A APLICAÇÃO DA TECNOLOGIA DA INFORMAÇÃO NO DESENVOLVIMENTO DE PRODUTOS EM PROJETOS AUTOMOTIVOS ℑ

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Abstract

This paper aims to analyze the importance of the Information Technology (IT) in the products development process in an automobile industry, focusing in quality improvement, cost reduction and optimization of time in the development. This paper is started with a theoretical description of models that analyzing the IT paper, an evaluation process report and their benefits, also describes as the IT influences the company strategy, as well as points how the information provides advantage competitive face to the current market. This paper is complemented with a brief description of the New Product Development (NPD) process, having the responsibility to develop products with the market expectations and economically viable. Finally, it is intended in this present paper, in form of case study, the application of the theory approached on IT in the vehicles development process, in order to verify IT efficiency and effectiveness.

Key words: Information technology - IT, New product development - NPD, Automotive project.

Resumo

O trabalho visa analisar a importância da Tecnologia da Informação (TI) no processo de desenvolvimento de produtos em uma indústria automobilística, vislumbrando a melhoria de qualidade, a redução de custo e a otimização de tempo no desenvolvimento. O trabalho é iniciado com uma descrição teórica de modelos que analisam o papel da TI, um relato do processo de avaliação de seus benefícios, descreve também como a TI influencia a estratégia da empresa, bem como aponta como a informação proporciona vantagem competitiva mediante ao atual mercado. O trabalho é complementado com uma breve descrição do processo de desenvolvimento de novos produtos (NPD – *New Product Development*), cabendo a ele desenvolver produtos que atendam às expectativas do mercado e que sejam economicamente viáveis. Por fim, pretende-se neste trabalho apresentar, em forma de estudo de caso, a aplicação da teoria abordada sobre TI no processo de desenvolvimento de veículos, a fim de constatar sua eficiência e eficácia almejada.

Palavras-chave: Tecnologia da informação - TI, desenvolvimento de novos produtos, projeto automotivo.

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The Information Technology application in the product development in the automotive projects

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ABSTRACT

This paper aims to analyze the importance of the Information Technology (IT) in the products development process in an automobile industry, focusing on quality improvement, cost reduction and optimization of time in the development. This paper is started with a theoretical description of models that analyzing the IT paper, an evaluation process report and their benefits, also describes as the IT influences the company strategy, as well as points how the information provides advantage competitive face to the current market. This paper is complemented with a brief description of the New Product Development (NPD) process, having the responsibility to develop products with the market expectations and economically viable. Finally, it is intended in this present paper, in form of case study, the application of the theory approached on IT in the vehicles development process, in order to verify IT efficiency and effectiveness.

KEY WORDS

Information Technology, New Product Development process.

INTRODUTION

The strong competition in the automotive industry has been taking the companies to look for technologies that provide the products development with larger speed, quality and smaller costs. The strategic application of the IT became a fundamental element for the success of the NPD process. This is in the interface between the company and the market, having the responsibility to develop products to comply with the customer expectations, in terms of quality, timing and costs, integrating all of the company areas, aiming at products economically viable. In this scenery, the paper of the IT influences the company strategy, because contributes to increase the efficiency as well as the effectiveness, provides competitive advantage in the current market, as well as establishes a flexibility in the project management, making possible virtually to integrate several technological tools. On the other hand, the academic literature of businesses shows questions concerning the returns of the investments in IT, which glimpse the importance of studies that analyze the benefits of the IT in relation to accomplished structural investments. The purpose of this paper is to analyze the importance of the IT in the product development process in the automobile industry, through a case study in Brazilian automaker, trying to show the benefits that can be achieved in terms of quality, cost reduction and development time optimization.

THE PAPER OF THE IT IN THE ORGANIZATIONS

In the last years, it is noticed the fast evolution and spread of the IT, that is, the one which included data processing, the telecommunications and automation, modified the managerial responsibilities significantly. It appeared new departments, significant investments in "hardware" and "software", trainings, etc. The impacts of the IT affect different functional areas of the companies and also on a wide spectrum of industries (LAURINDO, 2002; PORTER, 2001; PORTER; MILLAR, 1985).

EFFICIENCY AND EFFECTIVENESS APPLIED TO THE IT

To understand such impacts of the IT, it is important to distinguish the efficiency and effectiveness concepts applied in the IT. Therefore, IT **efficiency** is the form of implementing the system with the smallest cost, developing the system in agreement with the made rising, using the resources in the best possible way, in the smallest time and with the best performance. Like this, if a company, when adopting a new systems development methodology, gets less programming failures and, therefore better quality and results precision, it would be getting efficiency increase.

The IT **effectiveness** consists of to implement or to develop the systems that better adapt to the users needs, of the business area and of the company, having the corporation global strategy and the best contribution to improve the activities and the functions carried out by the users and with competitiveness and productivity increase for the company.

In the extent of the IT, the **efficiency** is related to the internal aspects to the activity accomplishment, while the **effectiveness** is related to the relationship between the company and the possible impacts in the operation and structure (LAURINDO, 2002).

THE STRATEGIC IMPACT OF THE IT

Trying to obtain the advantages through the information systems, the **Strategic Grid** can be used with one in the ways of analysis of the impact, present and future, of the IT application in the strategy and in the position of the company, in which four quadrants are defined, each one representing a situation for the company: support, factory, transition and strategic, according to illustration 1 (McFARLAN, 1984).

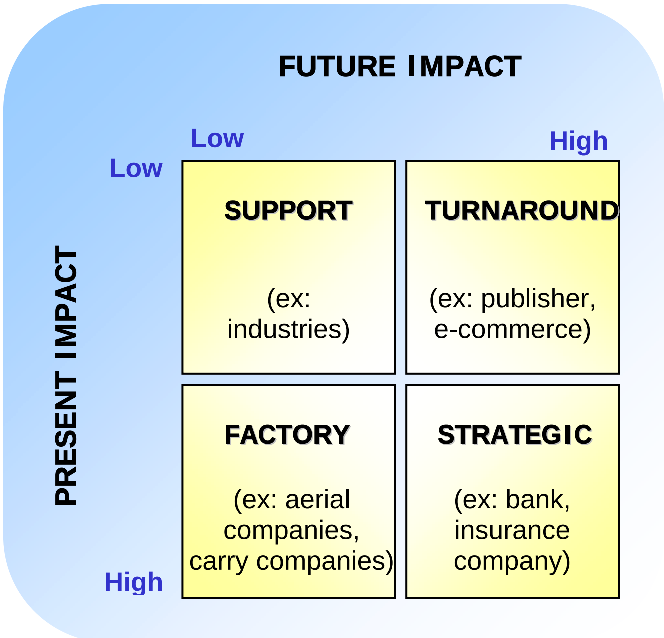

Illustration 1: Strategic Grid: impacts of the application of the IT - Adapted of McFARLAN (1984)

According to MENDES (1987), the good administration of the computer science doesn't have the same meaning for all companies, as it can visualize as follow:

- *Support*: For some companies, the computer science possesses an useful and economical paper, however essentially of support, possessing small influence in the current and future strategy of the company and some symbolic earnings of efficiency (i.e.: industries, accounting).

- *Strategic*: For other companies, the computer science represents an area of high strategic importance, being positioned in the high hierarchical level. The current and future applications in process are positioned directly to the final objective of the company (i.e.: bank, insurance company, carrier company).

- *Turnaround*: For certain companies, the computer science cannot have strategic impact, today, in the attendance of their objectives, but planning applications that will have great meaning in the future. The strategic applications exist, but they are still planes (i.e.: publisher, e-commerce, midsize supermarket).

- *Factory*: The opposite also happens, in other words, companies that apply, today, the computer science in strategic activities, but for the future don't foresee applications of same impact. It is limited to the maintenance of the ones that have, but don't visualize development of other applications of strategic character (i.e.: aerial companies, carrier companies). Obs: The term “Factory" was used by McFARLAN (1984) for analogy with a company place where something is produced, being important for the same, but where it is not made development of new products.

Still according to McFARLAN (1984), the technical changes have been so sudden, that information systems papers of a company have periodically to be reviewed, to assure that its location is still correct. Emphasizing, it is very important to recognize the correct location of the company inside of the strategic grid, as well as of their competitors, once the fast change in the performance of the information systems technology, as for the competitive conditions evolution, changing suddenly, could cause an erroneous strategy of difficult and onerous return.

THE CRITICAL SUCCESS FACTOR METHOD

One of the approaches for the computer science potential applications identification treatment was the development accomplished by ROCKART (1979), and denominated **Critical Success Factors** (CSF). This method discusses the company high administration elements, in the sense of being identified their individual needs in terms of information systems. According to the author, the CSF method is for any business type, the limited number of areas which guarantees the successful competitive performance for the company. These few essential areas have to work appropriately for the business prosperity.

According to BOYNTON; ZMUD (1984), CSF are activities that obligatorily should present an excellent performance for the management and company success. Therefore, the responsible areas for such activities, should receive a special and continuous attention by management, allowing high performance indexes and effectiveness, should be measured continually and revalued, once the respective information needs can change along the time and could also differentiate of an individual executive for other.

Basically, the CSF method includes the structure analysis of an industry in matter, as well as the organization strategy and the goals and their competitors. This analysis is followed by two or three interviews sessions with high executives, which are identified the CSF, defined the measures and the control systems of those measures. The obtained results should be synthesized and made available to all organization so that, the resources and the necessary activities turn, therefore, objectives to be reached by the company. In general, the application of this technique drives it a crucial information list for the business administration work, identifying those that are not still available.

Although the CSF method is an essential concept for the information systems development, especially systems at managerial levels, it also presents an important impact in the managerial practices and strategic planning.

ANALYSIS OF HOW IT INFLUENCES THE STRATEGY

With the great evolution speed of the computers and the significant reduction in the cost of these equipments and of the information systems, it becomes more and more accessible the use of operating systems, not just as support to the administrative activities, but also as systems that offer significant competitive advantages.

According to McFARLAN (1984), this new technology brings for the company the opportunity to change the use of own patrimony and to rethink its strategy. However, it is important to point out that the generated opportunities vary a lot of a company for other, as well as the intensity and the rules of the competition vary of a section for other.

To evaluate the IT definitive impact, McFARLAN (1984) tells that the companies have to approach five strategic questions that, according to the answer to one or more of these questions it is "positive", to IT represents a strategic resource that demands the highest level attention. Each one of these questions concerns the five competitive forces that determine the competition, in the vision of PORTER (1979).

- *Can the IT raise barriers for the entrance of other competitors in the market?*
- *Can the IT influence changes of suppliers, as well as to change the bargain power?*
- *Can the IT change the bases of the competition?*
- *Can the IT change the bargain power in the relationships with the buyers?*
- *Can the IT generate new products?*

THE STRATEGIC ALIGNMENT MODEL

More and more can say the IT has been developing of a traditional orientation of administrative support, for a more strategic function inside of the organization. In this context, it was developed by HENDERSON and VENKATRAMAN (1993) a model to consider and to address the emerging areas of IT strategic administration. This model, denominated of **The Strategic Alignment Model**, is defined in terms of four fundamental domains of strategic choice: Business Strategy, Information Technology Strategy, Organizational Infrastructure and Processes and Information Technology Infrastructure and Processes - each one with fundamental characteristics for the IT planning in the organization.

The Strategic Alignment Model identifies the needs to specify two integration types among the Business and IT domains. The first denominated of **Strategic Adjustment**, is the connection between the Strategy and the Infrastructure. Already the second integration type is denominated of **Functional Integration**, in which establishes the connection among the Business and IT functions in the strategic extents and of infrastructure.

The Strategic Alignment Model is illustrated by HENDERSON and VENKATRAMAN (1993), according to illustration 2, showing the choices range that can be addressed during the managerial process.

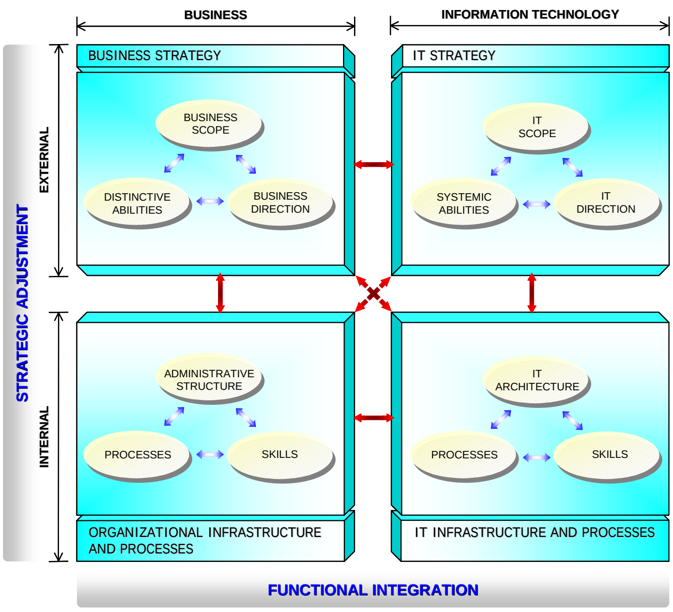

Illustration 2: The strategic alignment model - Adapted of HENDERSON and VENKATRAMAN (1993)

THE EVALUATION LADDER

The decisions concerning the information systems development in the companies generate expectation of a positive return in the investments. Therefore, the IT application and their objectives are extremely important, should be used satisfactory evaluation methods according to certain types of IT application. Considering the abundant diversity of organizations classifications and their IT applications, the task of selecting the more appropriate evaluation method becomes difficult and limited according to its applicability.

Before this scenery, FARBEY; LAND; TARGETT (1995) proposed an evaluation model denominated **Evaluation Ladder of Benefits**, in which is composed of eight steps, where each step represents a change type and consequently a type of IT application. Each step that rise, presents a growing potential of benefits, but also a growing uncertainty in the results, a crescent failure risk and a growing difficulty in convincing the pertinent stakeholders to accept such proposed. Therefore, for lower steps, the complexity is smaller and more objective and, for higher steps, the complexity is larger and more subjective.

1st: Obligatory changes;
2nd: Automation;
3rd: System of value added direct;
4th: MIS and DSS;
5th: Infrastructure;
6th: Inter-organizational systems;
7th: Strategic systems;
8th: Business transformation.

THE NEW PRODUCT DEVELOPMENT PROCESS (NPD)

The new product development process or NPD, is in the interface between the company and the market, with the purpose of: to develop a product to attend to the market expectations, in terms of total product quality, to develop the product in the appropriate time, in other words, faster than the competitors, and with compatible project cost. Besides, it should also assure the developed product manufacturability, in other words, the easiness of producing it, attendance the costs and quality restrictions (FLORENZANO, 1999). Already according to CLARK; FUJIMOTO (1991), it has that: product development is the process for which an organization transforms data about market opportunities and technical possibilities in products and information for a commercial product production.

The industrial competition that it is focused strongly in the NPD process can be evaluated by three basic parameters; quality, time and productivity, that should be optimized to qualify a company in its ability of attracting and satisfying their customers, increasing the competitiveness of their products, being the NPD to the competition game center among the companies, common situation besides in the automobile section. These three parameters exercise a particular paper in the global improvement of the performance and competitiveness in the products development, once to obtain a developed product optimized balancing, the companies should look for the excellence integrated in these three parameters (CLARK; FUJIMOTO, 1991).

NPD PHASES

The general phases that compose NPD are presented to flow, with the purpose of making possible intention a better product development process understanding.

According to AMARAL (1997), to contact employees of several organizations of product development area and to analyze the NPD phases definition, is necessary a reflection in terms of solid and clear phases, in the way that the answers sound very similar. However, unlike what it can seem, in a first view, to divide the product development process in phases is arbitrary and relative, depending a lot on the situation and advantages in applying such definition or, as a practical case, it depends a lot on the company industrial branch in subject.

Basing on CLARK; FUJIMOTO (1991), WHEELWRIGHT; CLARK (1992) and SILVA (1995) works, it exists five different phases basically, as it can be seen in the illustration 3, in which are very adopted in studies, as well as in the companies routine, however tending, more and more in practice, to get confused, given to the integration tendencies and overlap itself.

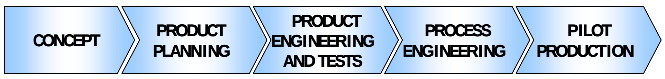

Illustration 3: NPD Phases

- *Concept*: In this phase the information about needs and products use for the customers, information about competitors, technology, risks, technological opportunities, environment patterns and rules are transformed in the product definition. It is the initial phase of NPD and its result, as well as all process phases, it will stay in continuous revision, in agreement with the other activities evolution. According to BACON et al. (1994), this phase influences the product development success significantly.

- *Product Planning*: The product planning phase defines the project execution and details the product, starting from what was established in the concept, composing an information base common for all NPD process and project members. In this phase, the physical models construction is executed, such as “mock-ups” for the style evaluation and “lay-out”, establishing, in the end, all necessary conditions for starting the calculations and final drawings. This phase comprehends the product project basic documentation (CLARK; FUJIMOTO, 1991).

- *Product Engineering and Tests*: In this phase, the project items technical details are in place, where is specified the requirements to be attendance, through descriptions, drawings and models for all systems and sub-systems. Besides, the assemblies are elaborated by modules, in which has the details of each sub-system, supplied or produced internally. Thus, the decision make or buy is accomplished and for consequence the suppliers / partners selection. This phase presents as result the product global geometry, several interferences verifications through “Digital Mock-Ups” (DMU), prototypes in natural scale, suppliers drawings and documentation and the supply logistics.

- *Process Engineering*: This phase comprehends in the product development finalization, with the production processes elaboration, the functional and durability tests. The previous activities in this phase include the production projects, the process planning, the mass production planning, the standard models production, the documentation liberation for the company official systems and internal prototypes results analysis, as well as of the suppliers’ subsystems.

- *Pilot Production*: In this phase the product production begins simulating the normal factory operation conditions, in way to produce the first product copies for test and to accomplish the final successes in the production process (CLARK; FUJIMOTO, 1991). The results of this phase comprehend in an approach with the suppliers, the production means and products approval, the sales preparation, net of dealerships and technical support. The mass production beginning marks the end of this phase.

These phases are linked, being put upon and being interacted continually, as well as the people involved in the project, in spite of a logical sequence of entrances and exits, in agreement with the interdependence of the different types of activities.

BASIC DIMENSIONS OF THE REFERENTIAL STRUCTURE FOR NPD

For the companies prepare to reach the excellence, it is necessary a comprehension of NPD as a whole, doing with the efforts for improvement and administration of this process be not wasted. WHEELWRIGHT; CLARK (1992) noticed this need and presented a proposal for the comprehension of the NPD complexity and critical evolution, based on analysis of six dimensions (illustration 4), that all of them join represent and aid the process perception, their interfaces and nuances, facilitating its administration and making the way for possible improvements and/or modifications. Although these dimensions interact amongst themselves to create a detailed pattern of product development, they involve different subjects and need an individual understanding of each one.

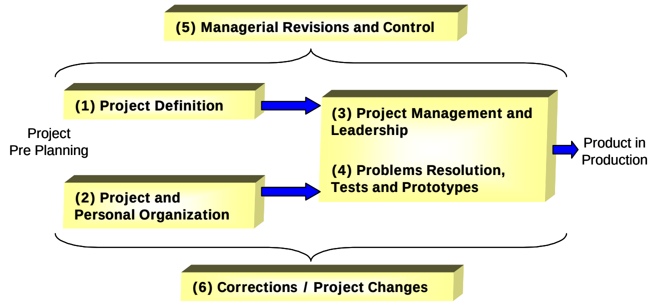

Illustration 4: Basic dimensions of a referential structure for NPD understanding - Adapted of WHEELWRIGHT; CLARK (1992)

- *Project Definition*: This dimension defines how the company configures the mark of its project, determining the project limits and their interfaces with the company, resulting in proposed and very defined objectives. The main activities are the concept development and definition, with the use of internal and external information to the company. Usually this dimension has as main characteristic the goals and objectives determination and compromising of resources.

The activities structuring of this dimension, such as the ideas generation, the concept development and the market study are outstanding for MAHAJAN; WINDY (1992) in a research in which studied the products development models in the companies. The study focused in current industry practice, analyzing which models and used methods, their faults and improvement desires, bringing as resulted implications for NPD creators, suppliers and users.

- *Project and Personal Organization*: This dimension relates the people allocated in the project and in the organization form, in other words, are considered the physical location, the organizational structures, individual responsibilities, training and relationship with support areas.

BROWN; EISENHARDT (1995) emphasized the importance of this dimension, in which they mention three aspects related to the teams that exercise influence in the NPD process performance: the team composition, the work process and the work organization.

- *Project management and leadership*: This dimension characterizes the project leaders' paper, as well as its administration, in other words, how the tasks are ordered and administered. It is considered the establishment of papers and responsibility for the project leadership so that the activities are executed in the best possible way. It also considers how the activities are contained and divided in phases and how the work is administered and controlled in these phases. Besides, it defines the verification points and marks used to signal the end of each phase.

The importance of this dimension is emphasized by BROWN; EISENHARDT (1995), in which affirm the manager's approach affects the process performance in terms of quality, speed and productivity terms, as well as the product concept. GRIFFIN (1997) also ratifies, saying the high management involvement and commitment with NPD are fundamental for the process performance, especially in the resources supply and appropriate funds.

- *Problems resolution, tests and prototypes*: This dimension involves the problems nature, be managerial or technicians and the way of how the prototypes and tests are used to confirm the done choices, besides looking for to focus the project in the remaining tasks. This element with project management and leadership determines how the project converges at the end, with the manufacture needs implanted and the consequent product introduction in the market.

JOHNE (1988) emphasizes the success factors in NPD, including critical operational sub-activities related in this dimension, such as the tests accomplished in the company, the tests accomplished the consumers, the productive tests and the market tests for commercialization.

- *Managerial revisions and control*: The high administration and the nature of its integration with the project team also constitute an important element. The path through which the high administration revises, evaluates and modifies the project and their goals, creates motivations and positive and negative incentives during the project development. The time, the frequency and the format of the revisions can generate a significant impact in the effectiveness and effectiveness of all project.

According to ANTHONY (1992), the managements revisions make possible to the high administration to obtain more visibility of NPD, tends the opportunity to make decisions without the knowledge need of all the process details.

- *Corrections*: The uncertainty associated to NPD brings the corrections necessity during the process. This dimension treats of subjects like measurement and evaluation of the project situation, reprogramming and tasks redefinition, solving differences between the project and the customer's requirements and determining when the organization is ready for the product launch. Maybe the most important part of this dimension is the balance between the conflicts resolution and its adaptability, the relationship between unexpected challenges and delay potencies. Besides, new choices should be accomplished in the activities reprogramming to maintain the motivation in opposition to maintain the project credibility.

These six dimensions are like the several components that form a product, in other words, the organization should have an effective way of defining products, it should understand the mechanisms and tools for the problems resolution and it should understand and insert these subjects to the high administration control and revisions. These dimensions joint should create a coherent system capable to drive the process to its final objective, that it is the product.

THE USE OF IT IN NPD

The organizational system complexity has been a pertinent difficulty, such in the studies about organizations, as in the products development study. An organization is a system formed by people and machines with intense, varied and complex relationships, becoming difficult the task of understanding it. Therefore, through the analysis of the IT application in this complex system can be removed useful information for the organizations interventions and management. For the NPD process study, this complex system difficulties the outline determination that delimits the composition of such process, since, in the reality, all of the systems elements interact amongst themselves.

THE CASE STUDY

The case study was conducted at General Motors do Brasil environment, which supplied necessary subsidies for the IT impact analysis in NPD in automotive projects, however with some restrictions for a confidentiality subject recommended by the company, not affecting the objective of this work.

General Motors is considered the largest automobile manufacturing company in the world, where this grand title of number 1 is due, mainly, to the fact of the group GM be formed by several trademarks and joint-ventures in all regions of the globe. The corporation GM includes more than 10 brands, like: Chevrolet, GMC, Opel, Vauxhall, Cadillac, Saturn, Oldsmobile, and in terms of strategic joint ventures, it has: Fiat, Subaru, Saab, Daewoo, Isuzu, etc. To be continue being the largest automobile company of the world next years, GM is found in 5 vital values that compose itself: their vehicles, employees, suppliers, dealers and customers, which according to PORTER (1979) it is a way to keep a differentiated strategy.

In this context, to maintain this longed leadership, several factors were analyzed and developed, being the IT application a fundamental strategy in the quality improvement, cost reduction and in the time optimization in the vehicles development. For that, GM has a proper NPD process, called GVDP (Global Vehicle Development Process), which started at the beginning of 1990. At that time, the average GVDP for a new project development was approximately 60 months. Along the years this process were being evolving and in 1996, the GVDP applied to the programs had an average of 48 months. However, they were still characterized by having a minimum integration, which means:

- Multiples project systems in use;
- Multiples project processes;
- Multiples Manufacturing Engineering processes;
- No-standardized processes implementation.

In general, it was denoted the low use of the Global Engineering. As strategy of changing this scenery, it was set down a double way of activities, having in one of the slopes, the **Processes**, and in the other slope, the **Infrastructure**. Related to the **Processes**, the idealization was to creating them leaner and leaner, through the NPD change and of the revaluation and standardization of the other processes. Regarding **Infrastructure**, it was updated according to the new applications development, building a way of mathematical data and promoting an integration of all of the development areas.

As result, in the project development at GM, all of the stages, since its creation, conceptual project, detailed project, simulations through CAE and the manufacture project of the vehicle, they are being managed by Integrated Parametric Applications. The Integrated Parametric Applications are constituted by a Nucleus of Solid Modeling, like *Unigraphics*, for a Manager of Mathematical Data and Processes, like TcAE (*Team center Automotive Edition*) and, last, for a Common Generator for Visualization, like *VisMockup*. All these systems that form the Integrated Parametric Applications are represented by a database and a library of reused resources that provide the accomplishment of optimized tasks inside a project, like: conceptual evaluation, project revision, factory simulation, process documents and services and interlinked communication with internal areas (Finance, Purchasing), as well as suppliers / partners.

It can also be verified the strategic use of global and common analysis tools in order to supply all of the needs of each product development center of General Motors. So, the existent systems CAD/CAE/CAM inside GM are common globally in all of the development centers. GM currently has 11.000 Unigraphics work stations, 18.000 computers and stations with TcAE and 26.000 computers and work stations with VisMockup, with the visualization purpose.

Based on that, the total time reduction of the process was notorious. With the IT infrastructure application, in the year of 2000 it was already possible to reach to a development time of around 24 months. With the application of a Systems Integration Program, converging to a last generation system for the products development and the "framework" integration, starting in 2003, it is already possible the project development in only 18 months.

Therefore, analyzing the time reduction of development in the past years, it is noticed that the evolution was decisive. Each area / phase integrating GVDP, in other words, Style, Product Engineering, Manufacture Engineering, Die Engineering, production facilities and start of production needed to be submitted to a kind of re-engineering to adapt to the new characteristics. However the most important is that the objective was reached, in other words, it was set down a faster process with global engineering systems.

Concerning costs and quality, it can be affirmed that in spite of arduous investments in systems and equipments, the longed result of the projects management was reached, which can be pointed out in the Product Engineering the quantitative and qualitative improvement of the use of analysis resources and simulation. The digital analysis became a constant and specific processes for each analysis were established, such as: durability and structural analysis, vibration and acoustics, thermal analysis, air flow analysis and thermal distribution. The applied simulations also got improved, like the impact tests, aiming to analyze: structural performance, survival space, plastic deformations and the occupant's protection. The validation of these impact tests became faster and founded by correlations of mathematical data with real tests, assuring the quality. Such actions propitiated a considerable economy in terms of time and resources, reducing the construction of physical prototypes and respective planning of physical tests. Another considerable advantage concerning economy of resources and quality improvement is the construction of virtual Mock-Ups, with the objective of verifying assemblies builds, interferences, gaps, parts quantity, routings and harnesses routes, etc., in a preliminary project phase, which any necessary change is less onerous and easy to be done.

Although the administrative changes were considered crucial and the main causes of the objective of the success in the process improvement of NPD, the IT application described above was considered one of the important contributions in the new projects control, which had its complexity level accentuated (in terms of quality and available information), as well as a drastic reduction in the implementation time.

THE CASE STUDY ANALYSIS

Analyzing the IT strategic impact, according to the **Strategic Grid**, it is noticed that GMB, in spite of the performance in the industrial branch, is totally consolidated in the IT, being part of the operation and company strategy. It can be affirmed that, without IT, GM doesn't have how developing new products, not even to operate. Another important factor to be outstanding is the market innovation (sales/ distribution), where GM is accomplishing their sales to the final consumer by INTERNET more and more, what motives a significant costs reduction in logistics and product delivery time to the customer, being an effective tool of sales. Therefore, the **STRATEGIC** quadrant is what best combines with its situation, once it has the new applications perspective with strategic impact.

Concerning analysis of the **Critical Success Factors** (CSF), were identified as fundamental for GMB, the following ones: emphasis in the quality; reduced costs; focus in the customer; leadership in the market; new products launched in the established "time to market"; vehicle delivery for the costumer on time. However, it can be verified that some of these CSF are already being reached, once the IT application in NPD through CAD/CAE/CAM, analysis and digital simulation, virtual Mock-Ups, etc, guarantee the quality longed for still in the development phase. The INTERNET use, as already mentioned, is also considered an important factor to reach the last mentioned CSF, as well as a direct line between GMB and the customer, allowing to approximate more and more in the customer's focus.

Utilizing the **The Strategic Alignment Model** of HENDERSON and VENKATRAMAN (1993), it can be considered that GMB is adopting the **Technological Transformation** perspective, according to illustration 5, due to the fact of the search for new IT applications, mainly those based on INTERNET, to allow a new strategy of more direct performance with the customers. It can also be mentioned the development of closer products of the suppliers, using an interlinked communication through Integrated Parametric Applications (*Unigraphics, TcAE - Team center Automotive Edition, VisMockup*), tends a wider performance than the one of supplying with physical goods, also incorporating it of providing information / technical solutions and services, seeking the IT like a contribution of a better positioning in the current competitive market.

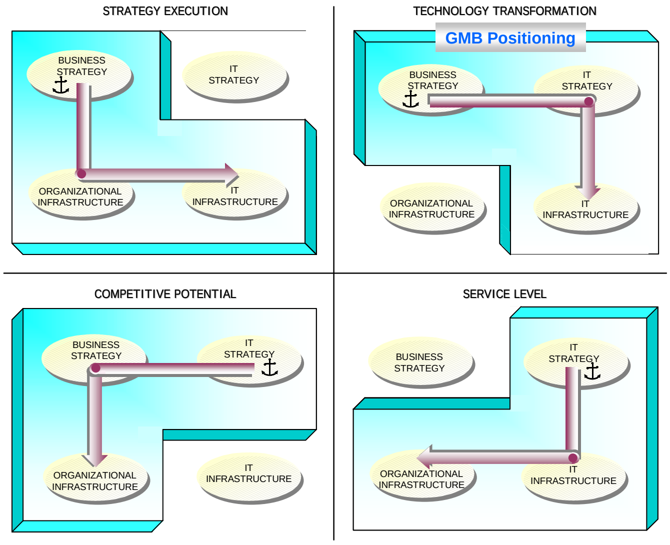

Illustration 5: Strategic Alignment Perspective - Adapted of HENDERSON and VENKATRAMAN (1993)

Analyzing the **Evaluation Ladder**, it can be mentioned as example DMU (Digital Mock-Up) application, because it started to have an emphasis in NPD as important as or even more than the physical area of prototypes assembly. The precision level presented in the results, mainly in the initial assemblies of the project, it started to be extremely important to avoid that significant mistakes were committed during the physical assembly, generating considerable impacts in terms of costs, time and quality. Due to that, the DMU application should be classified in the step 3 of the evaluation ladder, **SYSTEMS OF VALUE ADDED DIRECT**, due to providing a real value added direct to the business. Although the DMU application doesn't provide an increase directly in the market share, to consider this application as a system of value added direct, it is demonstrated appropriate in its classification.

CONCLUSIONS

Firstly, it can be said that the objective of this work was reached, once it allowed showing that the IT application in the NPD process can provide significant advantages in terms of improvement of the quality, cost reduction and in the time optimization in the development. Inside of this perspective, the presented study confirms the contribution of the IT application in the Product Engineering. Besides, it was possible to notice the positive impacts of the IT in the General Motors of Brazil as a whole, integrating the several involved areas in way to facilitate the planning, the execution and the project coordination, guaranteeing the quality of the necessary information.

According to exposed by FIORAVANTI; LAURINDO (2004), it should periodically analyze the IT effectiveness maintaining a continuous process, in which the tools presented like CSF, the Strategic Grid and the The Strategic Alignment Model, should be adjusted constantly according to necessary, to accommodate modifications in the organization strategy, in the environment or in the organizational structure. These changes are important not only by itself, but also for indicating the organization directions, because the information systems should be always analyzed in the context of the organization, in terms of operations as well as in the strategic objectives.

However, it is worth to point out that, if today GMB has a structured GVDP and a high available technology to their users, this is due to severe investments in equipments, systems, as well as dedicated trainings, in which caused significant changes in the work method as tools were implemented like UG, Digital Mock-Up, own INTRANET and INTERNET, in which without leaving his/her workstation, can even accomplishing meetings using software like *Netmeeting*, joining new tasks in function of the adopted technologies.

Finalizing, it is concluded that the IT integration in NPD are revolutionizing the automobile environment. However, it would not be worth if there would not be a high direction compromised in the objectives and goals, motivating the people involved in the process, being a decisive factor the conscience of the importance of using all available resources to obtain the longed for project success, like it is the case of GMB.

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