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A study of project critical success factors on three developments of commercial vehicle instrument panels using critical incident methodology and the EFQM models

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Abstract
To investigate the critical success factors in Brazilian Automotive Project Management studies were made on three successive development projects on instrument panels for commercial vehicles. These projects occurred between 1988 and 2002 in an important Automotive Industry. Based on a review of literature related to Quality, Project Management and Supplier Management, it was decided to utilize the application of the EFQM Excellence Models, in order to classify the critical success factors found in those projects. Participants of the three projects and interested parties from different levels of the Automotive Industry including their respective suppliers were interviewed. Through utilization of the critical incident methodology, the main positive factors, that led to success in the project as well as main negative factors that were not so successful were identified. The classification of these factors in to Criteria and Categories allowed a systematic comparison of the projects and the definition of the critical success factors as well as those success factors that indicated the suitability of the EFQM Excellence Models® Criteria
Keywords: Automotive instrument panel development; project critical success factors; excellence in project management; Critical Incident Methodology; EFQM Project Excellence Model®.

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1. INTRODUCTION: AUTOMOTIVE INDUSTRY

Developments in the worldwide automotive industry including Brazil, are characterized by the increasing importance of projects developed between vehicle producers and their suppliers; formerly only auto-part suppliers, but today these projects have evolved together with developments and technological partners, sharing investments and risks, transforming these projects together with the suppliers in to a strategic factor of great importance for the vehicle manufacturers.

This important development has been caused by the development of Project Management; the successful factors that lead to the project successes are changing and these demonstrate this new reality. Successes or failures of the projects should be evaluated through new methodologies, systems or models which follow these developments.

This paper proposes to study and research the main success (and failures) factors of project management involving Brazilian vehicle producers and their suppliers, together with the methodologies that were used in order to achieve their objectives. The principal research question of this paper will be:

How did the evolution of the critical success factors happen in the management of several successive developments projects for Brazilian commercial vehicle panels?

2. BIBLIOGRAPHIC REVIEW

With the aim of identifying and classifying the possible factors related to project management with suppliers, a Bibliographic Review was initially presented which involved the historical developments, methodologies, models and standards of Quality and Excellence (2.1), Project Management (2.2 and 2.3) and Supply Chain Management (2.5). The focus of this review was the comparison of EFQM with others Models and Standards. Item 2.4 presents a bibliographic review concerning Project Success Criteria and Critical Success Factors.

2.1. Quality and Excellence Models

The ISO 9004:2000 was introduced as a Guideline Standard for performance improvements in Quality Management Systems, with the aim of adopting a larger vision of Quality Management and to pursue an operational upgrade which would benefits the people involved with their business activities.

In order to evaluate the Excellence of companies and other institutions, 30 different models and awards were created all over the world. Originating with the Deming Award in Japan, models and criteria such as The Foundation for the Malcolm Baldrige National Quality Award in the USA, PNQ - Prêmio Nacional da Qualidade in Brazil and the EFQM European Quality Award were established. The main characteristics of some of the Quality and Excellence Models included the TQM – Total Quality Management is presented in the table 1.

Table 1 – Main characteristics of some Quality and Excellence Models

TQM (Shiba *et al.*, 1997)	ISO 9004:2000	FNQ 2005 (Fundação Nacional da Qualidade)	Foundation Malcolm Baldridge (2005)	EFQM 2000 Excellence Model
4 Revolutions: • Focus on clients, • Continuous improvement, • Participation of all, • Social involvement. 4 Levels: • Individual, • Group, • Organizational, • Regional or National.	8 Principles: • Focus on clients, • Leadership, • People involvement, • Process approaches, • Systemic approach for management, • Continuous improvement, • Decisions based on facts, • Mutual benefits of relationship with suppliers.	8 Criteria: • Leadership, • Strategies and Plans, • Clients, • Society, • Information and Knowledge, • Persons, • Processes, • Results.	9 Categories: • Leadership, • Strategic Planning, • Process Management, • Business Results, • Focus on Clients and Market, • Assessment • Management, • Analysis and Knowledge, • Focus on Human Resources.	5 + 4 Criteria (+2) 5 Enablers: • Policy and Strategies, • Leadership, • People, • Partnership and Resources, • Processes. 4 Results: • Key Performance, • Client, • People, • Society. • Innovation and Learning.

Therefore, strategy, clients, systems, people and partnerships are considered in almost all models. The EFQM model goes one step further by distinguishing separately but inter-connecting the Enablers, the Results, the Innovation and the Learning processes.

The EFQM Business Excellence Model (EFQM, 2000a) began in 1992 in the European Community. The present EFQM Excellence Model 2000 (KIRSTEIN, 2005) replaces the 1992 one, maintaining the graphic representation and the basic structure. The EFQM Foundation describes its model (EFQM, 2000a) as a practical and a dynamic tool which can be used for different applications: as a tool for self evaluation (self-assessment); as a means for comparisons (benchmarking) with other organizations; as a guide for identifying areas for improvements; as a basis for vocabulary and common reasoning; as a Structure for the organization management system, including project management.

2.2. Project Management Development

Many models have been developed related to Project Management Quality, Excellence and Maturity and some of the most important are presented below.

- ISO 10006:2003 (ISO, 2003): Guidelines for Quality Management in Projects.
- PMBoK® (PMI, 2004): Guide to the Project Management Body of Knowledge® developed in 1998 by PMI - Project Management Institute, used widely as the standard for managing single projects (SCHLICHTER, 2005).
- CMM® (SEI, 2005): Capability Maturity Model® (Version 1.1) developed in 1993 by Software Engineering Institute and applied for software.
- CMMI® (SEI 2005): Capability Maturity Model Integration® - developed in 2000 by SEI - Software Engineering Institute, as a corporative model for maturity evaluation of project management,
- OPM3®: Organizational Project Management Maturity Model® - developed in 2003 by the Project Management Institute for improving project management in organizations (SCHLICHTER, 2005).
- Project Excellence Model® - developed in 1997 by GPM - German Project Management Association (GPM, 2005) and adopted in 2002 by IPMA - International Project Management Association (IPMA, 2009).

These standards and models could be used as a basis for evaluation or classification of project success factors. The GPM Project Excellence Model® EFQM should be improved like the EFQM Excellence Model 2000' by defining and interconnecting the Enablers, the Results, the Innovation and the Learning processes.

2.3. EFQM application on Project Management

In Europe, the IPMA – International Project Management Association founded in 1965 (IPMA, 2009) became internationally very important, bringing together today, national project management associations; 30 in Europe, 7 in Asia, 4 in Africa, in the United State of America and in Brazil, which, since 2002 have been represented by the ABGP – Associação Brasileira de Gerenciamento de Projetos. The IPMA make the annual International Project Management Awards® to project teams that reach and can prove big achievements in this area. The evaluation is based on the Project Excellence Model® developed initially by the GPM and introduced since 2002 by the IPMA Award (IPMA, 2009) scheme.

The GPM - German Project Management Association (GPM, 2005) founded in 1979, is an association and federation of professionals in project management which, since 1997 has been using the Project Excellence Model® as a criterion to annually evaluate the winner of their Award.

The GPM Project Excellence Model® should be improved as it is used in almost all European Countries , based on the business EFQM Excellence Model 2000 (compatible for company strategies and business guidelines) which distinguishes separately - but inter-connects, the Enablers, the Results, the Innovation and Learning processes. The improvement of the use of the EFQM Model for the Brazilian Automotive Industry Projects has already been proposed (REHDER, 2006).

2.4. Project success criteria and critical success factors

The purpose of this paper is to study the most important factors involving the management and the results of automotive projects.

The critical success factors were defined by Rockart (1997 *apud* LAURINDO, 2002), as a limited number of areas in which the results, if satisfactory, assure the competitive and successful performance for the organization. The same definition could be used in this paper considering the areas related to the project for assuring the competitive and successful performance of the project and of the organization in general.

Baccarini (1999) defined two distinct components of project success: project management success, which focuses on project process, and product success, which deals with the effects of the project's end product. The author also identifies a common four-level structure fort project objectives: "goal; purpose; outputs and inputs, as well as three components for project management success: time, cost and quality (outputs and inputs). Other areas identified were - quality of the project management process and stakeholder satisfaction, and three components of product success: project goal, project purpose and stakeholder satisfaction".

Shenhar *et al*. (2001) identified in their analysis four major distinct success dimensions: (1) project efficiency, (2) impact on the customer, (3) direct business and organizational success, and (4) preparing for the future.

Cooke-Davies (2002) based on De Wit (1988) and other writers, distinguishes project success (measured against the overall objectives of the project) and project management success (measured against the widespread and traditional measures of performance against cost, time and quality). He also distinguishes success criteria (the measures by which success or failure of a project or business will be judged) and success factors (those inputs to the management system that lead directly or indirectly to the success of the project or business). Cooke-Davies assumes also three main questions related to those subjects: What factors are critical to project management success? What factors are critical to success on an individual project? What factors lead to consistently successful projects?

Lester (2007) considers that it is not difficult to set the success criteria but they can only be achieved if a number of success factors are met. He lists out below the most important of these factors, although not fully comprehensive but if only one of the functions or systems listed is not performed adequately, the project may be unsuccessful.

- Clear objectives and project brief agreed with client. Good project definition.
- Good planning and scheduling methods. Accurate time control and feedback system.
- Rigorous performance monitoring and control systems. Rigorous control change (variations) procedures.
- Adequate resource availability (finance, labor, plant, materials). Tight financial control. Full top management and sponsor support. Competent project management. Political stability. Motivated and well integrated teams.
- Comprehensive quality control procedures. Competent design.
- Good contractual documentation. Good internal and external communications.
- Good client relationship. Well designed reporting system to management and client.

Belassi *et al.* (1996, *apud* WESTERVELD, 2003) started to study project success criteria and indicated that these should be distinguished from the critical success factors.

Westerveld (2003) considered two visions related to project success criteria - the Results of the Project - WHAT was achieved by the project. As a Narrow Vision this includes Time, Costs and Quality and in the Broader Vision, this is based on: Project Excellence of the Model; including the Client; project personnel; contracting partners; Users and Stakeholders.

Westerveld (2003) also considered two visions related to the project critical success factors - HOW was the Project managed. The Narrow Vision includes Scheduling, Budget, Organization, Information, Risks and Quality and the Broad Vision, based on the Project Excellence Model: policy and strategy; Stakeholder management; resources; contracting; leadership and teams. The Broad Vision is also based on EFQM which will be used for analyzing and classifying the most important factors in the three projects studied in this paper.

2.5. Supply Chain Management

The literature concerning Supply Chain Management will be reviewed due to the importance of suppliers on projects.

Cox (1996) considers that strategic procurement management links competences, relationships and asset specificity in order to procure a supply and value chain which reduces the costs of transactions and improves profitability and differentiates itself from simplistic approaches to purchasing and supply management.

The EFQM considers in their PST - Process Survey Tool for Supply Chain Management (EFQM, 2004), based on SCOR - Supplier Chain Operation References (EFQM 2000c), that the Supply Chain Management begins with a clear definition and comprehension of the business strategy and its objectives.

Mentzer *et al.* (2001) based on an extensive review, defines the supply chain management as, "the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole".

Based on Fine (2001, 2004), basically 3 types of supply chains can be adopted:

- Technology Supply Chain, involving the delivery of technology, design and product development.
- Development Chain, involving the Project, the development of the product, the production beginning and the final product launching.
- Fulfillment Supply Chain, involving components supply, production, distribution and the sale of the final product.

Based on those concepts and the previously presented review of relevant literature, the model in figure 1 was proposed for the main subjects and activities concerning project and supplier's management, disposed in an hierarchical way to be used as references for study projects in the Automotive Industries.

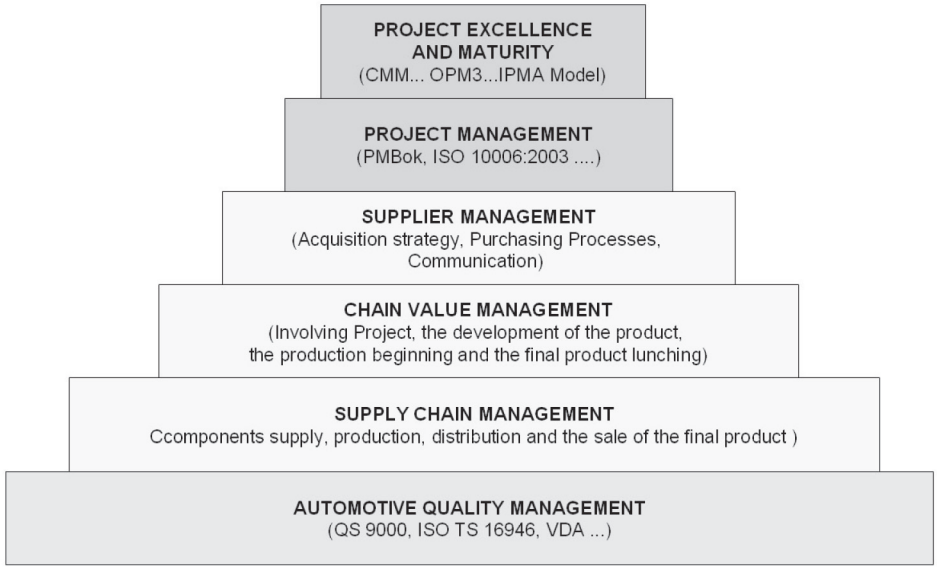

Figure 1 – Automotive Project Management Hierarchy
Source: Authors.

In the attached table 2 we present the project success criteria and the critical success factors based on EFQM - Scorebook 2000 (EFQM, 2000b) and the EFQM PST (EFQM, 2004), which will be the basis for the present study, considered to be wide-ranging and applicable in this evaluation of automotive development with suppliers. In order to obtain a procurement management view we also chose the OGC - OFFICE OF GOVERNMENT COMMERCE (UK) – Procurement Excellence Pilot and Procurement Excellence Guide, based on the EFQM Model. Those factors will be the basis for classifying the project success criteria and success factors.

3. RESEARCH METHODOLOGY

In order to study the critical success factors of automotive projects, we used Yin (2005) and research done by other authors into Case Study Methodology on the three successive project developments of panels for commercial vehicles, carried out between 1988 and 2002 in an important Brazilian Automotive Industry, as described below.

Project I

- Development of a family of instrument panels for light to extra-heavy trucks and buses carried out between 1988 and 1992.
- Cab design based on a European light truck, with intensive cab modularity for all vehicles.
- New panel design, based on a European model; know how, autonomy and responsibility of the Brazilian Automotive Industry.
- Panel and HVAC module (heat, ventilation, air conditioned) composed by many parts and assembled in the Brazilian Automotive Industry.
- Manufacture process know how by the suppliers.
- Production of 400.000 vehicles up to December 2005.

Project II

- Development of a set of instrument panels for light to extra-heavy trucks and buses carried out between 1994 and 1998.
- Modified cab design of Project I cab; know how, autonomy and responsibility of the Brazilian Automotive Industry.
- Panel and HVAC – main module composed of sub modules: panel structure, harness with electric central unit, HVAC module, cluster, switch panel.
- Developed through co-design and simultaneous engineering and the supply of tested modules by the module suppliers. Panel and HVAC mounted by / in the Brazilian Automotive Industry.
- Production of 220.000 vehicles up to December 2005.

Project III

- Development of instrument panels for light trucks and buses carried out between 1998 and 2002, initially with production planned for other countries too.
- Totally new cab design, know how, autonomy and responsibility under the Brazilian Automotive Industry.
- Panel composed of sub modules: panel structure, harness with electric central unit, cluster, switches and the HVAC modules.
- Developed through co-design and simultaneous engineering with the suppliers, furnishing already tested and complete panels for HVAC – modules mounted on the cab inside the Brazilian Automotive Plant.
- Production of 7.000 vehicles up to December 2005.

In the aforementioned case studies, the stakeholders were consulted, and also the critical factors that lead to the project success were analyzed. Paraphrasing Krishnan and Ulrich (2001), it was noted that by using the, "inside of the project black box", through consulting the participants still available from these Automotive Industry projects, as well as the suppliers, including people from top management.

The Critical Incident Methodology (HAYES, 2001; ROTONDARO, 2002) was used to seek from the consulted people's point of view, the most important factors that impact positively or negatively on the three projects . This methodology embraces a wide vision at all levels, of the various automotive industry and supply fields. As such the necessary factors were not pre-established but were detected by having an overall vision of the project. The survey was prepared in order to obtain from the participants of the projects, their opinions about the factors impacting on those projects and was not directed towards analyzing the company results obtained from the projects.

Yin (2005) considered in the first stage of a case study, the formation of a theory that will orientate the researches and should contain a set of propositions in such a way that their circumstances should be assumed as truth. It was considered in this paper that EFQM Excellence Model, Westerveld (2003) proposals, the EFQM - Scorebook 2000, the Process Survey Tool for Supply Chain Management and the OGC (UK) – Procurement Excellence Pilot and Procurement Excellence Guide, could be used as a tool for these studies, in order to study, classify and evaluate the success criteria and critical success factors of these projects.

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4. DATA ANALYSIS AND RESULTS

4.1. Answers to the Questionnaire and Data Analysis

The answers to the Questionnaire were classified in the attached table 3, in positive factors which could lead to success, or negative factors which could prevent or block the success of the project and were also classified in project management factors (HOW it was performed) and results (WHAT was achieved).

Those factors were classified according to the EFQM Criteria and when necessary, other sub-categorieswere created. These factors were considered, based on Rockart (1979, *apud* LAURINDO, 2002), as critical success factors if the evidence demonstrated that they belong to the group of few factors that really leads to project success or failure.

The number of factors for each class (Criteria or Category) can be of value for the importance of its classification and is considered as a measurement of success factor or project success criteria, and these factors were indicated in the Polar Diagrams (figures 2, 3 and 4).

The answers presented in the attached table 3 show the following characteristics:

- Thirty one people were contacted, mostly by telephone, and 22 (71%) answered the Questionnaires sent; some of them had participated in more than one of the nominated projects.
- The returned Questionnaires contain 239 factors considered critical by the interviewed people.
- All of the factors indicated in the Questionnaires could be classified by the EFQM criteria; some of them corresponded to more than one criterion and were considered and classified in the most representative Criteria group.
- Resources and Partnership items were classified separately.
- Among the indicated critical factors, 53, 1 % (127 answers) corresponds to the Project Management (HOW was the project managed?) and 46,9 % (112 answers) correspond to the Results of the Projects.
- Among the 239 indicated factors, 64 correspond to Project I, 93 to Project II and 82 to Project III.

4.2. Project I Results

Ten people answered the Questionnaire referring to the Project I, creating 64 critical factors, of which 32 were considered as positive factors which could have contributed to the project success and 32 were considered as negative factors, which could have contributed to failures of the project. The obtained data presented in attached table 3 is represented in a Polar Diagram in figure 2. The evaluation of the Management of Project I, (HOW it was managed) shows that the critical success factors are concentrated mainly in Process Criterion, with emphasis on product development and on Project Management processes.

Regarding the Result factors, (WHAT was achieved) in Project I, the success factors were focused mainly on Costs, Quality and on the Partnership / Supply Chain; the negative factors tended to focus mainly again, on Partnership / Supply Chain.

4.3. Project II Results

Sixteen people answered the Questionnaire referring to the Project II, creating 93 critical factors, 68 of the considered as positive factors which could have contributed to the project success and 25 negative factors, which could have contributed to failure of the project.

Similar to the treatment in Project I, the factors were classified according to the EFQM Criteria and when necessary, these were sub-categorized too. The obtained data is also presented in the attached table 3 and was represented on a Polar Diagram in figure 3.

Those Results point to the following conclusions:

- Based on the answers given, the Project Success Criteria that we can adopt for Project II are: the product development; the (introduction of) simultaneous engineering and co-design with suppliers, as well as systems development and efficient supply process made by the suppliers.
- The most important Results (WHAT was achieved in Project II), were related to the Key Performance Criteria (Costs, Supply Chain and Production), as well as Client and Suppliers Satisfaction.
- Project II shows the expressive number of 68 (73,1 %) which considered the positive factors versus 25 (26,9 %) who considered the negative factors, pointing to a positive perception of Project II.

4.4. Project III Results

Sixteen people answered the Questionnaire referring to the Project III, creating 82 critical factors, 47 considered as positive factors which could have contributed to the project success and 35 as negative factors which could have contributed to failures of the project.

Those factors were classified as in Project I and II, according to the EFQM Criteria and when necessary, sub-categories were made too, and presented in attached table 2 and on the Polar Diagram in figure 4.

The main conclusions related to this Project were described below.

- In this Project III the number of indicated positive factors (57,3 %), is higher than the negative ones (42.7 %).
- It is possible to assume that the critical success factors which led to the project success were the project management process based on simultaneous engineering and co-design with suppliers, the system supply and the highly technological standards of the suppliers.
- In relation to the positive Results, it should be pointed out the high quality of the product and the supply of the completed panel were factors attributable to these results.
- High investment costs for the targeted markets, created in the initial project strategy stage were considered as the negative results.

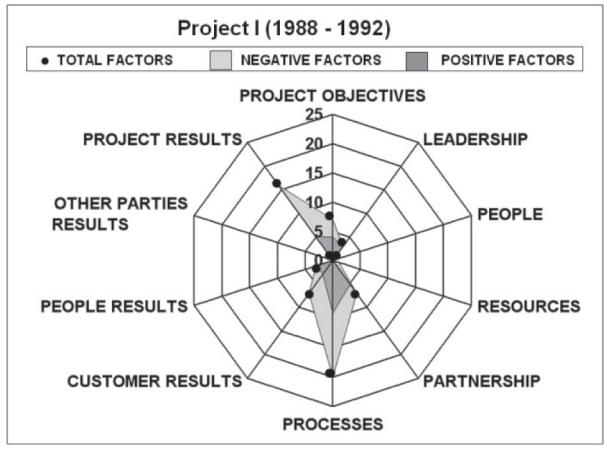

Figure 2 – Project I - Polar Diagram of the critical factors classified by the EFQM criteria.
Source: Authors.

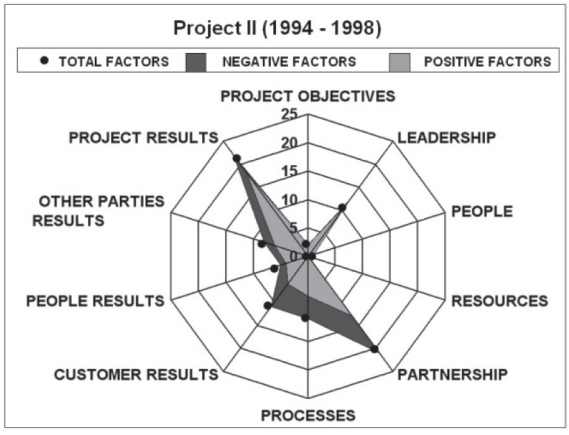

Figure 3 – Project II - Polar Diagram of the critical factors classified by the EFQM criteria.
Source: Authors.

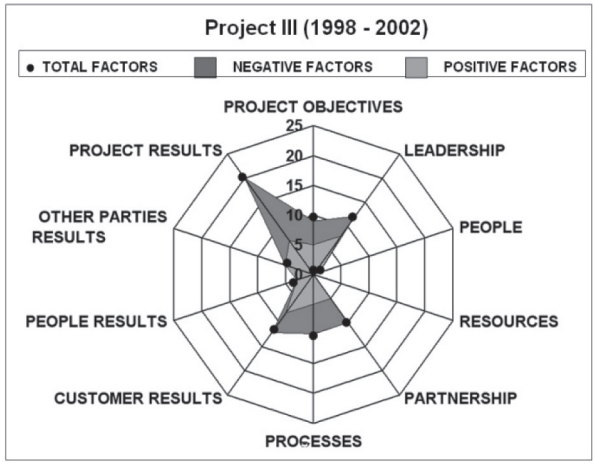

Figure 4 – Project III - Polar Diagram of the critical factors classified by the EFQM criteria.
Source: Authors

5. CONCLUSIONS AND FINAL RECOMMENDATIONS

Cross analysis of the three projects resulting in the following considerations:

1) **Case Selection:** The selection of the three projects over a different period of time demonstrates the importance of the variation of the different factors for each project, showing a dynamic evolution of the similar projects along the time base.
2) **Internal vision of Projects:** The research made at different levels of the automotive industry and that of its suppliers has contributed to achieving a broad vision of this industry, by allowing us to enter "the heart" of project management.
3) **Critical Incident Methodology:** This Methodology leads to a wide array of answers by the project participants, covering the most important subjects for each project, which could probably not have been achieved by a pre-established questionnaire type format.
4) **EFQM Model:** The results obtained from the EFQM Criteria for Project Management, (HOW it was managed) and (WHAT was achieved) used throughout the Project Excellence Model ® and Excellence Model®, mainly by the Scorebook 2000, were effective for demonstrating the differences and the evolution of each project.
5) **Categories:** The proposed use of 'Categories' was necessary mainly in the Criteria grouping with big quantities of factors resulting from interviewing the participants. The use of categorizing these criteria related to supplier relationship was especially important.
6) **Critical Factors involving Automotive Industries and their Suppliers:** These could be classified throughout the EFQM Criteria Partnership and it was suggested using the categories: Supplier Management, Value Chain Management and Supply Management.
7) **Supplier Importance:** This was based on simultaneous engineering, co-design, module development and module supply; the suppliers showed to be of great strategic importance and in many cases, they were the leaders in technology.
8) **Importance of the critical success factors:** With the evolution of the Project Management, the factors like Leadership, the Project Management Methodology, Product Development and Partnership became critical success factors. The Strategy and People Management question was not so significant according to the answers of the questionnaire.
9) **Resources Criteria:** This was not emphasized by the interviewers, probably due to the fact that the resources were always available and managed by the Automotive Industry.

10) **Panel Developments in other Brazilian Automotive Industries:** The principal research question: "How did the evolution of the critical success factors happen in the management of several successive development projects for Brazilian commercial vehicle panels?" studied in this paper was limited to three cases of Panel development in one sector of the Automotive Industry. Benchmarking with other studies (REHDER, 2006) shows similar tendencies in other sectors of the Brazilian Automotive Industry.
11) **Final Recommendation:** Introducing the Project Excellence Model based on EFQM and the Critical Incident Methodologies will bring to Brazil new effective tools for Project Management.

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7. ATTACHMENT

PARTNERSHIP CRITERIA	EFQM Scorebook 2000 (Items 4a and 4d): related to Partnership and Resources	EFQM Scorebook 2000 (Item 4a): Results, Key Performance Indicators	PST – Process Survey Tool for Supply Chain Management
SUPPLIER MANAGEMENT (includes Procurement Management) 1.1.1 1.1.2	•Identification of key partners, • Technological partnerships and opportunities for technological partnership in line with the policy and strategies of the company; • Assure cultural compatibility and share knowledge with partners organization; • Support developments together; • Create synergy on working together for process optimization and added value for clients and suppliers chains.	• Key Performance Indicators for monitoring, comprehension, preview or optimization of company Key Results,which could include: - Supplier Performance; - Supplier pricing; - Recognition of the Partner's contributions.	Commencing the Supply Chain Management with a clear definition and understanding of the business strategies and objectives,as well as consideration of the 10 elements: • Performance measurements and benchmarking; • Competence management.
VALUE CHAIN MANAGEMENT (involving Technology Supply Chain and Development Chain)	• Partnership structured to create and maximizes value; • Generate and support innovations by using partnerships; • Identification and valuation of alternatives and emerging technologies • Technologies portfolio management; • Exploring existing technologies; • Innovative technologies; • Harnessing technologies to support improvements; • Identifying and replacing old technologies.	• Numbers and value created by the partnership; • Quantity of Innovative products and value as well as service solutions created by the partnership; • Quantity of Improvements and value created by the partnership.	• Supply chain architecture; • Planning of the supply chain; • Planning of the supply sources; • Manufacture planning; • Supply planning.
SUPPLY MANAGEMENT (Fulfillment Supply Chain)	• Creation of value by partnership with suppliers.		• Delivery planning; • Manufacturing; • Supplies and Delivery.

Table 2 – Classification of factors indicated through EFQM models involving clients and suppliers.
Sources: Classification Criteria by Authors based on EFQM)

	Project I	Project II	Project III
PROJECT DESCRIPTION	Development of a family of panels for light to extra-heavy trucks and buses	Development of a family of panels for light to extra-heavy trucks and buses	Development of a panel for light trucks and buses
PERIOD	1988 - 1992	1994 - 1998	1998 - 2002
PROJECT MANAGEMENT: Critical Success Factors which leads to success	• Strategy: Project controlled by the Brazilian Automotive Industry, defined premises based on European Qualities and Design Criteria; • Process: Tooling development in Brazil managed by inter-related functional groups; • Leadership and Project Management: Existence of a Project Manager for the Vehicle Project.	• Strategy, Leadership, Partnership and Processes: Simultaneous engineering and co- design , module supply; • Leadership: Specific Project Manager for the Panel Project; • Partnership: partners selection methodology, product development, suppliers know how, suppliers resident engineers.	• Strategy: dedicated management in Brazil, support of local top Management, system development by the suppliers using international know how; • Leadership: Coordination by the Vehicle Project Manager, existence of groups with defined responsibilities and a project manager for the panel project; • Partnership: Supplier selection, product development, partnership and interface with suppliers.
PROJECT MANAGEMENT: Critical Success Factors which leads to failures	• Leadership: lacking of a specific project manager for the panel project; • Process: Product Development with many modifications, use of expanding plastic material, and standard model for tooling production lacking.	• Partnership: panel supplier and CAD designer not prepared for the development and coordination of the panel co-design engineering; • Process, Project Management: Project time insufficient, freezing of the project modifications not existent, departmentalized management.	• Strategy: local focus, not global, over engineered product, targeted market not defined, Headquarters not compromised; • Leadership: integration with vehicle project, conflicts, missing valuing co design; • Partnership: Project Management Process.
RESULTS: Factors which lead to success	• Process: Tool Quality (injection molding), robust design, European appearance; • Learning process: about projects.	• Client's Satisfaction: style, concept, technology; • Learning: on project management • Supplier Satisfaction: development and supplier chain, system supply;	• Client Satisfaction: high product quality, simple and ergonomic, technical characteristics; • Collaborators Satisfaction: experience and learning • Supply Chain: module or system acquisition, simple logistics;
RESULTS: Factors which leads to failures	• Supply Chain: Acquisition of too many items for mounting the modules in the Brazilian Automotive Industry	• Client Satisfaction: some product characteristics, price increase, local cluster application, no marketing evaluation post market launch.	• Product Development: risk of know how transfer to the suppliers and competitors; • Costs: high cost for this vehicle category, very high tooling costs for the amount sold.

Table 3 – Classification of the Critical Factors of Projects I, II and III based on EFQM Criteria.
Sources: Author.