An Empirical Assessment of the Extent and Intensity of User Involvement in the Early Stages of New Product Development

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ABSTRACT

In recent years, there has been an emerging consensus in the literature that interacting with users in the early stages of product development can be a valuable means of increasing the likelihood of success. Yet little is known about the overall current state of practice. This empirical study investigates the extent and intensity of involving users in these stages through the analysis of 572 telephone surveys, and 50 postal questionnaires of companies from the initial sample who actually involved users. The results demonstrate that the involvement of users in these critical early stages only occurs to a minimum extent. Additionally, intense user involvement was the preserve of the few. Results also indicate that intense user involvement in certain stages has a positive impact on the performance of the process. Implications of these findings for managers are also discussed.

INTRODUCTION

Developing a product that delivers superior benefits presupposes an understanding of user[2] needs and wants, a process that should ideally be undertaken prior to the commencement of any actual development [1, 2]. Without this up-front user knowledge, significant problems in later stages of the development process can be expected including likely product failure [3, 4]. However, user-need information can be costly, complex and often sticky [5, 6]. Moreover, in business markets, conventional market research tools are often of limited utility. Due to the relatively small number of users, many companies in these markets tend to involve individual customers in their development process, rather than engage in a large-scale survey of user requirements. Indeed, a number of theoretical and empirical studies have implied that coordinating new product development activities and resources with users in the stages prior to actual development (idea generation, screening, preliminary assessments, concept development and testing) can be a valuable means of enhancing the development process and increasing the likelihood of product success. While it would be erroneous to attribute product success to any single factor, evidence does suggests that interacting with industrial users in these predevelopment stages can provide firms with a competitive advantage through the provision of innovative and appealing new product concepts [7, 8, 9, 10, 11, 12. 13, 14]. Others [15, 26, 17, 18] suggest that user involvement can also reduce need uncertainty by supplying manufacturers with a more accurate assessment of user requirements and consequently reduce the potential risks of miss-fitting buyer needs to a deficient or poor product idea [19]. Additionally, the involvement of users in predevelopment

[1] This study forms part of an investigation into the sub-processes that enable early user involvement in industrial product development. The theoretical framework from the study and the current paper were presented at previous IMP conferences.

[2] In this paper, the term ‘user’ is employed in the context of a business-to business relationship and refers to companies who do not manufacture an innovation but incorporates it to the assembly of a finished product or process [39; 16]. The concept of user involvement refers to the process of interaction between the manufacturer and their industrial users. We provide this definition clarification because in the literature, the term user involvement has also being used in the context of end users being involved in the product development of consumer products [61] and also in an intra-organisational context [17; 21].

activities has been positively associated with accelerating the development process [15], reducing costs [20], stimulating inter-functional communication [21] and making the development process more effective and efficient [1]. Much of the literature on the involvement of industrial users in the development process has been positive [22] and generally implies that contact with users early on in the process results in a higher probability of commercial success [15, 23, 24, 25, 26, 27].

However, despite the enthusiasm for user involvement in predevelopment activities, evidence also suggests that many projects enter the development phase lacking any clear definition, often as the result of no customer involvement [15, 23, 28, 29, 30]. Numerous reasons have been proposed as an explanation for why companies fail to incorporate users in to their development process, including the lack of desire, discipline, time and organisational structure [31]. Other evidence suggests that many firms may not involve users due to the customers limited domain of expertise [32], the generation of inaccurate or unrepresentative feedback [33], the inability of customers to articulate the right kind of knowledge [34, 35] and the belief that user developed concepts tend not to be innovative or creative [36].

This raises an interesting research question: if the involvement of users in the early phases can eliminate some of the potential pitfalls associated with product failure, then why does evidence suggest a slow up take of the phenomenon among practitioners? We view this apparent contradiction as an indication that an empirical investigation is warranted. Despite the growing body of theory, there has been relatively little empirical research reported that details the current state of practice of user involvement in the early stages of product development. Indeed, the primary focus of industrial user involvement studies has been on the macro analysis of sources and patterns of innovations within industries [7, 8, 9, 10, 37, 38, 39] rather than focusing on the interaction that is occurring between the actors. From the literature, it is unclear if the practice of user involvement is widespread or what level of intensity the involvement entails within individual phases of development. Moreover, it is also unclear as to what predevelopment activities users are involved in? And what the consequential effect early user involvement has on the subsequent product development process? This knowledge deficit has implications for both practitioners and researchers. Without a clearer understanding by academics of the current extent to which the user involvement concept is being adopted in practice, a gap may be present between what academics are prescribing and what practitioners are practising. Involving users without an understanding of how intensely they are engaged can lead to a misapprehension of the importance of the interaction to the new product development process. The consequential effect of this knowledge deficit is that the effort of actually collaborating with users in practice will be even more difficult to achieve.

To address this gap in the literature, this paper reports an investigation in to the extent and intensity of user involvement in the early stages of product development. The rest of the paper is organised as follows. In the next section, the methodology employed in this research is discussed and subsequently, the results of that analysis are presented. In the concluding section, managerial and academic implications are explored. Limitations and future directions for research are also discussed.

RESEARCH DESIGN

Research Approach – Overview

The research presented in this article is based on a structured telephone survey[3] utilised to determine how widespread the practice of involving users is in the early stages of new product development. This was followed by a mail questionnaire investigating the intensity of that involvement within those stages. The justification for adopting this research approach was grounded in two rationales. First, by conducting a telephone survey initially, the researchers were able to contact a large number of respondents within a relatively short time period and identify those companies not only engaging in new product development, but also those companies who were involving users in the early stages of their new product development process. This allowed the researchers to specifically target the appropriate research audience with a detailed questionnaire measuring the intensity of that involvement within the six predevelopment stages. Second, the initial telephone survey allowed us to (i) identify key informants (ii) assess the informant's ability to serve as a key informant in terms of their position within the company and also their knowledge about the content of the enquiry (iii) to obtain cooperation and (iv) to verify mailing addresses. As detailed by numerous studies, the key informant approach allows researchers to gain access to rich information by collecting it from those who are highly knowledgeable about the phenomenon under investigation [19, 40].

PHASE 1

Sample and procedure

Companies for inclusion in the first research phase were selected from a Kompas Ireland database, which consisted of 2842 manufacturing companies dispersed across eight industries. Managing directors and new product development managers were selected as ideal respondents for this study because of their high level of knowledge about the company and its new product development activities [41]. The survey was conducted over a three-month period and to ensure high contact-ability of respondents call-backs were made at different times and on different days. A call record was meticulous maintained throughout the entire process as it allowed the researchers to organise questionnaires into their appropriate category, such as refusals, completed interviews, disconnected numbers, call backs at particular times or dates and so redundant calls were avoided [42]. After five failed attempts of contact, the company was considered a non-respondent. From the database, 1400 companies agreed to be interviewed of which 638 (46%) were actively involved in new product development. Only those companies that engaged in new product development activities in Ireland were included in the analysis. This process eliminated 66 firms, giving a population total for the sampling frame in phase one of 572 (638-66) firms. Further details of the respondent sample are contained in Table 1.

Although the response rate to the telephone survey compares favorably with recommended levels [42] the potential for non-response bias cannot be ignored. Following guidelines recommended by Armstrong and Overton [43] a series of analytical tests were conducted to overcome non-response bias. First, a comparison

[3] The primary objective of the telephone questionnaire was to assess the current practice of involving users and other third parties such as suppliers, competitors and research institutes in the development process. The research reported in this paper focuses on just one aspect of that study: the involvement of industrial users in the early stages.

was made of known demographics of respondent and non-respondent companies (industry and company size). Information was extracted from the Kompas Ireland database. The low chi-squares and the high probabilities suggest a lack of significant differences. Second, non-response bias was also examined through an extrapolation method of comparing early (responded in the first six weeks) with late respondents (responded in the last six weeks). The tests did not indicate any bias due to non-response.

Table 1: Respondent Sample Details

CHARACTERISTICS	Respondents %	CHARACTERISTICS	Respondents %
Nature of Business		**Turnover (2003)**	
Pharmaceutical/ Chemical	18.4	Under €5 million	65.4
Electrical and Electronic engineering	14.5	€5 million - €9.99 million	17.7
Industrial Machinery	28.8	€10 million – €19.99 million	9.3
Food, Tobacco & Beverages	11.7	€20 million - €49.99 million	5.1
Metal Manufacture	11.4	€50 million - €99.99 million	.8
Timber, Furniture & Paper	8.9	€100 million plus	1.7
Telecommunications	4		
Others	2.3	Companies engaged in continuous NPD	71.3
Number of Employees		Companies engaged in occasional NPD	28.7
1-50	66.1	Companies with formal NPD departments	37.6
51-100	15.7		
101-200	10	**Ownership**	
201-500	5.8	Irish Owned	80
501-999	1.5	Foreign owned	20
1000 plus	.9		

(n=572)

Questionnaire measurement

The telephone questionnaire was designed to ensure quick and easy answering by the respondent (approx. 10 minutes) and also to ensure easy administration and accurate coding of the responses by the interviewer [42]. Since a telephone survey relies on oral communication, it was necessary to keep the questions short and simple and so avoid misunderstandings, question repetition, response complexity and fatigue [42]. In addition, response categories were limited to a maximum of four choices. A systematic pre-test design was followed. First, the questionnaire was submitted to a group of academics who understood the nature of the study and so were in a position to evaluate the ability of the questionnaire to achieve its objectives and also provide feedback on question format and design. An iterative pre-test was then conducted over the telephone with 50 companies selected at random from the database. Feedback from the first iteration of pre-test calls, were used to make immediate revisions. The next iteration of calls used the revised format and so on, until a sound research instrument was developed. The final questionnaire consisted of closed and open-ended questions and was divided into three sections: the first section contained a number of screening questions that is questions that apply to some respondents and not to others. The next section asked questions related to whether the respondent involved users in the development process and the stage(s) in which they participated. Using an open question format, respondents were also asked why they involved or did

not involve users in predevelopment activities. The final section contained a series of classification categories.

PHASE 2

Sample and procedure

In the second phase of research, a mail questionnaire was administered to those companies identified in phase 1 as involving industrial users in the early stages of development (n = 68). Each informant was mailed a cover letter, a questionnaire and a prepaid self-addressed envelope. As an incentive for completing and returning the questionnaire, respondents were promised a report summarizing the major findings of the study. Three weeks after the initial mailing, a reminder letter with a replacement questionnaire was mailed out to non-respondents and this was followed one week later with a telephone call. An additional wave of survey materials was sent to informants who had not replied within six weeks, with a telephone follow-up conducted the following week. One company e-mailed back stating that the key informant was unable to participate due to health reasons. Additionally, during both iterations of telephone follow-ups*, two respondents expressed regret at not been able to participate as their work commitments took priority [*10 non-respondents were contacted by phone or e-mail and in most cases respondents stated that they had the best of intentions to complete and return the survey but had been too busy, the other non-respondents could not be contacted]. 51 surveys were returned. One survey was removed from consideration due to incomplete data, giving a 75% response rate. Following the same procedures as detailed in phase one, analytical tests were conducted to overcome non-response bias [43]. First, a comparison was made of known demographics (industry, company size, turnover, development spend) of respondent and non-respondent companies which was extracted from the Kompas Ireland database and classification data gathered in phase one of the research project. Second, non-response bias was also examined through comparing early (first 60% returned) with the remaining 40% of respondents who were considered late and representative of non-responding firms. The tests did not indicate any significant differences.

Questionnaire measurement

In respect of the specific objective of measuring the intensity of user involvement within each of the early stages of new product development, a new scale had to be developed. Very few studies have actually investigated the level of customer involvement within the early stages of product development [8, 15, 44, 45, 46, 47, 48] and as detailed by Ives and Olson [17], there are measurement problems associated with how the intensity of user involvement was assessed. Previous scales tend to use single item measures and generally do not differentiate between involvement in different stages of the development process. Questions of measurement validity and reliability are not normally addressed and the intensity of user involvement is often associated with the number of users or project duration rather than on the degree of influence the user had in the development project [17]. This is a particularly critical issue since user involvement has been shown to be more complex than examining the number of users or frequency of contacts; it implies examination to the depth of those interactions [16].

Therefore, following Hinkin [49], a multi-item measure of the user involvement construct was developed. However, it should be noted that the scale is still at an early

stage of development. First, based on an identified and defined construct from the literature, tentative items were either borrowed or developed from the existing literature. Next, to establish content validity, the construct and items were presented to three academics for sorting. As pointed out by Schriesheim and Hinkin [50] and Hinkin [49] sorting is a cognitive process that requires intellectual ability rather than work experience and so the use of academics at this stage of scale development is appropriate. The academics were asked to state which items in the construct they believed represented the domain of the concept being measured and also if there was any other items that should be included. Conceptually inconsistent items were deleted from consideration.

The next issue of concern related to the structure of the measure. Negatively worded items were not used as previous research had shown them to reduce the validity of the questionnaire response and that they may also introduce systematic error to a scale [51, 52]. Consideration also had to be given to the number of items in the scale, as too few minimises response biases but may lack content and construct validity and too many creates response fatigue or response biases [53, 54]. At this stage of scale development, the number of items for consideration was 8. This number compares favourably with the recommended length of 5-7 items [50]. An additional test for face validity was then conducted at a conference with researchers in the area. This procedure indicated that the items that were supposed to measure the concept did on the face of it look like that they were measuring the concept. Following good practice, depicted by Li and Calantone [19], interviews were then conducted for item refinement. Five NPD practitioners were asked to comment on the relevance and clarity of the measure and the items were refined accordingly. The intensity of user involvement was measured by six items on a five-point Likert scale (two items were eliminated after scale purification). The application of the scale to all six stages under investigation meant that comparisons could be made across all stages.

A pre-test was then conducted with 9 companies and respondents were asked for their suggestions for improving the survey instrument and items were refined accordingly. Finally, the questionnaire was subjected to a detailed review by a panel of academics and practitioners, which resulted in minor modifications such as the order of questions or the use of standard terminology (for example: terminology such as “early stages” were used in some questions, while in others the term “pre-development” was used). In general, the pre-test and the panel review demonstrated a sound research instrument. The final questionnaire contained the key construct intensity of user involvement, a predevelopment performance outcome and a set of control variables.

A five-item scale was used to measure the performance outcome of the predevelopment stages. Informants were asked to assess the extent to which the involvement of customers in the early stages resulted in good concepts proceeding to development, reduced costs, accelerated the development process, ensured a strong understanding of customer requirement and made the development process more responsive to customer needs. This measure borrows from the work of Biemans [46] and displays good reliability (alpha = .71). A series of variables were also included to improve validity by controlling for the type of new product development, market competitiveness, customer demandingness, customer dependence and the length of the relationship. These variables did not have any statistically significance in relation to intensity of involvement (two-tailed t-tests, $p<.05$).

Measure purification

For measure purification, internal consistency was examined through a series of conventional diagnostic methods such as item-to-total correlations, inter-item correlation and coefficient alpha [55]. In addition, exploratory factor analysis with varimax rotation was applied to scale items to assess unidimensionality [56].

Table 2. Reliability Analysis

Scale	Items	Coefficient Alpha
INTENSITY OF CUSTOMER INVOLVEMENT		
Idea Generation	The level of contact frequency with customers was high	.88
	The frequency of communication exchange with customers was high	
	The intensity of customer interaction was high	
	The degree of responsibility held by the customer was high	
	Activities in this stage were jointly performed	
	The perceived contribution of customers was high	
Idea Screening	See above	.87
Preliminary Market Assessment	See above	.88
Preliminary Technical Assessment	See above	.95
Concept Development	See above	.94
Concept Testing	See above	.95
PREDEVELOPMENT PERFORMANCE OUTCOME		
	Ensures that only good concepts proceed to development	.71
	Reduces the cost incurred in actual product development	
	Accelerates the development process	
	Ensures a strong understanding of customer requirements	
	Makes product development more responsive to customer needs	

The item-to-total and inter-item correlations for the items in each scale was examined and items with low correlations that did not exceed the generally acceptable cut-off levels of 0.5 and 0.3 respectively were deleted from consideration [57]. Table 2 describes the items and presents the Cronbach's alpha for each intensity construct and also for the predevelopment performance outcome scale. Examination of the coefficient alphas show that all exceeded Nunnally's 0.7 threshold value [58] or Hair et al's recommended 0.6 value for exploratory research [59]. Exploratory factor analysis was conducted for all scales (for the intensity scale, factor analysis was conducted separately for each predevelopment stage). The analysis revealed that the items loaded highly on a single factor, which provides support for the unidimensionality of the scales [56].

PHASE 1: RESEARCH FINDINGS AND DISCUSSION

The practice of user involvement

The first aspect of this research to be examined concerns the practice of user involvement, explicitly the percentage of respondents in the overall study that actually involve users in the predevelopment phases. As can be gathered from Table 3, the practice of involving users in the early stages of product development only occurs to a

minimum extent. From the 572 companies interviewed in phase one, only 13.5% or 77 firms indicated user involvement in predevelopment activities.[4]

When analysed by industry sector we can see that *Industrial Machinery* has the highest overall percentage of companies engaging in the practice at 3.3% followed by *Electrical and Electronic Engineering* (3.1%), *Food, Tobacco and Beverage* (1.9%), *Metal Manufacture* and *Pharmaceutical\Chemical* at 1.9% and 1.6% respectively. Considering that these industries account for approximately 80% of total expenditure on R&D in the industrial sector in Ireland [59] and given the strategic importance the literature assigns to the involvement of users in predevelopment activities, the low extent to which companies engage in the practice is disconcerting. Table 3 also highlights the various product development stages in which companies reported user involvement. 8.4% of the companies stated that they involved users in the generation of product ideas, while 7.9% of respondents involved users in the screening of ideas, 7.5% in preliminary market and 6.9% in technical assessment. In 6.1% of responses, companies involved users in the identification and development of product concepts. The highest percentage of companies involving users was in the testing of the concepts (9.3%). The main reasons cited for involving users in these early stages are presented in Table 4.

[4] As stated earlier, the original purpose of the telephone survey was to assess how widespread was the practice of involving external parties in the new product development process and so information was gathered not only on the extent of user involvement in the early stages but also in relation to other third parties such as suppliers, competitors and research institutes. Although slightly outside the remit of this paper, it is interesting nevertheless to note the comparisons between the extent of involvement of industrial users in the early stages with these other third parties and so place this research within the appropriate context. As shown in the table below, from the 572 respondents, 229 or 40% of the companies involved an external party in the early stages of their product development process. Various kinds of third parties were found to be involved including users from consumer markets (21.5%), suppliers (15.4%), competitors (5.9%), research institutes (2.6%) and others such as government agencies and consultants (1. 8%).

Table: Comparison of Involvement of Users and Third Parties in the Early Stages of New Product Development

Involvement with…	**Occurrence of involvement in predevelopment**		**The Occurrence of Involvement of different parties during the early stages of product development**											
			Idea generation		**Idea Screening**		**Pre. Mrk. Ass**		**Tech. Mrk Ass**		**Concept Development**		**Concept Testing**	
	No.	**%**	**No.**	**%**	**No**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Industrial user	77	13.5	48	8.5	45	7.9	43	7.5	40	6.9	35	6.1	53	9.3
User from consumer. Mrk.	123	21.5	90	15.7	41	7.2	33	5.8	21	3.7	29	5.1	38	6.6
Competitor	34	5.9	26	4.6	12	2.1	6	1.1	6	1.1	9	1.6	9	1.6
Supplier	88	15.4	57	10	25	4.3	19	3.3	22	3.9	28	4.9	30	5.3
Research Institute	15	2.6	12	2.1	6	1.1	4	.7	3	.5	8	1.4	2	.4
Others	10	1.8	7	1.2	4	.7	2	.4	1	.2	1	.2	0	0
Total	**229**	**40**	**169**	**29.6**	**90**	**15.7**	**84**	**14.7**	**71**	**12.4**	**80**	**13.9**	**105**	**18.4**

n=572

Table 3: The Extent of Industrial User Involvement in the Early Stages of New Product Development

Industry	No. of companies sampled	No. of companies that involved users in predevelopment stages	% of User Involvement by Industry %	Total percentage of user involvement n=572	Breakdown of User Involvement by Predevelopment Stage											
					Idea Generation		Idea Screening		Preliminary Market Ass.		Preliminary Tech. Ass		Concept Development		Concept Testing	
					No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Pharmaceutical / Chemical	104	8	7.7	1.4	5	4.8	5	4.8	7	6.7	6	5.8	5	4.8	7	6.7
Electrical and Electronic Engineering	82	18	22	3.1	12	14.6	12	14.6	9	1.6	11	13.4	8	9.8	11	13.4
Industrial Machinery	164	19	11.6	3.3	12	7.3	10	6.1	6	3.7	7	4.3	6	3.7	11	6.7
Food, Tobacco and Beverage	68	11	16.2	1.9	6	8.8	5	7.3	8	11.8	6	8.8	7	10.3	9	13.2
Metal Manufacture	64	9	14	1.6	6	9.4	7	10.9	7	10.9	6	9.4	4	.6.3	8	12.5
Timber, Furniture and Paper	51	4	7.8	.7	2	.3.9	0	0	1	2	0	0	0	0	2	3.9
Telecommunications	25	6	24	1.1	4	16	4	16	4	16	3	12	4	16	4	16
Others	14	2	N/a	.4	1	7.1	2	14.3	1	7.1	1	7.1	1	7.1	1	7.1
Total	**572**	**77**	N/A	13.5	48	8.4	45	7.9	43	7.5	40	6.9	35	6.1	53	9.3

Respondents noted a variety of reasons for involving users in predevelopment activities, with the users expertise and having a prior relationship with them being clearly cited as the most important by the majority of respondents. Also considered significant were reducing the costs and risks associated with actual product development by having users involved early on. A number of respondents also identified close proximity and technology as important.

Table 4: The Major Reasons for Involving Users in the Early Stages of product Development

Open ended question asked: What were the reason(s) for involving users in the early stages of product development ?

Reasons for involving users in Predevelopment Stages	% of Respondents mentioning factor
Because of an existing relationship	49
Because of their expertise	49
To reduce development risk	46
To reduce development times	35
Because of their reputation	35
To reduce cost	34
Because of close geographical proximity	13
Because of technology	7
Other	13

n=77

However, given that over 86% of the respondents had no user participation in the predevelopment stages, analysis was carried out on the reasons for the slow up take of the user involvement concept. Using an open-ended format, respondents (n=495; 572-77) were asked to indicate the major reason(s) for not involving users in any predevelopment activity. The responses obtained were categorised by the researchers and are presented in rank order in Table 5.

Table 5: The Major Reasons for not Involving Users in the Early Stages of product Development

Reasons for not involving users in Predevelopment Stages	% of Respondents mentioning factor
Other parties were involved	30
Product development is too specialised	22
In the early stages no additional skills outside the company are required	21
Of fears of sharing proprietary information	10
User involvement complicates product development making it more difficult to control and manage	9
Of issues of ownership	7
User involvement lengthens the development process	6
User involvement makes product development more costly	6

n= 495

As can be seen from Table 5, the main reason cited for not involving users in the early stages was that other third parties such as suppliers, users from consumer markets, research institutes, consultants were involved in predevelopment activities and therefore these companies felt that there was no need for industrial user participation (see footnote 3). This may partly be explained by previous research in the Dutch medical industry where Biemans [15] concluded that, while users are basically employed to provide user information, the involvement of third parties can be even more substantial in terms of their contribution such as in influencing

cooperation strategies, providing market information, funding research, providing highly specialised engineering and technological expertise, producing and testing components. The 22% of respondents mentioning that their product development was too specialised for user involvement also highlights this issue. Additionally, 21% expressed the view that in the early stages of product development no additional skills were needed outside the company, while the dangers associated with the dissemination of proprietary information and the issue of ownership were identified by 10% and 7% of the respondents respectively. Also identified as a significant reason for not involving users in the early stages was the belief that users would complicate (9%), lengthen (6%), and make the development process more costly (6%). Moving beyond the practice of user involvement frequency and the reasons for and against involvement, the intensity of user involvement was addressed.

PHASE 2: RESEARCH FINDINGS AND DISCUSSION

The intensity of user involvement

Given the substantial emphasis in the literature on early user involvement being a critical discriminating factor between product success and failure, the nature in which users were involved in the process was examined such as timing of user involvement, the number of stages users where involved in, and the number of users providing input into the various modes of involvement.

As shown in Table 6, of the 50 respondents in phase 2 of this research, 56% reported that the involvement of users began with the generation of ideas, 16% indicated commencement with the screening of ideas, a further 16% stated that involvement began with a preliminary assessment of the market, while 8% and 4% of respondents indicated that users first contributed to the development process in the concept development and concept testing stages respectively. Additionally, only 26% of the respondents involved users in all six predevelopment stages, while 18% involved users in both five and four stages respectively. The percentage of companies that involved users across three predevelopment stages was 12% and in two stages was 18%. Finally, of respondents, 8% involved users in only one stage. Another related question focused on the number of users involved in the early stages. An average of 5.28 users were involved in predevelopment activities, however this mean is skewed slightly by a few firms that involve a large number of users. The average firm tends to involve approximately 3 users in any particular predevelopment stage. Interestingly 70% of the respondents indicated that they used the same select few users in their development projects and that those same users are used throughout the process. The most frequently used mechanisms to involve users was through personal contacts (88%) and cross company teams (45%).

Table 6 also highlights that from the 50 development projects being analysed 46% were initiated by the user. Moreover, 50% of the respondents indicated that the decisions regarding the inputs or contributions of the participants to the early stages were made jointly by both the manufacturer and the user. However, in the majority of the development projects it is the manufacturer and not the user who manages the process.

Table 6. The Nature of User Involvement

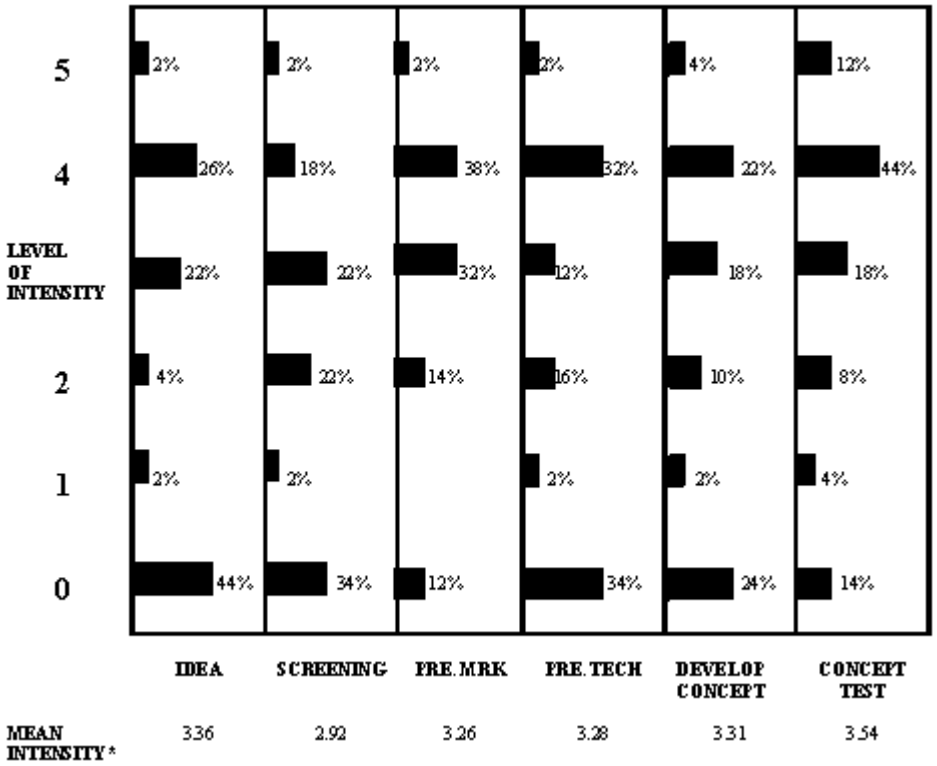
No. of stages users were involved in	1 stage		2 stages		3 stages		4 stages		5 stages		6 stages	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
	4	8	9	18	6	12	9	18	9	18	13	26

	Total		Idea		Screening		Prel.Mrk		Prel.Tec		Concept		Testing	
	No.	%	No.	%	No.	%	No.	%	No.	%	No	%	No.	%
User involvement commenced	50	100	28	56	8	16	8	16	0	0	4	8	2	4
Mean number of users involved	5.28		2.82		2.88		3.26		2.72		2.94		3.14	

	Total		NPD process initiated by				Control over the decisions regarding inputs						Predevelopment stages managed by					
Type of NPD			User		Manuf.		User		Manu.		Joint		User		Manuf.		Joint	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
New Product	26	52	12	46	14	54	2	8	13	50	11	42	0	0	20	77	6	23
Improved Product	24	48	11	46	13	54	0	0	10	42	14	58	0	0	20	83	4	17
Total	50	100	23	46	27	54	2	4	23	46	25	50	0	0	40	80	10	20

When examining the overall nature of user involvement in the predevelopment stages, the results tend to indicate that multiple user-manufacturer interactions occur throughout the process and that the users played an active role in terms of project initiation, decision-making and in some instances in the management of the process (20%). However the question still remains: to what intensity do companies actually involve their industrial users in the different predevelopment stages? As indicated in the methodology, for each company the intensity of user involvement by stage was measured based on the level of contact frequency; the degree of responsibility held by the user; the perceived intensity of the interaction; the frequency of communication exchanged; whether activities were jointly performed and the perceived contribution of the user. The summarised results of that analysis are presented in Fig 1. The diagram shows the occurrence in percentages of intensity of involvement and the overall mean intensity on a five-point Likert scale with 0 indicating no involvement, 1 representing the minimum level of involvement and 5 denoting the highest intensity of involvement. As is demonstrated above, with the exception of the second stage, the intensity of involvement typically increases during the predevelopment process; the number of companies with no involvement dropped from 44% in stage one to 14% in the final stage; also within the final stage is the highest percentage of companies involving users to an intense degree (56%). When examining the overall intensity for each predevelopment stage, it can be observed that all intensities except that of the idea screening stage (2.92) exceed the centre of the scale towards high intensity of involvement, with a peak of 3.54 in the concept testing stage. Yet to state that these companies involve their users to a high degree of intensity would be misleading. In general these findings indicate that companies involve their industrial users to a medium degree of intensity in the early stages of product development.

Fig 1. The Intensity of User Involvement in Predevelopment Activities



Interestingly, the stage with the highest number of companies involving users does not have the highest intensity of customer involvement. This reconfirms Gales and Mansour-Cole [16] and Ives and Olson [17] view that involvement intensity goes beyond the number of contacts.

PERFORMANCE IMPLICATIONS

In order to better understand how user involvement in the early stages affects the product development process, a detailed analysis of the responses to the predevelopment performance outcome measurement was conducted. From Table 7, it can be clearly seen that of the 50 respondents, the majority believe that user involvement in the early stages ensures a strong understanding of customer requirements and makes the product development process more responsive to customer needs.

Table 7: The Effect of Involving Users in the Early Stages on the product Development Process

How does user involvement in predevelopment activities affect the product development process ….	Agree / Strongly Agree %	Hard to say %	Disagree / Strongly Disagree %
Ensures that only good concepts proceed to actual development	66	16	18
Reduces the cost incurred in actual product development	62	22	16
Accelerates the development process	74	10	16
Ensures a strong understanding of customer requirements	90	6	4
Makes product development more responsive to customer needs	94	0	6
Makes the product development process complicated*	66	14	20
Makes it more difficult to manage and control the process*	66	16	18

n=50 * Items eliminated during purification

In addition, a high proportion of respondents also expressed the view that user involvement accelerated the development process and reduced the cost incurred

during the actual development and testing stages. While 66% felt that user involvement in predevelopment activities enhanced the likelihood of ensuring only good concepts proceed to development. While items 6* & 7* were eliminated during purification of the predevelopment performance outcome measure, it does not imply that these items are unimportant. It is interesting to note that while the majority of respondents did consider user involvement to be beneficial, they nevertheless felt that user involvement complicated the development process (66%) and made it more difficult to control and manage (66%). This finding illustrates the importance of managing the user involvement process.

However, in order to decide which of the analysed measurements of customer involvement intensity really have an influence on the predevelopment performance outcome, linear regression was used. The regression analysis showed that user involvement intensity in the idea screening (β = .696, p < .0005); concept development (β = .481, p < .0005); and concept testing (β = .695, p = .001) stages have a significant influence on the performance outcome of the predevelopment process (F = 63.908, p < .0005, Adjusted R square = .954). The R squared value is remarkably high indicating that most of the variation in the dependent variable is being explained by the independents. Collinearity diagnostics showed that the correlation between the independent variables was within the acceptable tolerance levels (between 0.01 and 1) as indicated by Brace et al [60]. Having high levels of user involvement in the idea generation, preliminary market and technical assessment stages were not found to be a significant influence in this model.

MANAGERIAL IMPLICATIONS AND CONCLUSIONS

The main purpose of this study was to empirically assess the current practice of involving industrial users in the early stages of new product development and through this provide a contribution to practice and theory. From the study, a number of important managerial implications arise. In general, the low state of practice indicates that the performance implications alluded to in the literature have not attracted a corresponding change in the practice of involving users. The results clearly indicate a reluctance to involve industrial users in the early stages of product development. The implication of this is that users may be an underestimated resource for companies and that a competitive advantage can be gained by manufacturers through increased interaction with their users during these critical stages. For instance, this research showed that of the 50 development projects that involved users, 23 were initiated by the user, and 12 of those were innovations. This indicates that managers should pay particular attention to users as a source of innovative and improved products [8]. In addition, the research also highlighted that early user involvement can enhance the development process by increasing the likelihood of sound product concepts proceeding to developmental stages and justifying their development in the first place.

With regards to the involvement of users, the findings indicate that managers can improve their product development processes through increasing the intensity of user involvement. In order to yield the most significant impact from the involvement of users in predevelopment activities, this research provides some insight into which stages customers should be intensely involved. The results encourage managers to involve users intensely in the screening of new ideas and in the concept development and testing stages. However, it was surprising that both the preliminary market and technical assessment stages yielded no significant impact on the predevelopment performance outcome. An explanation for this can be that due to the relatively small number of users in industrial markets, manufacturers tend to be familiar with their

target markets and so it may not be necessary to intensely involve users in these stages. Additionally, previous research has shown that it is normally the manufacturer and not the user who defines and determines the technical aspects of the product concept [15, 44, 48]. This does not imply that user involvement is not warranted in these stages, it merely emphasises that different intensities of user involvement are required in different phases. In other words, the development phase and the intensity of user involvement should be directly coupled with one another. If manufacturers do not distinguish between different user involvement intensities in different phases, they may end up spending as much time on co-ordinating and managing high intensity relationships in development phases that yield no significant contribution as they do on those that do yield a significant performance impact. This in turn has the implication that managers then need to understand how to effectively organise and integrate the involvement of users into their development process. However, this is a neglected issue in theory. With the exception of Biemans [15] very little empirical research has been devoted to how practitioners can actually achieve the potential advantages of involving users. Normative prescriptions that do exist tend to be few, broad in nature and often are so vague that their contribution is far from helpful.

In addition to these managerial implications, this research has also provided a contribution to theory through the development of a scale to measure the intensity of user involvement in the different stages. Albeit that the scale is still in the early stages of measurement development [52], its potential application to future research is strong, as it does incorporate and extend previous studies on user involvement. It is also important to view these results as a starting point in an ongoing investigation into user involvement in the product development process. While this study does provide preliminary insights into the nature and intensity of user involvement, it provides little insight about how best managers should incorporate users in to the process and even less insight into how the process should be managed. There is a need to understand the dynamics of user involvement in the early stages of new product development in order to provide managers with the process solutions needed to implement the concept. Understanding the processes that enable manufactures to successfully interact and involve users in the early stages is a key part of our research agenda. This ongoing research uses a social exchange view to understand intense involvement, which appears, from this study, to be the preserve of the view.

As is usual with survey research, this study has several other limitations, most notably the small sample size. This was in part a consequence of the phenomenon under investigation (that is the involvement of industrial users in predevelopment activities), and although the sample for investigation was systematically identified (from 1400 interviews 572 firms were identified as engaging in new product development activity; from these a total population of 77 companies were identified; 9 companies were used in the pretest; 68 surveyed; 50 responded), and the data rigorously scrutinized, the research, nevertheless, would have benefited from a larger sample size. Another limitation of the study is the exploration of the user involvement phenomenon from the sole perspective of the manufacturer. Future research could compare the data gathered from manufactures with data collected from the users.

Despite these limitations, the study does make an important contribution to theory and practice. In general our results show that for companies competing on the basis of product development, intense user involvement in those critical early stages has a clear and significant value.

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