Design Integration Mechanism at Collaborative Design Maturity Levels

Tung-Jung Sung[1], Chi-Shiang Wu[2], and Jhe-Jhao Chang[3]

Abstract

The front-end process of product design has been a challenge for academics and organizations. In order to facilitate the fuzzy process, a design team is often encouraged to have team collaboration across disciplines by adopting different mechanisms. Due to the importance of team maturity assessment in the process, this study aims to explore and validate the maturity levels of a design team. Integrating the capability maturity model (CMM) concept and the notion of team collaboration, this study categorized the team maturity into four levels, such as *initial*, *formative*, *managed*, and *optimizing*. Through applying the existing theory of integration mechanism in the context of product design, this study systematically proposed four types of design integration mechanism (DIM), which are 1) design interaction, 2) design collaboration, 3) design integrative tool and 4) design team reward. Furthermore, this study selected and observed an intra-university collaborative design team as the subject of this case study. After conducting several interviews with the team members, this study found that each type of DIM plays different roles in different maturity levels. Generally speaking, the results of this study are consistent with previous studies. However, *design collaboration* received the most importance at three of four team maturity levels, except for the *initial* level, while design team award received the least importance at all of four team maturity levels.

Keywords: design integration mechanism, maturity level, product design, team collaboration

Introduction

In recent years, product design has been recognized as a source of competitive advantages for firms that can open up overlooked opportunities for business (Swink, 2000; Zhang and Doll, 2001). However, how to effectively manage the front-end process of product design is a key to success in new product development (NPD) (Khurana and Rosenthal, 1998; Zhang and Doll, 2001). Furthermore, the front-end process of product design can be viewed as the creation of product definition that aims at concept generation, information sharing, object setting, and planning, while the NPD process focuses on strategic and managerial issues, detail design, prototype test, volume manufacturing, and market launch (Moultrie, Clarkson, and Probert, 2006; Zhang and Doll, 2001). However, the front-end process of product design is fuzzy, uncertain, complex, and vague. In order to facilitate the fuzzy process, a collaborative team composed of various disciplines to provide diverse design professional knowledge is encouraged (Khurana and Rosenthal, 1998; Zhang and Doll, 2001).

1 Associate Professor, Department of Industrial and Commercial Design, National Taiwan University of Science and Technology, No. 43, Sec. 4, Keelung Rd., Taipei, Taiwan, sungtj@mail.ntust.edu.tw

2 Research Assistant, Department of Industrial and Commercial Design, National Taiwan University of Science and Technology, No. 43, Sec. 4, Keelung Rd., Taipei, Taiwan, +886-9-60-564-727, bboygto@gmail.com

3 PhD Student, Department of Industrial and Commercial Design, National Taiwan University of Science and Technology, No. 43, Sec. 4, Keelung Rd., Taipei, Taiwan, mask.ntust@gmail.com

However, numerous studies (Cagan and Vogel, 2003; Griffin and Hauser, 1996; Olson, Walker, Ruekert, and Bonner, 2001) have argued that there exist gaps, which could impede team collaboration, between different disciplines. Furthermore, a number of studies (Cagan and Vogel, 2003; Griffin and Hauser, 1996) have asserted that certain integration mechanisms are required to remove these barriers. Although a growing number of studies have proposed different integration mechanisms in other fields, to date, what the roles of design integration mechanism are the different maturity levels of a design team remains unknown.

Literature Review

Maturity levels

The concept of maturity levels was originated from the Quality Maturity Model (QMM) (Crosby, 1979). However, the best known derivative from this work is the Capability Maturity Model (CMM), which is designed by the Software Engineering Institute in 1991 (CMM Product Team, 2001, Fraser, Moultrie, and Gregory, 2002). Fraser et al., (2002) noted that CMM, unlike QMM, is a more extensive framework that is comprised of a number of key process areas which include common features and key practices to achieve stated goals. In fact, CMM has been applied to various disciplines. One of the examples on the application of CMM is NPD process auditing (Fraser, et al., 2002; Maier, Echert, and Clarkson, 2006). Furthermore, Fraser, Farrukh, and Gregory (2003) proposed a team collaborative maturity grid (CMG) with different maturity levels. After integrating the capability maturity model (CMM) concept and the notion of team collaboration, this study categorizes the maturity of a design team into four levels, such as initial (L1), formative (L2), managed (L3), and optimizing (L4). The characteristics of each level are shown in Figure 1.

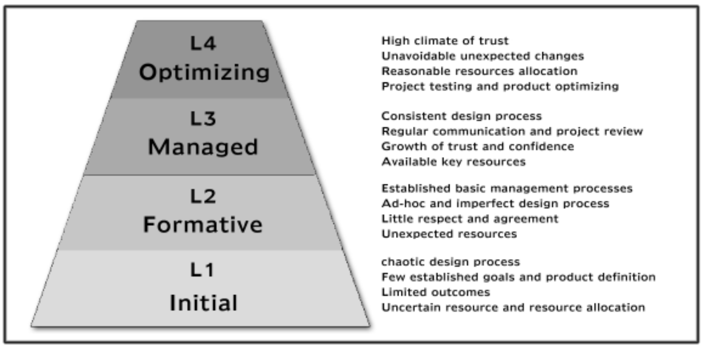

Figure 1. The characteristics of four maturity levels of a design team

As for the initial (L1) level, the product design process is often chaotic, and there is little team coordination. Particularly, team outcomes created are few, and, if any, most of them come from individual team members. Moreover, available resources and resource allocations are uncertain at this level. Since most of the team members may be not familiar with the team objectives, the specifications are often either too loose or over-constrained. Due to unfamiliarity among team members, they need to spend a lot of time with others and to communicate with them in different values or attitudes, or to resolve misunderstandings between different disciplines. In most of the time at this level, the changes often result in unpleasant. As for the formative (L2) level, some basic management processes are established. However, the product design process is still considered ad-hoc and imperfect. Since team members with different disciplines may not respect each other, they need to spend a lot of time and energy in communication or negotiation. The overall resources are unexpected. Generally speaking, the managed (L3) level is a continuous collaboration-improvement process. Team members progressively and clearly know their roles and responsibilities at this level, while there are regular project reviews. There is a growing sense of trust and confidence among team members. Furthermore, key resources can be evidently identified at this level. The optimizing (L4) level emphasizes the continuous progress of the product design process. The trust is high among the team members because they have learned to respect one another. The team members also do a lot of reviews and understand why the changes are unavoidable. The key resources can be applied to the development of key technologies effectively, while the testing and optimization of the project should be implemented at this level.

Design integration mechanism

Kahn (1996) advocated that integration allows teams composed of different disciplines to yield improved outcomes. However, what is integration? Iansiti and Clark (1994) affirmed the essence of integration is the generation, fusion, and accumulation of knowledge and forms the organization's capability of implementation. Therefore, as for the integration in the product design process, the issue would be the integration of design knowledge among the team members to realize a given goal or vision. While Swink (2000) proposed that design integration requires a large amount of communication, cooperation, and information sharing, some studies (Cagan and Vogel, 2003; Griffin and Hauser, 1996; Olson et al., 2001) highlighted that there are gaps between different disciplines. In order to remove the barriers, numerous studies (Griffen and Hauser, 1996; Kahn, 1996; Webber, 2001) have claimed that certain integration mechanisms are required. Furthermore, past authors (Austin, Baldwin, and Steele, 2002; Adderio, 2001; Corso and Pavesl, 2000) have argued that integrative tools are necessary for the improvement of the communication between different disciplines. Although there are many possible design integration mechanisms (DIM) for NPD, this study mainly focuses on the integration mechanism that is related to *design*. This study simply categorizes them into four types: 1) *design interaction* (type A), 2) *design collaboration* (type B), 3) *design integrative tool* (type C), and 4) *design team reward* (type D). The characteristics of each type are shown in Table 1.

Table 1. Four Types of Design Integration Mechanism

DIM	Characteristics	Reference
Design Interaction (type A)	• Centralization of decision-making powers • Formalized rules • Interaction • Standard operating procedures	Kahn (1996); Olson et al. (2001); Griffin and Hauser (1996); Ruekert and Walker (1987)
Design Collaboration (type B)	• Building positive relationships with other team leaders • Collaboration • Developing and articulating a clear mission for the team • Encouragement of risk-taking behavior • Increasing credibility of information • Negotiating expectations with functional leaders	Kahn (1996); Griffin and Hauser (1996); Olson et al. (2001); Ruekert and Walker(1987); Song, Neeley, and Zhao, (1996); Webber (2001)
Design Integrative Tool (type C)	• Visualization tools • Information exchanging tools	Adderio (2001); Austin et al. (2002); Corso and Pavesl (2000)
Design Team Reward (type D)	• Incentive and rewards • Reward systems	Griffin and Hauser (1996); Song et al. (1996)

Design interaction as a formal integration structure refers to the effective use of communication in the form of design meetings and design information flow across various functions (Kahn, 1996). This type of design integration mechanism can be seen as formalization through rules or standard operating procedures, such as routing meetings, planned teleconferencing, routine conference calls, relocation and physical facilities design, personnel movement, and memoranda. Thus, it can assist teams to establish regular communication and facilitate information sharing or technical assistance (Kahn, 1996; Ruekert and Walker, 1987; Song, Neeley, and Zhao, 1996). Design Collaboration as an informal integration structure is the pursuit of high level shared design values, mutual trust, and design goal commitments among different internal or external functions (Kahn, 1996). Ruekert and Walker (1987) stated that an informal integration structure can create the opportunity for teams to make decisions which cross levels of authority. Moreover, Jassawalla and Sashittal (1998) asserted that design collaboration is a high level of integration in which participants achieve high levels of transparency, mindfulness and synergies. Design Integrative Tool refers to the ways, approaches or methods of design integration for integrating design knowledge of cross-functional expertise into a coherent design process. Past studies claimed that tools, such as 3D Computer Aided Design (CAD) modeling, 2D drawing, or CNC-machined physical model, could provide visualization functions and serve as a medium of information sharing and communication (Adderio, 2001; Maher and Rutherford, 1997). A recent surge of research (Austin et al., 2002; Adderio, 2001; Corso and Pavesl, 2000) on integrative tools, such as E-mail, encryption software, direct file transfer, document management systems, or audio/video conferencing, has given us new opportunities and challenges in terms of information capture, representation, change management, and referencing. Moreover, such tools allow coordination among people who are distributed in different geographic locations (Austin et al., 2002; Maher and Rutherford, 1997). As for design team award, Song et al. (1996) stated that a reward system has a great impact on information sharing. While participators are rewarded for working together, the quality and quantity of information exchanged will be higher. Furthermore, a suitable reward system can also decrease the inherent barriers between the functions due to differing organizational responsibilities, and allow participants to have satisfaction, enthusiasm, team spirit, and morale and commitment (Griffin and Hauser, 1996; Thamhain, 2004).

Research design

As stated earlier, this study aims to explore and validate the maturity levels of a design team. Therefore, this study first selected an academic intra-university collaborative design project in which team members are from different universities, so-called *win_health* design project. Then, this study constructed in-depth interviews and a questionnaire survey with the team members of the design project. In fact, the design project was composed of two design disciplines, industrial design (ID) and engineering design (ED). The main objective of the design project was to develop a smart medication-taken device, as shown in Figure 2. In fact, some companies were interested in the *win_health* design project, which has applied for several design-related patents, and had signed co-operation agreement with the project team to market in United States.

It should be noted that the *win_health* design project was initially composed of one ID team and one ED team, since past studies (Jehn, Northcraft, and Neale, 1999; Olson et al., 2001; Webber, 2001) asserted that that too many teams from different disciplines would result in negative effects on cross-discipline collaborative activities or design outcomes. The functions and responsibilities of six *win_health* team members as the participants of

Figure 2. The prototypes of the *win_health* design project

this study are listed in Table 2. A seven-point Likert scale ranging from "least importance" to "most importance" was used in the questionnaire survey. As for the 12 measured items of the maturity level, respondents were asked to indicate the importance of each type of design integration mechanism to different maturity levels.

Table 2. Functions and responsibilities of the *win_health* team members

Member	Functions	Responsibilities
D0	Industrial Design	Monitoring the whole progress and Industrial Design
D1	Product Form	3D modeling and prototype
D2	User Interface	User-interface and product usability
E0	Engineering Design	Monitoring the whole progress and Engineering Design
E1	Software Design	Software design
E2	Firmware and Hardware Design	Firmware and printed circuit board (PCB) design

Results and Discussion

According to the characteristics of different maturity levels of a design team, this study articulated the team activities of the *win_health* design project as shown in Table 3.

Table 3. The team activities in four maturity levels of the *win_health* design project

Maturity level	Team activities
Optimizing (L4)	Building the prototype models for design tests and evaluations Applying for patents, participating in design competitions, and striving for technology transfers Close friendships among the team members
Managed (L3)	Receiving a three-year financial aid Optimizing the roles of individuals and the overall team Growing of trust and confidence Adopting MSN or E-mail for information sharing and problem solving Employing the 3D CAD software for design discussions Regular design meetings and reviews
Formative (L2)	Having clear design goals and project definitions Applying for financial support Having more formal contact Defining the roles of each team members Using Pro-E, CAD, Protel 2004, and other visualization tools to define the product architecture
Initial (L1)	Having less design resources Building up the relationship among the team members Few clear design goals and project definitions Having informal contact Having few of formal meetings

Table 4. The means and standard deviations of the importance of four types of DIM at four team maturity levels

	type A			type B			type C			type D		
	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.	N	Mean	S.D.
L1	6	**6.33**	1.49	6	5.50	1.26	6	5.42	1.56	6	4.00	2.37
L2	6	6.50	0.84	6	**6.33**	0.82	6	6.08	0.66	6	4.33	1.97
L3	6	6.00	1.10	6	**6.83**	0.41	6	6.67	0.61	6	4.83	2.14
L4	6	5.33	1.63	6	**6.67**	0.52	6	6.58	0.80	6	5.00	2.10
Average mean		***6.04***			***6.33***			***6.19***			***4.54***	

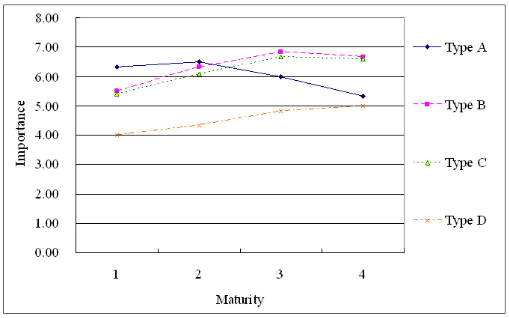

Figure 3. The importance of four types of DIM at four team maturity levels

Participants responded to the questionnaire survey concerning their beliefs about the change of the importance of design integration mechanism in the different maturity levels. The results of the importance of four types of DIM to four team maturity levels are shown in Table 4 and in Figure 3. First, the mean score (mean = 6.50) of design interaction (type A) at the *formative* level was higher than those of other three levels. The importance of design collaboration (type B) first increased from the *initial* level (mean = 5.50) to the *managed* level (mean = 6.83), then dropped at the *optimizing* level (mean = 6.67). The importance of design integrative tool (type C) was quite similar to that of design collaboration at four different maturity levels. Last, unlike other design integration mechanisms, the importance of design team reward (type D) gradually increased from the *initial* level to the *managed* level. On the whole, design collaboration received the highest average mean score (6.33), while design team award had the lowest average mean score (4.54). As shown in Figure 3, this study also found that design collaboration was ranked as the most importance of design integration mechanism at three of four team maturity levels, except for the *initial* level. Moreover, comparing with other design integration mechanisms, design interaction received the highest average mean score (6.33) at the *initial* level. Up to this point, these findings are in line with previous studies (Kahn, 1996; Jassawalla and Sashittal, 1998; Song et al., 1996). The findings from these data support the claim that a formal integration mechanism, such as design interaction, can not only benefit from closer integration in the early stages of NPD, but also help team members to understand their roles and responsibilities.

The following responses from the interviews gathered from the participants can further exemplify how they use design integration mechanisms in the different maturity levels. First, design interaction as one of design integration mechanisms did provide an effective way to get all of the team members working together and to identify the team objectives at the *initial* level. And, most of the interviewees agreed that: "*formal meetings can provide the environment and opportunities to make a close link between them effectively, and to understand their own roles and responsibilities at the initial level.*" At the *formative* level, design interaction could help the team to construct proposal budgets for financial aids. E0 said: "*since all the members were asked to attain the regular meetings, they would provide and share their own opinions and insights so that the proposal was made* quickly." In addition to understanding the project progress, the formal rules could achieve the close relationship between the team members who interact with each other. At the *managed* level, the importance of design interaction would decrease, while some of the design issues were discussed and solved through MSN or other contact modes. However, D1 noted that: "*since the leaders could not often watch the progress of the individuals, a routine meeting is a very important mechanism for self-management.*" At the *optimizing* level, design interaction could assist the team for design tests, evaluations and other paper work, such as patents or project reports and sustain the project progress.

Basically, design collaboration did play an important role in understand other design professionals at the *initial* level. D2 said: "*they often had lunch together after the formal meetings and felt free to talk about anything; therefore, they could gradually other design professionals.*" Furthermore, through informal contacts frequently, such as on phone or by E-mail, the team was gradually able to share visions and common goals. D0 further expressed that "*they often exchanged opinions and expectations on the phone so that a common goal could be achieved easily at the initial level.*" As for the *formative* level, design collaboration did encourage team members to help each other. D2 said: "*in addition to understanding other professionals and sharing visions and common goals, better collaborations did let them know how to provide supports to others and to ask for helps from others.*" At the *managed* level, design collaboration could increase team trust levels. And, D1 said that "*rather than waiting for regular meetings, they often directly contacted each other on the internet, such as MSN, when they needed help; therefore, the real progress of the project often progressed ahead the plan.*" At the *optimizing* level, design collaboration could help the team to accelerate the modification of product details. However, E2 said: "*since most of the design works were finished, design collaboration was less important at this level than at the previous level*."

Moreover, design integrative tool also played a key role in conveying design ideas or concepts at the *initial* level. Since there are different opinions or values among the team members, visualization tools, such as Pro-Engineer (Pro-E) or Protel 2004, could offer an effective way to remove communication barriers at the *formative* level. E0 said: "*almost all of all decisions were made based on the performance of design visualization*." At the *managed* level, the team members could not only adopt E-mail for information sharing, but also employ the MSN. Since the team members separated in two different schools, the MSN was a useful tool for them to collaborate or share information directly without geographical limitation. D1 expressed that "*it was impossible for team members to work and cooperate in the same place; therefore, we often used the video chat function of MSN to solve the problems and enhance the quality of intra-university collaboration.*" However, similar to design collaboration, design integrative tool was less important at the *optimizing* level.

In general, design team reward could not be a critical factor in the *win-health* design project since the subject of this case study was an academic design team. In fact, the design team received the financial supports at the *managed* level. D0 made the following comment: "*the reward is not only an incentive, but also a promise to make sure that the* *project would be carried out for a certain period of time."* At the *optimizing* level, design team reward gradually became a crucial incentive for the team members. D1 said that: "*since it was the first time he had the experience of collaborating with others from different disciplines, he was exciting; in particular, the design team reward was important, while they got used to the routine and felt tired of the job.* According to the responses of the interviews and the related design activities, this study systematically proposed a matrix to demonstrate the major roles of each types of DIM on each team maturity level as shown in Table 5.

Table 5. The major roles of each types of DIM at four team maturity levels

	Initial (L1)	**Formative (L2)**	**Managed (L3)**	**Optimizing (L4)**
Design interaction (type A)	• To get all of the team members working together • To understand their own roles and responsibilities • To identify the team objectives	• To get all of the team members working together • To construct proposal budgets for financial aids • To understand the project progress	• To get all of the team members working together • Self-management	• To assess design details • To sustain the project progress
Design collaboration (type B)	• To understand other design professionals • To share visions and common goals	• To let team members to collaborate effectively • To understand other design professionals • To share visions and common goals	• To accelerate the project progress • To foster the relationship among the team members • To enhance team trust level	• To accelerate the modification of product details
Design integrative tool (type C)	• To deliver information and data • To establish 3D model(s) of the project	• A medium for communication and information sharing • To establish 3D model(s) of the project	• A medium for communication and information sharing • To modify the 3D model(s) • To allow geographical distributed collaboration	• A medium for communication and information sharing • To allow geographical distributed collaboration
Design team reward (type D)			• A promise for running the project	• A promise of running the project • To maintain collaborative activities

Conclusion and Suggestions

As stated earlier, how to effectively manage the front-end process of product design is crucial for success in the NPD. In order to facilitate the fuzzy process, a collaborative team composed of various disciplines to provide diverse design professional knowledge is encouraged. Due to the importance of team maturity assessment in the process, this study first integrated the capability maturity model (CMM) concept and the notion of team collaboration to categorize the team maturity into four levels, such as *initial*, *formative*, *managed*, and *optimizing*. Then, through applying the existing theory of integration mechanism in the context of product design, this study proposed four types of DIM, which are design integration, design collaboration, design integrative tool, and design team reward. To further explore the roles of each type of DIM in different maturity levels of a design team, this study selected an intra-university collaborative design project, so-called *win_health*, as the subject of case study.

There are four major findings in this study. First, design collaboration receives the most importance at three of four team maturity levels, except for the *initial* level, while design team award receives the least importance at all of four team maturity levels. Secondly, the results echo those reported by previous authors, such as Kahn (1996), Jassawalla and Sashittal (1998), and Song et al. (1996), a formal integration mechanism, such as design interaction, can not only benefit from closer integration in the early stages of NPD, but also help team members to understand their roles and responsibilities. Thirdly, in line with recent research (MacLeod, Muller, Covo, and Levy, 2009), design integrative tool as one of design integration mechanisms plays a key role in co-design and enhancing the collaboration efficiently. Last, design team reward can become a great incentive at the *optimizing* level.

In conclusion, this study has systematically demonstrated the roles of each type of DIM on different team maturity levels. However, like any empirical research effort, this study contains a number of limitations. Due to the limited team numbers of an intra-university collaborative design project, this study may reflect in part the way in which the data were collected. In the future, we do hope to conduct a similar survey in the industry field to verify the results of this study. To sum up, this study may be importance in exploiting design integration mechanisms for the front-end process of product design, as well as providing a reference for design managers to effectively manage the team maturity.

References

Adderio, L.D., 2001. Crafting the virtual prototype: how firms integrate knowledge and capabilities across organizational boundaries. *Research Policy*, 30, 1409-1424.

Austin, S.A., Baldwin, A.N., and Steele, J.L., 2002. Improving building design through integrated planning and control. *Engineering, Construction and Architectural Management*, 9(3), 249-258.

Cagan, J. and Vogel, C.M., 2003. *Creating breakthrough products: Innovation from product planning to program approval*. New Jersey: Prentice Hall.

Chang, S.L., Chen, C.Y., and Wey, S.C., 2007. Conceptualizing, assessing, and managing front-end fuzziness in innovation/NPD projects. *R&D management*, 37(5), 469-478.

CMMI Product Team., 2001. CMMI^{sm} for System Engineering/Software Engineering, Version 1.1 (CMMI-SE/SW, V1.1) Continuous Representation. CMU/SEI-2002-TR-001, Software Engineering Institute, Pittsburgh, PA, December.

Corso, M. and Pavesl, S., 2000. How management can foster continuous product innovation. *Integrated Manufacturing Systems*, 11(3), 199-211.

Crosby, P.B., 1979. *Quality is Free*. New York: McGraw-Hill.

Fraser, P., Farrukh, C., and Gregory, M., 2003. Managing product development collaborations- a process maturity approach. *Journal of Engineering Manufacture*, 217, 1499-1519.

Fraser, P., Moultrie, J., and Gregory, M., 2002. The use of maturity models/ grids as a tool in assessing product development capability. *Proceedings of IEEE International Engineering Management Conference, IEMC, August 19-20, Cambridge, UK*. Cambridge: Cambridge University Press, 244-249.

Griffin, A. and Hauser, J.R., 1996. Integrating R&D and marketing: A review and analysis of the literature. *Journal of Product Innovation Management,* 13, 191-215.

Iansiti, M. and Clark, K.B., 1994. Integration and dynamic capability: Evidence from product development in automobiles and mainframe computers. Industrial and Corporate Change, 3(3), 557-605.

Jassawalla, A.R. and Sashittal, H.C., 1998. An examination of collaboration in high-technology new product development processes. *Journal of Product Innovation Management,* 15, 237-254.

Jehn, K.A., Northcraft, G.B., and Neale, M.A., 1999. Why differences make a difference: A field study of diversity, conflict, and performance in workgroups. *Administrative Science Quarterly,* 44, 741-763.

Kahn, K.B., 1996. Interdepartmental integration: A definition with implications for product development performance. *Journal of Product Innovation Management*, 13, 137-151.

Khurana, A. and Rosenthal, S.R., 1998. Towards holistic “Front Ends” in new product development. *Journal of Product Innovation Management*, 15, 57-74.

MacLeod, D., Muller, L., Covo D., and Levy, R., 2009. Towards a design nation, *OURTPOIAS*, 109-120.

Maier, A.M., Echert, C.M., and Clarkson, P.J., 2006. Identifying requirements for communication support: A maturity grid-inspired approach. *Expert Systems with Applications*, 31, 663-672.

Maher, M.L. and Rutherford, J.H., 1997. A model for synchronous collaborative design using CAD and database management. *Research in Engineering Design*, 9, 85-98.

Olson, E.M., Walker, O.C.J., Ruekert, R.W., and Bonner, J.M., 2001. Patterns of cooperation during new product development among marketing, operations and R& D: Implications for project performance. *The Journal of Product Innovation Management,* 18, 258-271.

Ruekert, R.W. and Walker, O.C.J., 1987. Marketing’s interaction with other functional units: A conceptual framework and empirical evidence. *Journal of Marketing*, 51, 1-19.

Song, X.M., Neeley, S.M., and Zhao, Y., 1996. Managing R&D-Marketing integration in the new product development process. Industrial Marketing Management, 25, 545-553.

Swink, M., 2000. Technological innovativeness as a moderator of new product design integration and top management support. *Journal of Product Innovation Management,* 17, 208-220.

Webber, S.S., 2001. Leadership and trust facilitating cross-functional team success. *Journal of Management Development*, 21(3), 201-214.

Zhang, Q. and Doll, W.F., 2001. The fuzzy front end and success of new product development: a causal model. *European Journal of Innovation Management*, 4(2), 95-112.