DESIGN EDUCATION FOR SUCCESSFUL CROSS-FUNCTIONAL COOPERATION IN NPD

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ABSTRACT
There is consensus that the effective implementation of cross-functional teams is critical to new product success. However, such teams face particular challenges because of well-documented barriers between functions, and there is little evidence-based guidance for practitioners on how to achieve effective cross-functional teamwork. Furthermore, recent scholars have suggested that the industrial design function is adopting a more prominent position in the management of new product development for the successful achievement in the changing consumer electronic market environment, nevertheless the current nature of the role of design in new product development (NPD) is under-investigated with limited empirical research into the nature and dynamics of this phenomenon. This paper suggests design group training concept based on the critical success factors for successful collaborative teamwork within organisation.

Keywords: Cross-Functional Cooperation (CFC), Design Education, Critical Success Factors (CSFs), Design Group in NPD

1 INTRODUCTION

As new product development principles such as shortening product life cycles, imperatives for faster development and global roll-out demand more flexible organizations, the emergence of cross-functional cooperation is one of the most significant recent trends in organizational design. Moreover, the creation of cross-functional cooperation around key value-adding processes has become an increasingly common organizational response to the competitive pressures. This situation is replicated in many firms which have become increasingly interested in stimulating, facilitating, and maintaining cooperation between the various functional areas, and much work sought to find better solutions and strategy for successful cross-functional cooperation in NPD [1]. Many researches have introduced the techniques like cross-functional new product teams, quality function deployment, and simultaneous engineering, which are used to enhance cross-functional communication in NPD, and ultimately, the likelihood of new product success. Researchers also argued that having briefly discussed group effectiveness and inter-functional integration the foundation has been laid to examine critical factors to the success of cross-functional cooperation [2]. However, there are limited empirical researches to identify and prioritize the success factors of the CFC process development.

In addition, design skills and roles in new product development process are shifting. Implementing the new notions of team-based and parallel NPD processes compelled

designers to work closer with other functions. This fueled interest in the interactions between design and other functions. It was suggested that the nature of information flows between functions influenced success or failure factors of the new product. Further success and failure studies indicated that the relationship between design and the marketing function was particularly critical. However, studies revealed that design frequently misinterpreted information deriving from the marketing function in the cooperation process. Many of the mechanisms have been criticized as ineffective as design briefs often contain unclear and superfluous information. Problems of unclear relationships and distinction between design team and others have serious consequences such as financial losses, time wasting, and failed projects in NPD. Furthermore, in the design literature there appears to be a lack of evidence addressing professionals' ability to learn interdisciplinary team skills while working, without formal education.
To overcome these limitations, this research empirically assesses which critical success factors of cross functional cooperation have the most significant impact on the NPD process, and provide some designer education concepts for cross functional cooperation in the customer electronic industry.

2 CROSS-FUNCTIONAL LINKAGES IN NPD

The long-term survival of a business hinges upon its ability to successfully introduce superior products into the market place. Shortening product life cycles, imperatives for faster development and global roll-out demand more flexible organizations. Competition is increasingly fought on the basis of intangible organizational competencies [3]. Such competencies are embedded within the structure, processes and culture of the organization. The creation of cross-functional teams around key value-adding processes is an increasingly common organizational response to these pressures. In much of the NPD literature, integration is used not only as an umbrella term to describe a variety of cross-functional linkage, it is often used interchangeably with collaboration. Both terms commonly refer to the coming together of diverse interests and people to achieve a common purpose via interactions, information sharing, and coordination of activities. Overcoming the problems created by physical and perceptual distances among research and development(R&D), marketing, production and other functional groups, ensuring early involvement of all participants, and joint sharing of responsibility in ways that ultimately improve and accelerate NPD processes are among the commonly described advantages associated with both terms [4].
Moreover, the design activity has been essentially characterized as compromise, choice, creativity and complexity in new product development process. Olson [5] stated that design has a value in the successful development of a new product. The design group is emphasized with marketing and technology as the key functional groups in the NPD process, according to Cooper and Jones [6]. There are broadly three key function areas involved in successful NPD: marketing, design and technology. Each interface between the design group and the other key function groups may be summarized in three parts. Firstly, some researchers explored the design and marketing interface. There ought to be a continuous interaction between marketing and design. Not only do designers need to know the product, the competition, the target market and the price, but also information on the characteristics of the consumer. This range of information needs to be presented clearly and, at all times, must be appropriate to the needs of the designers [7]. Secondly, as with the marketing interface, it is recommended that there should also be regular contact between design and R&D. They need to be able to consult with R&D, who

themselves also need to communicate with market research and marketing about new products which may be developed in the future [8]. R&D information is essential to designers working on product design development, and they need to know what is happening at the forefront of technology, in terms of materials, machines and manufacturing methods. Such knowledge feeds the creative process and enables designers to develop an innovative and leading edge practice. Finally, companies increasingly recognize that integration of design and manufacturing contributes to improving product quality, lowering cost, and speeding up the product development process. And a report by the DTI (Department of Trade and Industry in the UK) also emphasized the relationship between design and manufacturing groups. The report also mentions that it is beneficial to involve production and manufacturing from the start and there needs to be a continuous interaction between manufacturing and design [9].
In this environment, the harmony needed between the design and other functional people and the various functions are not independent - they are interdependent, namely separate functions begin to work together. Furthermore, there is an increasing need to improve the cross-functional collaboration process and interfaces between the design and other key functional groups.

3 CRITICAL SUCCESS FACTORS OF CROSS-FUNCTIONAL COOPERATION

This exploratory research was conducted using a five-phase iterative procedure. First, the existing literature for scales designed to measure the constructs examined in this study were reviewed. Second, in-depth individual interviews with fifteen managers of cross-functional NPD team from eight global consumer electronic companies were conducted. Third, subsets were identified that were unique and possessed different shades of meaning to informants. A list of constructs and corresponding measurement items of senior managers from the companies was compiled. Then a focus group panel was formed to critically evaluate each of the success factors and asked to suggest additional factors. Fourthly, based on feedback from the focus group members, three draft questionnaires were prepared, one in English, one in Korean, and one in Japanese. The parallel-translation / triple–translation method was used to make sure the translation was accurate and that the question meanings were not altered. Finally, a questionnaire survey was conducted to define the success factors for CFC NPD team of consumer electronics products. Six hundred and forty questionnaires were distributed to the above-mentioned eight global consumer electronics firms in three countries.
The survey was designed to seek factors affecting CFC A total of 52 factors were gathered from the interview survey. 420 surveys, sent by mail resulted in a total response of 243 usable questionnaires (representing a 60.75 percent response rate). Most of these questionnaires were completed by senior designers and managers who are in the consumer electronics companies in Japan, Korea and the UK. Table 1 presents the means and standard deviations for the 11 CSFs among 24 success factors in descending order of importance (5=critical, 4=very high, 3=high, 2=moderate and 1=low).

Table 1. Critical Success Factors in Cross-Functional Cooperation

	Critical Success Factors	Total	Time performance	Cost performance	Quality performance
1	Unified culture with partners	0.300	0.112	0.184	0.299
2	Choosing suitable partners	0.486	0.311	0.260	0.519

3	Unified vision and goals	0.618	0.466	0.280	0.560
4	Building trust and cohesion	0.686	0.468	0.405	0.607
5	Informal social relationship	0.651	0.135	0.124	0.305
6	Proper organisational culture	0.516	0.358	0.301	0.472
7	Interaction between partners	0.339	0.507	0.476	0.532
8	Managerial support	0.676	0.487	0.630	0.82
9	Coordination of senior manager	0.474	0.363	0.245	0.427
10	Working rationally	0.593	0.501	0.334	0.445
11	Close physical location	0.278	0.088	0.074	0.319

4 DESIGN GROUP VERSUS NON-DESIGN GROUP

To compare success factors of CFC between a design group and a non-design group, five main success factors were analyzed. Table 2 lists the CSFs, in order of their importance, between a design group and a non-design group of global customer electronic companies. In a non-design group, 'unified culture with partners', 'building trust and cohesion', 'choosing suitable partners', 'interaction between partners' and 'proper organisational culture' are in the ranking. One factor 'unified cultures' is shown there are not much of a gap between a design group and non-design group. In case of a design group, the designers have realized 'choosing suitable partners' makes for successful cross-functional collaboration in NPD. By contrast, the marketing and engineering managers in organizations (non-designers group) showed 'building trust and cohesion' is a higher priority success factor for cross-functional cooperative NPD team.

Table 2. Main success factors of a design group and a non-design group

	Critical Success Factors	Mean Value	Critical Success Factors	Mean Value
		Designers		Non-designers
1	Unified culture with partners	5.58	Unified culture with partners	5.94
2	Choosing suitable partners	5.33	Building trust and cohesion	5.23
3	Proper organisational culture	5.13	Choosing suitable partners	4.94
4	Unified vision and goals	4.93	Interaction between partners	4.80
5	Managerial support	4.85	Proper organisational culture	4.62

5 DESIGN EDUCATION FOR CROSS-FUNCTIONAL COOPERATION

From the table, it can be seen that 'unified culture with partners', 'choosing suitable partners' and 'proper organisational culture' are important success factors in the design group. In these results, there is no doubt that 'culture' is the most important issue to designers in cross-functional cooperation. The culture means common language, common geographic and ethnological condition in the organisation. To build the common culture with others, designer needs the understanding of the other languages and managerial situations in the company. In the 1970's, anecdotal evidence concluded that perceived NPD project 'success' depends more on behavioural skills than technical skills [10]. However, recent evidence by Monczka, R. M. et al. finds that cooperative behaviours are predictive of successful outcomes [11]. In conclusion, building cooperative behaviours in a common culture is one of important issues for successful

cross-functional cooperation with designer group. Therefore to create a collaborative culture and behaviours, designers need the learning what questions to ask and how to ask as inter-team communication skill.
Furthermore, designer group agrees the success factors, 'unified vision and goals' and 'managerial support' to cross-functional cooperation compared with 'building trust and cohesion' and 'interaction between partners' of non-designer group. It means that non-designer group needs to learn how to build trust and interactive method with partners, but designer group requires an alignment skill with the organisational and departmental goals and strategy and executives motivation methods.

Table 3. Factor analysis between a design group and a non-design group

Section	Designer group	Non-designer group
Common factors	• Unified culture with partners • Choosing suitable partners • Proper organisational culture	
Different factors	• Unified vision and goals • Managerial support	• Building trust and cohesion • Interaction between partners

6 CONCLUSION

Yet while companies are forming cross-functional, distributed teams, supporting them is increasingly challenging. It involves looking holistically at the unique nature of distributed work and ensuring that the work is properly planned, governed and enabled. It also requires an approach that is a good deal more rigorous than that needed for NPD projects with centrally located teams [12]. In particular, managers in NPD must address four areas;

- Dealing with cultural change and the organizational resistance to cross-functional work,
- Managing a diverse team with the right mix of skills and competencies,
- Implementing the right enabling collaboration and knowledge management technologies that can be particularly supportive of distributed work,
- Relying on an effective methodology that defines the work and establishes the proper handoffs from one part of the team to another.

Especially, training needs to occur the managers understand the requirements and limitations of co-operation in NPD. Organizations must learn how to identify the critical issues that affect the implementation process of cross-functional cooperation and know when in the process to address them effectively to ensure that the promised benefits can be realized and potential failures can be avoided. Besides, the key issue in successful managing the cross-functional cooperation is creating the right relationship between design and all other areas in NPD.
In sum, this research result suggests the educational approaches of design group for cross-functional cooperation as below four issues;

- Creating culture and teamwork for working together,
- Improving communication skills,
- Motivating design team of supervisors and executives,
- Aligning design teams with your organizational and departmental goals & strategy.

The concept of successful collaborative work of design team is formulated by design managers facing the complexities of cross-functional cooperation in NPD. Accordingly, design managers have to consider these training elements of the design group to achieve the optimal balance with other groups.

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