COMPRESSED NEW PRODUCT DEVELOPMENT CYCLE & ITS IMPACT ON OUTSOURCING DECISIONS IN AUTO COMPONENT INDUSTRY

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ABSTRACT

The compulsion to continuous development of new product has resulted in compressed product life cycle.A consequence of this compressed product life cycle is the time crunch or the "schedule pressure" that the new product development (NPD) team in a company confronts. The time-to-market or schedule pressure can be one of the main reason of increasing outsourcing activities related to NPD as outsourcing brings together multiple best-in-class suppliers work simultaneously on individual components of a system and gives the company required flexibility in regards to NPD .The main hypothesis of this paper is to find out whether schedule pressure on NPD encourages outsourcing. The study aims to explore the impact of schedule pressure in NPD in the auto component industry. The other aim isto assess the relationship between schedule pressure in NPD and the outsourcing decision.

KEYWORDS

New product Development, Schedule Pressure, Outsourcing, Auto-component industry

1. INTRODUCTION

Technological changes and increased competition have forced the companies to become more market driven and focused on sustaining competitive advantage through continuous stream of new product development (NPD). The NPD process is often described as a sequential linear process consisting of activities from idea generation to product launch. Contemporary and performing organizations are under tremendous pressure to bring new products and to market them quickly. However, the task of new product development requires significant investment and time in addition to making various decisionsduring the NPD process. Managers responsible for new product development (NPD) need to constantly improvetheir processes and strengthen core R&D capabilities as pointed by Wheelwright and Clark [1].

New product development (NPD) is vital for all companies. Previous research indicates that the success of new products is dependent upon how professionally the development process is performed. In particular, the proficiency of NPD activities has a positive effect on product

quality.The evolution of the NPD process means that manufacturing firms are facing the challenge of implementing new approaches and working methods. As a result, the challenges and demands on the NPD process is under-renewed pressure to deliver product efficiently in faster time-scales and at higher quality levels. This has resulted in increased outsourcing at different stages in NPD process. According to Quinn [2], one or more activities in NPD can be outsourced. The choice whether to outsource or not is, not only dependent upon the transaction costs that arise from different modes of governance but on the schedule pressure.Schedule pressure is generally a consequence of missed milestones or late attemptsto shorten project time. As the product development process is accelerated, regardless of which acceleration technique is used, the deadline for each individual project becomes closer to the date when project started, and accordingly project teams have less time available to carry out the tasks. Put differently, schedule pressure is the strain caused by thegap between the work that has been done and the time left to complete the project.The challenge however is whether to develop the required resource capability to address this issue in-house or to outsource it. Even if the in-house capability development may seem to be a better option at first glance, the lack of scale of economy and the need for flexibility may make an in-house solution expensive.

The reduced time-to-market is one of the main reason of increasing outsourcing activities related to NPD as outsourcing brings together multiple best-in-class suppliers work simultaneously on individual components of a system and gives the company required flexibility in regards to NPD .Thus the main proposition of this paper is that schedule pressure on NPD encourages outsourcing. Therefore the study aims to explore the effect of the schedule pressure on NPD with reference to the auto component industry in India and whether it is impacting the outsourcing activities related to new product development positively.

2. LITERATURE REVIEW

There is a considerable body of literature which seeks to identify the ingredients forsuccessful NPD and various methods that have been developed in order to improve processefficiency and overallNPDeffectiveness as shown by Link [3]; Griffinand Page [4]; Pittiglio andMcGrath[5]. Lee and Wong [6]examined the important issue of how competitive intensity andtechnological uncertainty affect newproduct development and a project'sadherence to schedule and efficiency.Lee and Wong[7] find that in context of Korea, higher technologicaluncertainty reduces the positive relation of crossfunctionalintegration with on-time project completion. This was found to be counterintuitive and in contrast to research conducted outsideEast-Asia as pointed by Bstieler [8]. Such a potential country specific effectpoints to further antecedents, which must be understood. In the same line there is a need to understand the NPD with reference to the emerging economies like India as they are fast becoming the manufacturing and service provider of the world.

Tight deadlines in projects veryoften create the sense of schedule pressure within the project team. High levels ofschedule pressure can endanger the performance of the project team by overcommitment, stress or other health problems as shown by Karasek and Theorell [9]; Campionet al. [10]; Carver [11]; Van Eerd[12]. Deadlines in projects regulate and help to structure the work through breaking down the project into a number of interim goals, defining the different courses of action, and anchoring those goals and tasks in time illustrated by Nordqvist et al. [13].

While the literature indicates that the way NPD is organized is important, very few studies have analyzed to what extent one or more stages in the NPD process may be outsourced.Despite the fact that NPD and outsourcing represent two of the most important issues facing a

firm'smanagement, the effects of outsourcing different parts of NPD have not attracted much attention in the literature so far as shown by Rindfleisch and Moorman,2001[14].Enabling a timely launch requirescapabilities and resources, organizational structures, the rightmix of people, and a supporting culture that allow an organizationto efficiently manage the product from concept to launch highlighted by Calantone& Griffith[15]. Researchers and managers have high interest in timeliness, time to market, cycle time, and acceleration or similar constructs that all dealwith some aspect of time and new product developmentas shown by Stalk and Hout, [16]; Wheelwright and Clark [1]. According to Kato [17] since much of the NPD activity is human dependent, reduced development time creates time pressures for the design engineers. Patricia and Bruggeman[18] agree that the combination of cost and quality with development time determines the success of a future product. Consequently, we investigate in this study the impact of schedule pressure on NPD and how it is related to the outsourcing decision an organization takes pertaining to new product development activities.

3. RESEARCH METHODOLOGY

In this paper we used an exploratory research to help formulate relevant questions that can be the basis of subsequent inquiries into the issues faced in NPD for auto component industry in India. This type of research is particularly useful when the researcher is uncertain of the theories that are relevant, and would like to seek insights and ask questions to assess the phenomena he has observed in a new light.The tools one may employ to conduct exploratory research include review of literature, surveys of opinion of experts and focus groups. In addition to the review of literature, this research is also based on the secondary data provided by the Automotive Components Manufacturers Association of India (ACMA), Society of Indian Automotive Manufacturers (SIAM).

The fieldwork was carried out in two stages. The first stage was carried through semi structured interviews of Indian auto component manufacturers. The main objective of this stage was to ascertain the issues pertaining to NPD practices in the Indian auto component industry and to investigate the main determinants associated with its implementation. A total of eight top managers in charge of NPD in different organizations were interviewed. Theduration of interviews varied from 90 to 120 minutes. This was supported by an exploratory questionnaire survey which was divided into two parts. The first part was essentially focused on issues related to the NPD for auto component industry in India such as motives, enablers and inhibitors. The issues discussed were to primarily determine the causes of schedule pressure and its severity in delivering the output in time. We tried to find answer to the following questions during the discussion.

Q1. To what degree has the time available for a new product development has decreased in last five years?

Q2. What are the main causes of this decrease in product development cycle time?

Q3. How much impact schedule pressure has on the overall outsourcing decision making process related to NPD projects

Major variables those came out of discussion those causes schedule pressure were Resource constraint, Multi project environment, Sharing & reallocation of resource , Scale of economy when deciding to add resources to organization, More rework in NPD process and Change management.

The second issue was to assess the relationship between schedule pressure in NPD and the outsourcing decision.Questions discussed were to determine if schedule pressure encourages outsourcing decisions.

Q1. Does outsourcing help in reducing schedule pressure?

Q2. Does outsourcing nullify the causes, responsible for schedule pressure?

Q3. Does outsourcing provide a long-term solution to address the issue?

Major variables those came out of discussion that impact outsourcing decision were Flexibility in resource management , Concurrent development, Flexibility in terms of rework & change management , IT enablement and Risk mitigation.

Once the variables were determined, the next stage was to design the final questionnaire.

The questionnaire consists of three sections. The first section characterizes the NPD projects for last 5 years in the organizations. The characterization section includes questions such as number of NPD projects, resource availability for NPD projects, completion time of NPD projects and outsourcing pattern of the NPD projects. The other two sections dealt with the causes of schedule pressure and its relationship with the outsourcing decision.

The scale items included in the questionnaire, their relevance, their wording and directions and the format of the questionnaire was refined based on the comments from the practitioners. Five point Likerttype items were used to operationalize all constructs. All items were scored so that higher numbers reflect increases in underlying constructs. Traditional psychometric approaches were used to evaluate each scale's reliability and validity [19]. They included correlation analysis, reliability evaluation and principal component factor analysis using varimax as the method of rotation. Factor analysis results and reliabilities are included in Appendix1. Reliabilities for all variables were evaluated via item to total correlations and Cronbach's alpha coefficient [20]. All items to total correlations are above 0.5. Cronbach's alpha coefficients showan acceptable figure. All the items meet standards for convergent validity (i.e., all items load on unique components with factor loadings larger than 0.5). In summary, the evidence provided in these analyses suggests that the measures included in this study possess sufficient reliability and validity to proceed with testing.

We employed judgmental sampling technique to collect data to ensure that responses are gathered only from people with experience (direct/indirect) in NPD in auto component industry. For the current study, target population includes

- Employees of major tier one auto component manufactures who have direct or indirect experience in NPD & outsourcing
- Consultants with experience in auto industry

The structured questionnaire was sent out to 260people out of whom 227 responses were finalized for study purpose. The data collected through questionnaire was analyzed through SPSS 17.

4. RESULTS

4.1 Reasons for Schedule Pressure and Outsourcing

For data analysis, one sample t-test was conducted. Table 1and 2 presents the parameter estimates and the t-values.

Table 1: Reasons for schedule pressure

					95% Confidence Interval of the Difference	
	T	Df	Sig. (2-tailed)	Mean Difference	Lower	Upper
Resource_constraint__SP	-2.451	226	.015	-.093	-.17	-.02
Sharing_SP	-1.016	226	.311	-.062	-.18	.06
Scale_of_economy__SP	-.483	226	.630	-.022	-.11	.07
flexibility_SP	2.101	226	.037	.084	.01	.16
Resource_allocation_SP	-5.137	226	.000	-.330	-.46	-.20
Concurrent_engineering_SP	.956	226	.340	.035	-.04	.11
Dividing_NPD_cycle_SP	10.567	226	.000	.370	.30	.44
feedback_mechanism_SP	.075	226	.940	.004	-.11	.12
IT_SP	1.259	226	.209	.070	-.04	.18
high_autonomy_SP	-13.841	226	.000	-.595	-.68	-.51
rework_in_NPD_SP	-12.970	226	.000	-.824	-.95	-.70
change_management_SP	.097	226	.923	.004	-.08	.09

Based on the one-sample t-test, following reasons are found to be major causes of schedule pressure on NPD: Resource Constraint, flexibility in resource management, Resource allocation in initial stages of NPD, Dividing NPD cycle in to increasingly smaller discreet components, high autonomy and rework in NPD projects.

Table 2: Major benefits from outsourcing

					95% Confidence Interval of the Difference	
	T	Df	Sig. (2-tailed)	Mean Difference	Lower	Upper
resource_constraint_OS	-5.528	226	.000	-.247	-.33	-.16
sharing_reallocation_OS	-1.129	226	.260	-.048	-.13	.04
scale_of_economy_OS	-13.411	226	.000	-.639	-.73	-.54
flexibility_OS	-1.061	226	.290	-.053	-.15	.05
resource_allocation_OS	-15.008	226	.000	-.872	-.99	-.76
concurrent_engineering_OS	-11.909	226	.000	-.758	-.88	-.63
Dividing_NPD_cycle_OS	-1.117	226	.265	-.048	-.13	.04
feedback_mechanism_OS	-18.597	226	.000	-.956	-1.06	-.85
IT_OS	-8.611	226	.000	-.476	-.58	-.37
autonomy_OS	-18.783	226	.000	-1.009	-1.11	-.90
rework_in_NPD_OS	-11.052	226	.000	-.731	-.86	-.60
change_management_OS	-14.354	226	.000	-.841	-.96	-.73

Based on the one-sample t-test, the major benefits of outsourcing NPD activities are found to be sharing and reallocation of resources , more flexibility in resource management and dividing NPD cycle in to smaller discreet components.

4.2 Relation between schedule pressure & outsourcing

To find out the relationship between schedule pressure and outsourcing decision a multiple regression test was run with “Increase in outsourcing activities” as dependant variable and “increase in no. of NPD projects”, “increase in NPD projects running simultaneously” & “Decrease in NPD cycle time” as independent variables. The results are shown in Table 3 and 4.

Table 3: Regression Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.501[a]	.251	.241	.613	.251	24.941	3	223	.000	2.190

Table 4: Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.343	.111		12.115	.000
	Decrease_in_NPD_time	.269	.046	.564	5.893	.000
	increase_in_NPD_proj	-.124	.081	-.232	-1.524	.129
	Increase_in_simulatnious_proj	.002	.099	.004	.021	.984

Based on the test we found out thatmultiple correlation coefficient is found to be 0.501.Rsquare is found to be .251. Hence 25.1% of variability in outsourcing decisions is explained by these three variables.If we look at the significance of the independent variables only “Decrease in NPD cycle time” is found to have an impact on outsourcing decisions.

5. DISCUSSION

Based on a sample of 227 executives of auto component industry in India, the results of this study notably shed light on the issues related to NPD. The research highlighted the major causes of schedule pressure on new product development in auto component industry and its impact on outsourcing decision. The major findings of the study are:

- Not being able to divide NPD cycle in to smaller discreet components and less flexibility in resource management are found to be the major causes of schedule pressure. This leads us to conclude that organization which are able to divide the NPD cycles into a combination of smaller activities and flexible in juggling its resources are better prepared to handle the increasing schedule pressure on its NPD
- Analysis also revealed that lack of concurrent engineering, lack of feedback mechanism,improper change management &lack of IT infrastructure are other major causes of schedule pressure.

- Sharing and reallocation of resources, more flexibility in resource management, enabling NPD cycle to be divided into smaller discreet components are found to be major benefits of outsourcing.
- It can be observed that the major two causes of schedule pressure i.e. "Not being able to divide NPD cycle in to smaller discreet components & less flexibility in resource management" can be overcome by outsourcing as these are two of the three major benefits of outsourcing as found out from the analysis.
- From the regression analysis it is found that 25.1% of the variability in the outsourcing decisions can be attributed to the causes related to schedule pressure with "Decrease in NPD cycle time" being the only significant independent variable. There is no significant relationship between outsourcing activities and increase in no. of NPD projects and the number of NPD projects running simultaneously. This seems somewhat counterintuitive in light of the intensive interest of practitioners and academics to understand the relation between NPD and outsourcing decisions. To sum it up, survey results indicate that outsourcing of NPD activities can help in addressing two of the major reasons of schedule pressure. However only 25.1% of variability of the outsourcing decisions is found to be explained by these variables. Hence we can conclude that though schedule pressure is a prime influencer in taking outsourcing decisions there are other factors in financial and strategic domain that influence the final decision.

6. IMPLICATIONS AND CONCLUSION

Our sample is carefully drawn from a population and therefore includes the people who have been dealing with the issues of NPD. Therefore our research acknowledges the schedule pressure in NPD faced by the firms and the possible solution in terms of outsourcing. In other words, the result sheds light on the importance of outsourcing as a contextual variable in NPD process. Additionally the present study is sensitive to issue pertaining to schedule pressure in contemporary NPD and the possible solutions adapted by the organizations.

Having illustrated that certain factors are more relevant as context in NPD process of auto component sectors, it provides guidance for the NPD process in this sector. This may help the decision makers in this sector to understand which factors are relevant. Our findings reveal relationship between schedule pressure in NPD and outsourcing. Hence schedule pressure and outsourcing are contextual variables that NPD decision strategies need to account for. This finding is consistent with the literature on New Product Development.

The objective of this research was twofold: (1) To provide a detailed operationalization of the schedule pressure in NPD; and to (2) to examine the relevance of outsourcing to resolve schedule pressure issues in NPD.

First, the article contributes to the research on NPD by providing a detailed operationalization of the schedule pressure in NPD. Building on a thorough examination of the NPD taxonomies proposed in the literature as well as on interviews with practitioners, we compiled and empirically validated constructs.Second the findings support the assumption that there are association between schedule pressure and the outsourcing decision, that is, these are relevant contextual variables in strategic NPD decisions. Overall, the data reveal a significant, but rather low impact of schedule pressure on outsourcing decision in NPD.

Several managerial implications can be deducted from this study. First, schedule pressure has a significant impact on NPD process. Thus, decision makers should turn their attention to the

management of schedule pressure and bear in mind an acceptable cost benefit trade off in dedicating resources. A focus on outsourcing clearly appears to be a solution in this line.

The two major reasons of schedule pressure as per the findings of the study are not being able to divide NPD cycle in to smaller discreet components and less flexibility in resource management. These issues if addressed carefully can speed up the product development cycle.

Companies can address these concerns with a good experienced program management team. Organizations can have traditional departments as per functions or something like center of excellence to carry out research or develop excellence for a particular domain. For a particular product development a cross functional team per product with a "Project Organization" structure is advisable. This will not only help in dividing the complete project in to smaller activities, but also the dedicated project team will be able to track each activities project wise and can easily decide the activities that required to be outsourced. With the project team breaking down the activities in to around five to six levels will also help in performing many activities in parallel. But companies must find an optimum level of breaking the activities in order to strike a balance between the benefits of concurrent engineering and the burden of change management and feedback loop for each activity.

Early and effective integration of suppliers in the Organization's NPD process will also add to the flexibility in resource management. Early supplier integration can help in completing long lead activities at supplier end such as tool development or purchasing related activities. This will help in concurrent engineering and a better change management process which are the other major causes of schedule pressure as per the findings of the study.

Strategic alliances with universities, government organizations and other agencies can also reduce the schedule pressure as activities like testing or research activities can be outsourced to some universities or agencies as it will address the issues like resource management and speed up the concurrent engineering activities.

The use of IT tools such as SAP, PDM can create a better change management system in the organization. IT can also be used to develop a better feedback mechanism that can be customized to suit the way particular organization works.

By addressing the key findings of the study such as; dividing NPD cycle in to smaller discreet components, less flexibility in resource management, concurrent engineering, better change management and feedback mechanism with the help of a dedicated project management structure, initial involvement of suppliers, strategic alliance with different institutes and IT usage can reduce the schedule pressure and help in taking outsourcing decisions and managing outsourcing activities.

Several areas of future research can be highlighted. As described above, the data for this survey were collected from auto component industry in India. Therefore, the results hold only true for comparable firms based in countries with similar setting. Therefore, a replication of this survey in other sectors like pharma and electronics where new product introduction rate is fast would be a consequential next step. Also, a replication of the survey in other countries with presumably different settings can be would be highly interesting.

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Appendix 1

Items	Number of Items	Cronbach alpha	Factor loading	Item to total correlation
What are the major causes of schedule Pressure (SP) on NPD in auto component industry?	12	0.722	0.834	0.798
Resource constraint is a major factor in increased SP			0.809	0.712
Sharing & reallocation of resources in multi-project environment adds to SP			0.713	0.668
Scale of economy is a major concern while adding new resource More flexibility in resource management helps in handling SP			0.698	0.578
Resource allocation in initial stages of NPD helps in minimizing SP			0.734	0.692
Concurrent engineering has helped in minimizing SP of NPD projects			0.830	0.788
Dividing NPD cycle in to increasingly smaller discreet components helps in minimizing SP			0.705	0.598
A better feedback mechanism helps in minimizing SP			0.678	0.586
IT has helped in minimizing SP			0.690	0.599
Projects with high autonomy can better handle SP			0.767	0.712
Number of rework in NPD projects has increased due to SP	12	0.746	0.841	0.790
Better change management helps in minimizing SP			0.806	0.788
			0.788	0.722
			0.710	0.688

What are the relationship between schedule pressure and outsourcing decisions related to NPD?			0.708 0.809	0.598 0.798
Outsourcing has helped in managing resource constraint			0.852	0.803
Outsourcing has helped in managing sharing & reallocation of resources in multi-project environment			0.658 0.688	0.566 0.589
Outsourcing has helped in addressing the issue of scale of economy related to resource management			0.732 0.624	0.698 0.522
Outsourcing has helped in adding more flexibility in resource management			0.608 0.822	0.504 0.786
Outsourcing has helped in resource allocation in initial stages of NPD projects			0.738	0.699
Outsourcing has helped in better managing concurrent engineering				
Dividing NPD cycle in to increasingly smaller discreet components encourages outsourcing				
Outsourcing has helped in establishing a better feedback mechanism				
IT has made "managing outsourcing activities" a lot easier				
Outsourcing has helped in adding autonomy to NPD Projects				
Outsourcing has helped in handling increasing number of rework in NPD projects				
Outsourcing has helped better change management				
A good outsourcing mechanism of NPD				

activities creates a long-term advantage over competitors in handling schedule pressure Outsourcing helps in minimizing risk associate with SP				

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