

New Product Development based on Web Technology – Case Studies in Brazilian Companies

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Abstract

The advent of new information and rapid-communication technologies such as extremely powerful desktop computers, the Internet, and the World Wide Web (web) are leading to new and exciting methods of concept evaluation. This paper aims to analyze how companies are exploring Web (Internet) technology for developing new products, based on the concepts of interactivity and connectivity. The adopted methodological approach was case study. Two service companies were studied, selected according to their previous (and preliminary) classification in the Strategic Grid. A plan was developed based on the theoretical background in order to carry out this research. Interviews were made with at least three different professionals (from different areas and hierarchical positions) of each company. Information was collected through semi-structured interviews. The choice of companies of different classification in the Grid is important to analyze the differences and similarities in the new product development process and to allow a comparison among these enterprises. The preliminary results allowed the identification of enablers and tools for supporting the development of a new product as well as the identification of the components that are used during the innovation cycle of creation of a product based on the web.

Keywords: services, new product development, internet

Introduction

In the 21st century, operations management will continue to emphasize the creation of value through innovation and improvement of products and processes. New challenges

and opportunities are arising driven by global markets, global competition and the global dispersion of engineering talents. In that scenario, communication and information technologies are adding new capabilities for products development (PD) and customer input to all stages of the product development process.

Nowadays, the economic scenario, sometimes identified as "The Digital Economy" (Tapscott et al., 1996) or "Digital State" (Martin, 1997), is well known the increasingly critical role played by Information Technology (IT). In special, the Internet (or the Web) has been considered the most ubiquitous application of IT (Porter, 2001; Zwass, 1998).

Laurindo (2002) discussed the relationship between IT and business strategy and enterprises operations through the Strategic Grid (McFarlan, 1984), the Information Intensity Matrix (Porter and Millar, 1985) and the Strategic Alignment Model (Henderson and Venkatraman, 1993).

According to Smithson and Hirschheim (1998), due to pressures to implement costs reduction and improve the quality of products and customer services, the organizations have faced the need to review their processes and to transform their business models. Therefore, information technology (IT) has assumed an important role within the organizations, in terms of creating the conditions for the viability of these requisites so that the organization can strive to and maintain its competitiveness. Thus, it has been observed that organizations make high investments in IT, and these investments have increased mainly due to need of Internet based applications.

This paper aims to analyse if the companies are exploring Web (Internet) technology for developing new products in organization, based on the concepts of interactivity and connectivity.

The adopted methodological approach was case study (Yin, 1991; Claver et al., 2000). Two service companies were studied, selected according to their previous (and preliminary) classification in the Strategic Grid. Another criterion was the existence of important IT projects based on Internet.

The selected companies can be classified in the Strategic and Turnaround boxes of the Strategic Grid (McFarlan, 1984). The choice of companies of different classification in the Grid is important to analyse the differences and similarities in the new product development process and to allow a comparison among these enterprises.

A plan was developed based on the theoretical background in order to carry out this research. Interviews were made with at least three different professionals (from different areas and hierarchical positions) of each company.

The preliminary results allowed the identification of enablers and tools for supporting the development of a new product as well as the identification of the components that are used during the innovation cycle of creation of a product based on the web.

Literature Review

IT can assume different roles in the organizations, varying from simple support until a strategic position, regarding present and future IT impacts on business strategies (Nolan and McFarlan, 2005; McFarlan, 1984). McFarlan (1984) mentions that the Strategic Grid (Figure 1) allows to analyze the impact of current and future IT applications on the company’s business. The grid is divided into four quadrants, each one representing a situation to the organization: Factory, Support, Turnaround and Strategic.

Nolan and McFarlan (2005) discussed that the impacts of existing IT applications is related to the need for reliable IT and that the impacts of future IT applications is related to the need for new IT. They also pointed out that companies classified in the Factory and Support quadrants show a defensive approach regarding IT use. Meanwhile, companies classified in the Turnaround and Strategic quadrants adopts an offensive behavior about IT utilization.

Among the enterprises investments in IT applications, it must be highlighted those based on the Internet. According to Porter (2001), Internet it is the most important IT ever available in order to allow enterprises to establish differentiated strategic positioning, since these enterprises follow the principles of “good strategy”.

In the vision of Tapscott (2001), Internet brought a revolution in the economy and in the way companies develop their business, which should be based on network approach, instead of the traditional way based on single enterprises. He called this new form of business as the “business-web” or simply “b-web”.

According to Zillur (2004) various authors have described benefits from web for individual functional areas such as marketing (Mckenna, 1997), purchasing (Ellinger and Daugherty, 1998) and logistics. In particular, the flow of goods is expected to become more transparent (Bowersox and Daugherty, 1995) and to allow to the integrated management

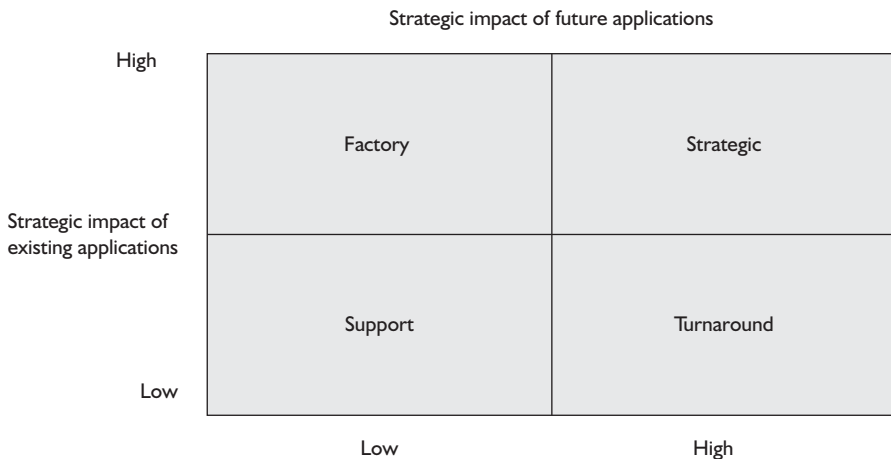


Figure 1 – Strategic grid of impacts of IT applications (McFarlan, 1984).

of a physically dis-integrated unit (LaLonde and Powers, 1993). Besides, it would enable decentralization and centralization within one operating system (Bowersox et al., 1992), and the increase of relevance of information exchange by avoiding one of the best known problems in the supply chain: the Forrester's bullwhip effect (Lee et al., 1997).

Dutta and Segev (1999) mention that enterprises are increasingly more dedicated to explore the potentialities and capabilities provided by the Internet. These authors detail this affirmation based in a proposed model, called "The Marketspace Model", which presents two basic dimensions: interactivity and connectivity. These two aspects, interactivity and connectivity, are transforming business models in the organizations. Interactivity allows a greater richness in the relationship with customers and creates new paradigms for designing products and services, meanwhile connectivity allows new mechanisms of coordination among organization and its customers.

Venkatraman and Henderson (1998) consider that virtuality is a characteristic that can be applied to any organization. However, this emerging architecture of virtual organizations is not possible or cannot be constituted without the significant power of IT. Considering that virtuality can be used by any organization, these authors developed a framework in which virtuality is defined as a strategy that reflects three distinct but interdependent vectors:

- Customer interaction vector;
- Asset configuration vector; and
- Knowledge leverage vector.

The first vector, organizational virtuality, represents interaction with the customer (virtual encounter). This first indicator of organizational virtuality reveals the organization's relationship with the customer. This vector deals with challenges and opportunities for the interaction between companies and customers. IT enables customers to try products and services in a remote way, besides participating actively in the dynamic customization process and creating communities of customers.

This architecture represents, in Venkatraman and Henderson's (1998) opinion, the structure to conduct the business, the guide that provides a context for the organization (Table 1).

In that context, the Web can transform product engineering, market research, prototyping, and revision of new products. Web-enabled product development will allow companies not only to drastically reduce costs and time expended in developing new products, but also to design what customers really want.

Several fields of research accentuate the increasing importance of customer orientation and customer integration. For the success of new products, customer integration is seen as an important factor (Cooper and Kleinschmidt, 1995; Griffin and Hauser, 1993).

Dahan and Hauser (2001a) mention that, while information technology transforms internal PD processes within firms, it also impacts firms' external interactions with

Table 1 – Virtual Organization: Three Vectors and Three stages (adapted from Venkatraman and Henderson, 1998).

Vectors	Stage 1	Stage 2	Stage 3
Customer interaction	Remote experience with products and services	Dynamic customization	Communities of customers
Asset configuration	Modules	Interdependent process	Coalition of resources
Knowledge leverage	Work unit	Corporate asset	Professional community
Characteristics	Stage 1	Stage 2	Stage 3
Focus	Tasks	Organization	Inter-organization
Performance objective	Efficiency (ROI)	To add economic value (EVA)	Innovation and sustainable development (MVA)

potential consumers of new products. Customers’ broadband connections at home and work, combined with emerging Internet panels of willing respondents and prospects, mean that PD teams can reach customers more quickly and, ultimately, less expensively. Media rich computing and communication mean that product stimuli can include more realistic virtual prototypes and more realistic product features. And powerful, server-based software and downloadable applets mean that web-based methods can be more adaptive to customer input and change questioning procedures on the fly.

New Vision for Developing Products - i4PD - Dahan and Hauser (2001a)

According to Dahan and Hauser (2001a), by the end of the 1990s, the challenges of product development began to change as markets and competition became more global, as engineering and design talent became more dispersed, as internal product development efforts migrated into the extended enterprise, and as information and communication technologies changed the way people worked. According to Holmes (1999) the new vision of product development is that of a highly disaggregated process with people and organizations spread throughout the world. The new challenges call for a product development process that should be integrated, information intensive, almost instantaneous, and that makes strong use of new technologies such as the Internet. These authors call this new vision i4PD: integrated, information, instantaneous, and Internet. The characteristics of each of these four factors will be discussed in the following paragraphs.

Integrated

In relation to “Integrated”, Holmes (1999) mention that research challenges of the next decade are those that address product development as an integrated, end-to-end process that requires a detailed understanding and coordination of customers, competition, and

internal capabilities. The design now means the design of the product, the assembly and manufacturing process, the service delivery process, the entire value chain, and the marketing materials – all integrated to provide high value to the customer.

Information

The demands for information have grown since PD teams must integrate information from the customer, the assembly process, the manufacturing process, the channel delivery process, and the marketing process. In some cases, some firms now use “marketing engineers” - this means the appearance of new professional roles – who help design a product that would be easy to market. Methods such as services exchanges are just the beginning of integrated information systems that could lead to greater product development competitiveness.

Instantaneous

In the new context, speed-to-market has been proposed as a competitive advantage – at least if it can be obtained without sacrificing cost or customer satisfaction. (Dahan and Hauser, 2001a). Greis and Kasarda, (1997) also emphasize that the speed and agility are important factors for gaining competitive advantage.

New methods such as virtual prototypes, web-based voice-of-the-customer methods, web-based conjoint analysis, the Information Pump, listening in, Securities Trading of Concepts, and user design all have the potential to provide information to the PD team almost instantaneously.

New web-based methods have the potential to reduce that to two days, opening up the potential for the PD team to have its customer preference questions answered almost instantaneously. In fact, it might soon be possible to get statistical information about customer wants and needs almost as fast as it used to take to debate them. Virtual prototypes mean that products can be “created” in days, and Internet connectivity means that these prototypes can be tested with customers in hours. Service integration methods mean that many engineering design decisions can be reduced from months to days. Interestingly, in the future we might be in a situation where the decision on how fast to introduce products might be more of a strategic decision on product positioning rather than constrained by the firm’s ability to design and test products.

Internet

The i4PD paradigm is one perspective on the future of product development; a perspective that describes how the process will look. The internet represents the technology that are enabling the process to be integrated, information intensive, and instantaneous. (Dahan and Hauser, 2001a).

Dahan and Hauser (2001a) said in that article that end-to-end processes should be robust, knowledge-based, people-based, and market-based.

- “robust” means a process that can adapt to changes in the environment, market conditions, and organization.
- “knowledge-based” means that it is recognized that the firms that will be most competitive will be those that can train their PD teams to design and build products most effectively.
- by “people-based”, it can be understood that the process respects the teams’ needs and that the metrics and incentives (explicit and implicit) are designed so that team members, acting in their own best interests, make decisions and take actions aligned with the best interests of the firm.
- “market-based” means two things: first that the process will be responsive to customers and competitors, and second, that it empowers teams to make their own choices in the context of their own specific expertise and knowledge.

Ogawa (2006) mentions that new products suffer from notoriously high failure rates. Many new products fail, not because of technical shortcomings, but because they simply have no market. Not surprisingly, then, studies have found that timely and reliable knowledge about customer preferences and requirements is the single most important area of information necessary for product development. To obtain such data, many organizations have made heavy — but often unsuccessful — investments in traditional market researches (Bartl et al., 2004).

According to Urban (2000), the Internet can represent an indirect method of capturing unmet customer needs by observing customer interactions with an Internet-based sales recommendation system. Virtual engineering aim to organize the web site based on features related to customers needs. In order to do this, virtual engineers should observe and understand how customers process attributes and, in particular, when they search for attributes, features, or needs that cannot be satisfied by any existent product.

The Internet also provides the means to identify customer needs by passively observing interactive customer behavior on a web site.

Paustian (2001) in the paper describes promising pilot tests of all six methods proposed by Dahan and Hauser (2001a) and suggests a more than 90% correlation between web-based conjoint-analysis measures and consumers’ preferences for a camera’s features. The six methods for gathering customer input are:

- Web-based conjoint analysis: Conjoint analysis is the most widely used method to understand customer trade-offs; McArdle (2000) reports on the application of conjoint analysis to the design of a new camera. The advantages of such web-based applications are that rich, contextual, yet virtual media can be used to illustrate products.

- Fast polyhedral-adaptive-conjoint estimation. By exploiting new computational algorithms to select questions rapidly, a tool called fastpace gathers considerable information on preferences using far fewer questions than existing methods. This is extremely important for hurried web-based respondents.
- User design: Customer can design a product using a drag-and-drop application. costs and engineering constraints are computed automatically — the prices and the entire virtual product change as the customer makes choices.
- Virtual concept testing: Rather than waiting for physical prototypes, product-development teams can test virtual prototypes with customers in a media-rich presentation.
- Securities trading of concepts: Product concepts are represented by “securities”, which respondents buy and sell in a stock-market-like environment. Research suggests that the security price is a good predictor of how the market will accept the product.
- Information pump: a web-based interactive game, with fine-tuned incentives for truth telling, elicits information from customers about their needs and shows how they describe those needs.

Hauser (2001) states that:

“you want to be able to design products that will sell and be profitable: that’s what these techniques enable you to do” .

He predicts the move to adopt the techniques will be led by the large, consumer packaged-goods companies, but he says the methods can be used by any type of company.

Kwak (2001) said that Web sites could use the individual-based approach to construct pseudo-users, and combine them with real customers in a collaborative-filtering system. Using a variety of bots to rate different items, he explains, provides a way to enrich sparse databases and quickly feed in information on new products.

Web-enabled product development can also improve the fit of a product to a market by allowing potential customers to “experience” virtual product prototypes several times during the product’s development, and give detailed on-line reactions to its appearance, functionality, and features. In addition, companies can monitor how customers actually use products to uncover unconventional uses and to determine failure modes.

Companies can continuously monitor how customers actually use products to assess usage patterns, uncover unconventional uses, and determine failure modes. For example, several large machinery manufacturers are integrating wireless sensors into products to report performance and use such information that will allow companies to create new products that better meet customers’ needs, fulfil unmet needs, and last longer. They may even reduce costs by allowing developers to remove from later models features they discover are largely unused.

Web-based rapid concept testing provides the means to gather customer input about virtual concepts, and service exchanges provide the means to design quickly these virtual concepts.

Dahan and Srinivasan (2000) developed and tested a web-based method of parallel concept testing using visual depictions and animations. Respondents viewed eleven new product concepts, and expressed their preferences by “buying” their most preferred concepts at varying prices.

Case Study and Results

The problem of the present study was investigated through a Qualitative Research approach and the method used was Case Study (Yin, 1991; Claver et al., 2000).

The case selection criteria were: the existence of an expressive IT projects based on the Internet for developing new services and products and different classification based on the Strategic Grid (Nolan and McFarlan, 2005; McFarlan, 1984).

Based on these criteria, two companies were selected, one that can be classified in the strategic box and another that can be classified in the turnaround box of the Strategic Grid (McFarlan, 1984). The choice of companies of different classification in the Grid is important to analyse the differences and similarities in the new product development process and to allow a comparison among the processes of these enterprises.

In order to analyze how companies are exploring Web (Internet) technology to develop new products, this study was based on the points below:

- The availability of product related information on –line;
- The customization of products for individual or groups of customers;
- The participation of customer s in the specification and design of products;
- The provision of on-line communications to customers; and
- The participation of suppliers in the specification and design of products or services.

Interviews were carried out with at least three professionals from the company (CIO, project managers and executives from the business area), based on the established script. However, during the interviews, there were attempts to obtain, through the conversation, more subsidies for the qualitative analysis of the case.

The main aspects of the gathered information can be found in the following items.

Case background – Case A

The first studied case is as a commercial bank that is part of a diversified group and that have been obtaining important results in their operation segments: Asset Management, Insurance, Pension Funds, Capitalization. The company has 800 employees and 300 offices.

The IT area became independent of the Bank in 2002. Nowadays, it provides services for the bank, other companies of the group and for the market.

One of the main investments in IT in the last years has been the Internet. These investments in the Internet started in 1997 and a special group was appointed to work in this project. The main objectives were the development of infrastructure focusing on the electronic commerce market, ASPs (application server provider) and the creation of the corporate portal. The bank's Corporate Portal begun its operations in 1999 and since then has been significantly improved. The Portal has been considered the most important for competitive advantage.

The main decision criteria pointed by the Projects Manager (e-business) to investments in projects, mainly to WEB projects, are:

- Flexibility and low cost in the implementation of branches;
- Reduction in back-office;
- Re-utilization of workflow in the creation of new businesses; and
- Base for developing news products.

The focus for that organization it is on using the power of the Internet to enhance customer relations. The case study showed that new services have been developed based on WEB.

All "logs" of the Internet and everything what it is made during the previous day is stored and transmitted for the central office, with all the types of transaction that had been carried through. This allows the emission of reports that offer a detailed knowledge of the use that customers make of the Portal. It was observed that the analyzed company effected some customization of its services in function of the relationship allowed by the Internet what demonstrates alignment with the theoretical reference previously presented.

It was observed in the case that the company virtually monitors how customers are using the products of the bank, searching for detecting imperfections earlier and trying to find ways how to solve them, in order both to anticipate and to detect the necessities of the customer. This was one of the benefits that appeared with the use of web in the products development process.

Case background - Case B

Established in 1977, company B was created with the objective to supply tickets to the employees of the companies. This activity is regulated by the Federal Government in Brazil. The companies that provide this kind of service occupies important position in the services sector in Brazil, with about 18 thousand companies as its customers. The analyzed company offers a variety of products. Beyond traditional tickets, it also offers products as personal credit, life insurances and others. The company created an internet portal that is a channel for electronic commerce for products of the company, besides supplying information of human resources, as training programs, wages and legal research, among other types of information. The description of products that are based on web can be seen below:

- Order receipt and entry;
- Human resources Portal;
- Internet Banking : the objective to facilitate the access to the information on the product and to speed the taking of loans, what it can be made by the proper employee in the Portal; and
- Also it was created Plan for funds to be commercialized and to all have its relationship for the Internet. The differential is that it had one of the lesser taxes of administration, minimum limits of application of the market.

Currently, more than 55% of the orders generated by the customers are made by the Portal of the company, as informed by the executive regarding the transactional site lead by the company, considering both the distribution of tickets, and the access of the information for the employees of the customers.

The portal is offering more flexible services, so that customers might customize them according to their preferences. By adding user-friendliness, reliability and additional services to the Website, company B found that this is the best way to have customers to improve the company's products.

Specific application of the web (portal) for developing products new is limited. Actual situation show that the company is using Human resources Portal as way to create new products, for example, recruiting on-line. This product is one is that was developed considering many inputs from customers and was based on web capabilities.

Case Analysis (A and B)

Analyzing the role of IT in case A, it is possible to verify that IT applications are critical for present operations, and planned IS uses are critical for future success, which allows to classify the organization in the Strategic quadrant in the strategic grid (McFarlan, 1984). The case B can be classified in the Turnaround quadrant in the strategic grid, since it is possible to verify that planned IS uses are critical for future success, meanwhile present applications are not essential for current operations.

In case A it is also possible to observe that IT investments are directed to achieve organizational goals, searching for innovations in products and services.

Company A uses internet according to Dutta and Segev (1999) mentioned in their article, since it is exploring both interactivity and connectivity. As mentioned before, Interactivity enriches the relationship with customers and enables new paradigms for designing products and services. Connectivity, at same time, allows coordinating the organization with its customers. The interactivity of the Web also allows user-specific feedback. In company A, when a user completes the assessment form online, he is immediately provided with a score in a pop-up window on their computer. More than just a rating, the score includes specific written explanations and suggestions for improvements, as well as references to other sources of information. As data are collected, the tool would

provide users with comparative benchmarking with others who have completed the assessment.

In Company B, it was not observed the aspect related to interactivity on the use of internet. Company B initially created a portal with objective to pass some processes for the Internet environment and to sell some services only by web. For instance, organization B launched services as order entry by the internet. After that, company B searched for innovations in services, starting by offering Internet banking facilities.

Company B created the Resource Human Portal that provides integration services to the community in order to bring the power of free information exchange among users, encompassing:

- Newsletters and electronic alerts distribution based on user profile; and
- A wide range of resource human discussion forums

In Table 2, it is possible to see a summary of the comparative analysis of the two cases, considering the main aspects previously pointed out in the literature review.

By the analysis of these two cases presented, it seems that Company A used the idea of the Internet to conceive new products, meanwhile company B used the Internet was a way to facilitate the development and the use of previously conceived products. Therefore, Company A is using more intensively the potential provided by the Internet.

Conclusions

The advent of Internet has transformed industries and redefined rules of competition in many markets and changed the nature of relationships between businesses and between

Table 2 – Comparative of Cases A and B, considering the main points highlighted in the theor.

Description	Case A	Case B
Strategic grid (McFarlan, 1984)	Strategic; IT affects current and future strategic situation.	Turnaround; IT affects only future strategic situation.
Portal (site)	To establish a relationship with customer.	Only to establish transactions for offering news services.
Duta and Segev (1999) – “MarketSpace” model	Interactivity and Connectivity provide a way to enrich sparse databases and quickly feed in information on new products.	No provide a way to understand customers in more detail; The organization is using the portal only for Connectivity.
Urban (2000)	Method of capturing unmet customer needs by observing customer interactions.	Observed that is beginning to explore the portal as way to capture customer needs;
Kwak (2001)	Using a variety of bots to rate different items provides a way to enrich sparse databases and quickly feed in information on new products.	It still does not use as a way to enrich sparse databases.
Venkatraman and Henderson (1998)	Vector Interaction Customer; Stage 2.	Vector Interaction Customer; Remote experience with products and services; Stage 1.

businesses and their customers. Old rules still exist, but they have also given way to new channels and infomediaries. Given current trends, the Internet's influence will continue to grow into the foreseeable future as businesses will collaborate with suppliers and partners. With the support of the Internet, they will source, produce and distribute products and services globally. Web offers an even greater and lasting advantage: a powerful, low-cost means of integrating customer feedback into all phases of product development. The speed, convenience, interactivity, and worldwide coverage of the Internet match the requirements of the different activities in the new product development process, which involves uncertainties and risks and requires firms to take into account the views of customers and to introduce their new products to the market fast.

The findings from this study tend to agree on the potential benefits of applying web tools in product development. However, disappointments have also been expressed by academics that related situations of web tools that have not yet been practiced to an extent to maximize their potentials. Company A is applying the web tool for user-specific feedback, but in company B the web have not yet been used to maximize its potential. In both cases the tool is based on a Portal.

Web-based interaction between customers and producers offer new promising ways of bringing customers into the company right to where the value creation begins – in new product development. Despite the high potential of virtual customer integration practical application is limited. In a sum, Web can help to reduce uncertainties and costs of new product developments and implementations by allowing more ideas to be conceptually tested in parallel.

Future studies should deepen the main conclusions of the present paper. As a continuation of this study, further and refined empirical research will help reveal deeper insights into the potential of web as way to improve interaction customer for developing products process.

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