The 'Double-Edged Sword' of High-Feature Products: An Explorative Study of the Business Impact

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Abstract

In high-technology consumer markets, manufacturers integrate a growing number of technologies and features to satisfy consumers' preference for high-feature products. At the same time, companies report an increasing number of consumer complaints and even product returns, not due to product faults but to usability problems and the product's inability to meet customer expectations. To investigate the potential business impact of these developments, we set up an exploratory case study with three different smart phones. Based on the unique selling points advertised by the manufacturers and a feature importance ranking made by the target customer group, we selected four different features. We further tested these features in a usability study with 43 subjects in total in a between-subjects design. A large number of user-product interaction problems that related to all four features were identified. Further analysis of these problems revealed that the products' complexities and a lack of adherence to design guidelines triggered this large number of problems. Our findings suggest that in high-technology consumer markets there is a need to integrate insights, methods, and perspectives of Marketing, Design, and Quality disciplines. Furthermore, cross-disciplinary research is necessary to integrate insights from those fields to adequately address this need.

Key words: Design, Marketing, Quality, Customer Complaint, Voice of the Customer, Consumer Electronics

Introduction

Technology advances at an exponential rate, making possible solutions and products not even dreamed of a decade ago (Cooper, 2001). In high-technology consumer markets, such as the market for Consumer Electronics (CE) products, manufacturers are integrating a growing number of these new technologies and features to satisfy consumers' preference for high-feature products. Fierce global competition in these markets has accelerated speed-to-market of new features and applications, because companies assume people will adopt new products that deliver more value or utility than the existing ones (Cooper, A., 1999; Gourville, 2006; Norman, 1998). As a result, there is an increase in complexity of CE products on two aspects:

- The embedded technologies, i.e. open systems, ambient intelligence, increasing software content (Siewiorek et al., 2004).
- The number of functionalities provided (Norman, 2007). For example, the television of today can be used to access the Internet, watch digital photos, and connect to a personal computer to watch downloaded movie content. Furthermore, because of the globalization of demand, these products require a high level of connectivity with other products and other brands.

Research has shown that companies report an increasing number of consumer complaints and even product returns for such products (Den Ouden et al., 2006), as is shown in Figure 1.

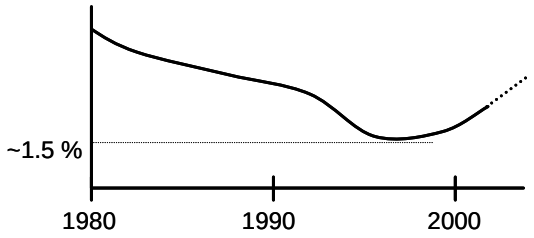

Figure 1: Average percentage of customers complaining about new CE products relative to the number of products sold worldwide (Den Ouden et al., 2006)

The increase in complaints is not due to product faults (i.e. not meeting product specifications), but to usability problems and the product's inability to meet consumer expectations (Den Ouden et al., 2006). This not only induces more costs for complaint handling and customer service centers, but also has a negative effect on consumer dissatisfaction, word of mouth, and even repurchase intention. Therefore, the goal of this paper is to obtain more insight into the potential business impact of these developments.

Developing new products that meet the needs and expectations of the consumer in itself is surely not a new topic. It does involve multiple disciplines related to New Product Development (NPD); Marketing for capturing and translating customer needs, Industrial Design for designing attractive and easy to use products, and Quality Management for ensuring excellent product quality from a customer's perspective. However, as discussed by Veryzer and De Mozota (2005), the relationships among the disciplines involved in NPD are very complex, and the integration of these disciplines can have a significant effect on a product's success or failure. In order to obtain more insight into the phenomena described above, we therefore set up an exploratory study with three different smart phones in which we took into account the perspectives of the multiple disciplines involved in NPD. We selected smart phones because they are complex, high-feature mobile communication products (Zheng & Li, 2006). Moreover, several market studies (Deluca-Smith, 2007; Overton, 2006) have shown that smart phones are particularly vulnerable to the developments discussed above.

The remainder of this paper is organized as follows. First, we will discuss relevant literature related to marketing, quality, and design disciplines. The gaps found in the literature review will be used to formulate two research questions. Secondly, we will discuss the set-up and results of a web survey with professional smart phone users and we will discuss the set-up and results of a quasi-experiment. Finally, we will discuss the overall results and we will conclude with managerial implications and directions for further research.

Literature Review and Research Questions

In this section we will discuss relevant literature related to marketing, quality, and design disciplines. Research on NPD success factors has shown that, among other things, providing unique features with excellent price / performance characteristics as well as excellent product quality are key to a successful product (Cooper, R.G., 1999; Cooper, 2005). Key to achieving this is capturing the Voice of the Customer with various market research techniques, translating the identified customer needs into design attributes, and subsequently performing detailed consumer tests and field trials to ensure the designed product is still meeting the needs of the target customer group (Cooper, R.G., 1999; Griffin & Hauser, 1993; Veryzer & De Mozota, 2005).

Marketing research has shown that consumers buy products based on the number of features provided (Brown & Carpenter, 2000) and that sales of high-feature products are rising (e.g. for smart phones (Martin, 2008)). Research into 'feature fatigue' (increasing the number of useful functions at the expense of usability) has shown that even though consumers know that products with more features are harder to use, they still choose high-feature models initially (Rust et al., 2006; Thompson et al., 2005). They even pile on more features when given the chance to customize a product for their needs. Once consumers have actually worked with a product, however, usability becomes more important to them than capability (Cooper, A., 1999; Rust et al., 2006; Thompson et al., 2005). For example, a study of mobile device returns in the United Kingdom showed that one in seven cell phones was returned as faulty within the first year of purchase (Overton, 2006). Of these returns, about 63% had no hardware or software fault but the reported problems related to usability problems, a mismatch with the consumer's expectations, or issues relating to the configuration of the device. Another study of user-feedback data for a DVD recorder showed that, from the 251 product failures collected at a call center, even 74% of the complaints were related to so-called design-development failures (Koca & Brombacher, 2008). In other words, manufacturers in high-technology markets try to meet consumer needs by developing high-

feature products that, at the same time, also generate a higher number of consumer complaints because these products do not seem to meet consumer expectations during product use.

In research on the design of mobile devices and applications, a vast amount of literature on design guidelines (Ballard, 2007; Weiss, 2002) and usability evaluation techniques (for example Zhang & Adipat, 2005) can be found that focus on reducing usability problems and enhancing mobile user experience. The design of mobile devices is specifically challenging because of, among other things, the small screen size, mobile context, and multimodal data entry methods (Zhang & Adipat, 2005). Design guidelines such as limiting the number of features and menus, consistency between platforms, and recommendations for key and menu design are available to aid the product designer in dealing with these design challenges (Ballard, 2007; Weiss, 2005).

To summarize, marketing research promotes increased product capability and additional features to achieve the required sales. At the same time, design for ease of use suggests to limit the number of functions and features. The increasing number of consumer complaints, attributed to phenomena such as feature fatigue, suggests that companies are currently not successful in achieving easy to use, high-feature products. We approach this problem by investigating the following research questions in this paper:

1. What are the key attractive features for which the target customer group purchases a smart phone? Are these the same as the companies' advertised unique selling points?
2. Does the usability of smart phones meet both the customer's expectations and the companies' marketing promises?

In the following section, the set-up and results of a web survey will be discussed that was used to answer the first research question.

Feature importance survey

Method

To investigate what the key features are on which the target customer group for smart phones makes its purchasing decision, we used a web survey. Since smart phones are

currently mainly adopted by professional users (Martin, 2008), the target group for this survey was set accordingly. To reach this specific user group, an invitation to fill out the web survey was sent to 6000 subscribers of two professional magazines on mobile communication published in The Netherlands and Belgium. We collected 461 responses, from which 236 participants could be categorized as professional smart phone users based on measurements of smart phone ownership and usage for business purposes. The mean age of the professional user group was 39.0 years (SD = 9.11 years, range = 21 to 64 years) and the group consisted of 210 men and 26 women. To investigate whether the professional users' feature importance ranking was similar to the advertised unique selling points, promotional material of three commercially available smart phones was investigated. These smart phones were selected based upon several criteria: they should: (1) Offer similar features; (2) Focus on the same target customer group (i.e. professional users); (3) Have different platforms (to achieve ecological validity); and (4) Have a similar User Interface (UI) with Qwerty keyboard. The smart phones selected for this study are shown in Table 1.

Table 1. Overview of selected smart phones

Smart phone	Nokia E61i	HTC S710	Palm Treo 680
Operating system	Symbian S60	Windows Mobile 6	Palm OS
Physical appearance			

Measures

The features included in the questionnaire were selected based upon a comparison of features available in smart phones that had recently been introduced on the market and discussions with experts in market research on mobile communication products. In the final questionnaire, 24 features were included ranging from general mobile phone features to

business applications, connectivity options, and multimedia applications. For the feature importance ranking, the 'Rating of function on a Pre-established List' method (Lines et al., 1995) was used. In other words, a ranking of features was obtained by first asking the participants to rate the importance of each listed feature on a scale of 0 to 10 and then summating these ratings across all participants.

Results

The feature importance ranking did not meet the assumption of normality and equal variances. Consequently, the non-parametric Friedman test was used to test for significant differences between the feature importance scores. The Friedman test showed significant differences in the feature importance scores ($\chi 2(17) = 2315.31$, $p < 0.0001$). Subsequently, the Wilcoxon signed-rank test was used to test which feature scores were significantly different. The resulting top five ranking of features is shown in the second column in Table 2 below. Furthermore, for each smart phone the promoted features and keywords relating to promoting easy to use and high-feature products, mentioned in the product advertisement sheets (HTC, 2008; Nokia, 2008; Palm, 2008), are coded. Although subjective, this gives an indication of which aspects of these smart phones were promoted as unique selling points. The most frequently mentioned features and keywords are shown in the third column of Table 2.

Table 2. Feature importance ranking and advertisement coding

Rank	Web survey feature ranking (mean rank Friedman test)	Advertisement coding
1	Phone (21.10)	(Push) mail (10), Phone (9), Input method (8), Camera (8), Internet access (7), Multimedia player (6), All-in-one product (6), Applications (5), Ease-of-use (5)
2	Text messaging (18.21)	
3	Synchronization (17.54) / Network connection (17.33) / Personal information management (17.25) / Wireless connection (16.92) / Security (16.89)/ Input method (16.14)/ Internet access (15.84)	
4	Push mail (13.97)	
5	UI (12.64) / GPS Navigation (12.15) / Wired connection (12.00)	

All smart phone advertisements focused on promoting a complete, high-feature, and multi-purpose mobile communication product that is easy to use and offers added value for professional users. Furthermore, especially the business-related and innovative features were

emphasized, e.g. pushmail, camera, and Internet access. When this is compared to the feature importance ranking, it can be seen that the respondents to the web survey ranked the 'basic' mobile phone features as highest, followed by the more complex features, including the features that were advertised as unique selling points. These observations are consistent with previous research on the marketing of high-feature products:

- Product developers overvalue the new benefits of their innovations (Norman, 1998; Cooper, 1999), while consumers overvalue the already existing benefits of innovative products (Gourville, 2006).
- Consumers buy products based on the number of features provided (Brown & Carpenter, 2000) and companies respond to this by focusing on high-feature products providing all-in solutions.
- Product marketers try to reduce learning-cost perceptions for complex products with innovative features by offering 'evidence' of ease of usage, which is consistent with suggested methods to manage technophobia as discussed by Mukherjee and Hoyer (2001).

The emphasis of the companies on the new and unique features while also promoting ease of use might result in higher expectations. Consequently, the related complaint rates might be higher when problems are encountered during product use. To verify this, the feature importance ranking made by professional users and the advertised unique selling points were used to select features that were further tested in an experiment in which their usability was evaluated. The set-up of this experiment will be discussed in the following section.

Experiment methodology

To investigate whether the selected smart phones meet the customer's expectations and the marketing promises, we designed a between-subjects experiment in which the subjects were asked to perform four tasks with different levels of complexity on one of the three smart phones.

Experimental variables

The standard usability measures effectiveness, efficiency, and satisfaction were used as dependent variables (Dumas & Redish, 1999). Effectiveness was measured as the percentage of tasks solved. Efficiency was measured with three parameters: task completion time (in seconds), number of hierarchical levels in the menu used to complete the task, and number of detour steps (number of returns to a higher level in the menu). As qualitative measures, the keys used, the steps taken in the menu, and the user complaints were recorded. Satisfaction was measured per task on a seven-point scale by means of the After-Scenario Questionnaire (ASQ), which addresses three components of user satisfaction with system usability: ease of task completion, time to complete a task, and adequacy of support information (Lewis, 1991).

Experimental Tasks

Based upon the feature importance ranking made by professional users and the advertised unique selling points, we selected the following tasks for the participants to solve during the tests: (1) Calling a number that was stored in the contacts list; (2) Retrieving information from a website; (3) Entering an appointment in the calendar; and (4) Setting up a pushmail account and using this account to send an email. It is evident that the more advanced a feature is, the more complex the related task is. To account for differences in speed of typing, the participants were instructed to enter the appointment and email with a minimum amount of text. Furthermore, the same information regarding the account settings was provided to all participants, independent of the smart phone tested. The task order was varied to account for possible learning effects. Based upon results of the pilot test, time limits were set for each task. The time limits for the tasks in consecutive order were 4, 7, 10, and 14 minutes.

Participants

We decided to carry out the experiment with students of a technical university. Although this is a convenience sample, students are generally familiar with and confident in using related technologies and therefore resemble the profile of potential professional smart phone

users. To ensure that differences in usability would not be attributable to differences in personal characteristics among the participants, we used a survey to select participants with regard to familiarity and expertise with, and ownership of cell phones and computers, and intention to use smart phones. Only students who did not own a smart phone or PDA were selected for the experiment. In total, 43 participants (33 males and 10 females) with a mean age of 20.6 years were randomly assigned to either one of the smart phone groups: 14 participants in the Nokia and Palm group, and 15 participants in the HTC group. Non-parametric Kruskal-Wallis tests showed no significant differences between the personal characteristics of the participants in the three groups.

Apparatus and Materials

All three smart phones used were configured for use by the same mobile network operator. The tests were performed in a usability lab. Manuals were provided and the basic first-use installation settings such as location and time had already been set. Both the participant interacting with the smart phone and the UI of the smart phone were recorded on video cameras.

Procedure

At the beginning of the experiment, the participants were informed that the experiment was set up to examine the ease of use of the smart phone and not to test the participants. The participants were given information on the capabilities of smart phones in general and were asked to read through a list of instructions. They were asked to perform the tasks in the predefined order and to fill out the ASQ after completing each task. Furthermore, they were asked to return to the main menu of the smart phone before starting a new task, to ensure that every task in every test was started from the same position in the menu. The participants were asked to think out loud while performing the tasks and completing of the questionnaires. The participants were not instructed to solve a task within a certain time limit. However, when a participant gave up because the task was too difficult or spent more time than the predefined

time limits discussed above, the participant was asked to proceed with the next task. Apart from the Calendar task, the tasks were set up such that participants could verify whether they had successfully completed the task. An entire experiment lasted 30 to 50 minutes, depending on the working speed of the participant. After the experiments, the participants received a token of appreciation for their participation.

Results

In this section, we will discuss the usability measures, effectiveness, efficiency and satisfaction for all the tasks. In addition, the users' actions and problems will be discussed in more detail for the tasks combined to give insight into the potential business impact. In Table 3 an overview is given of the performance of the three smart phones for each of the tasks. Since not all users were able to complete the tasks, the efficiency measures (time, number of menus used, and number of detour steps) shown in this table are only reported for users who were able to complete the task.

Table 3. Overview of task performance

	Nokia				**HTC**				**Palm**			
	Phone call	Internet	Calendar	Pushmail	Phone call	Internet	Calendar	Pushmail	Phone call	Internet	Calendar	Pushmail
Effectiveness [%]	100	92.9	92.9	50	100	33.3	93.3	60	92.9	100	64.3	71.4
Time [s]	65.6	195.9	190.9	689.6	61.4	400.9	241.6	705.6	105.9	239.9	254.5	490.2
Number of menus used	2.3	7.2	9.1	26.1	3.2	7.0	13.8	18.3	10.8	1.5	6.8	6.9
Number of detour steps	0.3	1.7	1.6	6.0	0.7	1.9	3.2	4.3	1.1	0.2	1.0	0.9
Satisfaction	6.0	5.3	5.8	3.9	6.3	4.3	5.1	4.0	4.9	5.2	4.9	4.3

From this table it can be seen that, for a substantial number of tasks and for each of the smart phones tested, a substantial number of participants were not able to complete the task. Regarding these results, it is important to note that none of the performance issues that came up during the experiments were caused by technical malfunctions or temporary service or network unavailability. For example, for the HTC only 5 of the 15 users were able to retrieve

the requested information from a website. Moreover, for those who were able to complete this task with this phone, it took approximately twice as long as with the other two phones. The usage patterns and user complaints reveal that HTC users were confused, because after they entered the web address the phone displayed a search screen, while they expected to immediately get the requested website. Furthermore, when we look at the performance for the pushmail task, it can be seen that none of the phones achieved a high effectiveness percentage. The usage patterns and user complaints for this task reveal that, in general, users were confused with the sequence of steps and the detailed information required to complete the set-up.

This experiment only targeted the first-use phase and did not investigate extended use when learning effects could be observed. Nonetheless, the potential business impact of these results is high because research shows that most of the reported product returns occur during the first-use phase (Boersma et al., 2003; Den Ouden, 2006; Overton, 2006). The results demonstrate that the tested features, which were promoted as unique selling points, did not meet the customer's expectations and the marketing promise of ease of usage. Additionally, the identified usage problems could also impact the business of mobile service providers since users will sometimes be unable to use the features for which these providers can charge additional costs (e.g. use of pushmail or Internet).

To gain more insight into the causes of bad product performance, we classified these problems by using categories that had been identified in earlier research as design aspects of cell phones that influence usability (Ji et al., 2006; Weiss, 2002). Table 4 shows the number of problems per problem category that were encountered by users during the execution of the various tasks. For example, for the phone task carried out with the Palm, 37 times a problem was mentioned that was related to ambiguous design of the keys (i.e. difficulty with using and / or understanding of the green, the red and the phone button).

Table 4. Overview of different problems encountered by users

Problem classification	Nokia				HTC				Palm				Total number of problems per problem category
	Phone call	Internet	Calendar	Pushmail	Phone call	Internet	Calendar	Pushmail	Phone call	Internet	Calendar	Pushmail	
Ambiguous location of function	5	2	0	15	2	1	5	14	0	0	6	3	53
Ambiguous icons and/or naming of functions	0	0	6	5	0	0	6	11	0	4	8	13	53
Ambiguous keys	1	2	3	2	0	5	15	3	37	10	4	12	94
Non-intuitive sequence of menus or steps	0	1	0	13	0	15	0	0	0	0	2	0	31
Disorientation in menu	0	0	0	0	0	0	0	1	2	0	0	1	4
Unclear status or lack of feedback	0	18	1	3	0	1	0	6	0	2	4	8	43
Difficulty with data input	0	0	0	0	0	2	3	8	0	0	1	0	14
Total number of problems per task	6	23	10	38	2	24	29	43	39	16	25	37	

Some problem categories shown in Table 4 are inherent to the required number of features that the smart phone needs to include, such as having to navigate to allocate a specific function. Furthermore, the integration of multiple functionalities originating from different product domains is causing ambiguity in the understanding of keys and icons and difficulty with data input. In other words, the findings reported above clearly demonstrated that the problems were caused by violation of the design guidelines related to handheld devices (Ji, 2006; Weiss, 2002). These design guidelines are still valid, but their applicability is restricted by the desire to integrate more features to create competitive products.

The major drawback of the experiment is the use of a convenience sample consisting of university students to test the performance of the smart phones, while professional users are the target customer group. To investigate whether professional smart phone users encounter the same type and number of problems as students, we set-up an additional experiment with the Palm. For this experiment the same tasks, measurements and procedures were used as for the experiment with students. In total 10 professional smart phone users (7 males and 3 females) with a mean age of 42.0 years participated. An overview of the results of this experiment is shown in Table 5 and Table 6 below.

Table 5 and 6. Overview of task performance for experiment with professional users.

Task performance	Palm			
	Phone call	Internet	Calendar	Pushmail
Effectiveness [%]	90	80	60	30
Time [s]	133.8	227.8	190.8	437.3
Number of menus used	8.7	2.4	6.5	13.3
Number of detour steps	2.2	0	0.7	2.0
Satisfaction	4.1	3.9	4.8	2.9

Problem classification	Palm			
	Phone call	Internet	Calendar	Pushmail
Ambiguous location of function	3	0	3	2
Ambiguous icons and/or naming of functions	0	2	2	8
Ambiguous keys	23	10	10	14
Non-intuitive sequence of menus or steps	1	0	0	0
Disorientation in menu	0	0	0	3
Unclear status or lack of feedback	2	2	2	8
Difficulty with data input	0	11	4	5
Total number of problems per task	29	25	21	40

Regarding these results, it can be concluded that professional smart phone users encountered even more difficulties when carrying out the four selected tasks. First of all, the professional users were, on average, less able to complete the selected tasks. Furthermore, the results show a substantially lower level of satisfaction and a relatively higher number of problems. However, the distribution of the recorded problems among the problem categories is slightly different than for the students. Professional users typically encountered more problems with data input because of the use of small keys and difficulties in understanding when to use these keys and when to use the touch screen. One typical example of a problem encountered relates to the use of the red key as 'on/off button' while almost all the participants expect this button to have a 'back button' functionality. One participant even noted: 'this feels like I have to learn how to make a phone call again'.

Discussion and Implications

This study investigated the potential business impact of recent developments in high-technology markets where manufacturers try to meet consumer needs by developing high-feature products that, unfortunately, also generate a higher number of consumer complaints.

In order to gain more insight into these developments, we set up an explorative study with three different smart phones while using multiple perspectives from the Marketing, Design, and Quality disciplines.

The results of the feature importance survey show that the key features for which the professional users purchase a smart phone are the basic phone features and some of the more complex features such as Internet and pushmail that are advertised as unique selling points by the product manufacturers. However, these important features are only a relatively small part of all the features included in a smart phone. Other, less important, but complexity increasing, features are also provided to increase the competitive edge and reach a larger group of potential customers. Although manufacturers promote their products as 'easy to use', when the high ranking and highly promoted features are tested in an experiment, the results demonstrate that most of the features tested are not easy to use due to the products' complexities and a lack of adherence to design guidelines.

The business impact of these results is very high since research has shown that once consumers have actually worked with a product, usability has a bigger impact on satisfaction than capability (Cooper, A., 1999; Rust et al., 2006; Thompson et al., 2005). Furthermore, although research has shown that promoting such a complex product as easy to use initially decreases complexity expectations at the moment of purchase (Mukherjee & Hoyer, 2001), disconfirmation of this marketing promise during usage eventually results in negative emotions towards the product and its brand (Wood & Moreau, 2006).

From a design research perspective, our results could have been expected. User-centered design and goal-directed interaction design have increased the usability of products by restricting the number of features to the goal of the product, and improving the UI by reducing the number of keystrokes to perform a task, and by a better design of menus, keys, and icons (Cooper, A., 1999; Norman, 1998; Weiss, 2002; Zhang & Adipat, 2005). However, these design guidelines drive towards products with fewer features and target at a smaller user group or market segment, which contradicts with the implemented marketing strategies to increase the product's competitiveness.

When we combine the results from an overall business impact point of view, it becomes clear that manufacturers in high-technology markets are facing a challenge for which no easy solution exists. On the one hand, technological developments, for example touch screen interfaces for smart phones, are expected to result in easier to use products. On the other hand, because technology push is still dominating, the complexity of high-technology products and the number of features are expected to increase at the same or an even higher pace. The new technologies (e.g. ambient intelligent technologies for smart phones providing applications and information dependent on the location of the user (Svendsen, 2006)) will challenge designers of high-feature products to include even more applications on those systems than before. Moreover, at the same time, consistency is at stake as many applications will be designed by different parties.

During this research, we have combined views from three main disciplines in New Product Development: Marketing, Design, and Quality to understand the background of the problem. Each of these disciplines has made considerable progress in the development of new products that meet the customers' needs over the last few years:

- In marketing, better market and consumer research techniques have been developed to understand the (hidden) consumer needs and ensure that new products will meet the customers' expectations. The main focus has been on understanding the customer's needs in order to increase sales and margins on new products.
- In design, research in human-computer interaction and user-centered design has resulted in guidelines for designers to ensure ease of use of new products.
- In quality, the development of test strategies and design guidelines has resulted in products that are easier to manufacture, with a higher product quality and less technical problems in the field.

Despite all these efforts, many new, complex products do not meet the expectations of consumers and have a low performance on usability resulting in high complaint rates. What can be done to solve this issue? Simply stating that designers should adhere to design

guidelines for usability will not work: marketing will push for increased functionality to ensure competitiveness of the product and to meet the needs of the customers who are looking for high-feature models when purchasing a new product. For this reason, simply stating that marketing should restrict new product specifications to fewer functions and features will not work either. This issue will have to be looked at on the business level; the total value and costs of a product will need to be taken into account. During the development of the product, several aspects need to be looked at integrally, and a trade-off has to be made between the market potential (how many products at which price), the design (how many features at which usability performance level), and the integral quality costs (how many complaints at which costs for service and helpdesk support).

From an academic point of view, more cross-disciplinary research (NPD, Design, Quality, Marketing etc.) is needed to investigate these developments, their antecedents and their consequences. Additionally, a research and discussion platform is needed to present and discuss research on these developments since the mono-disciplinary research platforms often do not consider these issues from an overall business impact point of view.

Acknowledgements

This work has been carried out as part of the Trader project under the responsibility of the Embedded Systems Institute. This project is partially supported by the Netherlands Ministry of Economic Affairs under the BSIK program. We would like to thank Jakajima who provided the smart phones, SIM cards, and Bluetooth headsets and several students for their help in setting up and executing the test and analyzing the data.

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