AND FUTURE RESEARCH

Today, more and organizations are indulging in concurrent engineering. It is believed that the success of the concurrent engineering depends on a variety of dimensions. Thus, it is important for the managers to understand the importance of various interrelated factors helping the development of the dimensions of concurrent engineering practices. Given the importance of cross functional teams in the CE context it is important to further the research in this area. To the best of our knowledge, no study has considered interaction between socialization, communication performance, coordination, cross functional team performance, product development cycle time and their relationship to organizational performance in an unified context.

One of the major limitations of the study was that it is conceptual in nature. Empirical testing of the testable propositions need to be carried out in order to add generalizability to the study. Data from different firms needs to be considered for external validity concerns. The importance of contextual variables such as group cohesion and social loafing is mentioned elsewhere, however these factors were not considered to maintain parsimony of the study (Levine & Moreland, 1990). Effect of other dimensions such as team size, team composition, can be considered on cross functional team performance. The impact of construct interdependence on team and impact on organizational performance might also yield interesting insight. Interdependence is defined as the level at which different members of the team interact cooperatively. In addition, there is the individuals depends on team members for information, material and intellectual inputs (Emery & Trist, 1969).Interdependence is believed to directly influence work team processes (Stewart & Barrick, 2000). Setting challenging goals leads to improved performance of teams, combined interaction of interdependence and impact of challenging goals on teams can also be studied.

The construct of cohesion can also be integrated in the model and empirically tested for relationship with coordination and communication performance. Impact of knowledge management as a construct moderating team performance can further be explored. As organizations continue to carry majority of work in teams, it becomes important for the researcher to focus on issues of team performance and its impact on overall organizational performance.

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