
Geographical distribution of product development capabilities in the automobile industry: towards a hierarchical division of labour in Mercosur

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Abstract: In the last decade, some carmakers with operations in Mercosur delegated a growing number of product development responsibilities to their subsidiaries operating in Argentina and Brazil. As a result, these subsidiaries were able to accumulate capabilities that allowed them to introduce innovations of increasing complexity into the vehicles manufactured in the region. Empirical evidence suggests that, beyond the differences observed in the strategies adopted by carmakers in Mercosur, the most intense capability accumulation experiences were largely concentrated in subsidiaries located in the Brazilian territory. As a result, a hierarchical division of labour has progressively taken shape within Mercosur favouring the subsidiaries located in this country, at the expense of their Argentinian counterparts. Through the examination of three companies, this article aims to analyse the process of accumulation of product development capabilities in subsidiaries operating in Argentina and Brazil between 1991 and 2011.

Keywords: innovation management; multinational companies; automotive industry; product development; emerging markets; Mercosur.

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1 Towards the crystallisation of a hierarchical division of labour in Mercosur

In the last decade, after the difficulties faced by companies which attempted to pursue ‘world cars’ or ‘global platforms’ strategies, carmakers seem to have found in regional areas ‘automotive viable spaces’ (Jullien and Lung, 2011; Lung and Van Tulder, 2004). Companies progressively organised their commercial and manufacturing activities around regional territories attending demand structures which exceed the boundaries of individual countries (Lung and Freyssenet, 2004). Some companies have gone a step further in this direction decentralising their product development (PD) activities to the regional areas where they operate. This required the delegation of responsibilities to overseas subsidiaries in a field which had traditionally remained in the hands of parent companies. The purposes of the geographical decentralisation of PD activities are manifold: to exploit territory-specific resources, to cut down development time and costs, to offer products better tailored to the preferences of consumers of the host regions, etc. (Quadros, 2009).

Since the signing of the Treaty of Asunción which gave birth to Mercosur in 1991, and in particular, of the automotive protocols agreed between its two largest member states, i.e., Argentina and Brazil, this region has become one of the main ‘emerging’ car markets and production poles in the world¹. In the last decade, some carmakers organised their PD activities at regional level and delegated a growing number of responsibilities to their Argentinian and Brazilian subsidiaries. In this process, subsidiaries were able to progressively accumulate more complex PD capabilities (Amatucci and Mariotto, 2012; Balcet and Consoni, 2007; Dias et al., 2011; Dias and Salerno, 2004; Consoni and Quadros, 2006; Ibusuki et al., 2012; Quadros, 2009).

However, the strategies adopted by carmakers in Mercosur are far from homogenous. First, they have differed in the degree of PD decentralisation carried out by the parent company in favour of subsidiaries operating in the region. Second, they have been different in terms of the distribution of PD responsibilities between the subsidiaries located in Argentina and Brazil. In general, however, evidence shows that the most intense capability accumulation processes were largely concentrated in subsidiaries operating in the Brazilian territory (López et al., 2008). As a result, a growing differentiation in the level of PD capabilities as well as in the knowledge intensity of the responsibilities assumed by the individual subsidiaries seems to have been taking shape between the Argentinian and Brazilian subsidiaries. This process is leading to an intra-regional hierarchical division of labour among subsidiaries.

Through the examination of three case studies dealing with the experiences of Fiat, Renault and Toyota, this article aims at analysing the evolution of PD capabilities of car makers’ subsidiaries operating in Argentina and Brazil. The overall purpose of this examination is to contribute to the understanding of the process leading to the articulation of a hierarchical division of labour between the subsidiaries operating in the two countries.

The article is organised as follows: in the next section the research design will be presented. The third and most extensive section discusses the three case studies. Finally, a cross comparison of the cases is carried out; finally, some conclusions are drawn.

2 Research design

2.1 *A framework for the analysis of the accumulation of PD capabilities in the automotive industry*

The present study of the process of accumulation of PD capabilities in automotive subsidiaries in Mercosur draws on an adapted version of the PD capability scale elaborated by Consoni and Quadros (2006) which, in turn, builds upon the broader technological capabilities matrix developed by Lall (1992) and Bell and Pavitt (1995).

I elaborated an eight-level scale (Table 1) which groups PD capabilities in three main categories: basic capabilities, intermediate innovative capabilities, and advanced innovative capabilities. The first group regards the basic skills necessary to operate a manufacturing plant in a given country. In essence, it entails the ability to assemble products, to develop a local supply chain, and to introduce minor changes in the products locally manufactured. The second group of capabilities involves the utilisation of more complex technological knowledge to adapt products, design facelifts or advance in the development of partial derivative vehicles. The third group corresponds to skills necessary to develop complete derivative projects or new platforms, and to conduct consistent R&D activities.

Table 1 Product-development capabilities in carmakers

Basic capabilities	1	CKD assembly operations: <ul style="list-style-type: none"> • Replication of fixed product specifications. • Standard quality controls.
	2	Nationalisation: <ul style="list-style-type: none"> • Localisation of parts: search, evaluation, selection and contracting of local suppliers of parts and components. Technical support to local suppliers. • Minor changes in parts and/or components, for instance, in response to local availability of materials or regulations.
Intermediate innovative capabilities	3	Adaptation/restyling/facelift: <ul style="list-style-type: none"> • Adaptations in parts/components to comply with domestic market features and conditions (e.g., suspension, engines). • Restyling/facelifts involving external body and minor adjustment in platforms.
	4	Development of partial derivatives from existing platforms for regional/emerging markets: centre of excellence on certain systems/components for the whole corporation.
Advanced innovative capabilities	5	Complete derivative projects from existing platforms for regional/emerging markets.
	6	New platform and family of vehicles for regional/emerging markets.
	7	New platform and family of vehicles for world markets.
	8	Consistent R&D activities for the development of new products, technology and/or materials using leading-edge technology (engine, driving, braking, suspension, body, electronics, materials).

Source: Own elaboration

2.2 Multiple embedded case studies

In order to address the research problem raised above an embedded multiple case study research was designed (Yin, 2009). The main unit of analysis corresponds to the PD strategies followed by carmakers at the level of Mercosur between 1991 and 2011 (Table 2). In a second level of analysis, I identify ‘embedded cases’ corresponding to the process of accumulation of PD capabilities by individual subsidiaries operating in Argentina and Brazil.

Table 2 Configuration of embedded case studies

<i>Main case study</i>	
PD strategy adopted at the level of Mercosur	
<i>Embedded case</i> : PD capability accumulation in the Argentinian subsidiary	<i>Embedded case</i> : PD capability accumulation in the Brazilian subsidiary

Note: Units of analysis.

The justification for this multi-level approach lies in the fact that the technological learning trajectory of individual subsidiaries operating within the same regional area cannot be properly understood if examined as independent phenomena. Rather, they are mutually interconnected as part of global and regional functionally integrated networks are largely dependent on the broader PD regional strategies within which they evolve.

In order to analyse the case studies, the empirical evidence collected during the fieldwork process was organised in timelines (1991–2011) representing the process of accumulation of PD capabilities in individual subsidiaries. The vertical axis corresponds to the level of PD capabilities achieved by each subsidiary – ranging to 1 to 8, in accordance to Table 1. Then, the technological trajectory of each firm was divided into different stages, marked by changes in the business strategy adopted by the company in the region. For each case, an account of the each stage of the technological strategy of the firm and the process of accumulation of capabilities of individual subsidiaries is provided in the article.

2.3 Selection of cases

Three carmakers with subsidiaries operating in Argentina and Brazil have been selected as case studies: Fiat, Renault and Toyota. The objective of the selection was to cover a range of different situations with respect to the history of the subsidiaries in the region, their relative positions within their corporations and the characteristics of the PD strategies followed in the Mercosur region during the period under analysis.

Fiat had a long history in the region. Car manufacturing activities in Argentina began in the 1960s, whereas the Brazilian plant was opened in the mid-1970s. Since then, the company has been one of the leading carmakers in the two countries. From the 1990s, the region as a whole, and the Brazilian unit in particular, gained increasing importance in the corporation. Whilst in 1990 the share of this subsidiary in the total car manufacturing output of Fiat was around 10%, in the mid-1990s it was above 23%. In the second half of the 2000s, the share of Mercosur subsidiaries in the total production output of the corporation skyrocketed, reaching levels over 39%².

Historically, the main country of reference for Renault in the region was Argentina, where the company started to produce vehicles in 1960. However, in 1991, the firm left the management of its operations in the country in hands of a local business group (CIADEA). It was only in the mid-1990s when the Mercosur region, and especially Brazil, became one of the strategic 'emerging' areas for the internationalisation aspirations of Renault. Then, the company decided to regain control of its operations in Argentina (1997) and opened three manufacturing plants in Brazil (the first one was inaugurated in December 1998). However, until 2006, the company had difficulties in consolidating its presence in the Mercosur market, in particular in Brazil. The participation of the two subsidiaries in the total car manufacturing output of the company between 1999 and 2006 averaged 3.8%³. The situation improved significantly from 2007, with the change of the product policy of Renault for emerging economies. Between that year and 2011, the two subsidiaries accounted in average for 8.87% of the total production of the corporation.

The presence of Toyota in the region dates back to 1959, when the company opened up its first manufacturing plant in Brazil. For almost four decades, the subsidiary produced a compact sport utility vehicle, the Toyota Bandeirante, in extremely low quantities (an average of around 2,500 vehicles per year between 1959 and 1997) and nearly with complete autonomy from the parent company. In the second half of the 1990s, Toyota decided to implement a new strategy in the Mercosur region. In 1997, it established a subsidiary in Argentina and, in 1998, inaugurated a new plant in Brazil. The initial volume of production of the two plants was very low (below 20,000). Although the manufacturing capacity increased over the years, reaching around 70,000 units in 2011, the participation of the two countries in the corporation remained very modest. Altogether, they never accounted for more than 2% of the total vehicle manufacturing output of the firm⁴.

2.4 *Data collection*

Multiple sources and information collection methods were employed in order to enable the triangulation of data (Miles and Huberman, 1994; Yin, 2009). Between March and December 2012 a total of 17 interviews were conducted with managers of the selected subsidiaries in Argentina and Brazil. Additionally, nine interviews were conducted with scholars and executives of business associations in the two countries. Internal documents of companies, newspapers⁵, and specialised literature were initially used to design the interviews, and, in a second instance, to validate and expand the information collected from them.

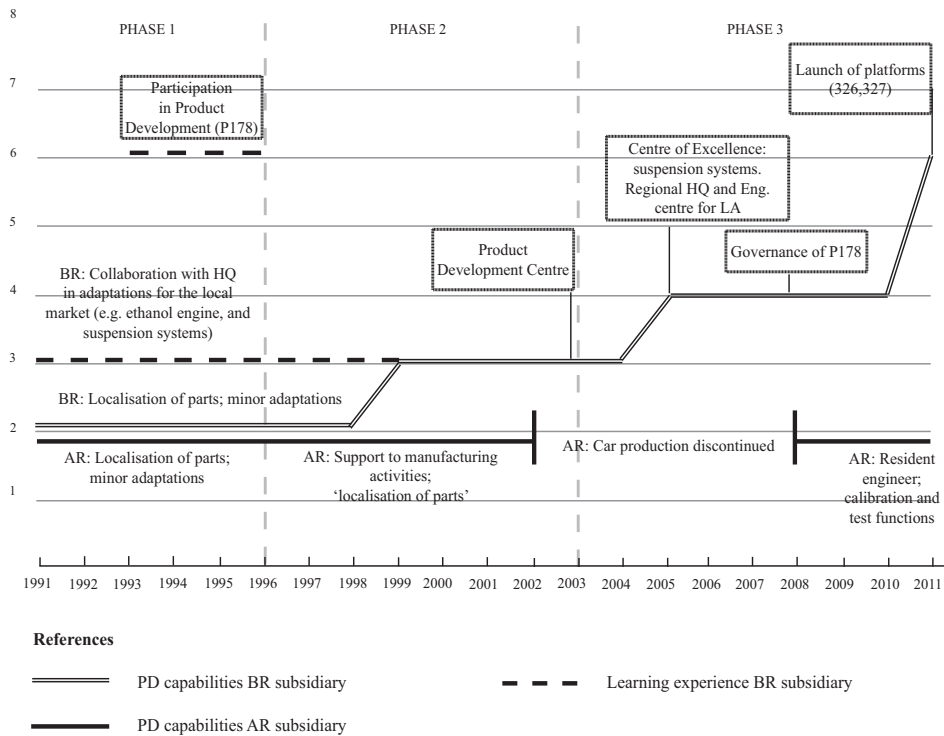
3 **Results**

3.1 *Fiat*

Three different stages have been identified in the technological trajectory of Fiat in Mercosur (Figure 1). The first one (1991–1996) corresponds to the development of a global car platform and the organisation of business activities in the region. In the second stage (1997–2002), the crisis experienced by the Argentinian subsidiary and the progressive accumulation of capabilities in its Brazilian counterpart contributed to

progressively widen the gap between the two units. Finally, in the third stage (2003–2011), the Brazilian subsidiary assumed advanced responsibilities in the field of PD activities and was formally appointed as leader of the region.

Figure 1 Process of accumulation of PD capabilities of Fiat’s subsidiaries in Argentina and Brazil



Source: Own elaboration

3.1.1 1991–1996: a parent company-driven process: towards the global car project

In 1992, Fiat decided to advance in the development of a global car platform (Project 178 – P178) with the objective of gaining presence in ‘emerging’ economies, among which the Mercosur region. The project aimed at developing a family of low niche vehicles using the same modular platform (Ciravegna, 2003). Although the management of the P178 was under the responsibility of the parent company, Fiat selected its Brazilian subsidiary as a co-leader of the PD process of the project. Until then, PD activities in Brazil had been limited to the development, in collaboration with the parent company, of some adjustments in the models produced in the country – mainly in the field of engines and suspension systems.

About 50 staff members of the Brazilian subsidiary moved to Italy to participate in the PD process. Since Brazil was the main destination of the P178, the subsidiary played an important role in collecting and providing information on the characteristics of the local market, e.g., consumer preferences, driving conditions – and collaborating in the

definition of the product specifications. This learning experience in Europe lasted nearly 18 months. Then, the project moved to Brazil – still under the management of the parent company, the first country where the Palio family of vehicles was manufactured.

In 1995, Fiat regained the control of its operations in Argentina and built a new plant with a production capacity of 120,000 vehicles⁶. Then, operations of Fiat in Mercosur were organised on a regional basis. The Brazilian subsidiary played a leading role in this regional scheme. In the specific field of product engineering activities a clear hierarchical division of labour prevailed between the two subsidiaries since the very beginning. The parent company controlled and supervised product engineering activities, but progressively delegated some product engineering responsibilities to Brazil. In this scheme, the Argentinian subsidiary operated as an assembling platform and concentrated on the nationalisation of parts for the production of two models of the P178: the Siena and the Palio.

3.1.2 1997–2002: increasing responsibilities of the Brazilian unit in the P178 and the widening technological gap with the Argentinian subsidiary

As the P178 evolved, the role of the Brazilian subsidiary within the corporation was strengthened. The parent company decided to delegate more complex PD responsibilities to it. Brazil had an active participation in the first ‘facelift’ of the Palio family launched onto the market in 2001. The Brazilian unit, for example, assumed increasing responsibilities and autonomy from the parent company in the verification tests and the process of validation of suppliers operating in the country.

But in parallel with the formal delegation of responsibilities from the parent company, the Brazilian subsidiary also demonstrated a growing degree of proactivity and autonomy to make decisions about the product strategy adopted by Fiat in Mercosur. For instance, in the second half of the 1990s, almost ‘clandestinely’ and against the will of the headquarters, it embarked in the development of a derivative of the P178 family aimed at giving it an off-road style: the line adventure (Araújo and Gava, 2012). The success of these products, which created a hitherto inexistent niche in the South American market, improved the reputation of the subsidiary within the corporation. At the same time, the experience proved that the Brazilian subsidiary was competent to assume higher PD responsibilities.

The achievements and progress of the Brazilian subsidiary contrasted with the decline of Fiat in Argentina. As early as 2000, only four years after the inauguration of the subsidiary, the company started to reallocate the production from that country to Brazil. The objective was to avoid the increasing relative costs of producing in Argentina as a result of the ‘drain’ of suppliers from the country and the devaluation of the Brazilian real. The decision to discontinue the production of vehicles in Argentina was finally adopted by the end of 2001.

3.1.3 2003–2011: the creation of a development centre in Brazil and the ‘tropicalisation’ of Fiat

An important milestone in the consolidation of the Brazilian subsidiary as a PD pole was the creation of the *Polo de Desenvolvimento Giovanni Agnelli* (Development Centre

Giovanni Agnelli) in 2003 (Fiat Automóveis, 2009). This Centre was the largest of the company out of Italy. With its creation Fiat aimed to reduce development time and costs, and to create the infrastructure necessary to develop a ‘Brazilian’ car.

After a few years after the creation of the Development Centre, Fiat reorganised its PD activities in Latin America. In 2005, the Brazilian subsidiary became formally responsible for engineering activities in the region. The same year, it was recognised by the parent company as a centre of excellence in the area of suspension systems – a field in which the subsidiary had accumulated skills since its establishment in the country.

With the creation of the Development Centre, the Brazilian subsidiary assumed PD responsibilities requiring the utilisation of more complex technological capabilities. For instance, the third (2008) and fourth (2012) facelifts of the Palio family remained under the complete control of the Brazilian unit. The highest responsibility assumed by the Brazilian subsidiary during this period corresponded to the development of two new platforms for emerging countries launched onto the market in 2011: the new Palio family and Fiat Uno (platforms 326 and 327, respectively). The subsidiary was in charge of all the stages of the PD process. With the exemption of some specific tests (e.g., aerodynamic, electromagnetic and safety tests), the bulk of PD activities were carried out in that country.

In 2008, after an interruption of six years, the Argentinian subsidiary gingerly started to come out from its stagnancy and resumed the production of vehicles. After its ‘reopening’, the Brazilian subsidiary delegated to the Argentinian unit some product engineering responsibilities. With the objective of relieving the burden of the Brazilian subsidiary the position of ‘resident engineer’ in Argentina was created in 2010. From then, Fiat Argentina remained in charge of some specific activities, such as the calibration and validations tests of vehicles.

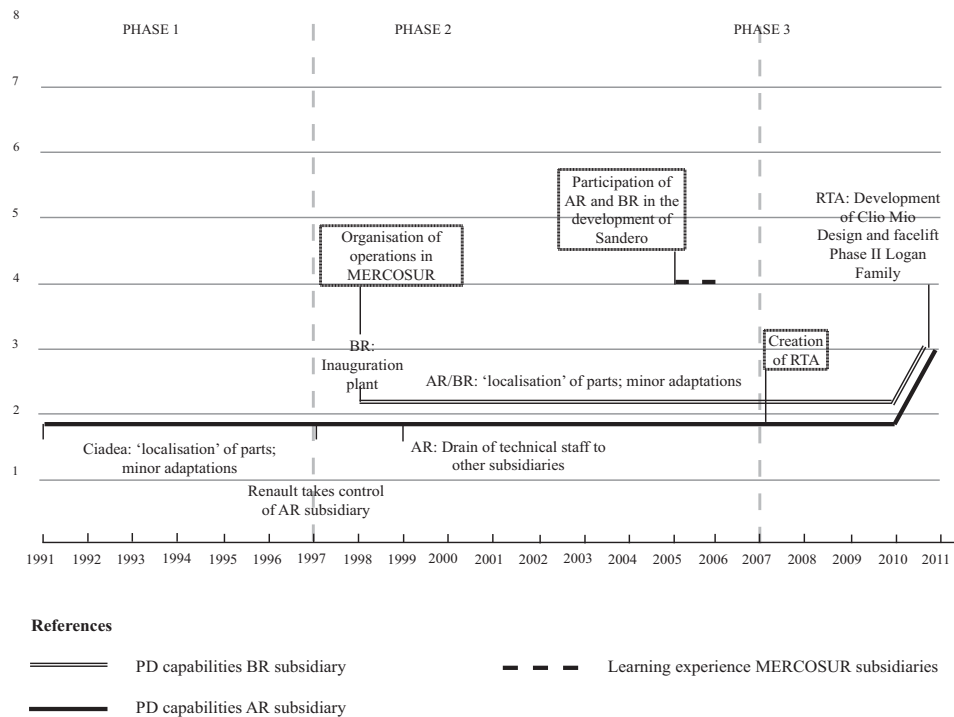
3.2 Renault

As pointed out above, in 1997 Renault regained control of its operations in Argentina and, in 1998, inaugurated its first production plant in Brazil. As can be seen in Figure 2, the first stage of the technological trajectory of the company in the region extended until 2006. During this period, the operations of the company concentrated in manufacturing and commercialisation tasks, whereas PD activities were exclusively carried out by the parent company. In 2007, the company changed its PD strategy at world level and decided to create a PD centre in the region. Since then, more complex responsibilities were delegated to the Argentinian and Brazilian subsidiaries.

3.2.1 1997–2006: the organisation of Renault’s operations in Mercosur

The return of Renault to the Southern Cone in 1997 – and, in particular, its establishment in Brazil a year later – was part of a broader internationalisation strategy intended to expand the operations of the company towards fast growing ‘emerging’ countries. In a nutshell, Renault aimed at moving from “europeisation to internationalisation” [Loubet, (2008), p.133].

Figure 2 Process of accumulation of PD capabilities of Renault’s subsidiaries in Argentina and Brazil



Source: Own elaboration

During this period, the organisation of product engineering activities in Renault was very centralised in the parent company (Boboc, 2002). The Technocentre, inaugurated in 1998, concentrated the bulk of engineering activities in one single French location. Consequently, the PD responsibilities assumed by the subsidiaries sited in Mercosur and other foreign locations were very limited. The role of local teams was practically constrained to two functions. Firstly, the collection of information used to develop minor alterations in the products manufactured locally (the Scénic, Clio 2 and Master in Brazil; and the Mégane, Clio 1, Trafic and Kangoo in Argentina). The purpose of these alterations was to ensure basic conditions of safety, resistance and durability demanded by the local environment. Although local teams were allowed to suggest proposals in this respect, the development of these minor adaptations was carried out in the Technocentre.

The second responsibility of subsidiaries in Mercosur was the localisation of parts to comply with minimum domestic/regional part content established in the bilateral automotive regime (60%). Local staff, however, simply operated as a liaison between the supplier and the corporate engineering department, which was in charge of the effective development of parts.

The establishment of Renault in Brazil in 1998 entailed a progressive displacement of the ‘centre of gravity’ within Mercosur. Some members of the engineering department of Renault Argentina were reallocated to Brazil. However, in 1999, the number of engineers

employed in PD activities was still larger in Argentina than in Brazil –35 and 30, respectively (Quadros and Queiroz, 2001). Imbalances between the two subsidiaries became more pronounced in the early 2000s as a consequence of the economic crisis in Argentina. This provoked a ‘drain’ of professionals in engineering areas from the Argentinian unit to other units of the corporation⁷.

Whereas in the first years of its operations in Mercosur, the product strategy of Renault was based on a reduced number of innovative models developed in France, the situation started to change in the first half of the 2000s (Freysenet, 2009). In 2004, Renault began a process of redefinition of its global product policy which progressively opened up opportunities for a more active participation of foreign subsidiaries in PD activities. Based on the Logan platform, Renault developed a new family of products targeting ‘emerging’ countries (Jullien et al., 2012).

In 2005, a group of about 50 engineers from Brazil and Argentina were involved in the development of a derivative of the Logan platform mainly targeting the South American region: the Renault Sandero. It was the first time engineers from the Mercosur region participated in the development process of a vehicle. Their role was oriented to collaborate with the Technocentre in the definition of the product specifications, and in the trials and tests carried out in South American countries.

3.2.2 2007–2011: the creation of Renault Technologies Americas

After 2005, when Carlos Ghosn took office as President of Renault, in parallel with the redefinition of the product strategy, the company initiated a process of management decentralisation in favour of its subsidiaries overseas. A network of engineering and design centres, under the coordination of the Technocentre, was created in 2007 (Table 3). The objective was to create local structures better prepared to meet the preferences of domestic consumers and to comply with the market conditions prevailing in each country.

Table 3 Renault technology and design centres

<i>Renault technology centres</i>	<i>Renault design centres</i>
Renault Technologies Romania (RTR; entities in Romania, Turkey, Russia, Slovenia and Morocco)	Renault Design Central Europe (Bucharest, Romania)
Renault Technologies Americas (RTA; entities in Brazil, Argentina, Mexico, Chile and Colombia)	Renault Design Latin America (Sao Paulo, Brazil)
The Renault Samsung Technical Center in South Korea (RTK)	Renault Samsung Design (South Korea)
Renault Technologies Spain (RTS; entities in Spain and Portugal)	Renault Design India (Mumbai, India)

Source: Renault (2013)

Since the creation of the RTA and the RDAL, subsidiaries located in Mercosur were able to accumulate PD capabilities and assume more complex responsibilities in this field. According to the managers interviewed, this process was carried out in different phases. Initially, the responsibilities of the RTA were focused on providing support for the

implementation of the production processes for the new models assigned to the region (i.e., the Logan and Sandero to Brazil, and the Symbol to Argentina). Furthermore, during its early years, the RTA assumed more responsibilities in the development of local suppliers with the objective of achieving a higher level of domestic/regional parts content. Then, the validation of local parts remained under the responsibility of the RTA. Later on, the RTA assumed the responsibility of working with suppliers to introduce some minor changes in some specific parts of the vehicle. The main objective of these changes was to improve the quality and safety levels, as well as to cut down production costs.

In a subsequent stage, the RTA, in collaboration with the RDAL, assumed responsibility for the design of some external and internal parts and accessories. The first project in which these skills were more actively deployed was the design of the local version of the Renault Duster and the phase II of some models of the Logan family (Logan II, Sandero II and Sandero Steptway II). The management of this platform was under the responsibility of Brazil. Another project in which the RTA assumed important responsibilities was the development of the Clio Mio (LAC Project) based on the original platform of the Clio II – under the responsibility of Renault Argentina. The project involved transforming a vehicle usually presented as a top segment model into an economic entry-level car.

In addition to the capabilities in the field of design, the RTA also achieved higher capabilities and autonomy in the area of engineering mechanics. The decision of advancing in this direction is fundamentally related to the extensive use of flex-fuel engines in Brazil, which accounted in 2011 for 83% of the domestic market⁷.

The RTA is organised on a regional basis. Individual subsidiaries have local teams working on the different functional areas, but the direction of each of these teams is in charge of a regional director. As can be seen in Table 4, the distribution of management responsibilities largely favours the Brazilian unit. The direction of the whole RTA is under the responsibility of this subsidiary, as most of the functional areas of the PD centre at regional level. The Argentinian unit only controls the area on chassis equipment and systems. In terms of human resources, according to managers interviewed, around 60% of the 847 members of the RTA (Renault, 2013) work in Brazil, 30% in Argentina and 10% in Colombia.

Table 4 Distribution of responsibilities between the Argentinian and Brazilian subsidiaries within the RTA

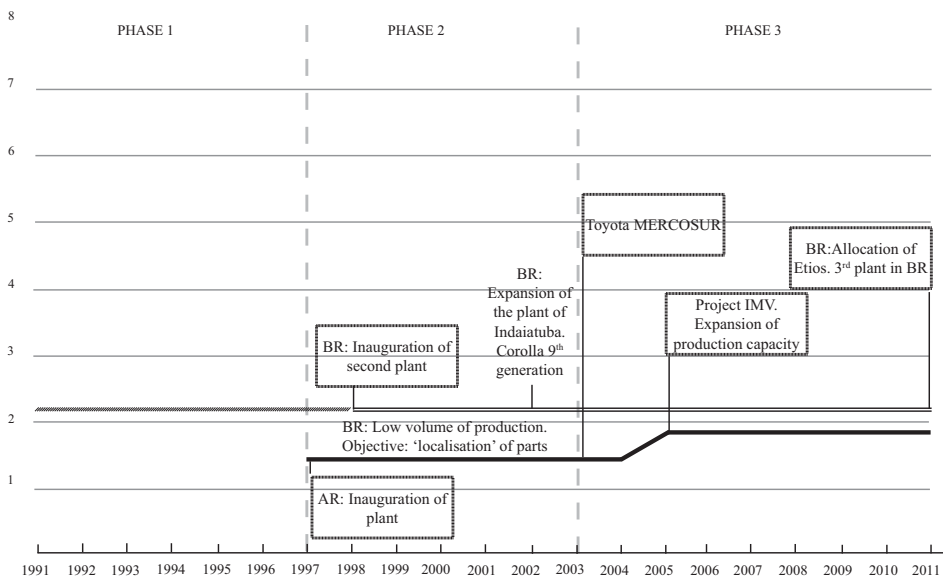
<i>RTA</i>	<i>Brazil</i>				
	<i>Vehicle engineering development</i>				
Functions	<i>Argentina</i>	<i>Brazil</i>	<i>Brazil</i>	<i>Brazil</i>	<i>Brazil</i>
	Chassis equipment and systems	Interior body equipment	Exterior body equipment	Electric and electronic systems	Mechanics
Platforms	<i>Brazil</i>			<i>Argentina</i>	
	Platform M0: Logan II, Sandero II			Alliance B: Clio Mio, Symbol	
	Platform B0: Duster			Alliance C: Fluence	

Source: Own elaboration on the basis of interviews with managers of Renault

3.3 Toyota

The technological trajectory of Toyota in Mercosur is divided in two phases (Figure 3). The first one corresponds to the period 1997–2002, when the company settled down in the region. During this period, Toyota deployed a conservative entry-market strategy in Argentina and Brazil, with very low yearly volumes of production. In these years, the two subsidiaries operated as independent units under the control of the parent company. In 2003, Toyota Mercosur was created. Since then, the operations in the region integrated progressively. However, progress in the field of PD capability accumulation in the region was very limited.

Figure 3 Process of accumulation of PD capabilities of Toyota’s subsidiaries in Argentina and Brazil



References

- ==== PD capabilities BR subsidiary
- ==== PD capabilities BR subsidiary before 1998
- ==== PD capabilities AR subsidiary

Source: Own elaboration

3.3.1 1997–2002: the soft landing of Toyota in the Mercosur region

During this period, Toyota pursued a very conservative and gradual entry-market strategy. Each plant produced only one model: the pick-up Hilux in Argentina, and the sedan Corolla in Brazil. The volumes of production were very low and never exceeded the 19,000 units in each case. In the case of Argentina, some managers qualified the operation as a quasi-semi knocked down (SKD) operation since the subsidiary did not even have a stamping plant and, consequently, had to import stamped parts from Brazil⁸.

The engineering activities of the subsidiaries of Toyota in Mercosur were fundamentally focused on manufacturing process, with the objective of achieving continuous improvement. One of the main challenges faced by the company during this period was to develop a network of local suppliers in conditions of very low scale of production. In order to address this issue a 'localisation department' was created in each subsidiary. This department operated as a liaison between the corporate engineering department and the local suppliers.

Against this backdrop, the scope of the product engineering responsibilities delegated to the subsidiaries in Mercosur was extremely limited. The two models manufactured in the region were 'mature' products which did not require any substantial alteration. Some minor adaptations were introduced in order to comply with the local legislation or to respond to the local availability of materials. The necessity of introducing modifications was evaluated by local product engineering teams together with resident engineers of the parent company in each subsidiary. However, the final approval and the development of the modifications were the prerogative of the corporate engineering area of the parent company. In the same vein, the restyling of the Hilux and Corolla during this period was completely developed in Japan. The participation of local subsidiaries was restricted to the work with suppliers for the development of local parts.

Until 2002, the Argentinian and Brazilian subsidiaries of Toyota operated as two units independent from each other. There was, however, some collaboration between them. It was mainly oriented to the development of suppliers or the provision of parts. A second field of collaboration was the commercial exchange of vehicles between the two subsidiaries to attend the demand in the two countries.

3.3.2 2003–2011: the creation of Toyota Mercosur

In 2003, Toyota initiated a new phase of its operations in the region which was symbolically represented by the creation of Toyota Mercosur. The objective of this new organisation was to create a regional structure capable of managing more efficiently the expanding activities of the two subsidiaries in the region. The headquarters of Toyota Mercosur were located in Brazil.

This period corresponded to a phase of substantial expansion of the two subsidiaries which more than trebled their manufacturing capacity. However, in comparison with other subsidiaries, the volume of production remained relatively low: Toyota Argentina reached a production of more than 70,000 units in 2010, whereas in Brazil, Toyota's output peaked in 2008 with 67,000 units. The role of the two subsidiaries in terms of PD responsibilities continued focusing on nationalisation activities. The main challenge during this period was to ensure a high level of localisation of parts for the new volumes of production, maintaining the quality standards.

In 2002 the Brazilian subsidiary initiated the expansion of the production capacity of the plant of Indaiatuba to produce the new generation of the Corolla. The new Corolla was completely developed by the parent company in Japan and manufactured in 15 countries with very few variations. The participation of local engineers in the development process was limited to the collection of information about the local market which was used for the definition of product specifications. During the life-cycle of the model, staff members of the local subsidiary were responsible for elaborating proposals on minor adaptations required in the vehicle. However, the ultimate responsible for the approval and effective development of the adaptations was the parent company.

Changes in the Argentinian subsidiary started to take place in 2003, when it became one of the subsidiaries participating at the so-called Innovative Multi-purpose vehicle (IMV) project. This global initiative gave birth to a new family vehicles (a pick-up, a SUV, and a minivan) produced in four different countries and exported to 'emerging' markets. Argentina was selected as the manufacturing and export platform of the new pick-up Hilux and the SUV SW4 (launched in 2005) for Latin America.

The management of the IMV project was completely original for Toyota. Although the parent company held the 'governance' of the initiative, differently from previous experiences, foreign subsidiaries played an important role in it. The Thai unit, in particular, assumed significant PD and management responsibilities in the project. The Australian Technical Centre participated in the development of the medium-size SUV SW4 (or Fortuner, as it was known in other countries).

The participation of the Argentinian subsidiary during the PD process of the IMV products was basically limited to the provision of information and the elaboration of some proposals related to particular features of the regional market. This did not imply a change in the level of PD capabilities as conceived in the scale of Table 1. However, it was considered by managers of the subsidiary as an important learning experience which contributed to improving problem identification and analytical skills.

Since the creation of Toyota Mercosur, the regional centre of gravity, including PD activities, slightly moved towards Brazil. The Brazilian unit assumed the direction of the area at regional level. As reported by interviewed managers, this process accelerated in 2010, when Toyota announced the building of a third plant in Sorocaba, with a production capacity of 70,000 units, to manufacture a compact car: the Toyota Etios⁹.

4 Cross-case study analysis

In the three case studies examined in this article, subsidiaries operating in the Mercosur area were progressively given PD responsibilities by their parent companies. In the frame of aggressive market-seeking strategies in emerging economies, the delegation of mandates in this field was largely motivated by the intention of gaining a larger market-share of the regional market. Subsidiaries were seen as more efficient agents than headquarters to develop lower cost platforms and carry out restyling activities to offer products better tailored to local consumer preferences and resources. Moreover, their proximity to host territories allowed them to provide faster responses to changes in local markets. Empirical evidence provided in this article is in line with the observations by Jullien and Pardi (2013) about the restructuring of the automotive industry as a response of the emergence of new markets and the relative stagnation of mature Triad economies.

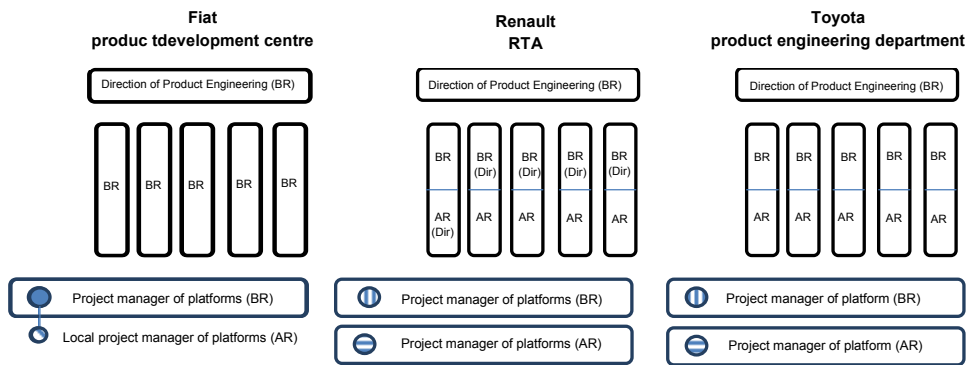
Empirical evidence presented in this study shows that, as pointed out in Section 1, the division of labour between subsidiaries operating in the Mercosur region in the field of PD activities was of a hierarchical nature.

In the case of Fiat, hierarchies reflected in the wide gap existing between subsidiaries in terms of their PD capabilities. As can be seen in Figure 1, whereas by 2011, with the development of two vehicle platforms (P326 and P327), the Brazilian unit attained the

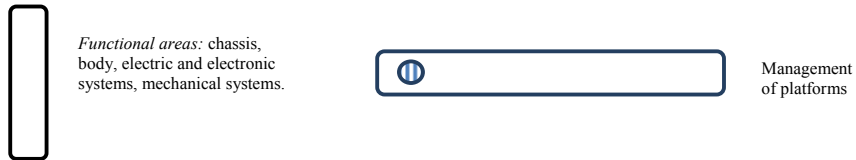
level 6 of PD capabilities; the Argentinian subsidiary only performed ‘nationalisation’ activities (level 2).

The hierarchy between the Argentinian and Brazilian units also crystallised in the organisational structure of the PD department at regional level (Figure 4). All PD responsibilities in Mercosur member countries exclusively concentrated in Brazil. This included the control over product engineering functions and the management of platforms produced in the region. The hierarchical verticality reflected in the great difference in the size of the PD department: whilst the Brazilian unit had 1000 members in 2012, the Argentinian one only had 18.

Figure 4 Organisational scheme of product engineering department in Mercosur (see online version for colours)



Notes:



Source: Own elaboration on the basis of interviews with managers of the companies

Table 5 Number of staff members of product engineering departments

	Fiat			Renault		Toyota	
	1991–1996	1997–2002	2003–2011	1997–2006 ^a	2007–2011	1997–2002	2003–2011
Argentina	n.d.	n.d.	18	35 (1999)	250	n.d.	31
Brazil	200 (1996)	350 (1999) ^b	1,000	30 (1999)	500	n.d.	75

Note: Information from the last period of each company corresponds to the year 2012, when interviews with managers were conducted.

Source: ^{a,b}Quadros and Queiroz (2001)

Own elaboration on the basis of fieldwork

In the case of Renault and Toyota, the hierarchical division of labour between subsidiaries is less evident, but still exists. The technological capability scale (Table 1) proved not to be adequate to grasp the differences in the knowledge intensity of the activities carried out by the two subsidiaries. Figures 2 and 3 show that the Argentinian and Brazilian subsidiaries of the two companies attained the same level of PD capabilities. Hierarchies between subsidiaries were revealed, however, through an in-depth study of the quality of the product engineering activities carried out by each subsidiary, and the distribution of PD responsibilities within regional product engineering departments (Figure 4 and Table 5).

In the case of Renault, the regional nature of the RTA's organisational structure made it difficult to differentiate the PD responsibilities assumed by each subsidiary. At first glance, it was the RTA as a whole which appeared to be able to achieve a level 3 of PD capabilities. The regional centre was in charge of the redesign of the Duster and the phase II of the Logan project, as well as in the development of the Clio Mio. However, as seen in Table 4, the distribution of functions and responsibilities within the RTA was largely unbalanced in favour of the Brazilian unit. Furthermore, the size of national PD teams was also unbalanced in favour of the Brazilian unit (Table 5).

As seen above, the scope of PD activities of Toyota's subsidiaries in Mercosur was very modest. During this period, the subsidiaries in the region only performed 'nationalisation' activities (Figure 3) and have small PD teams: in total, just over 100 members. However, in 2010, after the confirmation of the allocation of the compact vehicle Etios to the Brazilian unit, a process of differentiation between the Argentinian and Brazilian units started to take shape. The subsidiary in Brazil started to assume more product engineering responsibilities within Toyota Mercosur, as a consequence of the larger scale of its operations in the region.

5 Concluding remarks

The cases discussed in this article confirm the concerns about the progressive concentration of most intense PD capability accumulation processes in Brazilian subsidiaries. This trend raises some challenges for the Mercosur region, which is witnessing the crystallisation of an intra-regional 'centre-periphery'-type division of labour, as the one prevailing in other regions such as Europe (Layan and Lung, 2004; Van Tulder, 2004) and North America (Carrillo, 2004). The empirical evidence shows that in the case of Mercosur, however, it is more adequate to talk about a 'semiperiphery-periphery' division of labour scheme. In most cases, the subsidiaries in Brazil are still very dependent on their parent companies. Even in the case of those which assumed more complex responsibilities, technological frontier R&D activities are still concentrated in their parent companies.

This problem poses important questions that should be addressed in future research projects, regarding, for instance, the driving forces behind this process, the capacity of governments to affect them, and the degree to which Mercosur has opportunities to achieve higher levels of PD capabilities with an automotive industry totally controlled by MNCs.

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Notes

- 1 Between 1986 and 1989, Argentina and Brazil accounted for 2.14% of the world production. Between 2009 and 2011, their participation rose to 5.13% (source: International Organization of Motor Vehicle Manufacturers).
- 2 Source: Fiat Auto.
- 3 Source: Renault.
- 4 Source Toyota Motor Corporation.
- 5 The ISI Emerging Market Database was used to collect information from newspapers.
- 6 Since 1981, the company had operated through a local licensee, Sevel, in which Fiat maintained a minority stake.

7 Source: ANFAVEA.

8 As quasi-SKD operations were not considered in the capability scale (Table 1), a 1.5 level was assigned to the Argentinian subsidiary during this period to differentiate it from nationalisation activities (level 2).

9 The production of the Toyota Etios in Brazil started in 2012.