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Analysis of CSFs for NPD in Indian SMEs

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Introduction

Developing products is a knowledge-intensive process and the single greatest challenge that managers have been facing for a long time, is to raise the knowledge of performance in workers. The ability to evaluate performance may be an important part in improving performance in this as well as in every context.

The management of the early phases of the product innovation process is critical for the success of the whole innovative product. A significant part of the problems in the creation of product innovations are related with the early phases of product innovation and product definition. The purpose of finding Critical Success factor (CSF) in new product development (NPD) and the timely improvement of current products in line with the company policy. Identification of CSF on the basis of market research give directions of product development and all the people taking part in the product development process to make it possible for the company to create successful, competitive product innovations and to fulfill the company's strategies along with the fulfillment of customer requirement.

Several NPD studies investigating more specifically the role of market information in new product development have emphasized the need for studies with more interdisciplinary and multi-informant approaches to better understand the interdisciplinary nature of new product complex, development. The influence of departmental views seems to be particularly important in the context of assessing NPD processes, because the successful development and implementation of new products require the integration of specialized knowledge from different organizational units. According to a meta-analysis of 47 empirical studies on the NPD process (Montoya-Weiss and Calantone, 1994), most studies relied on a single information source within each company, and only a few studies included more than two respondents, multiple hierarchical levels and/or functional departments. Further the aspects related to design; materials selection and marketing of a product have been important factors for the successful development of products.

ABSTRACT

The present paper addresses the concept of CSF in the development of new products. More specifically, the aim of this research is to study how performance is perceived and measured within the companies, and how this can be improved. The target respondents are Indian SMEs. 18 critical factors are identified and with the help of semi structured questionnaire the data is collected. The collected data is being analyzed in SPSS software. The results show that the identified factors are related to success of new product in the Indian SMEs.

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Product Development

The term product development is often may be selfexplanatory i.e. the development of new products. However, product development is ambiguous in the sense of what is included in the process and what is not included. The definition of product development by Ulrich and Eppinger (2008) has found broad acceptance within the research community. Our research acknowledges this definition and argues that from a performance evaluation perspective, it is important to have a holistic process interpretation of product development. The objective of product development may be expressed as the creation of a *recipe* for producing a product (Browning, 2003), with new or different characteristics, that offer new or additional benefits to the customer. The process of identifying customer needs is thus a key activity in the product-development process in order to develop successful products. It is therefore argued that the tools and methods used to perceive a market opportunity should also be included in the definition of product development. The identification of a market opportunity may not be easily identified but it is decisive for performance in product development. If the market opportunity is wrongly perceived, the result of product development cannot be economically successful, however effective the performance of the realization of the product. Product development is the set of activities beginning with the processes and tools used to perceive a market opportunity and ending in the production, sale, and delivery of a product fulfilling that market opportunity.

Success Factors in Product Development

The idea of having a limited set of factors that affect the performance of the development of new products is appealing for both practitioners and researchers. As a result, a considerable amount of empirical research on the determinants of new product-development performance is reported in the literature (Ernst, 2002; Montoya-Weiss and Calantone, 1994). No prescribed common criterion can, however, explain how successful new products are created (Poolton and Barclay, 1998). The conclusions from this project are that successful companies have a much better understanding of customer needs, attend more to marketing and advertising, perform

product development more effectively, encourage more use of outside expertise, and authorize and promote responsible and experienced professional employees to senior management levels. Abdel-Kader and Lin (2009) summarize the conclusions of the SAPPHO projects as: Professional employees and good management skills are the key to success.

Tang et al. (2005) identified a distinct set of success factors for product development: *Leadership, Organizational culture, Human resources, Information, Product strategy, Project execution, Product delivery, and Results.* Leadership involves key characteristics of the project manager, the power delegated, and whether there is a clear strategic direction for the development project. The Organizational culture involves the extent to which management takes advantage of the established values of the personnel to improve project output. Human resources involve management's actions to improve the skills and the work environment.

In a thorough review of critical success factors by Ernst (2002), the following categorization, as previously developed by Cooper and Kleinschmidt (2007), was adopted: *Customer integration, Organization, Culture, Role and commitment of senior management* and *Strategy*. Adams et al. (2006) present another review drawing on a wide body of the product innovation literature, and identified the following seven categories as important in the product innovation process: *Inputs management, Knowledge management, Innovation strategy, Organizational culture and structure, Portfolio management, Project management, and Commercialization.*

Further, Bessant and Tidd (2007) argue for the following success factors in product innovation: Market knowledge, Clear product definition, Product advantage, Project organization, Top management support, Risk assessment, Proficiency in execution, and Project resources. Product advantage involves product superiority in the eyes of the customer e.g. delivering unique benefits to the user and a high performance-to-cost ratio. Market knowledge, i.e. assessment and understanding of customer and user needs, is critical. A clear product definition, defining target markets, clear concept definition and benefits to be delivered must be determined before the development activities begin. Holistic risk assessment including market-based, technological, manufacturing and design sources must be built into the business and feasibility studies. In a meta-review, by Chen et al. (2010), of the success factor literature especially focusing on decreasing the development cycle time, the success factors were grouped into process, project, team, and strategy. Chen et al. (2010) further argue, on the basis of their findings, that process and team characteristics are more generalizable and consistent determinants of cross-situational productdevelopment speed than strategy and project characteristics. This review differs from other reviews in the sense that it is focused on the time dimension, not the cost or product success as is most usual (e.g. Molina-Castillo and Munuera-Alemán, 2009). Few meta-studies focus on the time perspective as an aspect of product-development performance. One exception is the review by Gerwin and Barrowman (2002). The early but very influential review by MontoyaWeiss and Calantone (1994) found that certain factors related to strategy and the development process are most strongly linked to performance in product development.

In the review by Henard and Szymanski (2001) they conclude that out of the 24 determinants of productdevelopment performance only five, i.e. product advantage, market potential, meeting customer needs, predevelopment task proficiencies and dedicated resources, are salient determinants of product development performance.

Criteria	Sub-Criteria	Reference
Technical Factor	Technical	Cooper (1999) Sun
	capabilities	and Wing (2005),
	-	Poolton and Barclay
		(1998)
	Product	Cooper (1999), Sun
	Production in	Lynn et al. (1999)
	Time and cost	and wing (2003) , Lester (1998)
	Clear definition	Cooper (1999) Gupta
	of the functions	and Wilemon (1990)
	of the Product	· · · · · · · · · · · · · · · · · · ·
	Technically	Sun Lynn et al.
	difficult to	(1999), Lester (1998)
	replace	L (1000)
Marketing Factor	Appropriate	Lester (1998), Heverile (2012) Ernst
	strategy	Haverna(2012), Ernst Holger (2002)
	Focus on the	Cooper (1999) Sun
	customer	Wing (2005),
		Haverila (2012),Ernst
		Holger (2002)
	A growing	Poolton and Barclay
	market	(1998),Ernst Holger
	Clean definition	(2002) Sharma (2006)
	of the target	(1998), Cooper (1999) Sun and Wing
	market	(2005), Ernst Holger
		(2002)
Organisational	Long-term	Cooper (1999) Sun
Factor	vision	and Wing (2005
	Different levels	Cooper (1999),
	of cooperation	Haverila (2012),
		Havenia (2012) , Wing (2005)
	Entrepreneurial	Wing (2005) Wing (2005) Poolton
	culture in the	and Barclay (1998)
	Organization	• • •
	The time of	Sun Lynn et al.
~	replacement	(1999), Lester (1998)
Commercialization	Product Scores	Sun Lynn et al.
Factor	than	(1999),Sharma (2006)
	Resources to	Lester (1998) Cooper
	implement	(1999) Sun and Wing
	NPD	(2005)
	product	Sun Lynn et al.
	developed	(1999)
	Scores than The	
	Generating	Wing (2005)
	good ideas by	Haverila(2012). Sun
	Expert Groups	Lynn et al. (1999),
	- •	Lester (1998)
Social Factor	Cultural	Martin et al. (2007)
	competence	
	Communication	Minaret et al. (2000)
	Global VS.	Laniri et al. (2010)
	Local	Haverila(2012)
	Local Social Responsibility	Haverila(2012), Cooper (1999) Sun

Identifications of CSFs

The dilemma is sometimes figuring out exactly how to initiate and execute integrating all success factors into the innovative process due to the fact that there are so many success factors that one could find difficulty to work with all. The important critical factors are identified as presented in table 1.

Research Objectives

In this present paper, the focus is; how to increase the likelihood of creating successful new products by integrating the CSFs for NPD. Analysis of CSFs used in Indian SMEs for creating innovative new products to full fill the need of market. Also the analysis of factors influencing the success of new products is the concern of present paper.

Research Methodology

When focusing on evaluating performance in the development of new products, it is appropriate to adopt a system perspective view of the product-development process because of the new relationships among different factors. A total of 54 semi-structured interviews have been held at the selected case companies. An overview and timeline of the perused case studies are performed. The questions asked during the interviews were semi structured where 5 scales are provided in such a way, that the respondents were encouraged to talk about what they thought important from their point of view. The 5 point scale is compromised as; very much important, very important, important, not important and useless. This choice goes from 5 to 1 value in digit. Semi closed questions give answers within a limit and also saves too much time for researchers. Data collected from the respondents was analyzed with the t-test method and correlation analysis with the help of SPSS software. The degree of central role like mean mode and median represents the strength of influences both dispatched and received.

Results and Discussion

Table 2 analyses the detailed descriptive analysis for the data collected from the respondents on their views for the identified critical success factors for NPD in the respondents companies. The maximum and minimum values indicate the values taken for Likert scale data that ranges from 1 to 5 from very important to no important. The mean values indicate leanness of respondents towards a particular values and this values indicate in maximum case above the average (2.5). Further the standard deviations values indicate the nearness from standard. At last the variance indicates the actual variation of respondent's opinion from the mean values which are assumed and indicated by maximum numbers of respondents.

Table 2 shows a more detailed statistics of the questionnaires using SPSS program. From the values, in the engineers" point of view, the most important factors to NPD success in Indian SMEs is the role of the top management and social factor, topping the table with highest mean score of 3.31 which is in between "very important" and "extremely important". Next on the rank is the quality of each NPD activities.

		-				
	N	Minimum	Maximum	Mean	Std. Deviation	Variance
TF1	54	1.00	5.00	3.0370	1.35929	1.848
TF2	54	1.00	5.00	2.8889	1.56213	2.440
TF3	54	1.00	5.00	3.0000	1.22859	1.509
TF4	54	1.00	5.00	3.1111	1.22346	1.497
MF1	54	1.00	5.00	3.0370	1.38677	1.923
MF2	54	1.00	5.00	2.8889	1.20794	1.459
MF3	54	1.00	5.00	2.8519	1.33752	1.789
MF4	54	1.00	5.00	3.0000	1.42749	2.038

OF1	54 1.00	5.00	3.2037 1.39243	1.939
OF2	54 1.00	5.00	3.1481 1.29451	1.676
OF3	54 1.00	5.00	3.2222 1.25392	1.572
OF4	54 1.00	5.00	2.8889 1.19222	1.421
CF1	54 1.00	5.00	3.2222 1.29828	1.686
CF2	54 1.00	5.00	2.8148 1.22973	1.512
CF3	54 1.00	5.00	3.0556 1.37932	1.903
CF4	54 1.00	5.00	3.0370 1.40031	1.961
SF1	54 1.00	5.00	3.3148 1.38488	1.918
SF2	54 1.00	5.00	3.1481 1.26502	1.600
SF3	54 1.00	5.00	3.3704 1.17033	1.370
SF4	54 1.00	5.00	3.1852 1.36083	1.852
Valid N (listwise)	54			

Table 3. One-Sample Test

Test Value = 0

					95% Conf the Differe	Confidence Interval of Difference					
t	df	Sig. taile	(2- ed)	Mean Difference	Lower	Upper					
TF1	16.419	53	.000	3.0370	4 2.6660	3.4081					
TF2	13.590	53	.000	2.8888	9 2.4625	3.3153					
TF3	17.944	53	.000	3.0000	0 2.6647	3.3353					
TF4	18.686	53	.000	3.1111	1 2.7772	3.4451					
MF1	16.093	53	.000	3.0370	4 2.6585	3.4156					
MF2	17.574	53	.000	2.8888	9 2.5592	3.2186					
MF3	15.668	53	.000	2.8518	5 2.4868	3.2169					
MF4	15.443	53	.000	3.0000	0 2.6104	3.3896					
OF1	16.907	53	.000	3.2037	0 2.8236	3.5838					
OF2	17.871	53	.000	3.1481	5 2.7948	3.5015					
OF3	18.883	53	.000	3.2222	2 2.8800	3.5645					
OF4	17.806	53	.000	2.8888	9 2.5635	3.2143					
CF1	18.238	53	.000	3.2222	2 2.8679	3.5766					
CF2	16.820	53	.000	2.8148	1 2.4792	3.1505					
CF3	16.279	53	.000	3.0555	6 2.6791	3.4320					
CF4	15.938	53	.000	3.0370	4 2.6548	3.4192					
SF1	17.589	53	.000	3.3148	1 2.9368	3.6928					
SF2	18.287	53	.000	3.1481	5 2.8029	3.4934					
SF3	21.162	53	.000	3.3703	7 3.0509	3.6898					
SF4	17.200	53	.000	3.1851	9 2.8138	3.5566					

Further the analysis of T test for critical factors shows the highest value of mean difference is for the factor that are associated with all main factors under sub criteria. Which has the mean score above the 3.70;

Table 4. Correlation analysis among factors

											•		-							
	TF1	TF2	TF3	TF4	MF1	MF2	MF3	MF4	OF1	OF2	OF3	OF4	CF1	CF2	CF3	CF4	SF1	SF2	SF3	SF4
TF1	1	.126	079	.190	131	009	.387**	.107	064	068	.128	.049	.070	.004	.210	.138	.034	.106	.181	.088
TF2	.126	1	256	122	.167	017	.191	.034	.002	104	.128	.165	043	.028	.239	.071	106	.199	.085	035
TF3	079	256	1	238	244	025	172	.151	187	.036	.306*	245	237	162	.056	.088	166	.073	066	045
TF4	.190	122	238	1	169	209	.137	216	.230	177	041	.410***	111	.039	127	.042	$.268^{*}$	267	.037	.180
MF1	131	.167	244	169	1	110	.003	.010	.113	.428**	.049	.128	.299*	107	.216	.203	.053	.094	067	.266
MF2	009	017	025	209	110	1	291*	.153	.070	146	.129	.004	.160	.405**	109	.014	.055	150	.243	.150
MF3	.387**	.191	172	.137	.003	291*	1	119	085	.067	.020	058	.008	.086	.434**	027	.066	.158	.241	192
MF4	.107	.034	.151	216	.010	.153	119	1	123	225	.190	044	.244	.161	125	.566**	067	042	.237	.165
OF1	064	.002	187	.230	.113	.070	085	123	1	164	124	$.275^{*}$	099	.033	.132	014	.485**	200	163	.199
OF2	068	104	.036	177	.428**	146	.067	225	164	1	009	246	.092	.006	.038	024	.047	.378**	112	112
OF3	.128	.128	.306*	041	.049	.129	.020	.190	124	009	1	.080	112	.211	.113	.447**	085	.193	.457**	.031
OF4	.049	.165	245	.410**	.128	.004	058	044	$.275^{*}$	246	.080	1	240	194	.038	.036	.182	214	024	.129
CF1	.070	043	237	111	.299*	.160	.008	.244	099	.092	112	240	1	033	133	.120	.002	.117	.106	.318*
CF2	.004	.028	162	.039	107	.405**	.086	.161	.033	.006	.211	194	033	1	294*	.146	.146	.006	.337*	069
CF3	.210	.239	.056	127	.216	109	.434**	125	.132	.038	.113	.038	133	294*	1	167	306*	.157	.081	066
CF4	.138	.071	.088	.042	.203	.014	027	.566**	014	024	.447**	.036	.120	.146	167	1	035	088	.199	.214
SF1	.034	106	166	.268*	.053	.055	.066	067	.485**	.047	085	.182	.002	.146	306*	035	1	307*	015	001
SF2	.106	.199	.073	267	.094	150	.158	042	200	.378**	.193	214	.117	.006	.157	088	307*	1	076	214
SF3	.181	.085	066	.037	067	.243	.241	.237	163	112	.457**	024	.106	.337*	.081	.199	015	076	1	091
SF4	.088	035	045	.180	.266	.150	192	.165	.199	112	.031	.129	.318*	069	066	.214	001	214	091	1

Table 3 shows the detailed analysis that satisfies the assumptions. Therefore, the average amount each of the scores for that particular factor varies away from 3.70 is 1.001.

Association among Factors

The quantification of the degree of association between two variables was made by means of the so-called factor correlation analysis. Such measures describe, through a single number, the association (or dependence) between two variables on the significant values of 95% one tailed and two tailed Pearson correlation analysis. For the purposes of this research, the objective of factors association is to verify if it exists and how strong the association between that variable is with the success of the products developed, expressed by means of a 1 to 5 scale. For the present research, the highest value the factor association can assume is 0.7. Such value would demonstrate that for this variable all of the success cases would have maximum scores and all of the unsuccessful cases would have minimum scores, thus revealing a critical success variable for the product development project.

Therefore, the factor loading (association) with values close to or higher than 0.5, was adopted as strong, because these values indicate that in cases of non-success, the responses would be concentrated on the minimum values; and for the success cases, on the maximum values. That, indicates this is a critical variable for new product development management, namely, a variable strongly associated with the developed product's success.

Out of the 18 variables investigated, Table 4 illustrates the factors association for all variables that showed the strongest associations with the developed products' success of the companies investigated, always taking into consideration only the variables that had their respective p-values (t-test) below the significance level of 5% (p ≤ 0.05).

It was also intended to identify the critical success factors, through their mean values, for successful and unsuccessful projects. Those revealing wider mean amplitudes are factors which should receive more managerial attention, because a variable high scored for the success cases is deemed as critical for the new product success or failure.

Conclusion

This paper analyzed management practices and critical success factors during the realization of new product development. To identify critical success factors for Product development is a complex process and any research in this area shows great success of product. The main contribution of this paper is related to the option made to examine critical success factors in the new product development, within a specific sector of the Indian small and medium size companies. Future research may lead to investigate the core subject within other sectors, software and biotechnology. Despite the limitations, some considerations can be made in view of the results obtained. The success of new product depends also at the commercialization stage where large scale production is started.

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