ANTECEDENTS AND CONSEQUENCES OF TEAM VISION IN PRODUCT DEVELOPMENT. AN EMPIRICAL EVIDENCE.

IE Business School Working Paper DO8-146-I 12-03-2009

Elena Revilla

Instituto de Empresa Business School
28006, Madrid, Spain

e-mail: elena.revilla@ie.edu

Tatiana Cury

Instituto de Empresa Business School
28006, Madrid, Spain

e-mail: tcury.phd2009@ie.edu

Abstract:

The purpose of this paper is to explain product development performance through the link between knowledge management and knowledge integration. When product development teams integrate knowledge about two external entities -customers and suppliers, they acquire a better understanding of the market and of each other's needs and capabilities, which enables them to operate and innovate better than their competitors. In this context, our theoretical framework focuses on the social enablers usually associated to knowledge management, and combine them with knowledge integration as to determine product development performance. This performance is measured through two distinct components, or types of outcomes: (1) *process outcomes*, which analyze the effectiveness of the product development process and it is measured in terms of teamwork- and (2) *product outcomes,* which concerns the characteristics associated with the value of the product to customer. A survey conducted with product development managers was used in order to develop and test our hypothesis that knowledge integration in combination with knowledge management has a positive impact on product development performance.

Keywords: Team vision, product development, trust, learning culture

INTRODUCTION

In today's more complex, multinational and technologically sophisticated environment, the group has re-emerged in importance as the project team (Nurick and Thamhain, 1993; Thamhain and Wilemon, 1999). In an effort to decentralize and speed decision making, and to attend and meet more promptly market demands, companies are increasingly organizing themselves in teams (Oh et all, 2004; Manz and Sims, 1993; Mohrman et all, 1995). This is also true in the development of new products. Work teams are important to organizations in general, but they are especially critical in product development because this activity, by its nature, spans many functional areas including engineering, marketing, manufacturing, finance, etc. Also, new product teams are frequently composed of individuals from different backgrounds and perspectives.

Recent empirical research shows that most firms have implemented cross-functional teams for the majority of new product developments projects undertaken (Hong et al, 2005). The effectiveness of product development is contingent upon the integration of different specialized capabilities, strong functional groups, and large number of people and multiple pressures (Nellore and Balachandra, 2001). Clark and Wheelright (1993) and Coopers (1999) between many other researchers, suggest that success of the products development is determined by the integration of abilities of both upstream (e.g. research and development, marketing and design engineering) and downstream activities (e.g. manufacturing engineering, operations and quality control).

At the heart of realizing superior product development seems to be developing organizational mechanisms that fuel the integration process. Such integration approach demands effective teamwork. At the same time, the process of teambuilding has become more complex and requires more sophisticated management skills. In order to overcome those challenges and enhance team performance, it is necessary to develop a team vision of the project they have in hands (Lynn and Akgün, 2001). Lynn et al (1999) found that one of the two factors considered most critical of the new product development success was a clear and shared project vision. This means that it is important to develop a common view among team members, in order to minimize the effects of the functional diversity in the group, and to promote a better performance. In this work, we are going to call Team Vision

to the existence of a common background, a clear set of goals, priorities, trade-offs and a good understanding of the overall goals of the firm and of the project itself, above department or functional level.

Although the concept of team vision is receiving increased attention at the organizational level, there is a great deal we still do not know regarding vision at the product development level (Crawford and Di Benedetto, 2000). On light of this surprisingly little research on vision in new product development teams, the purpose of this articles is to explore the team vision at the new product project level to try to answer three research questions: 1. what are the components of an effective vision at the product development level?; 2. How are these components associated with greater new product success? and 3. What social drivers promote team vision and do these variables increase a company's ability to develop new product successfully?

So, the theoretical framework of this paper attempts to present two important social drivers that can lead to team vision among the cross-functional team members: trust and learning culture. Trust is needed in product development work because the higher interdependency between functional areas demands that team members rely and relied upon the functional expertise of each other for timely and accurate information, view points and decisions (Rauniar, et al, 2005). Likewise, interaction, dialogue, and frequent contacts must be promoted through a learning culture to create new ideas, share them, transmit tacit knowledge, and facilitate solutions to novel or existing problems. This framework also offers the impact of team vision on performance measures such as process outcomes (i.e. teamwork) and product outcomes (i.e. value to customer).

In order to do this, this research first describes the role of team vision in the context of product development, and then we explain our research model linking team vision to social drivers and performance in product development. The third section describes the research methodology used to test the proposed model and hypotheses. The fourth section presents the data analysis and results obtained, while the last section includes the discussion of the findings, the limitations, and further research suggestions.

2. THEORETICAL FOUNDATIONS AND HYPOTHESES

2.1. Team vision: components and impact on product development

The product development literature states that effective innovation in new products relies on inputs from different functions and that for innovation to cross the domain from the individual to the team domain, it needs the right mix of individuals from a variety of functional areas such as marketing, research and development, manufacturing and purchasing (Tang, 1998). The path to technology commercialization requires the combination of many different knowledge sets (Perry-Smith and Vicent, 2008). Accordingly, knowledge necessary for product development is usually codified and structured differently in the various functional areas (Carlile, 2002; Madhavan and Grover, 1998). One of the primary benefits of working in teams is that, as a unit, the team is more likely to have access to the necessary information and expertise to solve problems (Willians and O'Really, 1998).

While this type of team has great potential, it is simultaneously one of the more difficult types of team to manage successfully. Functional backgrounds differences are the key source of task conflict that can undermine group functioning. (Pelled et all, 1999; DeDreu and Weingart, 2003). While greater diversity in the functional background of team members is linked to a higher number of innovations the group proposes (Bantel and Jackson, 1989; Milliken and Martins, 1996), the cross-functional team has been noted as having difficulties in reconciling ideas and moving from wildly different perspectives towards consensus (Dougherty, 1992). Task conflict includes disagreements and debates regarding task content that revolve around what actions are necessary to complete the task. In this situation, process losses that jeopardize the final product development result may come about (Ancona and Caldwell, 1992).

In order to minimize the effects of functional diversity in the group and to promote better performance, it is important to develop a common view among team members (Imai et al.,1985; Hayes et al.,1988). Because individuals from various functional areas often have different ideas about the product to be developed, without effective team vision these individuals generally pull the project in different directions and thereby adversely affect the performance of new product (Sethi, 2000).

Kotter (1995) describes vision in terms of something that helps clarify the direction in which to proceed. Similarly, Crawford and Di Benedetto (2000) describe vision in terms of team direction, goals and objectives. From the perspective of the new product teams, Brown and Eisenhardt (1995) define vision as the meshing of an organization's competence and strategies with the needs of the market to create an effective concept. In this same line, team vision is seen as a shared purpose and plan of action that clarifies mission, strategic fit and sets of project targets and priorities that are consistent with the firn's internal capabilities and the market place realities (Clark and Wheelright, (1993).

The concept of vision becomes one of the tools or means to engender meaning to a project. Karl Weick (2001) has discussed how systems of sense-making are vitally important when specialization and decentralization results in segregation of people and differentiation of processes in undertaking an activity. Because product development requires coordination and aligns all functions involved, all team members must be able to make sense of project goals so that they can support them and internalize them as being aligned with their own. Furthermore, given the interrelation and dependence between the functional areas, there needs to be a clear understanding of the cause and effect relationships that exists so that the impact of adverse actions that some team member may have on others can be traced. This requires the project members to undertake a sense-making exercise focusing on what

the end point should be, so that the weavings of seemingly unconnected actions can be clarified to understand how the parts form the whole (Christenson and Walker, 2004). When this occurs, product developments members might better see the logic of mutual adjustment and enacting coping mechanisms to provide the required flexibility for the projects.

According to the above, this study identifies three components in the concept of vision. It should be clear, align the goal of the project with the company strategy and support the strategy offering an understandable trade off of projects goals.

The first component, *clarity*, refers to the extent of communication, understanding, and acceptance of a set of project goals that guide development efforts (Hong, 2004). It must create a clear image of what product development is trying to do and provide direction to its members. It has been demonstrated that goals are associated with enhanced performance and strategy development at both individual and team levels (Locke and Latham, 1990). However, the mere existence of those goals is not enough to influence performance. The product development goals must be well articulated and clearly understood and shared among team members. Project goals should be able to help members to determine what actions are consistent or inconsistent with the overall product development goal. Creating a clear vision requires excellent communication, unambiguous definitions and a deep understanding of project goals (Cooper and Slagmulder, 1999). It means that it must be based on realistic customer requirements (Rosenau, 1989) and good understanding of competitive situation and technical risk (Clark and Wheelright, 1993).

Thus, developing a common understanding about the product goals is expected to help in bringing functional knowledge and expertise together while important product development-related decisions are being made. When diverse knowledge is brought

together, teams come up with better ideas, make connections between seemingly unrelated pieces of information and consider a variety of approaches. As result, the team has extraordinary potential to achieve superior results.

The second vision component, *strategic fit*, is defined as the alignment between the projects targets and goals and the company's strategies. It is the extent to which a firm's strategy guides the product development. Strategy fit helps in creating consistency among various decisions, generating ideas for satisfying customer needs in a superior manner and building synergistically on the firm's existing technology and manufacturing process, which in turn facilitates the development of successful products.

Accordingly, strategic fit has been showed to be related to team performance and new product development efforts (Shum and Lin, 2007). To have compatible goals allow "the same vision" to be shared, suggesting a deeper understanding of how product development supports the company strategy. Product developments that have a high degree of strategic fit tend to receive quicker top management support and get easier access to internal resources (Hong, 2000). If not, others on and off the product development team, will continually question its direction and will try to change the vision as the project progresses.

The third component, *trade-off*, refers to the extent to which the relative priority of the goal of each project is clear. This is especially important given that product development teams consist of functional specialist with different priorities. Additionally, as more firms engage in time-based competition, defining, communicating and understanding the trade-offs between cost, quality and time come more critical (Hong, 2000). High time pressure creates a need for cognitive closure and can make it difficult for team members to develop a common understanding about the product (Karau and Kelly, 1992). Because of time-

based competition, team members may be forced to consider a narrow range of decision alternatives and may be not able to think deeply about the various ways to build superior products. As such, the ability to make quick trade-off decisions is expected to increase the product development performance.

Additionally, having clear trade-offs reduces confusion about what product development members are supposed to do and subjectivity in operational decision making. More subtly, understanding the trade-offs also builds team cohesion which is generally viewed as a desirable quality of high-performing teams (Perry-Smith and Vincent, 2008). On the contrary, unspoken and ambiguous trade-offs can generate confusion and frustrate team members. Moreover, it cuts misunderstanding and barriers to interchange so that the amount of information conveyed is increased. Similarly, the desire to satisfy too many goals can lead to loss of cohesiveness and sense of direction within the product development. Teams with unclear trade-offs often experience more difficulties than teams with clear tread-offs in defining how key issues should be valued or how to proceed with the product development

These components together will allow the development of a team vision that will guide the efforts of the team in a common direction, despite the differences among team members. As result, the vision will be inextricably linked to the end benefits (Christenson and Walker, 2004). Nellore and Balachandra (2001) suggest that the creation of visions will affect the core capabilities within the organization, which in turn, will affect the outcome of the product development.

For the purpose of this study, product development performance is classified in two categories: (1) *process outcomes*, which analyze the effectiveness of the product development process in terms of teamwork and (2) *product outcomes* concern the characteristics associated with product and its value to customer.

Teamwork refers the degree of collaborative behaviour in the product development team (Zirger and Maidique, 1990, Hong et al., 2005) and the effectiveness of developing new products from product concept to manufacturing. When cooperation and shared vision for integrated problem solving exists, the members of product development get work done quickly, cost and engineering hours are reduced and members have a general sense of productivity and timely conflict resolution, creative problem solving, and effective decision implementation and communication (Hong et al., 2004). Based on this explanation the following hypothesis is proposed:

Hypotheses 1: Team vision positively influences in process outcomes measured in term of teamwork.

Value to customer expresses the value of the new product in meeting the customer needs and expectations in the market place (Clark and Fujimoto, 1991). It is also reflected in the product success in the market place and its creation of value to customer in terms of highly perceived product quality (Clark and Wheelright, 1995). At this respect, a team vision helps to understand the needs of the targeted customers, facilitates the sensing and seizing of market and technological opportunities and translated them into the product. Likewise, it has been found that team vision is most strongly related to superior product quality, an antecedent of superior customer value (Slater and Narver, 1994). Thus, given the potential of team vision on product outcomes, this study sets the following second hypothesis:

Hypotheses 2: Team vision positively influences in product outcomes measured in term of value to customer.

2.2. Team vision enablers

Team vision in product development depends on how team members are able to share and organize their specific knowledge effectively, and also on how they use their distinctive knowledge synergistically to produce a collaborative, ongoing learning. Researchers and practitioners strive for clues on how to appropriately manage team vision in order to create an organizational context where members of the product development may work attending to different information, assigning new meanings, and trying new approaches when making sense of technical problems. The creation of a team vision involves the need to reconcile the departments' different meanings for fairly well-agreed upon goals. Underpinning this are

organizational values and the underlying assumptions that are shared by the group in the company. Team vision will not have meaning unless it reflects the values and culture of the company (Christensen and Walker, 2004). Similarly, Nellore (2001) suggests that an effective team vision incorporate the culture of the company.

From this point of view, team vision enablers should be consciously and deliberately concerned with providing conditions such that people can trust each other, work together, are motivated to share ideas, and can engage in dialogues. Create an effective project vision requires excellent communication skills, feedback processes and personal coordination. These behaviours are expected to affect the individuals' capacities to integrate knowledge, skills, and expertise as they work, and that the product development team functions as a whole. On the contrary, when members of the team do not share an understanding of product concept and product development process and or they disagree about goals, it becomes harder to align efforts in the same direction; it is possible that power issues will emerge, and conflict between the concurring views will prevent optimal performance. The same reasoning can apply to disagreement or lack of information on the necessary tradeoffs to achieve those goals (time X cost X quality); or to the mismatch between the goals of the project and the overall strategy of the company.

Thus, the role of the shared values, climate for learning (Gold et al., 2001; Lee and Choi, 2003; Van der Brink, 2003; Chuang, 2004) and other social aspects, are important to implement a successful team vision. Specifically, we select two major elements as significant in making up team vision in product development: trust and learning culture.

Trust involves the maintenance of reciprocal faith in each other in terms of intentions and behaviours. Some scholars define trust as one party's confidence in its partner's reliability and integrity (Morgan and Hunt, 1994). Team members, who trust each other, are more willing to share relevant ideas and comprehensive information, clarify problems and share long-term goals. In this same line, Dyer (1997) suggests that trust is required to maximize the use of knowledge in effective collaboration. As such, team members tend to be more willing to participate in knowledge exchange and creation (Lee and Choi, 2003).

The information, know-how, and capabilities shared at work can be valuable assets that could be used asymmetrically to gain advantages for some team members (Eisenhardt,

1989).When trust is embedded in the relationship among team members, opportunistic behaviour is unlikely to occur because product development members ignore short-term individual gains in favour of the long-term interest of product development. Trust-based interchanges rely on mutual interest between team members (Dwyer et. al, 1987). Trust allows assessing whether team members will act in the common interest and not jeopardize the product development. It is an important restraint to opportunistic behaviour (Morgan and Hunt, 1994).

In the light of these considerations, we expect trust to facilitate team vision. We establish our third hypothesis as follows:

Hypothesis 3: Trust positively influences team vision in product development

Lindskold et al. (1986) found greater cooperation, higher effectiveness, and fewer wasted resources in high trusting dyads than in low trusting dyads. When trust exists and cooperation and shared knowledge are present, the members of product development get work done quickly, reduced cost, and also reduce design and engineering hours, and have a general sense of productivity and timely conflict resolution, creativity, and effective decision implementation and communication. As result, we propose the following hypothesis:

Hypothesis 4: Trust positively influences teamwork in product development

Learning culture involves the existence of a collective conviction of the importance of knowledge and learning, which supports the routine of communicating and achieving a common language and methodology at work (Dougherty et al., 2004). Effective team vision occurs in companies that are characterized by greater openness and access to information and resources at all levels. Interaction, dialogue, and frequent contacts must be promoted in a learning culture in order to create new ideas, share them, transmit tacit knowledge, and facilitate solutions to novel or existing problems. One major reason for failure in product development is the attitude of protecting individual functions rather than securing participation across functions. In jointly developing clear goals and approaches, a participative learning culture incentives processes to gain firsthand knowledge from other team members (Song et. al, 1998) and establishes communication that support more involvement in decision making. However, the different backgrounds of each member can

often produce friction or conflicts that erode trust. Thus, a culture properly channelled to the learning and collaborative relationships should focus on the communalities among members rather than their differences. Thus, we establish our fifth hypothesis as follows:

Hypothesis 5: Learning culture influences team vision in product development

Learning culture helps firms to improve and renew product/ process development activities. It promotes innovation skills based on better technical and market knowledge for the firm. When team members are open to learning and change, there may be higher levels of participation in decision making and greater and faster changes. Organizational cultures with several controls and little freedom and risk-tolerance can inhibit creativity and innovation (McLean, 2005) which are sources of success in product development. According to this, several authors have found that a learning culture is one of the critical success factors for achieving knowledge integration within team and give a fast responsiveness to markets (Hodgetts et al, 1999). Firms that are able to integrate functions within and between them will be more successful in developing new products (Takeishi, 2001). Thus, given that a learning culture supports innovation, this paper establishes the following hypothesis:

Hypothesis 6: Learning culture influences customer value in product development

3. RESEARCH METHODOLOGY

3.1. Sample characteristics and data collection

Survey methodology was used for the empirical analysis. The questionnaire was designed and developed by authors from a thorough literature review. The questionnaire was next validated through a pre-test carried out through several personal interviews with product development executives. These interviews allowed us to purify our survey items and rectify any potential deficiency. Minor adjustments were made on the basis of specific suggestions.

After the pilot study, the mailing list was obtained from Madri+d (Madrid, Spain). Madri+d (www.madridmasd.org) is a society that groups firms and public research organizations with the aim of improving competitiveness by encouraging I+D, innovation, and knowledge transfer. Madrid is the most developed area in Spain, and the one that

concentrates the largest number of firms. By tapping into this area, the study gains a good insight into the effectiveness of various practices and is able to develop more credible constructs (Koufkeros, et al., 2007). Therefore, the population was composed of Spanish firms focused on R&D and innovation operating in the local area of Madrid.

Madri+d integrates a list of 3293 organizations (private and public research organizations) not all of which are involved in new product development. For that reason, we have removed public and private research organizations and service companies (such as consultancy, IT services and the like) from the list. We then focused on sectors where the incidence of product development is strong, providing a final list of 616 companies.

Targeted respondents were product development managers that agreed to participate in the study. They received the questionnaire by e-mail or by accessing a web page where they could find it. They had to answer questions concerning a specific product development effort managed by them and finished in 2004. A researcher involved in the study personally helped respondents to solve any questions on the survey.

The data collection process yielded 80 usable responses, for a response rate of 12.93%. Table 1 shows the profile of participating companies and responses. In terms of industry type, answers covered a wide number of industries, mostly the food and beverage (20%), chemistry and pharmaceutical (11,3%), electric systems and electronics (10,1%), computing systems (7,5%), equipment manufacture (5%) and transport (5%).

Table 1. Profile of participating companies

Number of employees	%
<= 499	65.8
500-999	9.6
1000-4999	12.3
5000-9999	6.8
>=10000	5.5
Age of the firm	
1-10 years	24,4
11-50 years	60,0
>50 years	15,6
Nationality	
Spanish	71,4
Multinational	25,7

Since a single response was asked from each product development, single informant bias in data collection might stem as a result. However, the presence of common method bias was tested by following one of the procedures described in Podsakoff et al. (2003). More precisely, Harman's single factor procedure was applied in such a way that all items from the main constructs (knowledge generation, knowledge integration and knowledge reconfiguration, autonomy, performance management, support, trust, product competence and process competence) were included into an exploratory factor analysis to examine the unrotated factors solution and determine the number of factors that are necessary to account for the variance in the variables. In this analysis, no single factor emerged and no general factor accounted for the majority of the covariance among the measures, so it may be considered that common method bias is not present and does not seem to be a problem.

3.2. Measures description

The measurement of the analysis variables has been built on a multiple-items method, which enhances confidence about the accuracy and consistency of the assessment. Each item was based on a five point Likert scale and all of them are perceptual variables. Table 2 displays items used to measure the analysis variables.

Table 2. Description of measurement items for each construct

Construct		Measurement items	Mean	S.D.
TEAM VISION	Clarity of project purposes	(bh1) The project goals were well understood by the entire team.	3,96	0,719
		(bp1) This product development team had a well defined mission	4,20	0,736
		(bz1) The project mission was well understood by the entire team	4,15	0,618
	Tradeoffs	(br1) The relative priority of each project target was clear.	3,65	0,748
		(bt1) Project targets clearly specified tradeoffs between time and cost.	3,37	0,832
		(bv1) Project targets clearly specified tradeoffs between quality and cost	3,61	0,849
	Strategic Fit	(be1)A clear set of project targets guided development efforts	3,76	0,807
		(bq1) Project targets reflected the competitive situation	3,89	0,811
		(by1) Our firm's overall product strategy guided the setting of project targets.	3,70	0,802
SOCIAL ENABLERS	Trust (TRUST)	(fa9) Project members are generally trustworthy	4,23	0,733
		(fa10) Project members have reciprocal faith in other's abilities, intentions and behaviours.	3,82	0,675
		(fa11) Project members have relationships based on reciprocal faith and trust.	4,10	0,691
	Learning culture (LEARNC)	(fa1) Project members understand the importance of knowledge to success.	4,10	0,761
		(fb1) Projects managers clearly support the role of knowledge in the firm's success.	3,95	0,766
		(fb3) Projects managers consider failures as an opportunity to learn instead a reason to be ashamed of.	3,87	0,925
PERFORMANCE	Value to customer (VALUECUST)	(c2a) The product had a high quality.	4,09	0,724
		(c2c) The product exceeded customer expectations.	3,68	0.904
		(c2k) The product created a high customer value.	3,97	0,805
	Teamwork (TEAMWORK)	(c1d)Team was productive	3,91	0,747
		(c1h) Team members coordinated their activity well	3,82	0,818
		(c1l) Team used product engineering hours effectively	3,63	0,870
		(c1m) Team members implemented decisions effectively	3,95	0,737

Team Vision

It has been measured with 9 items corresponding to clarity of product development mission and targets, the tradeoffs of product development targets and the strategic fit of product development's goals with the firm's strategy (Hong, 2000). The clarity of goals in the product development measures the communication, understanding, and acceptance of a set of product development mission and goals that guide development efforts (Clark and wheelwright, 1993; McDonough III, 2000; Bonner et al, 2002). Tradeoffs of product development expresses the project targets specification of performance, cost, time and quality (Ghosh and Wells, 1995; Babu and Suresh, 1996). Strategic fit is the alignment of the product development goals with the product development 's competitive situation (e.g., customer expectations and competitive offerings), and the product development resources available (e.g., internal design and manufacturing capabilities as well as suppliers' design and manufacturing capabilities).

Social enablers

It has been measured with 6 items corresponding to trust and learning culture as indicated in Table 2. Trust refers to the extent the project members are considered trustworthy, sincere, respectful and have relationships based on reciprocal faith. Learning culture values the importance and the role of knowledge in the firm's success, the efforts to improve the employees' knowledge and the consideration of failures as learning opportunities. Most of these items have been adapted from Lee and Choi (2003), Gold et al. (2001), Thomset and Hoest (2001) and Zarraga and Bonache (2003).

Product development performance

It has been measured through two components, in a total of 7 items: Teamwork expresses process outcomes and value to customer expresses product outcomes. Specially, to capture process outcomes, we ask product development managers to indicate the extent to which the product development team worked well together, coordinated activities well, implemented decisions effectively, was productive, and used product engineering hours efficiently. These items were previously used by Hong et al. (2004) who drawn them from Alder (1995), Ali et al. (1995), Crawford (1992) and Tersine and Hummingbird, (1995). To capture value to customer we ask our respondents to indicate in a five point Likert scale, the degree to which the product had a high quality, exceeded customer expectations, created a high customer value (Hong, 2000).

4. ANALYSIS AND RESULTS

4.1 Psychometric proprieties of measurement scales

Before testing this model, a series of tests was performed to asses the unidimensionality of the measures. Because multiple-item construct measures variables, and to verify that items tapped into their stipulated construct, a confirmatory factorial analysis (CFA) was employed to determine the validity of the constructs.

Table 3 summarizes the number of items and the results of the reliability and validity test for the analysis variables. The internal consistency measures (Cronbach's alpha) were obtained in order to assess the reliability of the measurement instruments. All but the Cronbach alpha for Learning Culture are above acceptable levels. Three separate confirmatory factor analysis were conducted by using SPSS 12: one corresponding to the social enablers (constructs of trust and learning culture), one for the dimensions of team vision (clarity of project, tradeoffs, strategic fit) and one more for product development performance (teamwork and value to customer). Based on these statistics and theoretical considerations we deleted items if appropriate (Anderson and Gerbing, 1988). Convergent validity was established by confirming that all scale items loaded significantly on their hypothesized constructs factors (Anderson and Gerbing, 1988). Discriminant validity was assessed by comparing the $\chi 2$ differences between a constrained CFA (where the interfactor correlation was set to 1, indicating they are the same construct) and an unconstrained model (where the interfactor correlation was free). All $\chi 2$ differences were found to be significant, providing support for discriminant validity (Anderson and Gerbing, 1988).

We have previously defined team vision as a higher order construct composed of clarity of project, tradeoffs and strategic fit. To confirm the multidimensionality of team vision as a higher-order construct we ran a second-order CFA. Table 3 shows how the loadings of the measurement items on the first-order factors, and the loadings of the measurement items of the first-order factors on the second-order factor (team vision) were all significant ($p \leq 0.05$). This second-order CFA was estimated by resuming in single factors the indicators of the clarity construct, tradeoffs and strategic fit constructs through principal components analysis (using SPSS 12.0 for Windows).

Table 3. Results of reliability and validity for the measures

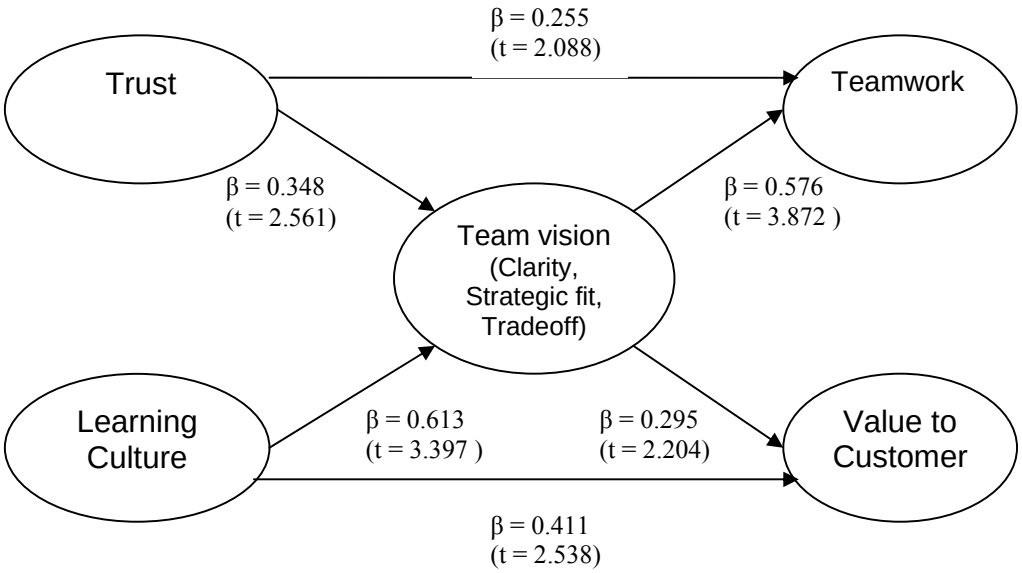
Paths	Standardized loadings	Goodness of fit indices	Reliability (Cronbach α)
First order			
Clarity (CLARITY)			
BH1	0,731		
BP1	0,547		0,713
BZ1	0,557	Chi square= 6.717	
Tradeoffs (TRADEOFF)		(P= 0.876)	
BR1	0,474	Df=12	0,770
BT1	0,651		
BV1	0,897		
Strategic Fit (STFENV)			
BE1	0,585		
BQ1	0,513		0,797
BY1	0,972		
First order			
Value to Customer (VALUCUST)			
C2A	0.603		
C2C	0,738		
C2K	0,788		0,779
		Chi square= 8,584	
Teamwork (TEAMWORK)		(P= 0.379)	
C1D	0,701	Df=8	
C1H	0,678		
C1L	0,820		0,872
C1M	0,888		
First order			
Trust (TRUST)			
FA9	0,798		
FA10	0,712		0,824
FA11	0,851		
		Chi square= 1,482	
Learning Culture (LEARNC)		(P= 0.830)	
FA1	0,641	Df=4	0,648
FB1	0,592		
FB3	0,632		
Second order			
Team Vision			
Clarity	0,720		
Tradeoff	0,656		
Strategic Fit	0,396		

4.2 Results of path analysis

We use a structural equation model (conducted with MPlus) to determine the significant paths between trust, learning culture and team vision, and between the last and teamwork and value to customer. A measurement model of four correlated first-order factors is examined, and also a construct of second order for the Team Vision was built using the factors Clarity, Tradeoffs and Strategic Fit.

Results are shown in Figure 1, which illustrates the estimated path coefficients and their associated t-values (in parentheses) as well as the goodness of fit indices (which proves a good overall fit for the model).

Figure 1



Chi-Square Test of Model Fit	
Value	208.561
Degrees of Freedom	178
P-Value	0.0582
CFI/TLI	
CFI	0.954
TLI	0.946

All proposed paths are significant. According to our hypotheses 1 and 2, the results show that Team Vision indeed has a positive influence in the new product performance. This influence is more significant in terms of process outcome (teamwork - $\beta = 0.576$, $t = 3.872$), than in terms of product outcome (Value to customer - $\beta = 0.295$, $t = 2.204$).

The hypotheses 3 and 4 deal with the impact of trust as an antecedent of Team Vision and also as having a direct impact on Teamwork. Both hypotheses were supported, showing

that although the direct impact of Trust in Teamwork is significant (β = 0.255, t = 2.088), the impact of trust as an antecedent of Team Vision is higher (β = 0.348,t = 2.561). This means that not only having Trust between team members is important, but how this Trust will help to build a Team Vision that will impact positively the product performance in terms of teamwork is the key to improve performance.

Hypotheses 5 and 6, similarly, deal with the impact of a Learning Culture on the creation of a Team Vision and on product performance in terms of Value to Customer. In this case, both paths are also significant, supporting our hypotheses. However, we can see that the direct impact of Learning Culture in Value to Customer (β = 0.411, t = 2.538) is higher than the impact of Team Vision itself (β = 0.295, t = 2.204) on Value to Customer. Also, the impact of Learning Culture in Team Vision (β = 0.613, t = 3.397) is higher than the impact of Trust in Team Vision (β = 0.348, t = 2.561). Those results, taken together, suggest the importance of the development of a Learning Culture to the process of Product Development as a whole, once it influences not only the creation of a Team Vision (Which in turn will impact the product performance), but also it impacts directly Value to Customer.

The model has good model-data fit ($\chi 2$ = 208.561, 178 degrees of freedom, p-value of 0.0582., TLI=0.946, CFI=0.954). The completely standardized coefficients (item-factor loadings) of the resulting model ranged from 0.255 to 0.613. The coefficients and their associated t-values are all statistically significant at $p<0.05$. No problems are revealed among the residuals in the fitted residuals matrix (Hu and Bentler, 1995).

5. DISCUSSION AND LIMITATIONS

This paper has explored the role of Team Vision at the Product Development level, identifying its antecedents and consequences. Although this concept has been largely discussed at the organizational level, only recently the discussion of the impact of team Vision in Product development has started (Crawford and Di Benedetto, 2000; Lynn and Akgün, 2001), and there is still some empirical issues to be tapped.

This is an attempt to fill some of those gaps, trying to understand the mechanisms that will allow the development of a Team Vision, as well as how exactly it impacts Product Development. Thus, this study contributes to research on product development success –a central issue to researchers and managers alike. From our model and results, it becomes clearer that social factors have an impact not only on Vision creation but on Product Development outcomes directly.

First of all, this paper helps to understand the important elements of team vision that contributes to product development success. Furthermore, the quantitative analysis found that team vision is vital for product innovation. These findings emphasized the importance of a clear and shared vision to minimize the effects of the functional diversity in product development, and to promote project success.

This research also finds that trust has a positive effect on team vision and teamwork. According to the mainstream thinking, this finding states that trust is a facilitator of effective cooperative behaviour in product development. The benefits of trust and its role to alleviate some of the risks and dilemmas associated with knowledge integration were supported by this study.

Finally, this study shows how learning culture influence directly on value to customer and also on performance through its contribution to team vision. An organization committed to learning seeks a full understanding of its environment, including customer needs. Given that product development is a learning process itself, a learning culture enable the implementation of new ideas and the integration of knowledge of individuals to solve problems and find innovative solutions to create product that have value in the marketplace. Through a learning culture, individuals learn and develop new skills as well as share goals and existing knowledge, both of which are crucial for the development of a team vision and product development performance. The literature has long acknowledged the benefits that a learning culture has in firms that aspire to stand out through product development (Calantone et al, 2002).

The findings of this research about the positive effect of learning culture on team vision encourage researchers in management and managers to apply a knowledge base view into applied fields such as product development. For that reason, it is not surprising that,

knowledge management is increasingly regarded as prerequisite for creating successful and innovative organizations (Cardinal and Hatfield, 2000). It is also important to note that both trust and learning culture are not elements that can be implemented in some situations or projects and be absents in others. To develop an environment where trust and learning culture are strive and present is what will enable them to be important in the product development process. They have to be constant elements in the organization, because ot the time needed to develop both among knowledge.

However, some limitations to this study need to be signaled. The first of them regards the measurements used. Since all variables were measured using perceptual measures, from a single respondent, some of the variables may be biased by these perceptions. For example, since the product success is a perceptual measure, maybe the respondent evaluate a product as being successful because the process of creating it was a pleasant one, and the relationship between team members was good, and not because it really achieved the proposed goals and value to customer. Some objective measurements on product performance could help to dissipate this question.

Another limitation concerns the sample of the survey. Since the managers surveyed are mostly Spaniards and the fact that their companies and projects are embedded in a specific culture, may increase the importance of those social factors in the product development process, due to the more collectivist nature of this culture, compared to Anglo-Saxon ones.

Future research can address those issues, replicating this study in other contexts, in order to validate or not the findings, and also using more objective measures when necessary. Also the next steps of this stream of research can address the issues on tools and techniques to develop trust relationships and a learning culture in a timely manner, for different teams at each product development process.

6. REFERENCES

Alder, P.S. (1995). From project to process management: an empirically based framework for analyzing product development time, Management Science, 41 (3): 458-484.

Ali, A., Krapfel, R., Jr. ,LaBahn, D.,(1995). "*Product Innovativeness and entry strategy: Impact on cycle time and break-even time*". *Journal of Product Innovation Management* 12 (1): 54-69.

Ancona, D.G. and Caldwell, D.F. (1992). "*Demography and design: Predictors of new product team performance.*" Organization Science, 3: 321-341.

Anderson, J.C., Gerbing, D.W.(1988) "*Structural Equation Modeling in Practice: A Review and Recommended Two-Step Approach***".** Psychological Bulletin 103 (3): 411

Babu, A. J. G.; Suresh, N. (1996). *Project management with time, cost, and quality considerations.* European Journal of Operational Research 88 (2):320-327

Bantel, K.A. and Jackson, S.E. (1989). "*Top management and innovations in banking: Does the composition of the top team makes a difference?"* Strategic Management Journal, 10: 107-124.

Brown, S.L. and Eisenhardt, K.M. (1995). "*Product Development: Past Research, Present Findings, and Future Directions*". The Academy of Management Review, 20 (2): 343-378

Carlile, P.R. (2002). *"A pragmatic view of knowledge and boundaries: Boundary objects in new product development."* Organization Science 13 (4), 2002: 442-455.

Christenson, Dale; Walker, Derek H.T.(2004). *"Understanding the Role of Vision in Project Success."* Project Management Journal, 35 (3):39-52.

Chuang, S. (2004). "*A Resource-Based Perspective on Knowledge Management Capability and Competitive Advantage: An Empirical Investigation*". *Expert Systems with Applications*, 27: 459-465.

Clark, K. B., and Fujimoto, T. (1991). "*Product development performance: Strategy, organization, and management in the world auto industry*". Boston, MA: Harvard Business School.

Clark, K.; Wheelwright, S.C. (1993). "Managing new product and process development: text and cases". New York: The Free Press.

Cooper, R. (1999). *"A multidimensional approach to the adoption of innovation*" Management Decision, 36 (8): 493.

Cooper, R. and Slagmulder, R. (1999). "Develop profitable new products with target costing" . Sloan Management Review, 1999

Crawford, C.M. (1992). "*The hidden cost of accelerated product development*". *Journal of Product Innovation Management* 9 (3): 188-199.

Crawford, C.M. and Di Benedetto, M. (2000). "New Products Management." McGraw Hill /Irwin.

De, Prabuddha, Dunne, E James, Ghosh, Jay B, Wells, Charles E. (1995). The discrete time-cost tradeoff problem revisited. European Journal of Operational Research**,** 81 (2): 225-239

Dwyer, R., Schurr, P., & Oh. S. (1987). "*Developing buyer-seller relationship*". *Journal of Marketing*, 51(4): 11-27.

Dyer, J.H. (1997). "*Effective inter-firm collaboration: How firms minimize transaction cost and maximize transaction value*". *Strategic Management Journal*, 18(7): 535-556.

Eisenhardt, K. (1989). "*Agency Theory: an assessment and a review*". *Academy of Management Review*, 14:57-74.

Englund, R.L, Graham, R. J (1999). " *From experience: Linking projects to strategy"*. The Journal of Product Innovation Management 16 (1): 52-65.

Gold, A.H., Malhotra, A. and Segars, A.H. (2001). "*Knowledge Management: An Organizational Capabilities Perspective"*. *Journal of Management Information Systems*, 18 (1): 185-214.

Hodgetts, R. M., Luthans, F., & Slocum, J. W. (1999). "*Strategy and HRM initiatives for the '00s environment: Redefining roles and boundaries, linking competencies and resources"*. *Organizational Dynamics*, 28(2): 7-21.

Hong, P (2000). "*Knowledge Integration in Integrated Product Development*". Doctoral Thesis. University of Toledo, USA

Hong, P., Doll, W. J, Nahm, A. And Li, X. (2004)."*Knowledge sharing in integrated product development*". *European journal of innovation management*, 7, 2:102-112

Hong, P., Vonderembse, M., Doll, W. J, & Nahm, A. (2005). "*Role Changes of Design Engineers in Integrated Product Development"*. *Journal of Operations Management*, *24*(1): 63-79.

Hu, L.-T., Bentler, P.M. (1995), *"Evaluating model fit",* in Hoyle, R.H. (Eds),Structural Equation Modeling, Sage, Thousand Oaks, CA.

Kotter, John P. (1995). *"Leading Change: Why Transformational Efforts fail."* Harvard Business Review, 73 (2): 59-68.

Koufteros, X., Nahm, A., Cheng, T.C. and Lai, K. (2007). "*An empirical assessment of a nomological network of organizational design constructs: From culture to structure to pull production to performance*" International Journal of Production Economics, 106 (2): 468

Koufteros, X and Vonderemse, M. and Jayaram, J. (2005). "*Internal and External Integration for Product Development: The Contingency Effects of Uncertainty, Equivocality and Platform Strategy"*. *Decision Science*, 36, (1): 97-133.

Lee, H. and Choi, B. (2003). "*Knowledge Management Enablers, Processes, and Organizational Performance: An Integrative View and Empirical Examination"*. *Journal of Management Information Systems*, 20 (1): 179-228.

Leonard-Barton, D. (1992). "*Core Capabilities and core rigidities: A paradox in managing new product development"*. Strategic Management Journal, 13: 111-125.

Lindskold, S., Betz, B. and Walters, P.S. (1986) **"***Transforming Competitive or Cooperative Climates*" The Journal of Conflict Resolution, 30 (1): 99-114.

Locke, E.A. and Lathan, G.P. (1990). *"A Theory of Goal-setting and task performance*". Englewood Cliffs, NJ: Prentice Hall.

Lynn, G., Abel, K. Valentine, W.S and Wright,R.(1999) "*Key Factors in Increasing Speed to Market and Improving New Product Success Rates*". Industrial Marketing Management 28, Issue 4: 319-326.

Lynn, G. and Akgün. (2001). ***"****Project visioning: Its components and impact on new product success"***.** The Journal of Product Innovation Management. 18 (6): 374.

Madhavan, R. and Grover, R. (1998). *"From embebbed knowledge to embodied knowledge: New Product Development as Knowledge Management."* Journal of Marketing, 62 (4): 1-12.

Manz, C.C. and Sims, H.P. (1993). *"Business without bosses: how self managing teams are building high performance companies"***.** New York: Wiley.

McDonough III, E.F. (2000*).* " Investigation of factors contributing to the success of cross-functional teams"**.** The Journal of Product Innovation Management 17 (3): 221.

McLean, L.D. (2005). *"Organizational culture's influence on creativity and innovation: A review of the literature and implications for human resource development"***.** *Advances in Developing Human Resources*, 7 (2): 226-246.

Milliken, F.J. and Martins, L.L. (1996). *"Searching for Common Threads: Understanding the multiple effects of diversity in organizational groups*". Academy of Management review, 21 (2): 402-433.

Mohrman, S.A. and Cohen, S.G. and Mohrman, A.M (1995). *"Designing team-based organiations: New forms for knowledge work.*" San Francisco: Jossey-Bass.

Morgan, R.M., & Hunt, S.D. (1994). *"The commitment-trust theory of relationship marketing"*. Journal of Marketing, 58: 20-38.

Nellore, R. and Balachandra, R. (2001). *"Factors influencing success in integrated product development (IPD) projects"***.** IEEE Transactions on Engineering Management, 48, Iss. 2: 164.

Oh, H., Chung, M., Labianca, G. (2004). *"Group Social Capital and Group Effectiveness: The role of Informal Socializing Ties"*. Academy of Management Journal, 47 (6): 860-875.

Pelled, L., Eisenhardt, K. and Xin, K. (1999). *"Exploring the Black Box: An Analysis of Work group Diversity, Conflict and Performance"***.** Administrative Science Quarterly. 44: 1-28.

Podsakoff,P.M., MacKenzie,S. B., Lee, J., Podsakoff*.,* N.P.(2003). "*Common method biases in behavioral research: A critical review of the literature and recommended remedies"* Journal of Applied Psychology, 88 (5): 879.

Rauniar, R. (2005*). "Knowledge integration in integrated product development: The role of team vision, mutual trust, and mutual influence on shared knowledge in product development performance"*. Doctoral thesis. The University of Toledo.

Rosenau, M.D. (1989). "*Schedule Emphasis of New Product Development Personnel*" The Journal of Product Innovation Management, 6 (4): 282-289.

Rosenthal, S. and Tatikonda, M. (1992). Competitive advantage through design tools and practices. Integrating design for manufacturing for competitive advantage, Oxford University press, New York, N.Y.

Slater, S.F. and Narver, J.C. (1994). "Does competitive environment moderate the market-orientation-performance relationship?", Journal of Marketing, 58:46-57

Song, X. M., Thieme, J. R., & Xie, J. (1998). "The impact of cross-functional joint involvement across product development stages: An exploratory study". Journal of Product Innovation Management, 15(4): 289–304.

Shum, P. and Lin, G. (2007). " A World Class New Product Development Best Practices Model". International Journal of Production Research, 45, 7.

Takeuchi, H. and Nonaka, I. (1998). "The New Product Development Game". Harvard Business Review, 64(1). 1986: 137-146.

Tang, H.K. (1998). "An integrative model of Innovation in Organizations". Technovation, 18: 297-309.

Tersine, R.J., Hummingbird, E.A. (1995). *"Lead-time reduction the search for competitive advantage".* International Journal of Operations and Production Management 12 (2):8-18.

Thamhain, H.J. and Wilemon, D.L. (1999) "Building effective teams for complex project. Environment". Technology Management, Vol. 5, No. 2, May, pp.203–212.

Van den Brink, P. (2003). "*Social, Organizational and Technological Conditions that Enable Knowledge Sharing*". Doctoral thesis, Technische Universiteit Delft, Amsterdam.

Weick, Karl (2001). "*Enactment and the Boundaryless Career: Organizing as we work*". In The Boundaryless Carrer: A New employment Principle for a New Organizational Era, org. Arthur, M.B. and Rousseau, D. Oxford University Press.

Zárraga, C. and Bonache, J. (2003). "Assessing the Team Environment for Knowledge Sharing: An Emprirical Analysis". International Journal of Human Resource Management, 14 (7): 1227-1245.

Zirger, B.J. and Maidique, M.A. (1990). "*A Model of New Product Development: An Empirical Test*" Management Science, 36 (7): 867-883.