Journal of Global Strategic Management | V. 2 | N. 2 | 2008-December | isma.info | 5-12 | DOI: 10.20460/JGSM.2008218482

EFFECTS OF CROSS FUNCTIONAL INTEGRATION, CO-DEVELOPMENT AND TEAM AUTONOMY ON INNOVATION PROCESS: AN EMPIRICAL STUDY

Ali E. AKGUN
Halit KESKIN
Ayşe GUNSEL
Gebze Institute of Technology, Turkey

ABSTRACT

This study explores the relationship between cross functional integration, co-development, team autonomy, and innovation speed and innovation success. The impact of project team management variables on the speed and the success of innovation process is empirically examined for 82 new product development projects executed. Empirical analysis shows that cross functional integration and co-development have positive effects on both the speed and the success on the new product development process. Moreover team autonomy is found to be positively and significantly related to innovation speed while the results provide no evidence in support of the relationship between team autonomy and innovation success. Another key finding of the study is that cross functional integration is more important for innovation success while co-development is imperative for innovation speed.

***Key Words**: New product development, cross functional integration, co-development, team autonomy, innovation.*

INTRODUCTION

There is an emerging recognition that innovation is important to a firm's creating and sustaining competitive advantage in today's harsh and rapidly changing business environments. The long term survival of firms is closely related to their ability to successfully introduce better products into the market place -innovate or die- (Holland et al., 2000). Accordingly innovation process has an extended history of academic and practitioner concern (Fredericks, 2005). Still there has been little theoretical advancement concerning the factors influencing the outcomes of the innovation process such as success and speed.

Teams are in the middle of a modern renaissance. Even though teams in organizations are not so new; they have recently gain importance as a primary unit of organizational structure (Ancona, 1990). Shortening life cycles and imperatives for faster development and global roll-out require more flexible organizational forms such as teams. The emergence of cross-functional teams is one of the most remarkable current trends in organizational design (Holland et al., 2000). In order to understand the determinants of innovation success it is necessary to examine the project teams. In today's dynamic, turbulent and ever-changing environment, the use of teams has become an imperative for accomplishing significant goals or tasks within most organizational settings (Green et al., 2005). Korine (1999) states that team-based organizations were already spreading broadly in the early 1990`s and teams had become the standard unit of performance in many firms by the end of 1990`s. Today, a great deal of economic activity depends on the success of teams composed of organizational members (Reus and Liu, 2004). Considering the complex and multidimensional nature of new product development process; it is widely accepted that the success of innovation process relies on teams (Tatikonda and Rosenthal, 2000; Green et al., 2005, Eisenhardt and Martin, 2000)

Given the fact that the use of teams is becoming a structural norm generally in organizations particularly in new product development process; it is an essential to get the highest degree of skill utilization from all members of the team in an effort to enhance speed and success of the innovation process (Green et al., 2005). Reviews of the innovation and product development literature suggests that there are many team related factors influencing the innovation speed and success (Kessler and Chakrabarti, 1996). For example Hage et al., (2008) states that, the role of a complex division of labor as cross-functional teams, has been considered as a critical factor in facilitating organizational innovation. Thus the integration of functionally diverse labor in new product teams is an old managerial challenge (Im and Nakata, 2008). On the other hand Olson (2004) emphasizes the importance of another kind of integration; participation of multiple parties crossing boundaries of companies, including consumers, suppliers and other third parties to the development process Successful new technology products are best developed by early and in-depth involvement of both customers and suppliers, a external integration process called as co-development (Neale and Corkindale, 1998).

One basic feature of current collaborative team arrangements in the context of new product development process is a high degree of autonomy for cross-functional teams. The literature, however, has not provided a well defined analysis of the affects of team autonomy on new product development (Gerwin and Moffat, 1997). Thus the purpose of our study is to investigate the relationships between cross functional integration, co-development, team autonomy on new product development process outcomes as success and speed. Scratching the surface of the connections between team related factors and project outcomes will enhance the new product development literature in many ways.

BACKGROUND

Cross Functional Integration

As development of innovative and unique products typically requires the different kinds of knowledge and expertise; one of the main topics in the management of R&D is ensuring a balance between increasing the complex division of labor needed to achieve radical innovation projects and maintaining integration among the project team (Hage et al., 2008). Thus assembling a diversity of experts to take part in an NPD project can result in a breakthrough new product. However without the cross-functional integration, the existence of specialists does not guarantee this end. Accordingly cross functional integration in new product teams has become an important concern for both practitioners and researchers (Im and Nakata, 2008). Cross-functional integration is the coordinated utilization of different functions in NPD teams toward value-creating activities (Im and Nakata, 2008)By synergistically blending together specialists from different areas of specialization, backgrounds and departments, cross functional integration exploits their different talents and knowledge toward formulating advantage in new products (Nakata et al., 2006; Sherman et al., 2005).

Cross-functional integration offers many benefits for new-product development (Song, 1998; Im and Nakata, 2008; Holland et al., 2000). For example Thieme et al. (2003), declares that teams function more efficiently when members with different backgrounds and from different functions share knowledge and understand different perspectives. Moreover Sherman et al. (2005) states that cross-functional integration influences product development cycle time, product development project success and failure rates.

Accordingly our first and second hypotheses are offered.

H1: Cross-functional integration is positively related to innovation speed.

H2: Cross-functional integration is positively related to innovation success.

Co-development

Co-development is basically described as the representativeness of customers, suppliers, stakeholders and other external groups in innovation process (Kessler and Chakrabarti, 1998). In other words co-development processes are mechanisms used to gain a competitive advantage and to reduce development costs emphasizing the early cooperation between the supplier and the buyer (Crespin-Mazet and Ghauri, 2007). An overview of the literature addresses a gap in current literature: the patterns of supplier and customer participation in new product development (Fliess and Becker, 2006). Moreover for co-development to occur on a project, all the parties have to develop trust and commitment and have a minimum of shared goals (Crespin-Mazet and Ghauri, 2007).

In the context of co-development; the technology originator, supplier and the customer become intimately involved in an integrated or joint development project, where parties contribute their expertise to the development process. In turn, this involvement is considered to affect the speed and the success of the innovation project (Neale and Corkindale, 1998). For example Fliess and Becker (2006), Using 12 case studies of small and medium-sized suppliers of a medium-sized European enterprise operating in the window and facades industry, highlights several problems resulting from the interaction and coordination between customer and supplier in new development. Carbonell and Rodriguez (2006) states that representativeness of external groups on development process decrease development time by increasing goal congruence amongst the functional groups, bringing more creative potential to problem solving, and ensuring the availability of critical input

Accordingly our third and fourth hypotheses are offered.

H3: Co-development is positively related to innovation speed.

H4: Co-development is positively related to innovation success

Team Autonomy

One of the important elements in maintaining a level playing field of creative and innovative ideas is management respect of team autonomy (Korine, 1999). Autonomy is the degree to which an organization, a group or an individual has power with respect to its environment Autonomy implies the decentralization of decision-making power to those who will do the job. There are several organizational levels and kinds of autonomy. An intermediate organizational level is that of the team level (Tatikonda and Rosenthal, 2000; Hoegl and Parboteeah, 2006). Teams often face increased job complexity and autonomy (Man and Lam, 2003). Team autonomy is a crucial feature of cross-functional teams engaged in a new product program encourages managers to support the team than interfere in its decision making. (Gerwin and Moffat, 1997). Man and Lam, (2003) emphasize the potential of the team autonomy to increase cohesiveness, which in turn translates into performance and success. Thus nothing so easily upsets the insubstantial alchemy of team decision-making as top management interference. Excluding periodic reviews and team initiated consultation, management must make a commitment to stay out of team activities (Korine, 1999). On the other hand, Kessler and Chackrabarti (1996) state that decentralizing the decision making can speed the development because it disseminates the power required to go against the status quo, increases the members` involvement in and awareness about a project and consequently strengthens the members` commitment to it.

Accordingly our fifth and sixth hypotheses are offered.

H5: Team autonomy is positively related to innovation speed.

H6: Team autonomy is positively related to innovation success

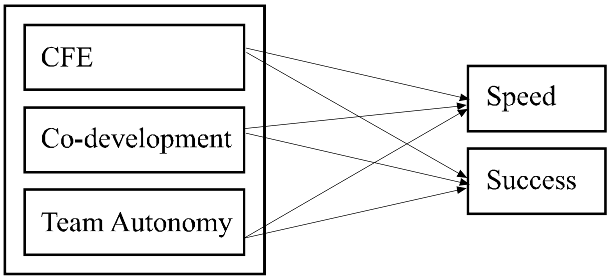

Figure 1. The theoretical model

METHODOLOGY

Data and Measures

The aim of this study is to evaluate the effects of cross-functional integration, co-development and team autonomy on innovation speed and success. In order to empirically investigate the hypothesis, new product development teams located around Kocaeli and İstanbul were surveyed. Using the documents obtained from KOSGEB, MAM and TEKMER, 150 firms among 1000 are identified as the target group of the research because of their availableness. Tools such as e-mail, letter and face to face interviews are used for gathering data. The analyze is conducted on team level. Minimum two members from each team claimed to participate the survey. As total of 170 questionnaires among 82 teams among 58 firms has returned. All constructs were measured with existing scales. All items were measured on a five point Likert-type scale where 1=strongly disagree and 5=strongly agree. Data is evaluated through SPSS 13.0. The relationships between the variables are tested using correlation, reliability, regression and factor analyses. The mean age of the participants were 29.27 (s.d.=5.58); the proportion of women, 9,8%, and married 69,5%. Of the participants, %81 had university educations and %38 had master education.

Cross-functional integration: Cross-functional integration was measured using five questions adapted from García, Sanzo and Trespalacios (2008), who derived the items from Pinto and Pinto (1990), Kahn (1996) and Song et al. (2000).

Co-development: Co-development was measured using four items from Athaide et al.`s (2003) co-development scale.

Team autonomy: Team autonomy was measured using four items from Sethi`s (2000) team autonomy scale

Project speed: Project speed was measured using four items from Kessler and Chakrabarti`s (1999) project speed scale

Project success: Project success was measured using seven items from Cooper and Kleinschmidt`s (1987) project success scale.

Table 1. Factor Analyses

Cross functional integration	Factor1	Factor2	Factor3
Marketing and R&D helped each other to accomplish their tasks in the most effective way	,746		
The departments tried to achieve goals jointly.	,779		
The departments shared ideas, information and/or resources.	,581		
The departments took the project's technical and operative decisions together.	,603		
There was open communication between the departments	,656		
Co-development			
Our team co-designed the product with the customers and suppliers		,774	
Our team co-developed this product with the customers and suppliers		,878	
Our team worked consistently with the customer/suppliers to solve the specific problems related to the product		,885	
Team autonomy			
Senior managers outside the team did not interfere the teams work unless the team requested their help			,675
Senior management provided self-administration for the team			,776
The team had a major role in making important decisions about the product.			,684
The team was allowed to do the project work as it deemed fit.			,821

ANALYSIS

Since the scales were used with a new sample, 12 items of independent variables and 11 items of dependent variables were submitted to exploratory analysis. A principal component analyses and scree plot indicated that five factors should be retained (eigenvalues above1.0). The best fit of data was obtained with a principal factor analysis with varimax rotation.

Table 2. Factor Analyses

Our product:	Factor4	Factor5
Project success		
Met or exceeded the first year number expected to be produced and commercialized	.616	
Met or exceeded overall sales expectations	.829	
Met or exceeded profit expectations	.860	
Met or exceeded return on investment expectations	.838	
Met or exceeded senior management expectations	.676	
Met or exceeded market share expectations	.810	
Met or exceeded customer expectations	.669	
Project speed		
Was developed and launched (fielded) faster than the major competitor for a similar product		.739
Was completed in less time than what was considered normal and customary for our industry		.821
Was launched on or ahead of the original schedule developed at initial project go-ahead		.709
Top management was pleased with the time it took us from specs to full commercialization		.669

The results of factor analyses show that the independent variables are gathered in three factors and the dependent variables are gathered into two. Factor 1 consists of six cross functional integration factors with an internal consistency reliability coefficient (Alpha) of 0, 74. Factor 2 includes three co-development items with an internal consistency reliability coefficient of 0, 834. Factor 3 includes four team autonomy items with an internal consistency reliability coefficient (Alpha) of 0, 738. Factor 4 includes four project speed items with an internal consistency reliability coefficient (Alpha) of 0, 773. Factor 5 includes seven project success items with an internal consistency reliability coefficient (Alpha) of 0, 894. Table 1 shows the factor loadings of cross functional integration, co-development and team autonomy while table 2 indicates the factor loadings of project speed and project success.

Means, standard deviations and inter-correlations are

Table 3. Mean value and standard deviation

	Mean Value	Standard Deviation	1.	2.	3.	4.	5.
1.Cross-functional integration	3,4530	,62621	(0,740)				
2.Co-development	3,4495	,95762	,210	(0,834)			
3.Team autonomy	3,8059	,60405	,272(*)	-,084	(0,738)		
4. Project speed	3,5147	,69858	,442(**)	,153	,282(*)	(0,773)	
5. Project	3,5024	,64296	,306(**)	,276(*)	,223(*)	,462(**)	(0,894)

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

summarized in Table 3. Cronbach`s Alpha values are shown using parentheses on the cross of the table. On a bivariate level project success was positively related to all variables while project speed was positively related to cross functional integration and team autonomy. According to the correlation results, all the independent variables have direct relationship between each other except co-development.

Regression

Table 4. Regression results for cross functional integration, co-development, team autonomy and project speed.

Independent variables	β	Sig
Cross-functional integration	0,371**	0,001
Co-development	0,091	0,377
Team autonomy	0,189*	0,075
Dependent variable: Project speed, R2=0,201, F=7,812		

**: p< 0, 01, *: p< 0,05 (2-tailed)

In the first regression analyze we investigated the influences of cross functional integration, co-development and team autonomy on project speed. The regression model is significant as a whole (F=7,812: p< 0, 01) ; it explains %20,1 of the change of project speed. The findings shows that as we predicted in H1 cross functional integration (blending together specialists from different areas of specialization, backgrounds and departments) and as we predicted in H5 team autonomy (decentralization of decision-making power to the team than the senior management outside the team) both have positive and significant effects on project speed. However the results do not provide any empirical evidence in support of the relationship between co-development (the representativeness of customers, suppliers, stakeholders and other external groups in innovation process) and project success. So our hypothesis H1 and H5 are supported while H3 is not.

Table 5. Regression results for cross functional integration, co-development, team autonomy and project success.

Independent variables	β	Sig
Cross-functional integration	0,202*	0,071
Co-development	0,249*	0,022
Team autonomy	0,188*	0,086
Dependent variable: Project success, R2=0,141, F=5,426		

**: p< 0, 01, *: p< 0,05 (2-tailed)

In the second regression analyze we investigated the influences of cross functional integration, co-development and team autonomy on project success. The regression model is significant as a whole (F=5,426: p< 0, 01); it explains %14,1 of the change of project speed. The findings shows that as we predicted in H2 cross functional integration (blending together specialists from different areas of specialization, backgrounds and departments) ;as we predicted in H4 co-development (the representativeness of customers, suppliers, stakeholders and other external groups in innovation process) and as we predicted in H6 team autonomy (decentralization of decision-making power to the team than the senior management outside the team) all have positive and significant effects on project success. Accordingly our hypothesis H2, H4 and H6 are fully supported.

CONCLUSION

Most of the technology and innovation management literature (TIM) is grounded and empirical studies are completed on organizational level rather than team level. But project teams are important for today's dynamic economy in which the success of organizations are increasingly determined with the success of small, autonomous work groups

Accordingly, enhancing the TIM literature with team level studies is imperative for both scholars and practitioners.

In this study, the relationships between cross functional integration, co-development, team autonomy, project speed and project success are tested in project teams of a developing country, Turkey. The findings of the study demonstrated that scales which are developed in Western countries, are appropriate for an emerging economy and eastern country; Turkey. Measures demonstrated high validity and reliability, and model results were similar with the empirical studies completed in developed and western countries.

The findings show that blending together specialists from different areas of specialization, backgrounds and departments and transferring the of decision-making power and providing freedom to the team play an important role on both project speed and project success. This means that in order to enhance the project speed and project success teams should be grounded on members from a variety of different discipline and specializations who have enough power to give their own decisions and express their ideas concerning the project.

The findings also reveal that co-development contributes to project success than any other team related factors ($\beta=0{,}249$, $p<0.05$) while it is not related to project speed. Representativeness of customers, suppliers and other parties in the project team may be a complicated and time consuming process; so while enhancing the success, co-development can be an barrier for speeding the project.

Moreover The findings also revealed that the influence of cross-functional integration ($\beta=0{,}371$, $p<0.01$) is higher than the team autonomy ($\beta=0{,}189$, $p<0.05$) on project speed. It means that integration and coordination of functionally diverse labor in new product teams are more important for project speed than decentralization of decision-making power to top management to team itself.

The findings of this study can not be taken as definite evidence because several limitations to the study results deserve commentary. First, these results reported here emerge from a local area; results may differ for teams located on different areas that are operating in different cultural, environmental and political conditions. Second, there was not an industrial separation while evaluating data; results may differ for different industries such as software, manufacturing and service. Despite these limitations, this study provides important implications from theoretical and practical perspectives. This study indicates that cross functional integration, autonomy and co-development are important variables of project outcomes; formulating an effective project team can lead firms to great profits

In conclusion, our results indicate a significant relationship between cross functional integration, autonomy and co-development and project outcomes. Our findings also reveal that cross functional integration team autonomy for project speed, while co-development is more important for project success than cross functional integration and autonomy.

REFERENCES

Fredericks E., (2005), "Cross-functional involvement in new product development: A resource dependence perspective", Qualitative Market Research; 8, 3; pg. 327.

Ancona D. G., (1990), "Outward Bound: Strategies for Team Survival in an Organization", The Academy of Management Journal, Vol. 33, No. 2 pp. 334-365

Tatikonda M. V. and Rosenthal S. R., (2000), "Successful execution of product development projects: Balancing firmness and flexibility in the innovation process", Journal of Operations Management, Volume 18, Issue 4, Pages 401-425

Kessler, E. H., and Chakrabarti, A., K., (1996), "Innovation speed: A conceptual model of context, antecedents, and outcomes", Academy of Management. The Academy of Management Review; 21, 4; pg. 1143

Green A.L., Hill A. Y., Friday E., Friday S.S., (2005), "The use of multiple intelligences to enhance team productivity",Management Decision Vol. 43, No. 3, pp. 349-359

Eısenhardt K. M. and Martın J. A., "Dynamıc Capabılıtıes: What Are They?", Strategic Management Journal 21: 1105-1121 (2000)

Nakata C., Im S., Park H. and Ha Y.W., (2006)," Antecedents and consequence of Korean and Japanese new product advantage", Journal of Business Research Volume 59, Issue 1, January 2006, Pages 28-36

Sherman JD, Berkowitz D., Souder W.E., (2005),"Development Performance and the Interaction of Cross-Functional Integration and Knowledge Management" - Journal of Product Innovation Management, 22 (5) , 399-411.

Thieme RJ, Song M, Shin GC (2003), "Project Management Characteristics and New Product Survival", Journal of Product Innovation Management, Volume 20 Issue 2 Page 104

Neale MR and Corkindale D.R., (1998), "Co-developing products: Involving customers earlier and more deeply", Long Range Planning, Volume 31, Issue 3, June 1998, Pages 418-425

Carbonell P., and Rodriguez A. I., (2006), "Designing teams for speedy product development: The moderating effect of technological complexity", Journal of Business Research, Volume 59, Issue 2, February, Pages 225-232

Gerwin D., and Moffat L., (1997), "Authorizing processes changing team autonomy during new product development", Journal of Engineering and Technology Management, Volume 14, Issues 3-4, 12, Pages 291-313

Hoegl M. and Parboteeah K.P., (2006), "Autonomy and teamwork in innovative projects", Human Resources Management, Volume 45, Issue 1 , Pages 67 - 79

Man D.C., Lam S.S.K, (2003), "The effects of job complexity and autonomy on cohesiveness in collectivistic and individualistic work groups: a cross-cultural analysis", Journal of Organizational Behavior Volume 24, Issue 8 , Pages 979 - 1001

Athaide, Gerard A., Rodney L. Stump, and Ashwin W. Joshi (2003), "Understanding New Product Co-development Relationships in Technology-Based, Industrial Markets, Journal of Marketing Theory and Practice, 11 (3), 46-58.

Sethi, R. "New product quality and product development teams," Journal of Marketing, vol. 64, pp. 1-14, 2000.

Cooper, R.G., Kleinschmidt, E.J. (1987), "Success factors in product innovation", Industrial Marketing Management, Vol. 16 pp.215-23.

García N., Sanzo M. J., Trespalacios J.A. (2008), "New product internal performance and market performance: Evidence from Spanish firms regarding the role of trust, inter-functional integration, and innovation type", Technovation, In Press, Corrected Proof.

Holland S., Gaston K. and Gomes J., (2000), "Critical success factors for cross-functional teamwork in new product development", International Journal of Management Reviews 2(3), pp. 231 - 259.

Hage J., Jordan G., Mote J. and Whitestone Y., (2008), "Designing and facilitating collaboration in R&D: A case study", Journal of Engineering and Technology Management, 25(4), pp. 256-268.

Im S. and Nakata C., (2008), "Crafting an environment to foster integration in new product teams", International Journal of Research in Marketing 25(3), pp. 164-172.

Fliess S. and Becker U., (2006), "Supplier integration-Controlling of co-development processes", Industrial Marketing Management 35(1), pp. 28-44.

Crespin-Mazet F. and Ghauri P., (2007), "Co-development as a marketing strategy in the construction industry", Industrial Marketing Management 36(2), pp. 158-172.

Olson J. G., (2004), "Co-development: collaborating across boundaries on joint strike fighter", Advances in Interdisciplinary Studies of Work Teams 10, pp.27-58.

Korine H., (1999), "The new team organization:: Learning to manage arbitrariness",

European Management Journal 17(1), Pages 1-7.

DeVaro J. and Kurtulus F. A., (2006), "What Types of Organizations Benefit from Team Production, and How Do They Benefit?", Advances in the Economic Analysis of Participatory & Labor-Managed Firms 9, pp. 3-54.