

Lessons from Applying Usability Engineering to Fast-Paced Product Development Organizations

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Abstract. This study discusses why usability engineering, which seems easy to contribute to more usable products, finds little support in fast-paced product development organizations. It discusses the ways in which the environment of a product development organization is quite different from that of a web or software company. Among the differences are faster-paced development, more rigorous process stages, lower number of iterations allowed, and higher cost for usability amendment. Thus many usability professionals cannot escape from the traps of simply fixing glitches instead of solving major problems, and working on product issues only in reaction to usability problems generated by other stakeholders. This study provides some innovative suggestions for usability professionals as effective alternatives to remaining stuck in the typical evaluation and refinement strategy of usability engineering.

Keywords: Usability engineering, product development organizations, limitation of usability engineering, ROI of usability engineering.

1 Introduction

Usability is now widely accepted as an important part of product development in many companies. Usability professionals participate in ongoing development projects, evaluate the usability of developing products, and suggest design alternatives, by which they contribute to the development of more usable and satisfying products. Many practices have reported success stories of usability engineering, which describe how usability engineering could contribute to better usability, increased productivity, and/or reduced cost of development and service [1, 2, 3].

Can these stories be applied to a product development organization? It is observed that most of the success stories have come from the domain of website and software development. A very small number of usability success stories come from product development organizations such as Nokia, Sony, LG, Samsung, or Philips. The ultimate goal of usability professionals in an organization is to make their companies into "user-driven corporations," as Nielsen termed it [4]. When we locate some of the

well-known companies in Nielsen's corporate usability ranking, we can easily see the tendency for product development organizations to have ranked lower than software and web companies. The maturity level of most product development organizations would be lower than stage 5, but the level of some software and web companies such as Google, Microsoft, eBay, and Amazon goes beyond stage 5.

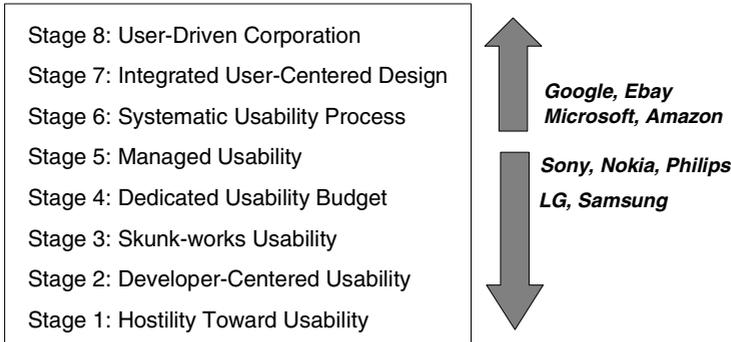


Fig. 1. Corporate usability maturity level of some companies (Subjective judgment by the authors based on known facts about whether a usability team exists in the company, and its role in the development process)

This study will discuss why it is difficult for usability engineering to succeed in product development organizations – especially fast-paced development organizations. The authors will present the lessons they have learned through experience at product development organizations, and will suggest the strategy of usability engineering.

2 Chasing Usability

"Spending \$60,000 on usability engineering throughout development resulted in savings of \$6,000,000 in the first year alone" [5]

As pointed out in many usability-related studies [4, 6, 7], forming a usability team is the first organizational milestone for usability professionals. The next step would be usability institutionalization by which usability evaluation becomes a set of mandatory steps in the product development process. Senior managers tend to expect that forming a usability team and promoting usability institutionalization will contribute to increased usability and better user satisfaction. Are the managers' expectations realistic? Here's what happened to the authors in a fast-paced product development company.

With strong support from the executives, the company organized a usability team in order to increase user satisfaction and restrain increasing service costs. The usability team scouted usability professionals, built a testing laboratory, and revised the development process by making usability evaluation a mandatory part of it. Figure 2 shows how the usability team collaborated in the product development process. The

team participated in all of the major development projects beginning with the requirement phase where product planning occurs, and evaluated usability through heuristic evaluation, cognitive walkthrough, and laboratory testing, both at the conceptual design stage and at the development stage. The team was permitted to force designers and developers to solve the usability problems found. The team also educated developers about usability and its importance to meeting business goals and objectives.

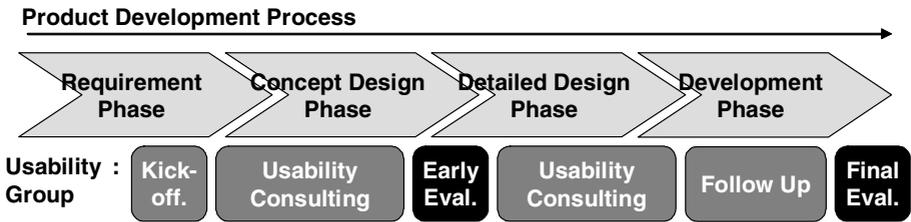


Fig. 2. Usability evaluation stages in the product development process. Two mandatory usability evaluations: the early evaluation after the conceptual design stage and the final evaluation after the product implementation stage.

In their experience, the authors found that the environment at product development organizations was quite different from that of software and web companies. First, the stages of the product development process were faster and more rigorous because of the higher pressure from time-to-market. This means that only a small number of iterations of design and evaluation were allowed, depending on circumstances. Thus the usability team had to expedite usability evaluation as quickly as possible in order to avoid being a delaying factor. Second, the development process was almost irreversible; the cost of solving usability problems skyrockets at later development stages. The team was forced to find and fix usability problems as early as possible. Third, more usability-related groups exist in a product development organization. Among them are design, software, hardware, product planning, marketing, sales, and quality assurance. Thus resolving usability problems requires more complicated and sophisticated collaboration and intervention.

Despite the difficulties presented above, it appeared that the usability team succeeded in meeting the managers' expectations. They solved many usability problems, helped to re-define the role of user interface groups, increased the awareness of usability, and piqued the senior managers' interest.

After two years, however, it was reported that the return rate and service costs of most of the company's products had continued to increase similarly to those of other competitors, and some products' return rate reached almost 40% [8, 9, 10]. The team members were puzzled at the unexpected results, and the managers started to doubt the value of the team. The team tried to prove the value of usability engineering but they could not show persuasive data to the managers; reduced service costs were not significant enough and developers viewed usability evaluation steps as a delaying factor.

3 Challenges to Usability Engineering

“You say that we have solved a lot of usability problems and the usability level of our products has been increased, so how is it that there’s no sign from the market that we have a better product than before? When do we start to see a return on our investment in usability?” The manager of the usability team (translated from Korean).

Eventually, the company downsized the usability team, relocated some of the members to user interface development groups, and moved the usability engineering role to the Quality Assurance group. Although this is the experience of the authors, the same story takes place in some other companies.

What was wrong with the team? What kept them from being successful in proving the value of usability engineering? Existing studies [6, 7, 11, 12] may show that the team had poor usability evaluation skills, were managed by the wrong person, were in the wrong place in the organizational structure, chose inappropriate testing methods, wrote poor-quality reports, caused delays in the market launch, and/or failed to build good relationships with others. Any of these factors may have influenced the managers’ decision to discontinue the operation of the usability engineering group.

But can we apply the above issues to the usability teams of Microsoft, Yahoo!, Sony, Nokia, and Philips? Those companies have very competitive usability teams. For example, Microsoft is known to have active usability teams with superior manpower, facilities, and authority to fix problems. Because other usability books have covered those issues well, this study will not discuss them. Instead, we will discuss the problem from a different perspective — a larger and broader perspective on design management.

A post-mortem analysis found four limitations of usability engineering in fast-paced product development organizations.

Fixing Glitches: First, the usability team had focused on solving glitches rather than serious complexity problems. Solving complexity problems requires longer design exploration and smart, solid ideas; thus, a fast-paced developmental environment prevents the team from solving complexity problems [13]. For example, a series of usability evaluations of a cell phone user interface found that users had difficulty finding appropriate menu commands. This was not an easy problem to solve, since most cell phones today have hundreds of menu commands. Even restructuring menu organization doesn’t guarantee better usability. Consequently, the usability team was forced to postpone finding resolutions to the complexity problems, electing instead to focus on smaller problems that they could solve quickly (this is known as “glitch repair”).

Reactive: Second, the team was working reactively; their development work consisted only of responses to the new usability problems generated by the added new features. Indeed, electronic products evolve quickly, continually sporting new features, and with each set of new features comes a brand new set of usability problems. The usability professionals, in their reactive position, were just trying to keep up. The role of usability professionals in an organization is to eliminate usability problems [13]. But

complexity increases exponentially – not linearly – in proportion to the number of features. As Norman [14] noted, complexity seems to increase as the number of features squared. This means complexity increases at a faster rate than the rate at which usability engineering can fix it. Therefore once complexity has started to dominate, investing in usability doesn't guarantee better products.

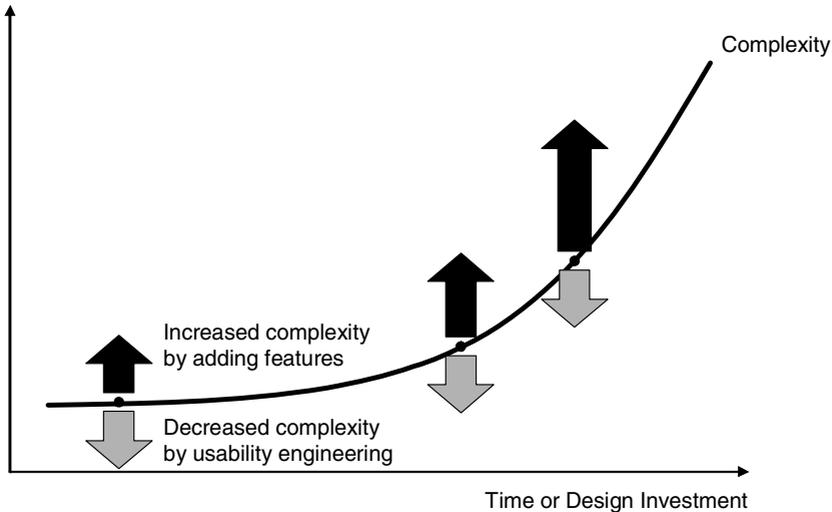


Fig. 3. Complexity curve in feature-overloaded products: Complexity increases exponentially as features are added. Over time, complexity increases at a faster rate than the rate at which usability engineering can fix it.

Lower financial benefits: Third, the financial benefit of usability engineering was not as high as described in the success stories for web and software companies [1, 2, 3]. Unlike with web companies, the reduction in service costs at electronics companies was not found to be high enough to justify usability engineering. For example, if a usability team reduced ten thousand service calls (10 percent of total service calls – a huge achievement in product development organizations), then the amount of savings in service costs was fifteen thousand dollars (if we assume \$1.5 service cost per call). This amount of money wasn't sufficient to cost-justify usability investment. In addition, the development group insisted that usability evaluation caused a longer development time. Even worse was the overall trend of increasing service costs and a return rate that had not diminished.

Lower impact on point-of-purchase: Fourth, usability is a less critical buying factor for electronics products. People do like products with more features and more buttons, even if they look complicated [15]. While people use and pay for websites, people pay for and use electronics. And once they have paid, they use the product for a longer period of time. Thus better usability has been politically defeated by faster development, better product design, and lower price.

4 Lessons and Suggestions

The authors interviewed several usability professionals from other product development organizations, and collected their stories. Almost all of them agreed on the limitations of usability engineering in fast-paced product development organizations, and said they were looking for alternatives to overcome the limitations in order to survive in their companies. In the meantime, the authors heard that one usability team disbanded because of its inability to solve major usability problems. It seems that evaluation and refinement, the normal strategy of usability engineering, doesn't work very well in fast-paced product development organizations.

The authors' experience and discussions with practitioners gave the following lessons regarding applying usability engineering in fast-paced product development organizations.

Invest more in solving major usability problems: First, usability professionals should focus more on solving complexity problems. Dependency on the typical strategy of evaluation and refinement, combined with fast-paced development schedules, forces practitioners to focus only on solving glitches. Usability professionals should avoid this trap by leveraging usability evaluation activities and design exploration activities. In many cases, major usability problems such as too much navigational complexity on cell phones and digital television menus, are common problems for competitors. This means that these problems are difficult to solve, but solving them could easily result in higher market competition. We call this *user interface innovation* – in the same fashion as Apple iPod's click wheel and Sony's cross media bar. Leading user interface innovation by solving usability problems is the key to flourishing usability.

Be proactive to future usability problems: Second, usability professionals should anticipate the usability problems of future products. Again, once complexity has begun to dominate and diminish products' value it is very hard to solve usability problems within a given amount of time. Despite a fast-changing environment, companies have development plans spanning a couple of years that describe what features are to be added in the future. Based on these plans, usability professionals should anticipate possible usability problems, and be prepared to solve the problems. For example, usability professionals of DVD players should ask what would happen if, with current information architecture, a DVD player had the functionality of downloading movies from a website and recording 25GByte blue-ray.

Measure the loss of investment: Third, return on investment (ROI) of usability in product development organizations should be calculated based on the loss of investment, such as development costs or loss of customer value. Reducing service costs and development costs seems unpromising when products continue to become more complicated as more features are added. It is also unhelpful to measure increased customer value by usability [8], since too many aspects of the products, such as price, brand, promotion, and market competition, affect the customer value. An alternative is to measure loss of investment. When products are in the planning stage, we expect that the value of the products is the sum of the capability of each feature. But after user interface design and development, the real value of the product decreases because of poor usability, which can be calculated by multiplying a product's usability by its capability (Figure 4). Thus, if we can figure out the cost for developing the

capability, the loss of investment by bad usability can be calculated by multiplying $(1 - \text{usability})$ and development cost. For example, if a company invested ten million dollars for development and the product’s usability index was 0.8, then the loss of investment is two million dollars. If the usability team increases the index to 0.9 then the value of usability improvement is one million dollars. Since product development organizations invest large amounts of money to develop products, this approach to measure ROI of usability makes sense even during the process of development.

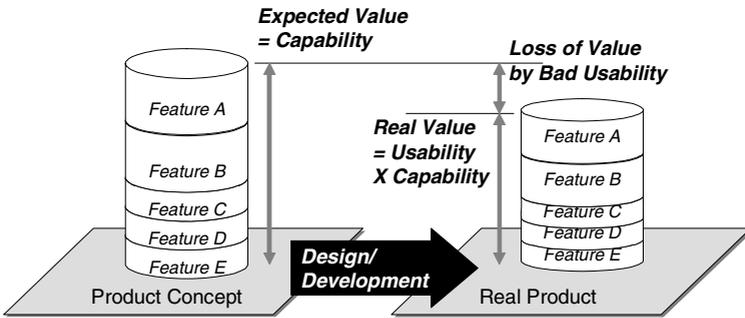


Fig. 4. Expected customer value vs. real customer value of a product: Product’s value became smaller because of poor usability after design and development

Re-positioning usability: Finally, the role of usability teams should be re-defined so as to survive in organizations. The strategy of evaluation and refinement doesn’t guarantee more usable products in a fast-paced development environment where refining a user interface is highly restrained. Lee et al. [13] refer to usability engineering as “following standard prescriptive approaches to technology development by solving short-term small repair problems at a local scale, and usually having to swim upstream relative to pressure on design, thus being trapped in a narrowing solution space.” Beyond swimming upstream, a usability team needs to gather user stories, observe users’ exploits and workarounds, anticipate future usability problems, and provide cues for user interface innovation. The tendency of changing the name “usability team” to “user experience (UX) team” in many companies supports the authors’ viewpoints.

5 Conclusion

This study discusses why usability engineering that seems so easy to apply to product development organizations is so difficult to achieve in practice. Based on users’ experiences and interviews with usability professionals, the authors suggest that the environment of product development organizations with fast-paced product development schedules, new features, higher pressure of time-to-market, more rigorous product development processes, and a lower number of iterations allowed are quite different from that of web or software companies, where usability engineering has been applied and studied with more emphasis. Having practiced usability engineering for two years in a product development organization, the authors found that they and

their colleagues were trapped in fixing glitches and being reactive to usability problems, and failed to cost-justify usability by calculating reduced cost for service and development. It seems that existing usability engineering studies do not take into consideration product development organizations such as consumer electronics and health-care products. This paper provides some organization, operation, and strategic suggestions for usability professionals in product development organizations. The authors hope that this study helps other usability professionals to survive and flourish in an organization, and trigger studies for usability engineering in product development organizations.

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