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# The modular consortium in a new VW truck plant in Brazil: new forms of assembler and supplier relationship

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Since November 1995, VW has been running an experimental plant to produce trucks and buses in Brazil. The manufacturing strategy is quite different from the current strategies one can see in the automotive industry worldwide. VW has defined its concept as "modular consortium". Describes the plant's main characteristics, and discusses the risks and the opportunities for VW and its partners to obtain sustainable competitiveness based on a radical new production concept.

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## Introduction

Two of the major areas of change in the world auto industry are the patterns of production organization and to the relationships between assemblers and suppliers.

An innovative experiment is being conducted in a new Volkswagen truck and bus plant in Resende, Brazil. All the operations are being carried out by suppliers *inside* the site. This organization concept has been called a "modular consortium".

This paper discusses a set of results from a larger research that is being developed by the authors and some other colleagues. The aim of the research is to monitor and evaluate the development of this new concept of organizing production, establish its relationship with other changes that are occurring in the global automobile industry and especially in Brazil, where huge investments are being made and planned by transnational companies. The development of this concept is a unique opportunity for researchers to follow and analyse from its very beginning a concrete experiment that is being conducted by a major assembling company outside US, Japan or Europe.

A series of interviews were conducted with VW directors, managers, and engineers; some of the suppliers involved in the project; managers of companies that participated in the process of negotiation with VW but eventually did not take part in the project; engineers from a company that was subcontracted to design the facility; trade unionists. Plant visits were also held.

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## Conceptual framework

Very little can be found in the literature that can be used as a theoretical framework for

this case. Some references discuss the benefits and the risks associated with initiatives like vertical integration, joint ventures and virtual factories which are relevant but do not deal exactly with the new aspects introduced by VW Resende plant. Nevertheless, Williamson's (1994) approach to "transactions economics", Hill's (1993) approach to focusing and the benefits and risks associated with vertical integration and the Chesbrough and Teece (1996) critique on the virtual factory concept will be briefly presented in order to build a useful conceptual framework.

Williamson (1994) argues that the degree of vertical (dis)integration must be considered in the light of the costs of transaction between organizations. This author has opened a wide range of new and important research questions by stressing the need of considering the various types of transactions and forms of contracts intra and inter firms to better understand their behaviour. One of his main conclusions is that the best management structure for a firm is one that allows stronger adaptability to uncertainties. Based on this assumption he stated that vertical integration could be a good choice when this adaptability can be obtained without the need for renegotiating contracts between parts.

According to Hill (1993), focusing strategies must be seen in the context of a reorientation in the business strategy, as a mean to reduce complexity and to concentrate efforts in less products/markets/processes.

When analysing what he calls the post-industrial company, Hill (1993) assumes that it would do little manufacturing and will rely on others for many important and essential business functions. The risk associated with this strategy is the possibility of losing the company ability to compete, since it will weaken its capacity of innovation and productivity

improvement. The author suggests that other alternatives less risky would be the formation of joint ventures, the non equity-based collaboration, long-term contracts and other initiatives that could retain one company's innovation capacity.

Referring to the "virtual factory" concept, Chesbrough and Teece (1996) also argue that the incentives to make a powerful decentralized/virtual company also leave it vulnerable. They are particularly interested in the risk of losing strategic competences as a result of certain types of firm alliances. After analysing some examples, they stress that "the virtues of being virtual have been over-sold" since, in the long run, innovation processes can generate unforeseen situations that work against the initial agreement. According to these authors it is necessary to find the right balance between the capabilities one company needs and the type of innovation that it is looking for: strong decentralizing policies would fit better for firms looking for autonomous (specific and well specified) innovations such as the need to develop a new part or subsystem in an automobile engine. In these cases the risk of sharing (and losing) strategic competences is less important. For firms interested in systemic innovations (which need fundamental redesign of product and/or the entire manufacturing process) alliances should be considered much more carefully.

### Context, environment and case background

The Brazilian automotive sector has gained strong momentum since 1993, mainly due to the Sectoral Chamber Agreement, reached between the government, industry and trade unions (Salerno, 1995) and to the stabilization of the economy, from 1994 onwards. The Brazilian automotive sector produced 1.813 million units in 1996, compared to only 0.914 million in 1990[1].

Many new investments have been announced for the subsector: Volvo is investing in the enlargement of its plant in Curitiba; Fiat announced the production of Iveco branded trucks; Ford is studying the production in Brazil of its new heavy-duty truck, designed in the USA; Scania built a new facility for the production of cabins; Mercedes-Benz transferred a development centre to Brazil, is modernizing its plant in Sao Bernardo and has closed down its site in Campinas, aiming to cut costs. Mercedes is still the biggest producer of heavy-, medium- and low-weight trucks but has lost market share to VW and Scania in the medium- and heavy-weight trucks market.

There is no doubt, however, that VW's new plant in Resende is the most interesting. Due to the end of the Autolatina venture with Ford, VW had to withdraw from the plant (Ipiranga/Sao Paulo) it was sharing with Ford to produce buses and trucks. This gave VW the opportunity of designing a whole new "greenfield" plant, based on the "modular consortium" concept. Engineering was stimulated by Mr Lopez, VW vice-president and responsible for Latin American operations at that time, to innovate; he was personally involved in the development of the "modular consortium" idea. The innovations involve not only strong changes in the production process and the organization of the plant, but also in the way the investment is made.

VW has decided to establish its truck division as an independent operation at the world level, in the same way that Audi, Seat, Skoda and VW are distinct operations. For VW Brazilian operations, trucks represented about 20 per cent of its income in 1994-95, and margins are much greater than for passenger cars.

The technological centre for product development of VW trucks is located in Brazil; a new facility is being built near the Resende plant. VW is taking advantage of its historical policy to have a design centre in Brazil; this capability was decisive.

- Even during the Autolatina years, when the predominance of truck operations belonged to Ford, VW was able to design and launch a very successful bus platform. By doing a special research with bus companies, by the utilization of simultaneous engineering design techniques, and by an aggressive marketing, VW was able to launch a cheaper and more convenient bus for the Brazilian conditions. The existence of a local design facility was decisive, since VW could be very fast in order to take advantage of a special moment, when local bus fleets were being renewed in large Brazilian cities[2].
- VW was able to learn from Ford trucks operations - to better know the suppliers, the assembly problems, etc.
- As far as truck consumers are professional consumers, VW was able to "customize" the product according to client needs.
- VW engineering staff is using its technological know-how to adapt product design to the new assembly conditions of the modular consortium.

### The VW modular consortium design

The modular consortium concept is based on the transfer of all assembly operations to nine first-tier suppliers (from now on, referred as

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“partners”), chosen from 47 bidders. The plant is located in Resende, between the cities of Sao Paulo and Rio de Janeiro. It is expected to be fully completed by November 1997. In November 1996 it was commenced output, producing only chassis for trucks and buses, without the paint shop. Buses and trucks are assembled in a conventional line and partners are responsible for the complete operation of seven modules, aggregating all parts and systems. VW does not have any direct workers of its own in this plant.

The modules are organized by the partners themselves. Capital investment and daily production process management (work organization, logistics, maintenance) will also be provided by them. Although VW will provide only land, buildings and infrastructure, one of the key aspects of this concept is that the plant will be dedicated only to VW's own products and needs.

VW claims it is investing US\$ 250 million and partners as a whole are supposed to invest the same amount to initiate operations. Each module is defined by a whole logical part of the assembly.

The layout scheme is shown in Figure 1. VW produces chassis for both trucks and buses, while cabins are produced only for trucks.

The VW engineering department is adapting product design to make assembly possible and easier. This is necessary to cope with the differences between assembling, for example, a whole engine (with gearboxes, filters, electrical devices, radiator and so on) and the traditional sequential assembly of the same subsystems and parts. Nevertheless, partners are expected to absorb greater responsibilities in product parts development and specification, remaining with VW the basic design,

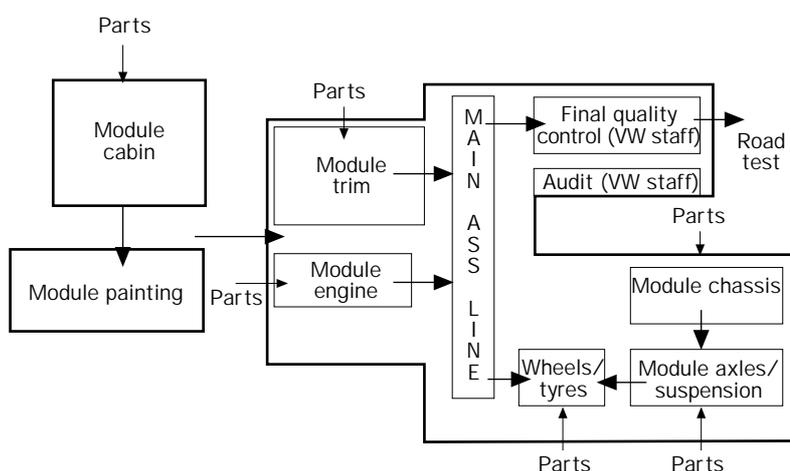
quality standards, R&D and co-ordination activities.

The choice of bus and truck operations to test this new concept would seem to be sound, as their design and production characteristics seem to be more appropriate to the modularization process. Differently from the automobile design, in the production of trucks it is easier to separate chassis and cabin in different modules. For buses, the cabin is chosen by the customer, independently from the chassis supplier. Another difference is the fact that VW is used to having its bus and truck engines outsourced; this is not the case with all automobiles builders around the world since engine is one of the passenger car's key differentiation aspects[3].

Each module is responsible for finishing parts and subsystems in its own area but in a second step it is necessary to assembly them inside the line, which is designed to pass through the modules. Some aspects of organizational issues can also be drawn.

- An executive committee (composed by VW and partners' representatives) will be responsible for defining long-term strategies and the main features of its implementation process.
- A co-ordination committee (also composed by VW and partners' representatives) will be responsible for managing short- and medium-term aspects.
- All 1,200 expected direct workers will belong to the same hierarchical level, based on VW policies. The majority of them are expected to be hired from Resende's neighbourhood. These assumptions may cause some friction with partners since, in principle, they would have autonomy to decide about these issues. It is also necessary to consider the complex task of co-ordinating the various modules and their relationship. Will it be possible to manage these needs without a more complex hierarchical structure?
- A VW employee, in a position called “meister” (master), has the responsibility for quality assurance, audit procedures and production co-ordination.
- Although VW assumes that most of final decisions regarding organization would be partners' responsibility, the company expects all workers to be organized in teams, in a model very much similar to the elementary technological unit (ETU) concept, adopted by companies like Fiat (for instance, in its Brazilian plant) and Renault. According to Fiat, an ETU is a unit that governs a segment of the process (a technological subsystem), in which such activities as prevention, variance absorption, self-control and continuous improvement are

**Figure 1**  
 Modular consortium at VW Resende (trucks)



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carried on, in order to achieve the firms goals in terms of quality/productivity and service. In Renault words, it is a group of multiskilled and multifunctional workers, in charge of a part of the whole process, animated by a group leader (Camuffo and Stefano, 1995).

The plant capacity is designed to a volume of 40,000 units per year, 120 per day, and it is expected that full capacity will be reached by the end of 1997. In terms of throughput time, there are some very ambitious goals: instead of the 28 hours measured in the Ipiranga/Sao Paulo plant – a Ford plant where the VW trucks and buses were assembled during Autolatina period – it is expected that with the new concept it will be possible to reduce it to eight hours/product. Production began in November 1995 in an experimental way, in a rented old plant near the estate where the definitive plant is built.

VW strategy seems to be the partial transformation of sequential times that predominates in a conventional high-volume dedicated line into parallel times which characterizes both “make to order” low volume and complex assembly operations. The focus is also towards the transformation of operations into a “virtual” or “fractal” factory (Warnecke, 1993), in which the owner only coordinates production, partners network and other service providers. The major issue is the reduction of the amount of investment, in order to control what VW managers define as the business core: the relationship with potential clients through commercial and design personnel, and through post-sale services. In Williamson’s (1985) terms it seems that the company is looking for a particular trade-off between the market (“suppliers”) and the firm (“consortium”).

The partners are being paid according to the number of finished and approved products at the end of the line. There is also a long-term contract (around five years) in which rights and obligations are detailed for both parts. This kind of contract is something very new in the Brazilian automotive industry.

With this plant the Brazilian VW truck and bus operations is expected to be transformed into the fifth company trade-mark headquarters, along with VW, Seat, Audi and Skoda. The Brazilian branch is responsible for all VW commercial vehicles designed around the world (except for the VW Transporter).

Many other aspects of the project will have to be deeply researched and understood in order to evaluate the possibilities of the concept and its viability: the day-to-day management of the line, the costing system, the information system, the logistics of distribution of

finished goods, the production planning, work organization, workers, and trade unions attitudes among others.

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## Discussion

There are many aspects involved in the concept that have to be discussed and defined in order to implement it. Consensus is something almost impossible to find when executives are asked to give their opinions about VW new plant. “I’d call it utopian. It’s too risky to go to such extremes”, says a manager from a competitor. Another one stressed what he calls the excessive interdependence between final assembler and their suppliers. “No contract is for ever. If either side runs into difficulties, what do you do? What would be the sanctions?” (Simonian, 1996). A director of a competitor in Brazil stated that “VW risks losing its core business, that is, the human resources management” [4].

In this paper we will focus on three of the many issues that can be raised:

- 1 the management of the economic risk involved;
- 2 the technological risk;
- 3 the management of the interface between different companies operating inside one single factory.

From this, we will examine whether this plant could be a sign of a new production model.

**The management of the economic risk**  
Innovations based on the same underlying principles of the modular consortium are being implemented elsewhere in Brazil: subcontracting is increasing and Ford and Fiat are introducing what is being called “industrial condominium”, where suppliers are allowed to install in areas in the assembler’s plant to produce pre-assembled subsets along the main assembly line. The main difference between these arrangements is the fact that VW shares the new investment with some key partners from the very beginning. This implicates a new partition of the business risk, traditionally wholly assumed by the assembler.

From the point of view of the partners, it means moving from a situation where they had to cope with the risk of getting a contract disrupted, or the risk of a fall in the demand, that could be compensated with a contract with another client, to a situation where the investment is dedicated to a single client, now a partner. The fixed capital and the workforce that is contracted will now be dedicated to the production of a final product that is and can only be sold by VW. This means a drastic reduction in the flexibility the partner had to

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decide how to use its investment. However, the trade-off is the reduction of fixed costs that the supplier would carry in his own factory: facilities, real estate, etc., are common costs that are shared by VW and all the partners.

All this leads to the definition of the commercial relationship between the parties: how much is it possible to invest in order to absorb the increase of risk? The common way of sharing the risk is the creation of a new company, with capital formed by VW and its partners, but this is not the case since the plant will be part of "VW do Brasil" Company.

This sheds a light on the way the commercial transactions are made: any transport of an engine and assembly to the chassis is in fact a sale, leading to taxation problems. The management of risk is strongly linked to the formation of price. If the increase of risk of the partners is reflected in higher prices, the whole idea can fail. In this way, costing would be a very delicate issue: VW insists that anything assembled will be paid only if the whole final product passes the quality threshold. This could be seen as common practice, but in this case, the issue is that only when the complete truck or bus is finished and audited by VW, the partners are entitled to receive the payment for the parts they assembled. If the final product is not approved, none of the partners are paid, even if there is a problem with a part produced by only one of the partners. So, another risk is added to the operation from the point of view of the partners.

What can still interest the partners is the possibility of having, for the first time in Brazil, long-term contracts with the assembler: the absence of this arrangement is responsible for the risks that are presently expressed in higher prices for the assembler. Another advantage is the possibility of having access to international markets, through VW (follow source, for example), if this concept is successfully implemented in Brazil.

#### **The technological risk**

From the point of view of VW the integration with the partners can be highly productive. A synergy can be established between the participants as different competences and different points of view can be put together to develop products and processes. Traditionally, some decisions that were taken by the assembler product engineers were restrictive to the partners' engineers. Sometimes negotiations could be held, but in many cases it ends up by leading to a compromise that was not seen as the best solution for each part. In the new arrangement there can be new communication channels and a deeper commitment between the parts.

On the other hand, it is possible for the partners to gradually increase their competences in areas that were unknown for them before. The level of dominance of product and process technology will depend sharply on the management of the relationship between partners, but VW will have to manage the risk of sharing its knowledge with others, whom can establish other contacts in the market, with other clients. Moreover, the extension of this gain for the partners can be the acquisition of the ability to make products without VW participation. For VW, this is one of the key elements to be monitored. In fact, there are no evidence to substantiate this risk at the moment, but this is an issue that was considered feasible both by VW and suppliers' engineers who were interviewed during the field research.

The concept that is being developed by VW leads to a very interesting question: what is really an auto assembler? In particular, what will be the role of VW in this scheme? If VW's differentiation is its technological capabilities and its brand in the market, in the long run could this contribution be restricted to the brand? Is this a particular situation of franchising, where different capitals are joined to operate under the brand of a third party? In other terms, will it be possible for VW to remain competent in the area as long as it withdraws from day-to-day production problems? Will it be possible for VW to appreciate its capital without the anchor of a production process? In a word, which are the critical factors of success in this business? These are all questions that could only be answered during the development of the experience, but that have to be borne in mind of the designers of the scheme.

#### **The organization of the interfaces between different companies in the same factory**

As many companies will operate inside one single plant, the increase in the complexity of the operation is inevitable. Some aspects of this complexity can be pointed out:

- the balancing of the line will difficult, not only because of putting different areas of the factory at the same pace, but different companies; this can make it much more difficult to rearrange one single operation to achieve a better line balancing;
- the workforce will have to be submitted at the same time to policies of the company to which it is linked and to a minimum of uniformity inside the plant;
- the quality procedures will have to be equalized as well among all partners operating in the plant, and this can lead to a set of procedures that is different from VW and from each company's. This is a very important

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issue if we consider VW policy to get ISO 9000 certification.

In spite of not having direct workers, VW must know that high quality and low cost are permanent targets that are achieved (or not) on the shopfloor: the ability to integrate different cultures and to solve day-to-day problems depends on having a co-ordination of the process that is unprecedented in the old scheme.

### Is this plant a sign of the rising of a new production model?

Mr Lopez de Arriortua has presented the project as something that will be known in the future as a model of production in the same way as the Fordist model or the Toyota model are known. Taking apart the propaganda aspects of the project, the complexity and novelty of this concept also arises the question of the degree of changes it embodies.

Some analysts claim that the VW plant has strong links with the fractal factory approach, developed among others, by Warnecke (1993) and de Meyer (1992). In the words of Warnecke, a fractal is "an independently acting corporate entity whose goals and performance can be precisely described" (Warnecke, 1993). Self-organization, self-optimization, goal-orientation and constant assessment and evaluation are its main characteristics.

Without going too far in the fractal concept, the question is: does the VW plant represents the next step in the automotive production organization, after the waves represented by the computer-integrated manufacturing (CIM) approach in the 1970s and the just-in-time (JIT) concept developed during the 1980s? If we take the hypothesis that the new model requires highly flexible and autonomous organization forms and so would provide better performance in a very complex and demanding market environment, the VW new concept can be a real experiment in this path.

The fractal company approach can lead us to an optimistic panorama representing the birth of a possible new production model. But the contrast with what is happening in the Brazilian auto-parts industry is not only embedded in optimism.

The components sector in Brazil has radically changed in the last three or four years: only half of the companies still exist. The number of first-tier suppliers has reduced and the concentration of capital has increased. Among the Brazilian small and medium-sized firms profits and survival perspectives have been shortened continuously. Mergers, acquisitions and licensing agreements are unavoidable for the bigger auto-parts companies but at the end of this

process some of them will probably also disappear due to the growing competitiveness and extremely selective process that is being developed by assemblers. For the smaller companies, the best future would be to become third- or fourth-tier suppliers.

One hypothesis to be checked is that this process will lead to a new wave of concentration in the automotive industry, meaning that small and medium native companies will not take part of the first-tier suppliers group – the modular consortium model requires fewer suppliers, with stronger technological and investment capabilities. The role of small- and medium-sized companies (mostly local) seems to be supplying the first group and not VW, as it used to happen in Brazil.

Another question concerns the technological capabilities of suppliers. The VW new plant concept seems to upgrade suppliers capabilities in such a way that it seems to be possible that in a near future, all the core activities still regarded as assemblers' ones could be performed by some big suppliers'. Some VW managers are considering this hypothesis although apparently nothing is being done to cope with this threat up to now.

Would it mean a sign of a different division of markets and labour among assemblers and suppliers? Will we see newcomers breaking the traditional hierarchical chain in the automotive industry? The main obstacle for this to happen may not be the technological capabilities but the huge investment that one company has to make in order to build and run a new plant. Only assemblers seem to have the capacity to do that up to now. This aspect is crucial and may prevent newcomers, depending upon which segment of the market is targeted.

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## Conclusions

The VW Resende plant is the most integrated experience in outsourcing in the automobile sector worldwide. The first few months of an experimental plant are not enough to derive firm conclusions; this will only be possible some years after the beginning of normal production.

VW has taken advantage of some opportunities: the end of Autolatina (VW-Ford joint-venture in Brazilian and Argentinian operations) imposed the necessity of building a new truck and bus plant, as the VW products were produced in a Ford plant; the VW success in this business in Brazil (although it is not known overseas as a commercial vehicles producer); a sharp restructuring and concentration of the Brazilian components sector, mainly due to global and follow sourcing,

reducing the partners' resistance to the idea; and a government policy that stimulates new investments in the assembly sector.

On the other hand, some important and decisive constraints cannot be denied: work and trade union regulation; commercial laws; taxation procedures; a complex co-ordination process related to different partners, with different cultures, approaches and methodologies; and the risk of losing the core business.

Certainly, this plant is a possible breakthrough in the automobile sector. Its success could deeply affect the conception and design of new plants. It is a case to be closely followed and studied in the near future.

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### Notes

- 1 All data from Anfavea (the Brazilian Association of Auto Producers), *Carta da Anfavea*, No. 128, January 1997.
- 2 The Brazilian government had set, at that time, a programme to this renewal, including financial support for the private bus companies.
- 3 There are some possibilities that the announced GM subcompact car plant, planned to be located in the south of Brazil, and the announced Chrysler Dakota plant near Curitiba will introduce some features of the modular consortium. For instance, it is possible that Dana Co. will be in charge of the assembly of the Dakota chassis inside Chrysler's plant.
- 4 Interview made by the authors.

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