

# Influence of virtual reality in the management of new product development

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**Abstract:** The high level of competitiveness, awareness of consumers' rights, increasingly demanding work environments, technical approach of competitive products, entrepreneur coalitions, technology transfers, globalization and half a dozen other terms have become part of the daily vocabulary in companies looking to new products development as their support base in this market of increasingly competitive growth. The adoption of more daring competitive strategies, the reduction of product life cycles and the fight for costs have become crucial elements in the quest to maintain a position of prominence in the market. However, this goal can only be achieved through correct and fast decisions, which are the true power springs to ensure and sustain the desired competitive advantage. In the process of developing a new product, the decisions that are made outline the path to be followed in the project, and the choice of path undoubtedly represents the difference between success and failure, costly and inexpensive, the right moment and the too late. In this context, fraught with the unexpected, with rapid changes, actions and reactions, the speed and precision with which information is treated makes all the difference. Project development involves the use of several tools aimed at reducing development time, costs and investments and at minimizing errors. This study investigates how the use of virtual reality technology influences the management of new products development processes. Based on a qualitative case study of a Brazilian high tech and joint value company that has already used this technology for some time, we show how and in what context virtual reality can contribute to reduce the elements of risk and uncertainty.

**Keywords:** product development, decision process, virtual reality

## 1. Introduction

There are some years, it is noticed that new terms, such as: technological innovation speed, high levels of competitiveness reached, consumers demand and understanding; technical and esthetic leveling of the available products in the market, globalization, coalitions, business acquisitions and technological agreements, they are becoming every day more present in the vocabulary of the companies that believe and adopt the new products development as foundation for the search, obtaining and sustentation of the their position before the competition.

Before the exposed, the fight for the obtaining and maintenance of the competitive advantage demands that the industries adopt strategies more and more daring, focusing the most varied aspects of the processes development, production, sale and after sales. In that search, points as: reaction speed, life cycle of the product, development time, costs and investments reduction, quality indexes, to fulfil the requirements of the consuming market and attendance after-sale obtained great importance in the acceptance of the final product, being decisive factor in the success or failure of a new release.

All this is of common knowledge, in agreement with CLARK & WHEELWRIGHT (1993), in an global environment, with high levels of competitiveness and dynamism, the efficiency in the new products and processes development, is the more important and decisive element in the business competition, however, the main criterion that separates an efficient project of a little efficient one is the efficacy of the decisions reached during of the project development.

The decisions reached along a project orientate the roads that to be following, and the choice of the road is certainly the difference

between the success and the failure, the expensive and the cheap, the right time and the late too much. The problem is exactly in how to define the best road in a complex environment like is the new products development. In that context, where unexpected are constant, panorama changes frequently happen, actions and reactions are demanded with a lot of speed, the precision with that the new information need to be understood and treated does all difference in the project final result.

Inside of the strategies adopted by the companies to fulfil the requirements mentioned above, several tools are used commonly, seeking to improve the understanding of the particularities, to minimize mistakes, to optimize time of development and to reduce costs and investments.

The objective of this study is exactly to discuss and to show the influence of the adoption of the virtual reality technology in the management of the new products development process, taking as base the experience of a high technology and joined value company of the Brazilian market, that it was one of the pioneers in its adoption. With base in the works accomplished in this company, we will show where and with who the virtual reality can contribute, taking to risks and uncertainties reduction in the flow of the new products development.

This first chapter creates a widespread vision of this study. In the sequence, we will present the methodology used for to obtain informations that allowed to answer the objectives of the study. The following chapter, based on the existent literature, creates the theoretical basis that orientate the mentioned aspects, later we will present the

results of the accomplished research. Finally, the conclusions of the study and the researched bibliography will be presented.

## 2. Methodology

The selection of the nature of a research is links to the intended objectives and the context where the research is inserted. In this case, where the objective is the knowledge, the understanding and the analysis of a phenomenon, the nature of the research is exploratory. The adopted method was a study of case, that it is, in agreement with YIN (2001), “a research strategy”.

The choice of the method study of case was consequence of this research is basis in a real situation, where the results of the application of a specific technology were discussed in a work flow, were verified the impacts of the adoption of that technology in referred work flow, and obtained contributions and knowledge for the practice and for the literature. YIN (2001) affirms that the “studies of case are an investigation of a contemporary phenomenon inside of their context of the real life, especially when the limits between the phenomenon and the context are not clearly defined.”

Have basis on the context where took place the research, it was opted for the execution of a qualitative research type. For, to leave of that research type, we can evaluates the impact of the adoption of the virtual reality technology in the management of the products development. In the phase of data treatment, it was used as referencial of evaluation a Likert scale, where it translated the expectations, sensations, knowledge, domain, the users’ difficulties in measurable data, to understand and to quantify the answers of the tool in the context of its use, generating like this a research of the semi-quantitative type.

As criterion of the selection of the people for the interview, the following condition was adopted: to have participated in the development of at least a project with the use of the virtual reality technology. It is needs to emphasize that the answers obtained in that research represent the personal opinion of each one of the people about the influences noticed during the project in that they participated, with the use of virtual reality and also their expectations about the potential of the use of that technology in future projects.

The interviews were accomplished through a structured questionnaire, where it was collected the sixteen workers’ answers, all with formation in engineering and participation activates in the process of products development.

The conceptual model used in the research is shown in the Figure 1.

## 3. Theoretical references

### 3.1. Competitive advantage

That theme is approached commonly in the existent literature. For CLARK & FUJIMOTO (1991), the competitive advantage appears for the companies that can bring the technology for a product in the opportune moment, already for CLARK & WHEELWRIGHT (1993), the new products and processes development have turned more and more, a survival source and generation of competitive advantage.

Such recommendations as: reduction of the products life cycle, smaller period of development and release, optimization of costs, competitiveness in price and quality, among other, they are pointed as preponderant factors in the search and maintenance of the so wanted competitive advantage.

According to COOPER & SCOTT (1999), the correct strategy, the appropriate resources and an optimized process are condicionantes of the effectiveness in the process of new products development, and still in agreement with CRAWFORD (1997), a new product

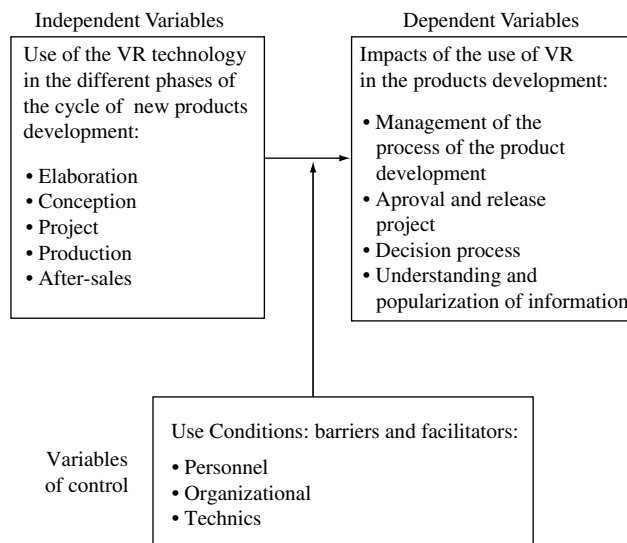


Figure 1. Conceptual model of the research (SILVA, 2003).

successful does more for an organization than any other thing that can come to happen.

### 3.2. Products development

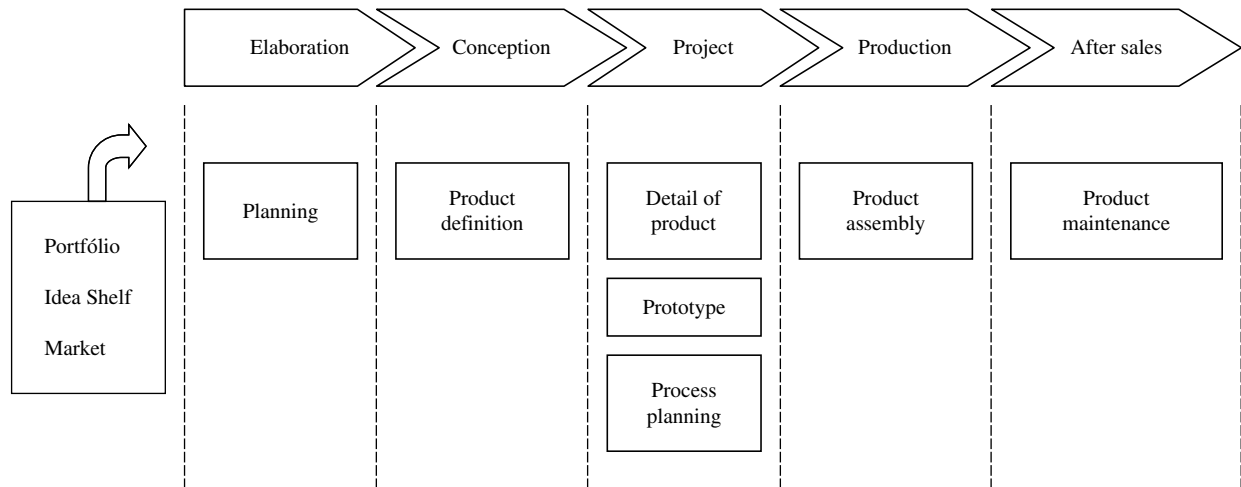
As the definition given by KRISHNAN & ULRICH (2001), product development is the transformation of the market opportunity in an available product for sale. Independent from where arose the need of the new product development, in this moment you increment the projects portfolio of the company and starts the race against the time and the against-times.

As form of systematizing the process of development, each company adopts a work flow that seeks to order and to coordinate all of the activities of the project. The literature show countless references about this theme, and it suggests several framework, that in spite of they be different has several points in common or similar. As this study is based on the dissertation of master’s degree of SILVA (2003), we adopted as reference the conceptual flow idealized by him, with base in the researched literature, and presented in the Figure 2.

Now a days, in function of the wide diffusion of work methodologies and of the competitive needs, practically all of the companies that work with products development adopted as work pattern the concept of simultaneous engineering, where, as the own name suggests, all of the pertinent areas participate simultaneously of the development of the product. In agreement with WINNER et al. (1988) apud PRASAD (1996), Engineer Simultaneous it is a systematic approach for the integrated development and parallel of the project of a product and the related processes, including manufacture and support. That approach tries to do with that the people involved in the development consider, since the beginning, all of the elements of the cycle of life of the product, of the conception to the discard, including quality, cost, periods and the customers’ requirements.

### 3.3. Decision process

According to BROWNE (1992), in the context of the organizations, a decision can be described as an answer for a subject, or a choice among two alternatives, however when we talk about products development, the decisions are much more complex. A process of development is submerged in an atmosphere of high pressure,



**Figure 2.** Conceptual flow for new products development (SILVA, 2003).

intransigent competitiveness, tight periods and high uncertainty degree. In that condition, to make decisions is a risk task and it can change the directions of the project.

During the develops of the project, there are a increment over the compromisings caused by the route changes, consequently larger the involved risks. However, it is always in the final stages, that the managers of the project are more demanded and the only form of making the correct decision is the perfect understanding of the happened phenomena and of the implications of the decisions to be taken.

In agreement with WOHLERS (1998), the cost of the changes in the project along the cycle of product development, increases approximately in geometric progression of reason ten, when of a phase of the project its happens for the following, as demonstrated in the Figure 3. WOHLERS (1998), he just speaks about the evolution of the cost of the alteration, but it is of general knowledge that the periods are also very affected and the risks of modification of last hour are more accentuated, exactly for the difficulty to make a analyse of the details and consequences of that change.

Independent of the cause root that generated the need of a modification, there were an evaluation and a wrong decision somewhere in the past, generating like this a rote correction. Any tool that contributes in the precise diagnosis of a phenomenon is of great help in the decision process.

### 3.4. Virtual reality

The virtual reality technology began to be developed in the sixties, however, only in the end of the nineties, its became available for industrial use. In agreement with BURDEA, JACOBSON & KRUEGER apud NETTO (2002), the best definition for virtual reality is: “an advanced technique of interface that allows to the user to accomplish immersion, navigation and interaction in a synthetic three-dimensional atmosphere generated by computer, using multi-sensorial channels.”

According to PORTO et al. (2002), that atmosphere allows to increment the quantity of prototypes based in computer in the initial stages of the process of products development, reducing the need to build a great number of physical prototypes, influencing like this, the cost and the time of the development. It allows still the expansion of the “space of available solutions” in the project phase, because it turns possible the fast verification of projects.

In the search for the competitive advantage, some high technology and joined value companies are adopting the virtual reality as increase tool in the process of products development. As mentioned by SILVA (2003), “its main characteristic is exactly to allow the interaction between the human and the object generated by computer program in real time and, where that interaction, happens with six degrees of freedom, what makes possible the user to move the virtual object in all the directions. It is still: through that interaction, the user visualizes, manipulates, explores and feels the virtual object as it was real. The great advantage of the interaction about other methods is the learning and the understanding of the phenomena around them.”

The virtual reality can be applied in practically all of the phases of the product development, but it is in the prototyping’s phase that it offers larger advantages. That work condition allows a learning degree and agility until then unknown in the process of the product development.

## 4. Results analysis

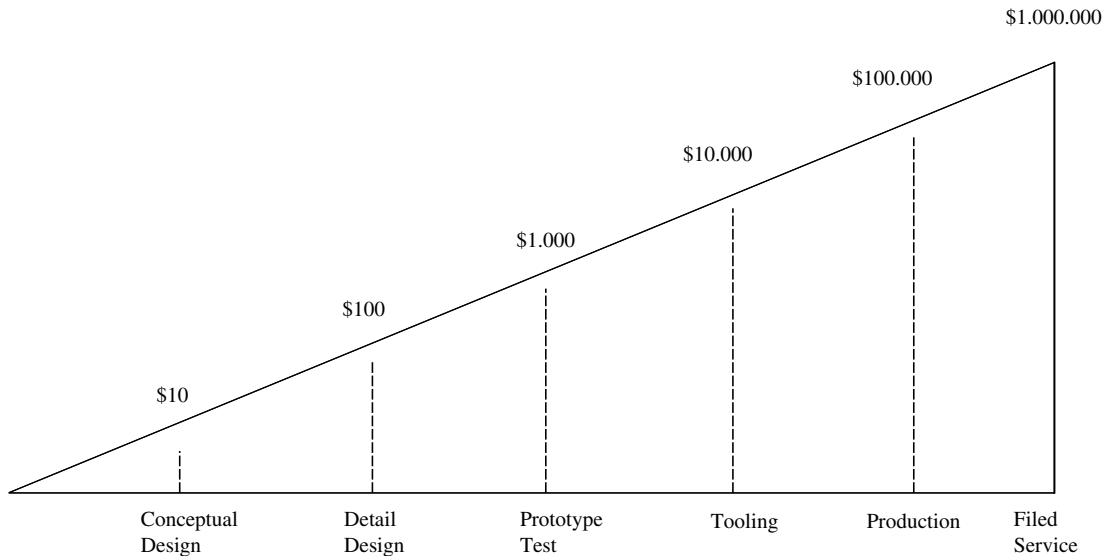
### 4.1. Levels of influence of the virtual reality in the phases of the flow of the products development

It was verified which the level of influence of VR as shown in the Table 1, crossing the phases of the cycle of products development (presented in the point 3.2. of this study) against degree of use of the technology in passed projects, use expectation in future projects and influence in requirements as of identification of:

- Potential risks: realistic vision of the possible problems and difficulties that can be faced during the product development; and
- Identification of mistake in the project: it indicates the anticipation of possible mistakes during the project phase, before there is a compromising with construction of the equipment.

### 4.2. Influence of VR in the management of the products development

To evaluate the influence of the virtual reality in the management of the process of development, the level of influence of VR was



**Figure 3.** Cost of project alteration along the cycle of the product development (WOHLERS, 1998).

**Table 1.** Presentation of results ( influence of the VR in each phase of the flow of the products development) (SILVA, 2003).

Phases of the flow of products development	Degree of use of the VR in project already performed	Influence of the VR to identify risks during the project	Influence of VR in the identification of failures during the project	Expectation of use of VR in the next projects
Elaboration	Medium	High	Low	High
Conception	High	High	High	High
Project	High	High	High	High
Production	Low	Medium	Medium	Low
After – Sales	Low	Low	Low	Medium

**Table 2.** Presentation of results (influence of VR in the managerial aspects of the product development) (SILVA, 2003).

Management of the product development	Influence level
Approval of the project or of phases of him	High
Reach of decision (selection of the best road)	High
Understanding and popularization of information	High
Success index among expected and performed values	Medium

questioned in the four topics, in agreement with the Table 2, they were adopted as indicators of verification to project products management.

## 5. Conclusions

### 5.1. Impact VR in the phases of the flow of products development

As the data presented in the item 4.1., we ended that:

- The technology of virtual reality generated positive impacts in the conception and project phases during the products development flow, however it has great potential contribution also in the elaboration phase in future projects;

- The virtual reality has great impact in the identification of potential risks of a project during the elaboration, conception and project phases, because it facilitates a deep knowledge and interaction of all the members of the team with the details of the project; and
- The impact is also positive in the identification of failures in the intermediate phases of the project, before there is larger compromising of the project, involving other systems, equipments or suppliers. In that phase, the VR can be used as support for application of tools as FMEA, FTA, FFMA and others.

### 5.2. Impact of the VR in the management of the products development

In agreement with shown it in the item 4.2., the virtual reality can contribute in way accentuated in the management of the products development, because its main characteristic is exactly to facilitate the comprehension and the understanding of a phenomenon, influencing directly in the quality of the information and consequently benefitting the decision process.

### 5.3. Final considerations

As this study was accomplished in just a company, their conclusions are limited to the interviewees perception certain section of the market, that have own characteristics of size, competition,

demands, costs and other. The possibility lack of extending the research for other sections can create a mistake that is the to conduct the conclusions for a specific section, however, that doesn't reduce the reliability of the final result in the studied segment.

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