Evolution trajectories of Operations Strategies: The case of a newcomer in the automotive engine sector

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ABSTRACT  
The growth of competition in the Brazilian and international automotive market has revealed to the automakers urgent demands for quality and productivity improvements.

Also during the last decades, a new set of ideas has been developed in the field of strategic management, the “Resource-based View” (RBV). In addition to an “inside” focus on companies, the RBV also emphasizes the issue of competence development, and the trajectories that companies follow while making efforts to develop their capabilities.

Taking into consideration (1) the changes that the automotive industry has experienced in Brazil, and also the different points in time at which Brazilian automotive industry was set up, (2) the relevance of the engine segment, (3) the importance of strategy trajectories, mainly emphasized by the resource-based view of strategies, the present paper aims at identifying and analyzing the recent trajectories followed by a newcomer engine assembly plant set up in Brazil regarding its operations strategy.

Findings indicate that the newcomer engine assembler has prioritized cost reduction and quality enhancements among their operations priorities, as well as making efforts to increase its product nationalization.

INTRODUCTION  
The production of automotive engines is extremely relevant to the operations inside Brazilian automotive industry, once that this component: (1) represents a meaningful share of production costs, (2) has been impacted by important technological innovations, for example more powerful low-displacement engines, bi-fuelled engines, etc. and (3) is composed of a large number of parts, supplied by companies belonging to distinct segments (Maia, Cerra and Alves Filho, 2005).

Although those engine manufacturers have outsourced a meaningful amount of their activities (mainly Product Development ones) to their suppliers, the control of interfaces and the knowledge of how to put together the several parts in order to create a unique product with integrated functionality still belongs to the engine manufacturer. The ownership of such knowledge suggests that innovative capability in the Brazilian automotive market is still controlled by the engine manufacturers (Cerra, 2007).

Also, the setup of Brazilian automotive industry took place in two distinct periods of time: the automakers that started their productive activities at the beginning of Brazilian Automotive Industry (before 1980) are called “mature companies” by (Consoni, 2004), whereas the automakers that set up their plants in Brazil after 1995 are called “newcomers” by the same author.

Also during the last decades, a new set of ideas has been developed in the field of strategic management, which became known as the “Resource-based View” (RBV). According to (Fleury and Oliveira Jr, 2001), the main contribution brought in by RBV is to emphasize the competitive relevance of a resource which is costly to imitate, transfer, buy, sell or substitute, and which has a systemic integration with the other company’s resources.
With its “inside” focus on the companies, the RBV draws on the “path dependence” concept developed by other fields of study (mainly innovation economics) and applies it to the study of strategic decisions. This way, companies are believed to proceed along competence-developing trajectories, with every decision being part of such trajectory and thus having impacts not only on the present, but also on the possibilities the company is able to consider in the future. As (Teece et al. 1997:515 apud Dannels 2002) argue, “choices over a competence spectrum are influenced by previous choices. In a given period of time, firms must proceed along a competence development trajectory. This trajectory defines not only which choices are possible for the firm today, but also set limits to its internal repertoire and its suitability for the future. Thus, firms in the long-term make almost irreversible trade-offs for certain competence spectra”.

Taking into consideration the relevance of the engine segment and the importance of strategy trajectories, mainly emphasized by the resource-based view of strategies, the present paper aims at identifying and analyzing the recent trajectories followed by a newcomer engine assembly plant set up in Brazil regarding its operations strategy.

The next sections present a literature review on Operations Strategies and Resource Based View (RBV). Then, the research method is presented, along with the two cases here studied. Concluding the paper, some final remarks are made, and possibilities for further research are indicated.

**OPERATIONS STRATEGY (OS)**

Several definitions for the concept of Operations Strategy can be found in the literature, each one focusing a particular aspect of Operations Management, or a certain school of thought about Strategy. Here we will adopt the definition proposed by (Hayes et al, 2004), for whom “operations strategy is a set of goals, policies and self-imposed constraints that jointly describe how an organization intends to manage and develop the resources invested in operations, in order to better execute (and possibly redefine) its mission”.

From the Strategic Planning point of view, Operations Strategy is a functional strategy and, thus, must support competitive strategy. In this sense, each type of strategy demands certain tasks from the manufacturing function and specifies certain objectives, known as “competitive priorities”, which were initially classified by (Skinner, 1969) as productivity, service, quality and return on investment.

In subsequent papers, other authors have presented different combinations of priorities. The framework that will be here adopted is the one proposed by (Garvin, 1993), which categorizes priorities as cost, quality, deliver, flexibility and service. This framework also divides competitive priorities in several sub-priorities, as shown in Table 1.

Competitive priorities should reflect demands imposed by competitive strategy, and set certain goals that need to be reached by the productive system. In order to achieve such objectives, we need to develop a plan of actions in specific decision areas. In his seminal paper, (Skinner, 1969) suggested five decision areas: plant and equipment, production planning and control, workforce and management staff, product design/engineering, and organization and management.

Based on Skinner’s proposition, (Hayes et al, 2004) proposed a new categorization, based on their previous work, with eleven decision areas grouped under two categories: structural and infra-structural (Table 2).

**RESOURCE BASED VIEW (RBV)**

The group of theories known as the “Resource Based View” (RBV) or “Resource Based Theory” (RBT) started to emerge during the 80’s, with the central tenet that the resources owned or controlled by the firms are the sources of their competitive advantage. Such theories, according to (Barney, 1999), emerge as possibility to overcome the shortcomings of strategic planning (the predominant school of thought, until then) in explaining how firms, inserted into the same competitive environments, could present different performance.

Firm resources comprise all the inputs that make companies capable of formulating and implementing their strategies (Olavarrieta and Ellinger, 1997), and can be defined as “assets that exist in the firm during certain period of time (Wernerfelt, 1984:173)”, being either tangible or intangible (Hall, 1992 apud Olavarrieta and Ellinger, 1997).
(Barney, 1991) argues that two tenets are central to RBV: a) resources are heterogeneously distributed among firms, and b) productive resources are costly to transfer among firms. Based on such remarks, the author puts forward some propositions: a) valuable and rare resources can lead to competitive advantage and b) when these resources are also costly to imitate, non-substitutable, and non-transferable, they will lead to competitive advantage.

Thus, in order to lead to competitive advantage, resources should not be owned by competitors, must be costly to replicate or imitate (either by copying or by any other methods), and must positively contribute to firm performance. (Barney, 1991). For the author, resources can be considered valuable when they “take advantage of opportunities, or neutralize threats found in the marketplace (p. 106).” According to (Chi, 1994 apud Combs and Ketchen Jr, 1999), such resources are called “strategic resources”.

The RBV indicates that organizations incorporate knowledge, which can be applied in order to create idiosyncratic forms of technology. (Conner and Prahalad, 1996). Therefore, the resources owned by a firm tend to lead to competitive differences in its products/services, and such differences tend to be sustainable in the long term if competitors are not able to access equivalent resources.

For RBV theorists, according to (Fernandes, Fleury and Mills, 2006:49), “resources are potential elements, a stock that the organization can take advantage of, and its existence does not lead, obligatorily, to superior performance”. Such resources need to be mobilized, coordinated and delivered in order to ensure organizational performance.

Based on the information about RBV presented so far, organizational competence can be defined as a set of coordinated resources which add value to the organization, are costly to imitate, can be applied to other organizational areas, products or services, and impact (during a certain period of time) on the performance achieved by a firm. (Fernandes, Fleury and Mills, 2006).

According to Teece, Pisano and Shuen (2000), managing competence dynamics is also a relevant issue when discussing resources and competences, once that resources should not be treated essentially as static and stockable variables.

In such context, the authors coined the term “dynamic capabilities”, so that the term “dynamic” concerns the ability that a firm has to renew its competences, in accordance with market changes.

The “dynamic capabilities” consist of the firm ability to reconfigure, redirect, transform, adequately shape and integrate existing “core competences” with external strategic resources, in order to adapt themselves to the changes occurring in the marketplace (Teece, Pisano and Shuen, 2000).

With its “inside” focus on the companies, the RBV draws on the “path dependence” concept developed by other fields of study (mainly innovation economics) and applies it to the study of strategic decisions. This way, companies are believed to proceed along competence-developing trajectories, with every decision being part of such trajectory and thus having impacts not only on the present, but also on the possibilities the company is able to consider in the future.

A process of economic allocation is path dependent when the history of the process has lasting effects on subsequent allocations. A path-dependent process does not converge to a unique, globally stable equilibrium allocation or even, in stochastic contexts, to a unique limiting distribution of allocations. Rather, the dynamic features of such a process give persistence to the effects of specific contingent events, so that the sequence of equilibria

<table>
<thead>
<tr>
<th>Subpriority</th>
<th>Cost</th>
<th>Quality</th>
<th>Deliver</th>
<th>Flexibility</th>
<th>Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Initial Cost</td>
<td>• Performance</td>
<td>• Accuracy</td>
<td>• Product Flexibility</td>
<td>• Client Support</td>
<td></td>
</tr>
<tr>
<td>• Operational Cost</td>
<td>• Characteristics</td>
<td>• Completeness</td>
<td>• Flexibility</td>
<td>• Commercial Support</td>
<td></td>
</tr>
<tr>
<td>• Maintenance Cost</td>
<td>• Dependability</td>
<td>• Availability</td>
<td>• Product Flexibility</td>
<td>• Problem solving</td>
<td></td>
</tr>
<tr>
<td>•</td>
<td>• Conformability</td>
<td>• Velocity</td>
<td>• Process Flexibility</td>
<td>• Information</td>
<td></td>
</tr>
<tr>
<td>•</td>
<td>• Durability</td>
<td>• Available Information</td>
<td>•</td>
<td></td>
<td></td>
</tr>
<tr>
<td>•</td>
<td>• Service Level</td>
<td>• Order Easiness</td>
<td>•</td>
<td></td>
<td></td>
</tr>
<tr>
<td>•</td>
<td>• Aesthetics</td>
<td>• Quality</td>
<td>•</td>
<td></td>
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</tr>
<tr>
<td>•</td>
<td>• Perceived Quality</td>
<td>• Order Flexibility</td>
<td>•</td>
<td></td>
<td></td>
</tr>
<tr>
<td>•</td>
<td></td>
<td>• Transport flexibility</td>
<td>•</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Return Easiness</td>
<td>•</td>
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</tr>
</tbody>
</table>

Table 1 – Competitive Priorities
Source: Adapted from GARVIN (1993)
depends on the history or “path” of the process (David 1993, 1997 apud Puffert, 1999).

As (Teece et al, 1997:515 apud Dannels, 2002) argue, “choices over a competence spectrum are influenced by previous choices. In a given period of time, firms must proceed along a competence development trajectory. This trajectory defines not only which choices are possible for the firm today, but also set limits to its internal repertory and its suitability for the future. Thus, firms in the long-term make almost irreversible trade-offs for certain competence spectra”.

Although exogenous factors have played a secondary role in the literature on RBV, there are strong arguments for the influence of market conditions on the value assigned to different resources (Barney, 2001; Prem and Butler, 2001).

Regarding such exogenous factors, other authors consider them to be a confluence point between RBV and Strategic Planning. For (Spanos and Lioukas, 2001), both approaches are complimentary regarding firm performance: while the former emphasizes the development and combination of resources in order to realize competitive advantage, the importance of the environmental effects emphasized by the latter must also be taken into consideration.

RESEARCH METHOD

Field research was conducted by means of case studies, which were carried out during different periods of time, what characterizes this work as a longitudinal, qualitative and descriptive (or exploratory) research. The case study method is appropriate to investigate a contemporary phenomenon inside its real context, using multiple sources of evidence: interviews, observations, documents, etc. (Yin, 1989 apud Lazzarini, 1997). For the author, the possibility of using multiple sources of evidence is one of the most relevant strengths of research based on case studies.

The newcomer engine assembler produces 1400cc and 1600cc gas-fuelled engines in a single plant. Its installed production capacity corresponds to 335,000 engines per year, if working on a three-shift system. However, the production is currently working on a two-shift system, and about 190,000 engines were produced by the company in 2006.

Case study was based on semi-structured interviews, which lasted about one hour each. The interviewees were preferably related to a) management, product and process technology and b) manufacturing processes.

Table 3 summarizes the data gathered in the case study.

CASE ANALYSIS

Field research was conducted by means of case studies, which were carried out during different periods of

The plant, set up in 2000 with the intent of producing 800 engines/day, has not seen its initial expectations met. Since 2004, the total production has averaged 500 engines/day - in other words, almost 40% of idle capacity. This fact has certainly impacted on the economical viability of the plant, which has strongly prioritized cost reduction, given that its planned production level (and consequent revenues) has not become real.

Also we should add to this fact the expectation (not met) of increasing product nationalization index, which was of 60% in 2000 and should quickly reach to 80%. However, after six years, this goal has not been reached yet (once that nowadays it averages 75%).

One of the main difficulties in the nationalization process, according to the interviewees, concerns product quality. This fact has major impacts on the “quality” competitive priority (emphasized by the newcomer company) and also on the use and consolidation of quality tools like SPC (Statistical Process Control), Kaizen, FTC (First Time Through Capability) and in obtaining the ISO TS 16949 certification. Besides, the company has altered its sourcing policies, using two suppliers instead of single sourcing for parts under nationalization process.

The newcomer engine assembler tends to differ significantly from Brazilian mature engine manufacturers (Maia, 2006), when it comes to the division and localization of technological-development and product-design activities for the Brazilian branch.

In the Brazilian branch, there is an established department with seven engineers, which are responsible for the technological activities. Such activities consist in adapting the existent production processes to the new engine models developed by the headquarters.

In 2006, the newcomer company set the goal of creating a “Product Engineering” department in Brazil. In this context, company’s Product Development efforts would emphasize Innovation. The employees responsible for local technological activities have intensified contact and knowledge sharing with international headquarters. These Brazilian engineers are often attending courses in the headquarters and intend, in the near future to start developing new engine models, based on the ones that are currently manufactured in the Brazilian plant.
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>Competitive priorities</strong></td>
<td>Intends to produce 800 engines/day</td>
<td>=</td>
<td>Cost and Quality</td>
<td>=</td>
</tr>
<tr>
<td><strong>Production capacity</strong></td>
<td>=</td>
<td>Production of 450 engines/day</td>
<td>Production of 520 engines/day</td>
<td></td>
</tr>
<tr>
<td><strong>Products</strong></td>
<td>Two models of 1600cc 16-valve engines, all of them turbocharged. All products made for export.</td>
<td>=</td>
<td>=</td>
<td>1400cc and 1600cc engines – 23 models</td>
</tr>
<tr>
<td><strong>Outsourcing</strong></td>
<td>Nationalization index ¹ is about 60%, but there are plans to reach 80% Machining is accomplished in-house, and foundry is outsourced.</td>
<td>=</td>
<td>Efforts to increase nationalization, but hampered by quality issues</td>
<td>Nationalization index is about 75%.</td>
</tr>
<tr>
<td><strong>Number of suppliers</strong></td>
<td>Approximately 100, being one supplier for each acquired part. In some cases, the engine assembler provided equipment and tools for suppliers</td>
<td>=</td>
<td>73</td>
<td>92 (it has increased due nationalization strategy)</td>
</tr>
<tr>
<td><strong>Workforce</strong></td>
<td>Plans for hiring almost 1000 workers</td>
<td>425 (160 third party workers)</td>
<td>420 (150 third party workers)</td>
<td></td>
</tr>
<tr>
<td><strong>Workforce training</strong></td>
<td>=</td>
<td>=</td>
<td>Programs for continuous formation and training, mainly concerning people management.</td>
<td></td>
</tr>
<tr>
<td><strong>Work organization</strong></td>
<td>4 assembly lines, organized according to lean production concepts. Inflexible and dedicated equipment</td>
<td>=</td>
<td>=</td>
<td>Process-oriented layout, with distinct areas for producing blocks, cylinder heads, crankshafts and connecting rods, and one area for final assembly. Inflexible equipment.</td>
</tr>
<tr>
<td><strong>Production Planning and Control / Logistics</strong></td>
<td>=</td>
<td>=</td>
<td>Accommishes Production Planning and Control by means of an ERP system.</td>
<td></td>
</tr>
</tbody>
</table>

¹ Ratio of parts produced in Brazil to the number of imported parts.
Quality Management

ISO 9001 and ISO 14001 certification.
Uses SPC (Statistical Process Control), poka-yoke, Kaizen, FTC (First Time Through Capability) and Kamishibai route.

Product and Process Development
Dependence on the headquarters both in R&D and product development activities. Only processes are locally developed.

ISO 9001 and ISO14001 certification

Legend:
- Cells left blank means that we have no data about that aspect in the specified period of time
- Cells filled with “=“ means that there was no significant changes from the immediately previous period of time

Table 3 –Data about the newcomer engine manufacturer

In this sense, product technical changes are still being accomplished at the headquarters. The Brazilian branch receives the product design and adapts it to the actual production processes (process Technical Changes). Process technological activities are relatively rare, since the processes are not flexible and only two models of engines are produced.

FINAL REMARKS

The growth of competition in the Brazilian and international automotive market has revealed to the automakers (and their corresponding engine manufacturers) urgent demands for quality and productivity improvements. In the context of automotive manufacturing, engines can be considered strategic systems for the automakers’ competitiveness, being composed of a great number of parts, from distinct industry segments.

Although we do not intend here to make generalizations about newcomers in Brazilian automotive industry, it’s important to mention several studies by (Cerra, 2007; Alves Filho et al 2006; Consoni, 2004); which argue that, regarding operations and technological strategies in this industry, newcomers keep important similarities among them; and mature companies and newcomers are different when compared with one another.

Central to the present analyses is the idea that companies must develop, reconfigure and integrate their strategic competences, proceeding along competence trajectories that both leverage their competitive success and constraint their strategic options.

Regarding the operations strategies undertaken by the newcomer, the company has prioritized cost reduction and quality enhancements among their operations priorities.

Also, Product Development (PD) issues seem to play a key role in the future competences that companies need in order to achieve competitive success. In this sense, the newcomer has been making efforts to increase its product nationalization.

Considering operations trajectories, it seems that the engine manufacturers are already following competence trajectories, as proposed by (Teece et al, 1997:515 apud Dannels, 2002). Those competence trajectories are directly related to the topic about uniqueness and appropriability of interfirm resources, as originally described by (Barney,1991).

In this context, competitive priorities in a certain period guide operational decisions, and these decisions influence (or constraint) the priorities pursued in the next periods.

Based on the aspects here investigated, we indicate some possibilities for further research. Although we do not aim to provide an exhaustive list, some themes include: (1) studying other engine manufacturers (including mature ones), in order to analyze different trajectories; (2) analyzing other functional strategies (including technological ones); (3) analyzing auto suppliers, to identify their trajectories and the mutual influences between trajectories followed by engine assemblers and by their suppliers; and (4) analyzing the technological...
trajectories followed by Brazilian companies that had been taken over by multinational corporations.

REFERENCES


