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The impact of cross-functional communication on absorptive capacity of NPD teams at high technology firms in Thailand

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ABSTRACT

Absorptive capacity (ACAP) is an essential component for new product development (NPD) teams to effectively manage knowledge received from external sources. This paper extends the existing theory of ACAP by examining the impact of cross-functional communication on the ACAP of NPD teams at high technology firms in Thailand. The results indicate that all characteristics of cross-functional communication, including frequency, quality, and informality have direct impacts on ACAP. However, only quality and informality have a significantly direct effect on all activities of ACAP, which includes knowledge acquisition, assimilation, transformation, and application.

1. Introduction

New product development (NPD) teams play a critical role in many high-technology manufacturing firms during this era of intense competition. The performance of NPD teams enables the company to strengthen its competitive advantage (Cooper, 2001), speed to the market (Chen, Damanpour, & Reilly, 2010), and new product quality (Sethi, 2000). Prior research has revealed a wide range of factors that affect NPD team performance, including cross-functional communication. Cross-functional communication within an NPD team occurs when team members from different functional areas who own specific knowledge exchange work-related information in order to accomplish an NPD project. Many scholars have shown that cross-functional communication improves new product quality, reduces conflicts, increases profitability, and promotes team performance (Barczak, Griffin, & Kahn, 2009; Massey & Kyriazis, 2007; Song & Parry, 1997).

Besides cross-functional communication, NPD teams need to have the internal capacity to effectively apply external knowledge into new product projects. Since research and development activities involve a variety of knowledge fields from inside/outside the team, the capacity of the team to manage these bodies of knowledge is critical for team success. This capacity, namely absorptive capacity (ACAP), refers to the team's ability to acquire, assimilate, and utilize useful information to accomplish NPD project objectives. Extant research has found that ACAP is a valuable input for innovation performance (Chen, Lin, & Chang, 2009), manufacturing practices (Tu, Vonderembse, Ragu-Nathan, & Sharkey, 2006), and so forth. However, most of these studies have investigated the outcomes of ACAP. Moreover, very few studies empirically investigate ACAP in the context of NPD (Stock, Greis, & Fischer, 2001). This study, therefore, fills these gaps by examining the antecedent (i.e. cross-functional communication) of ACAP in an NPD setting at high technology firms.

The objective of this study is to address the importance of ACAP in an NPD team environment and to contribute to the existing literature in two ways. First, this research selected cross-functional communication to be an antecedent of ACAP since communication process is the major constituent of ACAP (Zahra & George, 2002). Second, this research extends the study of organizational ACAP

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to a team level. Third, this research empirically further validates the impact of cross-functional communication on four activities (i.e. acquisition, assimilation, transformation, and application) that comprise ACAP.

The structure of this study is follows. A literature review is discussed in Section 2. Hypotheses are proposed in Section 3. Section 4 describes the methodology, including sample and research design. Section 5 explains the results of data analysis, including descriptive statistics, reliability and validity of the measurement, correlations between constructs, and the results of SEM output. The last section discusses the results of this study and provides the implications.

2. Conceptual framework

Absorptive capacity (ACAP) in previous studies is predominantly conceptualized as a firm's ability to identify, assimilate, and apply knowledge gained from external sources (Cohen & Levinthal, 1990). Importantly, it enables an organization to accumulate knowledge and convert it into a usable form that can be applied in business operations. Since this study focuses on ACAP on a team level, it refers to the ability of the members of a team to interrelate with the expertise of the team members. However, ACAP in NPD teams does not just simply equal the cumulative amount of individuals' ACAP (Cohen & Levinthal, 1990). It also depends on the effectiveness of communication between team members. A team's ACAP in a particular knowledge domain is therefore a function of the expertise in that domain and the process of communication within that team.

In later research, ACAP is distinguished into two dimensions (namely potential and realized ACAP), each of which consists of two main activities (Zahra & George, 2002). First, potential absorptive capacity (PACAP) includes the efforts of knowledge acquisition and assimilation obtained from external sources. Second, realized absorptive capacity (RACAP) includes knowledge transformation and application of new insights into existing operations by the combination of existing and newly acquired knowledge, and incorporating transformed knowledge into operations. These two dimensions are fundamentally different concepts that involve distinctive behaviors, but they do have complementary roles. On one hand, PACAP involves personal internal processes, such as reflection, intuition, and interpretation. It requires changing abilities, flexibility, and creativity. On the other hand, RACAP involves the efficiency of leveraging externally absorbed knowledge. It requires order, control, and stability (Newey & Zahra, 2009). These two dimensions may result in different outcomes. As such, companies that focus on PACAP may be forced to continually renew their knowledge at a high cost of acquisition, but gain less benefit from knowledge application. On the other hand, companies that focus on RACAP may obtain short-term profits through knowledge application, but fall into competence traps, and unable to cope with changing environments (Ahuja & Lampert, 2001).

ACAP is a critical component for learning processes that help individuals understand new technology used to generate new product ideas (Tsai, 2001). ACAP allows an NPD team to identify and value new knowledge that generates new product concepts beyond its original boundaries, and to assimilate and integrate such new knowledge with the existing knowledge (Arora & Gambardella, 1994). Many scholars have suggested that team's ACAP enables it to convert and apply external knowledge into new product ideas and innovations (Harrington & Guimaraes, 2005). The previous literature has widely examined the outcomes of ACAP, such as NPD performance (Stock et al., 2001), innovativeness (Chen et al., 2009), and competitive advantage (Easterby-Smith, Graça, Antonacopoulou, & Ferdinand, 2008). Most of these studies investigated the outcomes of ACAP, but a few studies explicitly examined the antecedent of ACAP in NPD teams. One exception, Tiwana and Mclean (2005), suggests that a team should promote the integration of expertise while working on a project in order to effectively enhance ACAP. This study, therefore, further attempts to fill these gaps by proposing an antecedent that enhances the ACAP level of NPD teams. The selected antecedent is cross-functional communication among NPD team members who are from diverse functional areas.

2.1. Cross-functional communication

Cross-functional communication is a channel for information exchange between NPD team members across functional operations (Bulte & Moenaert, 1998; Griffin & Hauser, 1996; Moenaert & Souder, 1990b; Pinto & Pinto, 1990; Souder & Moenaert, 1992).

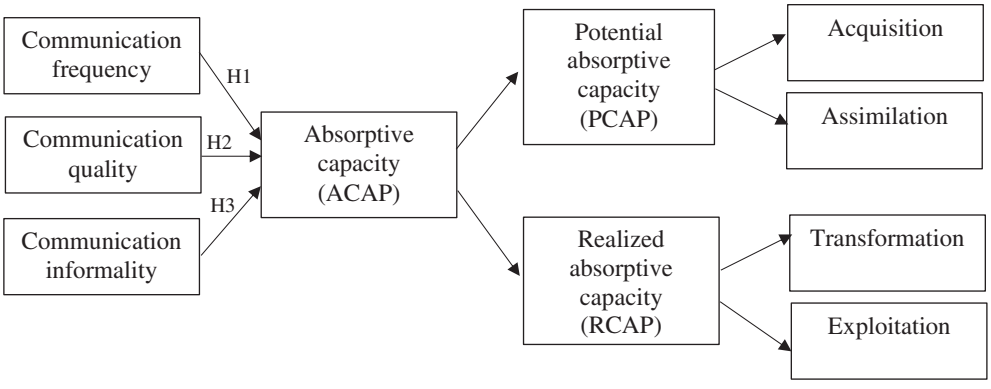

Fig. 1. Conceptual model.

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In inter-functional integration theory, cross-functional communication facilitates reciprocal information flow among functions responsible for the development, design and implementation of new products (Van de Ven & Ferry, 1980). This type of communication is a crucial element for a NPD team whose members have different "thought worlds" (Dougherty, 1992), since it develops mutual understanding of the others' technical information, means and objectives. This communication process draws complementary skills and knowledge from each member to accomplish new product projects (Zolin, Hinds, Fruchter, & Levitt, 2004).

From the literature on communication, there are a variety of dimensions of communication characteristics. This research captures the three most-mentioned dimensions: frequency, quality, and formality. First, communication frequency refers to the amount of information exchanged between cross-functional NPD team members. Second, communication quality refers to the degree to which exchanged information in NPD teams is useful, comprehensive, novel, detailed, credible, well-presented, and relevant. Third, communication informality refers to the extent to which communication in NPD teams is personalized, spontaneous, and unstructured. For example, informal communication includes unplanned face-to-face discussion, and meeting or personal conversation during breaks.

Fig. 1 identifies the relationship between three characteristics of cross-functional communication and absorptive capacity. Specifically, absorptive capacity consists of two categories, which are divided into four activities. The following section discusses the hypotheses linking these two groups of variables.

3. Hypothesis development

There is a strong link between communication and ACAP. Cohen and Levinthal (1990) emphasize that the structure of communication between the external environment and the organization, as well as among subunits of the organization, enable members to share knowledge and information. However, this factor has received very little attention with regard to its role in the creation of absorptive capacity and development in communication. On a business unit level, Minbaeva, Pedersen, Björkman, Fey, and Park (2003) found that communication between units is likely to contribute to employee's motivation to exchange knowledge. Communication enables individuals to be aware of useful complementary information that they need to accomplish their tasks. Subramaniam and Venkatraman (2001) found that high frequencies of communication among overseas managers in transnational teams increase the capabilities of knowledge acquisition. Moreover, high frequencies of communication increase opportunities for assimilating deeper knowledge flows (i.e. PCAP) across functional boundaries. This type of communication enables team members to overcome differences, interpret issues, and build understanding about new external knowledge (Daft & Lengel, 1986). When team members frequently exchange knowledge with each other, they tend to combine sets of newly acquired knowledge and implement it (i.e. RCAP) into their current tasks. In NPD teams, when individuals frequently obtain sufficient communication, they are likely to increase their ability to acquire, assimilate, transform, and apply new knowledge in their jobs. Therefore, it is posited that:

Hypothesis 1. Cross-functional communication frequency is positively related to the absorptive capacity of NPD teams.

In a number of previous studies, the impact of communication quality on ACAP has been implicitly researched. The quality of communication is determined by the relevance of exchanged information. Moenaert and Souder (1990a) suggest that an NPD team member's perception of the relevance, novelty, credibility, and comprehensibility is the major determinant of the utility of the information received from other functional members. For instance, high quality information enables marketers to better acquire and assimilate the knowledge (i.e. PCAP) on market requirements and the competition, especially when a new product is ready to launch. In addition, Calantone, Droge, and Vickery (2002) found that the quality of marketing communication increases the managers' ability to assimilate the received knowledge among manufacturers. With regard to RCAP, Mohr and Spekman (1994) imply that communication quality between a manufacturer and its partner is the key factor of trust in applying the exchanged knowledge and increases a business's success rate. In addition, the case studies by Perks (2000) show that the quality of marketing information entering a joint NPD process increases R&D's capability in using such information. Therefore, it is posited that:

Hypothesis 2. Cross-functional communication quality is positively related to the absorptive capacity of NPD teams.

Sufficient evidence shows that communication informality plays a significant role in NPD project activities. Pinto and Pinto (1990) suggest that informal communication improves cross-functional cooperation and provides greater openness and clarification opportunities among team members in acquiring and assimilating the new knowledge (i.e. PCAP) provided by other members. Moenaert and Souder (1990a) consistently found that informality results in the receivers of new knowledge feeling more willing and favorable toward receiving and understanding such knowledge. In terms of RCAP, Akgun, Lynn, and Yilmaz (2006) suggest that team intelligence, which includes a team's ability to process, interpret, manipulate and use knowledge (i.e. ACAP) can be influenced by conducting informal communication with project team members. Therefore, it is posited that:

Hypothesis 3. Cross-functional communication informality is positively related to the absorptive capacity of NPD teams.

4. Research methodology

4.1. Sample

The target sample consisted of 300 companies in high technology industries in Thailand, made up of automotive, auto parts, electric and electronic manufacturers. As a screening process, project managers from each firm were contacted by telephone and

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were informed about the aim of this study. They were also told that their responses and company product information would be kept anonymous and highly confidential. Of the 300 contacted, 168 were willing to participate in this research, providing an overall response rate for the survey of 56%. This response rate is moderate, given that the surveys were completed by mid-level managers or NPD team members whose time was often scarce. Respondents primarily were product and NPD project managers who had been involved in at least one new product project that was introduced into the marketplace for at least six months previously.

4.2. Measures

To operationalize all constructs, multi-item scales adopted from prior studies with a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree) were used. Following the back-translation method (Brislin, 1980), items were first translated into Thai by one person and then retranslated into English by a native speaker. The two translators then jointly reconciled all the differences and refined the wordings. A draft of the questionnaire in Thai was pre-tested by five graduate students who had worked in at least one NPD project. All questions were subsequently revised in accordance with the students' opinions. After the questionnaire was thoroughly reviewed, 300 questionnaires were distributed to target respondents and collected by the author, using a self-administered method.

5. Results

The descriptive statistics in Table 1 show general information on each factor and the correlation among all the constructs. A structural equation model was used, following the two-stage procedure recommended by Anderson and Gerbing (1988). First, the model's reliability and validity were tested by using SPSS. Second, hypotheses of the theoretical model were tested by structural equation modeling (SEM) techniques that combine factor analysis and path analysis.

5.1. Measurement model

In testing construct validity, Table 2 summarizes the results of the measurement model: 28 items across eight constructs. The fit indices show good statistics. The standardized factor loadings for each indicator are positive for each theoretically assigned construct. All loadings exceed the minimum values of 0.50, as suggested by Hair, Anderson, Tatham, and Black (1998). Although the measures of each construct in the study are widely used, well-developed, and repeatedly tested in the literature, they were partially modified to fit in a Thai context.

Composite reliability analyzed internal consistency for each construct, estimated using Cronbach's alpha. Table 2 shows the alpha coefficient of all eight constructs is ≥ 0.79, which is greater than a 0.70 value. These values indicated adequate reliability as suggested by Nunnally and Bernstein (1994). In addition, all values of estimated variance extracted surpass the 0.50 critical value, indicating further evidence of reliability. Overall, all values of reliability and validity support the suitability of the measurement model with acceptable fit indices ($\chi^2_{(273)} = 597.32$ ($p = 0.00$), root mean square error of approximation (RMSEA) = 0.08, and the comparative fit index (CFI) = 0.92).

5.2. Structural model

The overall structural model fit is good with the following values: $\chi^2_{(282)} = 618.47$, $p = 0.00$; RMSEA = 0.08; CFI = 0.91 (see Table 3). The model explains the 63% of variance in absorptive capacity. Absorptive capacity is influenced by cross-functional communication frequency (beta = 0.19, $p < 0.05$), quality (beta = 0.72, $p < 0.01$), and informality (beta = 0.14, $p < 0.01$), respectively. Thus, all hypotheses are supported.

Data were further analyzed by examining the differential impacts of cross-functional communication characteristics on each dimension of ACAP in order to clarify how ACAP could be developed and to reveal why high technology firms have difficulties in managing dimensions of ACAP successfully. In the second order analysis, all characteristics of communication have significant impacts on both potential and realized ACAP. Table 4 shows that all cross-functional communication characteristics have significantly positive

Table 1
Means, standard deviations, and correlations.

	Mean	SD	1	2	3	4	5	6	7	8	9	10
1. Communication frequency	3.32	0.75	1.00									
2. Communication quality	5.04	0.94	0.49	1.00								
3. Communication informality	4.66	1.50	0.37	0.46	1.00							
4. Absorptive capacity	5.17	0.97	0.47	0.72	0.51	1.00						
5. Potential absorptive capacity	5.12	1.04	0.44	0.70	0.50	0.96	1.00					
6. Realized absorptive capacity	5.22	0.98	0.45	0.67	0.49	0.96	0.84	1.00				
7. Acquisition capacity	5.13	1.10	0.37	0.64	0.48	0.90	0.96	0.78	1.00			
8. Assimilation capacity	5.11	1.08	0.47	0.70	0.48	0.94	0.96	0.83	0.83	1.00		
9. Transformation capacity	5.15	1.03	0.47	0.65	0.45	0.94	0.83	0.96	0.76	0.83	1.00	
10. Application capacity	5.29	1.01	0.38	0.64	0.49	0.90	0.79	0.96	0.74	0.77	0.83	1.00

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Table 2
Properties of the measurement model.

Construct	Standardized loading	Cronbach's alpha coefficient	Estimated variance extracted
Communication frequency		0.79	0.57
CF1	0.72		
CF2	0.61		
CF3	0.90		
Communication quality		0.93	0.64
CQ1	0.60		
CQ2	0.80		
CQ3	0.75		
CQ4	0.92		
CQ5	0.90		
CQ6	0.86		
CQ7	0.73		
Communication informality		0.93	0.87
CI1	0.94		
CI2	0.92		
Absorptive capacity		0.91	0.90
Potential absorptive capacity	0.97		
Realized absorptive capacity	0.93		
Acquisition capacity		0.86	0.68
AC1	0.85		
AC2	0.85		
AC3	0.78		
Assimilation capacity		0.90	0.71
AS1	0.88		
AS2	0.86		
AS3	0.82		
AS4	0.81		
Transformation capacity		0.93	0.78
TC1	0.84		
TC2	0.86		
TC3	0.94		
TC4	0.89		
Application capacity		0.85	0.67
AP1	0.72		
AP2	0.90		
AP3	0.82		

Model fit ($\chi^2 = 597.32$(p = 0.00), df = 273; RMSEA = 0.08; CFI = 0.92).
All loadings are significant at $p < 0.01$.

impacts on both potential and realized ACAP. That is, potential ACAP is influenced by frequency (beta = 0.15, $p < 0.10$), quality (beta = 0.76, $p < 0.01$), and informality (beta = 0.13, $p < 0.01$), whereas realized ACAP is influenced by frequency (beta = 0.22, $p < 0.05$), quality (beta = 0.61, $p < 0.01$), and informality (beta = 0.13, $p < 0.01$). With regard to ACAP activities, acquisition, assimilation, transformation, and application are influenced by quality (beta = 0.96, $p < 0.01$; beta = 0.90, $p < 0.01$; beta = 0.73, $p < 0.01$; beta = 0.60, $p < 0.01$, respectively) and informality (beta = 0.15, $p < 0.01$; beta = 0.12, $p < 0.05$; beta = 0.10, $p < 0.05$; beta = 0.12, $p < 0.01$, respectively).

6. Discussion and conclusions

This study illustrates the importance of ACAP in high technology firms that heavily rely on R&D investment in new product projects. The finding extends existing theory by examining how various characteristics of cross-functional communication influence ACAP in NPD teams. The results show that communication frequency, quality, and informality are positively related to ACAP. Theoretically, this is reasonable since communication among NPD team members should result in higher team's ACAP. Teams with

Table 3
Results.

Independent variables	Hypothesis	Path coefficient
Communication frequency	H1	0.19[b]
Communication quality	H2	0.72[a]
Communication informality	H3	0.14[a]
R^2		0.63

Model fit ($\chi^2 = 618.47$(p = 0.00), df = 282; RMSEA = 0.08; CFI = 0.91).
[a] Significant at the $p < 0.01$ level.
[b] Significant at the $p < 0.05$ level.

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Table 4
Further analysis.

Independent variables	Potential ACAP	Realized ACAP	Acquisition	Assimilation	Transformation	Application
Communication frequency	0.15[c]	0.22[b]	NS	NS	0.22[b]	NS
Communication quality	0.76[a]	0.61[a]	0.96[a]	0.90[a]	0.73[a]	0.60[a]
Communication informality	0.13[a]	0.13[a]	0.15[a]	0.12[b]	0.10[b]	0.12[a]
R^2	0.62	0.58	0.65	0.69	0.61	0.63
CFI	0.89				0.84	
RMSEA	0.09				0.12	

NS not significant.
[a] Significant at the $p < 0.01$ level.
[b] Significant at the $p < 0.05$ level.
[c] Significant at the $p < 0.10$ level.

high frequency and quality of communication across functional areas could better acquire, assimilate, transform, and apply external knowledge into NPD tasks. Moreover, informal communication, such as talks and conversations during lunch breaks and after-work dinners, can also promote ACAP in an NPD team. When team members talk freely, they can actively and effectively learn and utilize the knowledge from each other to accomplish their tasks (Akgun, Byrne, Keskin, Lynn, & Imamoglu, 2005). In addition, this research further attempts to investigate absorptive capacity by extending and empirically validating the conceptual distinction between PCAP and RCAP. Interestingly, further data analysis shows that these two dimensions can only be enhanced by the quality of communication and informal communication. It can thus be suggested that NPD team leaders should improve communication quality and informality to enhance the ability of knowledge acquisition, assimilation, transformation, and application of the team.

The implications of this result can be introduced to NPD team leaders. First, they should develop new ways of improving the quality of information exchanged across functions during the development process. For instance, face-to-face meetings are established prior to information exchange in order to help communicators improve their understanding and reduce irrelevant messages during the communication process. Second, cross-functional team members should be encouraged to frequently communicate with each other via a wide range of modes. In this case, information technology, such as mobile applications, can be introduced to allow all team members to freely communicate and discuss the same issues at the same time. Moreover, team leaders may also arrange informal communication environments such as coffee corners or after-work social activities that provide opportunities for all members to interact and exchange work-related information.

Since this study examines only cross-functional communication, future research could expand the investigation to a cross-cultural context. Darawong and Igel (2012) suggest that cross-cultural communication between an expatriate and a local NPD team plays a critical role in driving new product success. In addition, future research might include an analysis of product newness and team diversity as potential moderators of the relationships in this study. One additional limitation is that the construct of informality has only two items which are limited in terms of scope. Therefore, future research should find scales that contain more items.

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