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Market leadership in the Brazilian automotive industry: The case of Marcopolo

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DISCUSSION PAPER

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Luiz Ricardo Cavalcante
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MARKET LEADERSHIP IN THE BRAZILIAN AUTOMOTIVE INDUSTRY: THE CASE OF MARCOPOLO¹

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ABSTRACTⁱ

The aim of this paper is to analyze the factors that explain the industrial leadership of a Brazilian bus bodywork manufacturer (Marcopolo). From a methodological point of view, the paper was a case study based on bibliographic review and on in-depth interviews. The underlying hypothesis is that, at some point in the past, some idiosyncratic factors regarding Brazilian market led the large auto manufacturers to give up contesting Brazilian incumbents in these segments. Then, Brazilian companies managed to grow hand-in-hand with the Brazilian automotive market, and dictated the customer-supplier relationship patterns. Marcopolo had to develop technological and organizational capabilities related to stock management, and lean production principles of modularity and product platforms or families, very important to its CKD exports. Recently, Marcopolo found its own way to internationalization, especially towards developing countries (Marcopolo is present in all BRIC countries), through acquisition of existing plants, joint-ventures and involvement of local suppliers. In sum, Marcopolo's strategies and decisions – going public, exporting and FDI – have been ahead of the Brazilian public policy discourse or market trends. These strategies were clearly riskier, but once succeeded, help to understand Marcopolo's leading position.

Keywords: Marcopolo; automobile industry; market leadership; bus bodywork manufacturing.

SINOPSE

O objetivo deste artigo é analisar os fatores que explicam a posição de liderança de mercado ocupada pela Marcopolo, que é o principal fabricante brasileiro de carrocerias de ônibus. Do ponto de vista metodológico, o trabalho é um estudo de caso baseado em uma revisão bibliográfica e em entrevistas. A hipótese subjacente é que alguns fatores idiossincráticos relativos ao mercado brasileiro levaram as multinacionais fabricantes de veículos de grande porte a renunciar à competição com os produtores brasileiros no segmento de carrocerias de ônibus. Em relação ao conjunto do setor automobilístico, a fabricação de carrocerias de ônibus é um segmento relativamente intensivo em mão de obra, com menores níveis de faturamento e menos intensivo

ⁱ *The versions in English of the abstracts of this series have not been edited by Ipea's editorial department.*
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em pesquisa e desenvolvimento (P&D), uma vez que as inovações tendem a ser incrementais. Essas características permitiram que as empresas brasileiras do setor conseguissem crescer em paralelo ao crescimento do mercado local e ditassem os padrões de relacionamento entre fornecedores e compradores. Para se tornar uma exportadora de veículos completamente desmontados (CKD), a Marcopolo precisou desenvolver capacidades tecnológicas relacionadas à produção enxuta, especialmente modularidade e plataformas de produtos ou famílias. Para desenvolver suas capacidades tecnológicas, a Marcopolo privilegiou as atividades internas de P&D e a integração vertical da cadeia de produção. Por outro lado, a cooperação da Marcopolo com universidades, centros de pesquisa e outras empresas do segmento de fabricação de carrocerias de ônibus não parece ser um elemento central para o acúmulo de capacitações tecnológicas e para a posição de liderança ocupada. Recentemente, a Marcopolo passou a enfatizar a internacionalização através da aquisição de plantas existentes, de joint-ventures e do envolvimento de fornecedores locais especialmente em países em desenvolvimento. Esses movimentos, no entanto, não se destinaram a ser uma fonte de novas tecnologias. Em suma, as estratégias e decisões adotadas pela Marcopolo estiveram à frente da retórica das políticas públicas adotadas e das tendências do mercado no Brasil. Essas estratégias foram claramente mais arriscadas, mas, uma vez bem sucedidas, ajudam a entender a posição de liderança da Marcopolo.

Palavras-chave: Marcopolo; indústria automobilística; liderança de mercado; carrocerias de ônibus.

1 INTRODUCTION

The increasingly more important role played by Brazil, India and China in the world economy has been widely recognized. In fact, the acronym BRIC – formed by the initial letters of these three countries as well as of Russia – represented, in 2008, 42% of the world population and 12% of the world GDP and was converted in an analytical category for economic and social purposes. The acronym was originally proposed by Goldman Sachs in 2003 to refer to the emerging economies marked by large demographic and territorial dimensions (Baumann et al. 2010, p. 9). Besides, innovation in Brazil, India and China is a recurrent subject of analysis. This is the case, for example, of the recently published book on global innovation strategies adopted by companies in these three countries and in South Africa (Reddy, 2011).

Some domestic companies from these countries have become marketleaders.¹ As proposed by Mowery and Nelson (1999, p. 2), the concept of industrial leadership applies to companies with advantage in world markets as a result of being ahead of their competitors in product or process technology, or in production and marketing. On several occasions, domestic companies from Brazil, India and China do not fit this definition because their leading position might be the result of trade protectionism, for example. In these cases, the expression “market leadership”, as opposed to “international leadership”, seems to be more applicable.

Besides its obvious association with the firm’s strategies and trajectory, the factors which explain market leadership vary across countries and sectors. In particular, internal capabilities and the sectorial system of innovation (Malerba, 2002; 2005) may have different impacts on the firm’s leading position. These are essentially the questions focused in the project “the rise to market leadership” (Malerba; Nelson, 2010), which intends to focus on ICT, auto and auto parts market leaders from Brazil, India and China aiming at discussing cross-national and cross-industry differences. Accordingly, Malerba and Nelson (2011) have also published a study examining the evolution of six different industries, each in several countries and claimed that “catching up is a learning process that requires a long time and often differs significantly across economic

1. According to Santiso (2008), “the number of companies from emerging economies in worldwide rankings is increasing along with their overseas investments: in 1990 only a happy few emerging multinationals from developing countries were listed in the Fortune 500 rankings; by 2005, their number had risen to 47”.

sectors in the factors leading to success or failure”. The focus both on cross-national and cross-industry differences relies on the perception that “industries differ significantly in the extent to which they draw from universities for the knowledge and skills they need to compete, and the nature of the government policies that can help to support them. Countries differ in the extent to which they can provide the broad background conditions for the development of different industries” (Malerba and Nelson, 2011, p. 1646).

In the case of the Brazilian automotive industry, there are no nationally-owned market leaders in light vehicles, heavy duty trucks or buses assembling segments. However, there are important national leaders in niches such as road implements and bodyworks segments. The hypothesis is that some idiosyncratic factors regarding Brazilian market led the large auto manufacturers to give up contesting Brazilian incumbents in these segments. As a result, Brazilian companies managed to grow hand-in-hand with the local automotive market, and dictated the customer-supplier relationship patterns. Moreover, these companies recently found their own way to internationalization, especially towards developing countries.

Hence, this paper focuses a Brazilian bus bodywork manufacturer² which might be considered one of the incumbents mentioned in the previous paragraph. Marcopolo’s net revenues reached US\$ 2.0 billion in 2011,³ the company exports to more than 100 countries and its market share in Brazil exceeded 50% during the same year. Currently, Marcopolo has four production units in Brazil and thirteen abroad and employs over 17 thousand people around the world (Marcopolo, 2012). As a result, Marcopolo represents around 8% of the world bus bodywork market (Zignani; Deiro, 2011). Just before it began its operation in India in a joint-venture with Tata Motors, a Brazilian business magazine called Marcopolo “the bus Embraer” (Revista Exame, 2007).

The aim of this work is to analyze the factors that explain Marcopolo’s market leadership position. The main steps involved *i*) an analysis of the dynamics of the bus bodywork manufacturing sector and its sectoral innovation system (bibliographic review and

2. Bus manufacturing may include coaches, urban buses, midi, micro and minibuses production. In this paper, the word “bus” refers to this range of vehicles.

3. Throughout this paper, Brazilian currency was converted into US dollars using the correspondent annual average exchange rate.

systematization of sectoral data); *ii*) a bibliographic review on Marcopolo, as the company has been subject of several case studies in Brazil; *iii*) systematization of data on the company; *iv*) in-depth interviews to capture the company's strategies and trajectory; and finally, *v*) an analysis of the role played by internal capabilities and system factors that led the company to become a market leader. Besides this introduction, the paper is structured in four additional sections. In section 2, a theoretical review on industrial and market leadership and some methodological concerns are presented. An overview of the bus bodywork manufacturing technological requirements and of the sector in Brazil is the subject of section 3. The background provided in sections 2 and 3 supports an analysis of the dynamics and evolution of Marcopolo's leading position in section 4. Finally, in section 5, the main conclusions of the paper are highlighted.

2 INDUSTRIAL AND MARKET LEADERSHIP: THEORETICAL REVIEW AND METHODOLOGICAL CONCERNS

The leadership position of a firm is clearly associated with the strategies it adopted as well as with the path it followed on time. Obviously, the oversimplified assumptions of the neoclassical theory cannot be used to explain leadership. In fact, leadership seems to be explained in an easier way if an evolutionary approach is adopted. According to Lall and Teubal (1998, p. 1371):

In evolutionary theory, firms do not work with full information on technical alternatives, with instantaneous and costless mastery of existing technologies and in isolation from other firms. They operate instead with imperfect, rather hazy and variable, knowledge of the technologies they are using (at a point rather than on a function). They need time and effort to learn to use technologies efficiently, and to conduct technological effort. Technical choice, mastery of technologies, minor improvements or adaptations, and more major technological innovations, are part of a continuum of technical effort, undertaken in a relatively risky and unpredictable world of imperfectly understood information and an even more imperfectly foreseen future. Firms cope, not by maximizing a clear and well-defined objective function, but by developing organizational and managerial routines. These routines are adapted over time as new information is collected, experience accumulated and other firms imitated.

Moreover, in a stylized neoclassical world, firms operate in isolation, without interlinkages and spillovers, and the role of the public policies is hardly considered in the models. Since the factors that explain market leadership are clearly associated with

internal capabilities and the sectoral system of innovation (Malerba, 2002; 2005), an evolutionary approach is proposed to study the subject. The fact that leadership is, by its own definition, a consequence of asymmetries among firms in terms of their process technologies and quality of output reinforces the perception that an evolutionary approach is required to analyze the factors that explain it (Dosi, 1988, p. 1155).

Back in the early 1980s, Lall (1980) described and assessed the emergence of domestic firms from countries like India and Brazil as exporters of capital and technology. More than ten years later, the same author (Lall, 1992) associated government interventions with industrial success of developing countries. The main argument is that these interventions, when carefully and selectively applied, may help technological and through it, industrial development in these countries. These policies would help firms to master new technologies, to adapt them to local conditions, to improve upon them, to diffuse them within the economy, to exploit them overseas (by manufactured export growth and diversification) and to export the technologies themselves (Lall, 1998, p. 166). Accordingly, Malerba and Nelson (2011, p. 1647) sum it up by stating that “catching up does not mean cloning”.

In a book published in the late 1990s, Mowery and Nelson (1999, p. 2) argue that the use of the term “industrial leadership” allows them to focus “the translation of technological expertise into commercial success, rather than solely with technological innovation *per se*”. These authors prefer “industrial leadership” to the term “competitive advantage” because they claim the latter focuses essentially on factors internal to the firm, while the first “prevents any presumption as to whether industrial leadership is determined by strengths that firms build for themselves, by their national environment, or by something in between”. (Mowery; Nelson, 1999, p. 2).

The concepts mentioned in the previous paragraph were used by Mowery and Nelson (1999) to analyze the sources of industrial leadership in a number of high-tech industries in developed countries (United States, Japan and Western Europe). However, when the focus is shifted to developing countries (such as Brazil, India and China) and, occasionally, to more technologically mature industries such as auto and auto parts, the term “industrial leadership” as originally proposed seems less applicable. In fact, domestic firms may be leaders in regional markets (for example, Brazilian firms which are leaders in other Latin American or Portuguese-speaking countries) but are

not ahead of their world competitors in product or process technology strictly speaking. Sometimes, the access to these markets is the result of trade agreements or trade protection. On other occasions, firms may have advantages because of some sort of identity between them and their customers abroad. This is the case, for example, of the same mother language or of institutional conditions which might be similar between two countries. All these examples reinforce the perception that firms might be “market leaders” without fitting the original concept of “industrial leaders”.

Mowery and Nelson (1999) explore four possible critical factors behind industrial leadership: *i*) resources; *ii*) institutions; *iii*) markets; and *iv*) technology. Still according to these authors, the *locus* of industrial leadership may be the nation-state, the firm, the region, the network, and the sectoral support system. As one extends the concept of industrial leadership to market leadership, there seems to be no relevant change in these categories. In other words, the industrial leadership framework of analysis is basically the same for market leadership.

However, in some cases when market leadership do not fit the industrial leadership archetype (as mentioned above), the relative importance of institutions (especially government regulations) among the critical factors behind leadership may be higher; as well as the role of marketing capabilities in identifying opportunities and providing adequate product/services to serve the market and sustain leadership. Accordingly, in these cases, the *locus* of market leadership might be placed in the nation-state, since “reserved markets”, on several occasions, are the locus of market leadership.

Malerba and Mani (2011) associate market leadership to capability building, and segment its sources into internal capabilities and system factors. The internal sources of capability building are *i*) human resources / learning by doing / marketing production; and *ii*) R&D. The external sources are *i*) services and consultants; *ii*) joint ventures and alliances; *iii*) mergers and acquisitions (M&A); *iv*) purchase of technology; and *v*) clusters and spillovers. These authors mention also the system factors which support the emergence of market leaders:

- government support (public policies): either pro-active (to push the birth of new leaders) or reactive (supports leaders once they have already merged as promising champions);

- universities;
- institutions (regulations, certification schemes...);
- financial system (banks, venture capital, IPO...); and
- users and networks (vertical and horizontal links with other sectors).

From a methodological point of view, the paper is a case study based on a bibliographic review and in-depth interviews.⁴ It is interesting to understand and explain the case contrasting different sources. According to Eisenhardt (1989, p. 537), although the selection of a case may be a random one, it “is neither necessary, nor even preferable” – one may select polar types, extreme situations and theory-challenging cases which may be theoretically interesting, which may replicate or extend emerging theories. It is the case of Marcopolo, a world-level player in a non-traditional segment for Brazil (auto parts).

3 BUS BODYWORK MANUFACTURING: AN OVERVIEW OF THE DYNAMICS OF THE GROWTH OF THE SECTOR

In this section, an overview of the dynamics of the growth of the bus bodywork manufacturing sector is presented. Firstly, the technological requirements for bus bodywork manufacturing are discussed in subsection 3.1. Essentially, it is argued that, although it is a more mature sector, customization requirements play an important role in defining the market structure. In the following subsection, the sector is compared with the automobile industry as a whole. Statistical data regarding the sector in Brazil are used to show that bus bodywork manufacturing is a relatively labor-intensive, smaller and less R&D-intensive industry. Finally, in subsection 3.3, the path followed by the bus bodywork manufacturing sector in Brazil is briefly described.

3.1 Bus bodywork manufacturing: technological requirements

The automobile industry encompasses a wide range of activities such as vehicles assembling – probably the most typical view of the sector – to auto parts production. An aggregate look on the sector reinforces the perception of a scale intensive industry

4. The analysis of Marcopolo was also based upon newspapers, magazines and presentations available on the internet. The questions of the interview with the Strategy and Development Director of Marcopolo, Ruben Antonio Bisi, are in the annex.

according to the taxonomy proposed by Pavitt (1984). In fact, “in the auto sectoral system, scale has always been critical for manufacturing and for industrial R&D (Malerba and Nelson, 2011, p. 1654). Besides light vehicles, the automobile industry involves the assembling of heavy-duty trucks and buses as well as vehicle body, interior and trailer manufacturing.

In the case of bus manufacturing, some companies like DaimlerChrysler (Mercedes and Setra), Volvo and Scania integrate chassis, motor and bodywork production. These companies are formally included in the heavy duty truck and bus manufacturing sector. On the other hand, companies which manufacture only bus bodyworks belong to the motor vehicle body, interior and trailer manufacturing sector. These companies may produce coaches, urban buses and medium, micro and minibuses, or a mix of these products.

Technological requirements for bus bodywork manufacturing may vary from product to product. As they are used for long distance journeys, coaches have a “often have a luggage hold separate from the passenger cabin and are normally equipped with facilities required for longer trips including comfortable seats and sometimes a toilet”.⁵ As a result, technological requirements for the manufacturing of coaches are different from the ones for the production of urban buses, for example. Besides fuel consumption, emissions reduction and alternative fuels – which do not directly affect bodywork manufactures – technological challenges for product innovation involve design concerns like *i*) maximizing seating capacity within legal constraints; *ii*) reducing weight to maximize laden capacity; and *iii*) stability. These concerns are strictly associated with the use of new materials – such as aluminum – which results in lighter structures, and aerodynamics, as these structures must be stable and durable. Besides these challenges – which apply to all types of buses – coaches have additional requirements involving comfort issues such as seats, air conditioning and noise reduction, and design flexibility to match different market requirements (see Castilho, n.d.).

Process innovation is essentially associated with lean production standards and modular consortia in an industry where mass production cannot be so widely used as in light vehicles manufacturing.⁶ In this sense, the adoption of stock management

5. Available at: <[http://en.wikipedia.org/wiki/Coach_\(bus\)](http://en.wikipedia.org/wiki/Coach_(bus))>.

6. See Womack et al (1990) for a detailed comparison between mass and lean production.

techniques such as just-in-time and Kanban play an import role. The assimilation of these practices in the bus bodywork manufacturing led to a segmentation of “tiers of suppliers”. While the first ones supply complete systems (such as chassis, motor, air conditioning system, seats and windows) and second ones supply components to the former, third tier suppliers produce isolated low value added pieces. In spite of the spread of lean production patterns, several bodywork manufacturers are vertically integrated with first tier suppliers. In Brazil – as opposed to the European case –, the existence of just few specialized suppliers in the bodywork manufacturing segment imposed the need for vertical integration. In this case, on the one hand, stock management techniques become a key factor for cost reduction and competitiveness, but, on the other hand, there is more room for customization.

All in all, technological requirements for bus bodywork manufacturing are lower in comparison with light and heavy vehicles assemblers. In fact, in the case of bus bodywork production, it is the tight process control the key factor for competitiveness, as customers decide what to buy based upon a cost equation which considers the cost of the vehicle, its operating and maintenance costs and its residual value. Lower technological requirements and higher labor intensity (as shown in the next subsection) of the bus bodywork industry leaves room for the presence of emerging countries in the sector. In fact, according to the International Organization of Motor Vehicle Manufacturers, world production of heavy buses reached almost 392 thousand units in 2010 and the world leaders are China (162 thousand units), India (55 thousand units) and Brazil (46 thousand units).⁷

In the specific case of Brazil, the early establishment of important bus bodywork manufactures and the lack of interest of large auto multinationals in this segment led the supplier-customer relationships to be dictated by national firms. Since the beginning, bodywork manufacturers have offered highly customizable sets of bus bodies/chassis to their prime clients, namely, bus transport companies. In turn, bus transport companies attribute high value to this possibility, and this flexibility became a competitive advantage.⁸ Moreover, almost all bus transport companies have their own insurance and maintenance structures. It means that if global heavy vehicle

7. Available at: <<http://oica.net/wp-content/uploads/buses-2010.pdf>>. Access in: 12/14/2011.

8. For example, according to the Strategy and Development Director of Marcopolo, Ruben Antonio Bisi, the company is able to offer three million combinations of buses to its clients.

assemblers wish to contest the bodywork manufacturing market in Brazil by providing complete buses, they will face customers who value customization and flexibility and for whom after-sales services are not so important.

3.2 Bus bodywork manufacturing and the automobile industry in Brazil

In Brazil, the bulk of the automobile industry dominated by multinational companies.⁹ Scale requirements and the massive presence of multinational companies since the mid of the 20th century left practically no room for national automobile, light truck and utility vehicle manufacturers in Brazil.¹⁰ In fact, Chevrolet, Citroën, Fiat, Ford, Honda, Hyundai, Iveco, Mahindra, Mitsubishi, Nissan, Peugeot, Renault, Toyota and Volkswagen manufacture automobiles, light trucks and utility vehicles in the country. Similarly, heavy duty truck producers¹¹ in Brazil tend to be multinationals. This is the case of DaimlerChrysler (Mercedes and Setra), Volkswagen, Ford, Volvo, Scania and Iveco. Among large heavy duty truck producers, only MAN and Renault (Paiva and Hexsel) are not present in the country. Of course, there are some Brazilian companies (such as Agrale), but far from being leaders according to the concepts discussed in the previous section. It is noteworthy that bus bodywork assemblers (such as Marcopolo) are not included in this sector as they do not produce frames and motors.

DaimlerChrysler, Scania and Volvo produce frames and motors for buses and coaches in Brazil, being in this sense close partners to Brazilian bodywork manufacturers. These companies have always focused on the heavy duty trucks as their prime market, and consider the bus assembling market a spinoff of the former.

In Brazil, auto parts industry¹² involves both national (smaller) and multinational (larger) companies, but the latter's leadership is quite clear. In fact, as stressed by Santos and Pinhão (2002, p. 16), in Brazil, in the late 1990s, "almost all large domestic companies were acquired". The leadership of multinational companies might be credited to the hierarchy of preferences of assemblers mentioned by Humphrey and

9. Formally, according to the Brazilian National Classification of Economic Activities (CNAE Version 2.0), the automobile industry encompasses "automobile, light truck and utility vehicle manufacturing and heavy duty truck and bus manufacturing" (CNAE 29). The Brazilian CNAE is compatible with Standard Industrial Classification (SIC).

10. CNAE 29.1 (Automobile, Light Truck and Utility Vehicle Manufacturing).

11. CNAE 29.2 (Heavy Duty Truck and Bus Manufacturing).

12. CNAE 29.4 (Motor Vehicle Parts and Accessories Manufacturing).

Salerno (1999, p. 48). According to these authors, “assemblers in developing countries appear to have a clear hierarchy of preferences when deciding to source “black box” parts: globally preferred supplier (wholly-owned or in a joint venture); alternative transnational supplier; locally-owned company using licensed technology from one of the globally-preferred suppliers; and least preferable, a local company using its own technology”.

These three sectors (CNAE 29.1, 29.2 and 29.4) mainly dominated by multinational companies are by far the most important ones in the automobile industry in Brazil as shown in table 1.

TABLE 1
Automobile industry in Brazil: number of companies, net sales and number of employees (2009)

CNAE Code	Description	Number of companies	%	Net sales (US\$ million)	%	Number of employees	%
29	Automobile, light truck and utility vehicle manufacturing and heavy duty truck and bus manufacturing	3,868	100,00	136,350	100,00	524,921	100,00
29.1	Automobile, Light Truck and Utility Vehicle Manufacturing	20	0.52	66,372	48.68	97,821	18.64
29.2	Heavy Duty Truck and Bus Manufacturing	17	0.44	21,498	15.77	28,974	5.52
29.3	Motor Vehicle Body, Interior and Trailer Manufacturing	861	22.26	6,613	4.85	63,621	12.12
29.4	Motor Vehicle Parts and Accessories Manufacturing	2,050	53.00	41,490	30.43	320,988	61.15
29.5	Rebuilding of Engines for Motor Vehicles	920	23.78	377	0.28	13,517	2.58

Source: Brazilian Institute of Geography and Statistics (IBGE).
Elaborated by the authors.
Note: data refers to companies with number of employees greater or equal to five.

As shown in the table, the three aforementioned sectors represent more than 50% of the number of companies, almost 95% of net sales and about 85% of the number of employees of the automobile industry in Brazil. There is a relatively small number of assemblers (codes 29.1 and 29.2) – only 37 – but their net sales reach almost US\$ 88 billion. The average net sales per company reach US\$ 3.3 billion for the automobile, light truck and utility vehicle manufacturing and US\$ 1.3 billion for the heavy duty truck and bus manufacturing sector. There are more than two thousand auto parts companies and their net sales reach R\$ 41 billion. In this case, average net sales per company (R\$ 20 million) are far below the value for the assemblers.

The remaining sectors (codes 29.3 and 29.5) represent roughly half the number of companies, but only 5% of net sales and about 15% of the number of employees of the automobile industry in Brazil. In the case of motor vehicle body, interior and trailer manufacturing (code 29.3), there are 861 companies, net sales reach US\$ 6.6 billion and about 64 thousand people are employed. Average net sales per company are below US\$ 8 million. In this sector, there is clearly a niche where some Brazilian companies play an important role. In fact, these firms tend to be national and are in general considered typically “family businesses”. In comparison with the automobile, light truck and utility vehicle manufacturing and heavy duty truck and bus manufacturing sectors, motor vehicle body, interior and trailer manufacturing is clearly a more labor intensive industry: while the first two present a net sales / employee ratio of US\$ 679 thousand and US\$ 742 thousand, the latter presents a ratio of only US\$ 104 thousand. Besides, as shown in table 2, the sector is less R&D intensive than the light and heavy vehicle manufactures.

TABLE 2
R&D investments and percentage of innovative firms, automobile industry in Brazil (2008)

Code (CNAE)	Description	Internal and external R&D exp./net sales (%)	Percentage of innovative firms (%)
29.1 + 29.2	(Automobile, Light Truck and Utility Vehicle Manufacturing) + (Heavy Duty Truck and Bus Manufacturing)	2.20	83.25
29.3 + 29.5	(Motor Vehicle Body, Interior and Trailer Manufacturing) + (Rebuilding of Engines for Motor Vehicles)	0.80	41.58
29.4	Motor Vehicle Parts and Accessories Manufacturing	0.81	46.71

Source: Brazilian Innovation Survey and Brazilian Institute of Geography and Statistics (IBGE).
Elaborated by the authors.

As shown in the table, the ratio R&D expenditures/net sales reaches 2.20% for light and heavy vehicles assembling, but remains as low as 0.80% for the motor vehicle body, interior and trailer sector.¹³ This is essentially the average R&D intensity for the auto parts industry. The analysis of the percentage of innovative firms in each sector (also shown in table 2) leads to the same conclusion.

In short, bus bodywork manufacturing is a relatively labor-intensive, smaller (only 5% of the automobile industry net sales) and less R&D-intensive industry, as

13. Although these data are only available for the aggregate Motor Vehicle Body, Interior and Trailer Manufacturing plus Rebuilding of Engines for Motor Vehicles (CNAE 29.3 and 29.5), net sales of the last one is too small and does not affect significantly this conclusion.

innovation tends to be incremental. It is precisely in this sector a Brazilian company had room to become a market leader.

3.3 The path of the bodywork manufacturing sector in Brazil

Two “waves of entry” mark the establishment of bus bodywork companies in Brazil. The first wave was in the late 1940s and early 1950s and the second wave was in the 1990s and early 2000s.

At the beginning of the 20th century, electrical trams began to spread in Brazil, replacing animal-powered vehicles. These vehicles were usually supplied by American, British and Canadian firms. After the Second World War, however, the imports shortage created room for a national industry which essentially assembled bus bodyworks on trucks chassis and provided spare parts. This movement is simultaneous with the industrialization and urbanization of the country. This is essentially the environment that marked the creation of Marcopolo, Busscar and Comil, which began manufacturing buses in 1949, and Ciferal, which began its operation in 1955.

Marcopolo was created under the name “Carrocerias Nicola” (Nicola Coaches) and in 1971 assumed its current name; Busscar was created in 1946, but produced its first bus in 1949; Comil was created under the name “Incasel Indústria de Carrocerias Serrana Ltda”; this company broke in 1985 and was acquired by the families Corradi and Mascarello, when the name was changed to Comil. In 2001, Ciferal was acquired by Marcopolo. The creation of these companies took place during the so-called “import substitution industrialization” (ISI) model adopted in Brazil between the 1930s and the 1980s (see Baer, 2002).¹⁴

The influence of European immigrant’s descendants is quite clear in all the reported cases. In fact, Marcopolo was created by Italian descendants, Busscar by Swedish descendants and Ciferal by an Austrian who immigrated to Brazil. Three out of the four companies created in this first wave were located in the Southern region of Brazil: Marcopolo was installed in Caxias do Sul (in Rio Grande do Sul, the southernmost

14. It is noteworthy that the ISI model relied on a protected market to attract multinational investments in light vehicle manufacturing, for example. In the case of bus bodywork manufacturing, however, mostly national companies benefited from market protection.

state of Brazil), Busscar in Joinvile (in Santa Catarina, which borders with Rio Grande do Sul) and Comil in Erechim (also in Rio Grande do Sul). Ciferal, on the other hand, was installed in Rio de Janeiro (in the state with the same name).¹⁵

Interestingly, while the bulk of Brazilian industrialization process took place in the Southeastern region (which includes São Paulo and Rio de Janeiro, for example), bus bodywork companies tended to concentrate in the South. This trend is probably associated with a more entrepreneurial spirit of the immigrants and with some skills they (or their family) might have acquired in coach production in previous time. Indeed, Italian immigrants who moved to Caxias do Sul region, in Rio Grande do Sul,¹⁶ were mostly from Piemonte and Veneto, and some of them had skills and experience in the metal-mechanic industry. Besides, the local market was, at the beginning, large enough to provide the necessary scale to the bus bodywork companies and the transportation costs between the Southern and the Southeastern regions of Brazil created a sort of natural market protection for these companies.

The initial concentration of these companies in the South of Brazil contributed to the formation of a cluster of firms in that region which remains up to the current days. A self-reinforcing presence of sectoral capabilities which would fit Myrdal's (1957) cumulative causation model took place so that the clustering of auto parts companies in the state of Rio Grande do Sul relied on the availability of skilled labor (as local universities focused on engineering, for example). Nowadays, Caxias do Sul hosts the two largest road implements companies in Brazil (Randon and Guerra), Marcopolo (bodywork) and their suppliers and spinoffs, both from ex-partners and ex-employees.

Between the mid-1950s and the 1990s no large plant was installed in Brazil. However, in 1991 and 1995, San Marino Neobus and Metalbus, respectively, were created in Caxias do Sul. In 1998, a Spanish company created in 1889 (Irizar) installed a unit in São Paulo (in the state of São Paulo) and, in 2003, a spin-off of Comil resulted in Mascarello, installed in Cascavel (in the Southern state of Paraná). The location of these plants is indicated in map 1 below.

15. In 1992 the plant was moved to Duque de Caxias, also in the state of Rio de Janeiro.

16. For the history of industrialization of Rio Grande do Sul, see Bueno and Taitelbaum (2009). For a historiographical study of the role of immigrants to the industrialization of Rio Grande do Sul, see Bartmann (2012).

MAP 1
Bus bodywork manufacturers' location in Brazil



Elaborated by the authors.

As shown in the map, in Brazil, bus bodywork manufacturers tend to cluster in the Southern region of the country, which represents around 17% of Brazilian GDP, while the Southeastern region – which hosts only two plants – concentrates 56% of GDP. That suggests the existence of a sectoral and regional innovation system in the Southern region, since a more “natural” choice (due to agglomeration economies) would be the Southeast.

Besides the obvious influence of European immigration in the formation of the Brazilian bus bodywork industry, both the American and European producers influenced products and processes in Brazil. According to Castilho (n.d.), American producers controlled the Brazilian market in the post war period and during the ISI period, so a natural influence was perceived both in bus design and in construction methods. Still according to Castilho (n.d.), European producers, on the other

hand, influenced product innovation as local manufactures (this is the case of Mercedes-Benz, which up to the mid-1990s produced buses in Brazil, and of the aforementioned Irizar) as well as sources of learning in visits and round tables Brazilian representatives took place.

In Brazil, the main bus bodywork companies are Marcopolo/Ciferal,¹⁷ Caio/Induscar, Neobus,¹⁸ Comil, Mascarello, Busscar, Irizar (Spanish capital) and Metalbus. According to Rosa et al. (2011), Brazilian bus production reached, in 2010, 33,395 units (28,285 for the domestic market and 5,110 for the external market). The leading company in Brazil (Marcopolo) kept its market share between 40% and 50% during the 2000s. The second larger market share is Caio/Induscar, which focuses on the urban bus segment. Neobus and Comil represented, in 2010, around 10% of the Brazilian market each.

This is the general environment where a Brazilian company turned out to be the third bus bodywork manufacturer in the world. A detailed description of its trajectory and sources of capability building is presented in the next section.

4 MARCOPOLO'S LEADING POSITION IN THE BODYWORK MANUFACTURING SECTOR

4.1 Marcopolo's trajectory

Marcopolo was founded in 1949 by eight partners. Although it was not a spinoff of any other preexisting company, most founders had previous experience in assembling and auto mechanics and repairing. The partners were painters (two), platters (two), woodworkers (two), polisher (one) and manager (one).¹⁹ Three of them (Dorval Antônio, Doracy Luiz and Nelson João) were Italian descendants brothers and belonged to the Nicola family. The company was created under the name "Carrocerias Nicola" (Cadó, 2001). Paulo Bellini, who originally worked with accounting and currently is

17. As described in section 4, Marcopolo acquired Ciferal in 2001.

18. As described in section 4, Marcopolo acquired 39.6% of Neobus shares in 2007.

19. Available at: <<http://blogpontodeonibus.wordpress.com/2011/07/26/fundacao-marcopolo-e-o-exemplo-de-empresa-com-atuacao-social/>>. Access in: Dec. 15th 2011.

its president, joined the company in 1950. His origins are Italian as well.²⁰ The Nicola brothers left the company between 1960 and 1967 to create a van manufacturing firm and, in 1971, a name of a bus model produced by the company was given to the company, which was named “Marcopolo S.A. Carrocerias e Ônibus” (“Marcopolo Bodyworks and Buses Corporation”).

The first bus bodywork produced by the company was handmade in wood and adapted from truck bodywork; its capacity was 26 passengers and it took 90 days to be produced. In 1952 the company began using the first steel structures. This was a relevant innovation for the firm, as these structures reduce vehicles weight and allow maximizing laden capacity. In 1954, the first intercity bus equipped with reclining seats was launched. That same year, the company went public, changed its name to “Carrocerias Nicola S/A” and began the construction of a new plant. According to Cadó (2001), at the time, stocks were sold to relatives and friends, marking some sort of “love money funding” in the early years of the company. In the mid-1950s, the availability of chassis specially designed for buses reduced considerably the manufacturing time. In 1957, Brazilian suppliers began producing chassis, which, up to that moment, were imported as completely knocked down (CKD).²¹ This movement is clearly associated to the ISI model adopted in Brazil at the time.

The early 1960s mark the first export experience of the company. The target was Uruguay, a neighbor of the state of Rio Grande do Sul. In 1963, the company takes part, for the first time, in the São Paulo Auto Show (Salão do Automóvel), when the “Nicola 63” model was presented. Branch offices were installed in the states of São Paulo and Paraná in 1963 and 1964. The last remaining Nicola brother left the company in 1967 and in 1968 the “Marcopolo” model was presented in the São Paulo Auto Show. The success of this model and the absence of the Nicola family justified the changing of the name to Marcopolo in 1971.²²

20. In 2005, Bellini was honored with the Distinzione prize, which distinguishes Italian origin people who succeeded in their communities. Available at: <http://www.marcopolo.com.br/website/2011/marcopolo/es/a_marcopolo/premios>. Acesso em: dez. 2011.

21. Vehicles can be traded as completely built up (CBU), completely knocked down (CKD), semi knocked down (SKD) and partial knocked down (PKD). From CBU to PKD the local value added tends to increase.

22. Verol and Campos Filho (n.d.) argue that the choice for the name “Marcopolo” involved market surveys which associated the name to challenging trips and recalled the company’s Italian origins.

In 1971 (ten years after its first export to Uruguay), Marcopolo started exporting technology and CKD bodyworks to Venezuela and acquired a local company (Elizário). According to Verol and Campos Filho (n.d.), the contract involved the supply of 2,500 bodyworks in ten years and, as the Venezuelan government used taxes to discourage imports of completely built up bodyworks, Marcopolo supervised the production of 1,000 bodyworks by a local company (Ensamblaje Superior). The remaining bodyworks were CKD exported. Ghana, in 1974, and Ecuador, in 1975, were the following targets of CKD and SKD bodywork exports. The choice for one of these processes is affected by three factors: *i)* local regulations on international trade; *ii)* freight costs and local content clauses and; *iii)* company's technology and local partners' ability of re-assembling to fulfill the necessary quality standards.

According to Martins (2003), while freight costs and average import taxes for CBU exports reached, in the early 2000s, US\$ 5,5 thousand and 25%, respectively, for CKD these numbers are US\$ 1,2 thousand and 0% - 5% (table 3). In this sense, the mastery of CKD re-assembling technology has been crucial for the internationalization process of Marcopolo.

TABLE 3
Estimated freight cost and import taxes for CBU, PKD, SKD and CKD exports (early 2000's)

Process	Estimated freight cost (US\$)	Average import taxes (%)
CBU	5,500 / unit	25
PKD	4,500 / unit	15 - 20
SKD	3,500 / 2 units	0 - 15
CKD	1,167 / three units	0 - 5

Source: Martins (2003).

Several new models were launched in the 1970s. Some examples are the modular urban bus called "Romeo and Juliet", whose rear part could be removed according to the required number of seats, buses specially designed for the urban transport system of the city of Curitiba, the first intercity articulated bus produced in Brazil and an electricity powered urban bus. Besides, some models incorporated flat-bed seats and air conditioning. Still in the 1970s, the company acquired Elizário, a bodywork assembler located in Porto Alegre (the capital of the state of Rio Grande), in 1971, and Nimbus, a bodywork assembler also located in Caxias do Sul, in 1977.

In 1979, Marcopolo installed a unit Betim (in the state of Minas Gerais). Although since 1954 Marcopolo had gone public, only in 1978 stocks began being traded in São Paulo Stock Exchange (Bovespa).

Trading stocks in the Exchange Market was a key decision in the sense it represented the engagement to a different growth strategy. As the Strategy and Development Director of Marcopolo, Ruben Antonio Bisi, pointed out during the interview, “you can imagine how hard it was to Mr. Bellini, an Italian man in essence, to give up his, his friends’ and relatives’ full control of the company”. Until the late 1970’s, the company had relied on own capital, “love money” and bank borrowings to grow. However, in order to keep the pace, the company would need to invest in riskier initiatives. Hence, the company board by that time decided that the best way was to call new partners to share these risks, even though it represented the sharing of the benefits as well.

The 1980s are widely considered a “lost decade” for the Brazilian economy. In fact, as a result of fiscal crisis and hyperinflation, the accumulated per capita growth rate during the period was negative. The crisis affected Marcopolo especially during the beginning of the decade: between 1981 and 1983, production was reduced from 12,267 to 6,695 units. But, on the other hand, the crisis encouraged the company to find out new forms of commercialization, such as leasing and sales consortia. Besides, the negative economic environment of the early 1980s in Brazil did not prevent the establishment of a new plant (the so-called “Ana Rech”, in 1981), the release of new models (e.g., the “low-driver” model; some of these new models became a reference for the sector) and the vertical integration process (in 1984, the auto parts company Marcopolo Distribuidora de Peças Ltda. was created and, in 1987, MVC Plastics Components was installed in São José dos Pinhais, in the state of Paraná).²³ Similarly to its previous operations in Venezuela, Ghana and Ecuador, in 1988 Marcopolo targeted Chile and Peru, spreading its presence in South America. That same year, Marcopolo began exporting minibuses to the United States, aiming at the mediumdistance market. It is noteworthy that during the ISI period in Brazil, innovation and exports were not exactly the focus of the public policies, which tended to emphasize the development of a national industry through the protection of the local market.

23. This plant began its operations in 1989.

However, during the 1960s, 1970s and 1980s, Marcopolo adopted a strategy which only in the 1990s – after the crisis of the previous decade and the collapse of the ISI model – became the focus of the industrial policies in Brazil.

Nowadays, Marcopolo is the third largest bus bodywork manufacturer of the world. According to the company's financial statements, net revenues reached US\$ 2.0 billion in 2011. In Brazilian currency, net revenues in 2011 were 13.6% above the net revenues in the previous year. In 2011, net profits reached US\$ 205 million and adjusted earnings before interest, taxes, depreciation and amortization (EBITDA), US\$ 277 million. As mentioned in the previous section, Marcopolo's market share in Brazil oscillated between 40% and 50% during the 2000s. The company's market share in Brazil reached 66.5% for intercity buses (coaches), 37.8% for urban buses, 42.0% for minibuses and 46.9% for minibuses in 2010. In 2011, Marcopolo produced 31,526 units (Marcopolo, 2012).

Currently, Marcopolo's capital structure comprises Brazilian and foreign shareholders. However, in spite of having only 25,7% of total stocks, the controlling group (including Paulo Bellini) owns 65,9% of ordinary stocks. Foreign shareholders do not own ordinary stocks; in turn, they have the majority of preferential ones. In general terms (considering both ordinary and preferential ones), stocks are rather equally distributed between controlling shareholders, other Brazilian and foreign shareholders, as depicted in table 4 below.

TABLE 4
Marcopolo's capital structure

	Number of Ordinary Stocks	OS (%)	Number of Preferential Stocks	PS (%)	Total	%
Shareholders	112,501,544	65.86	2,419,228	0.87	114,920,372	25.63
Controlling Shareholders	58,311,728	34.14	115,194,896	41.49	173,506,624	38.69
Shareholders in Brazil	0	0	157,944,764	56.89	157,944,764	35.22
Foreign shareholders	0	0	2,078,282	0.75	2,078,282	0.46
Shares held in Treasury	170,812,872.00	100	277,637,170	100	448,450,042	100
Total (%)	38.09		61.91			100.00

Source: Marcopolo's financial statements.

4.2 Towards a global company

In spite of a couple of experiences of exporting CKD and SKD bodyworks to some countries in the previous decades, it was in the early 1990s that Marcopolo began to become an international company with significant productive assets abroad. This movement seems to be a consequence of the perception that the technology licensing contracts established up to the 1980s would eventually encourage the emergence of new competitors which could assimilate the company's technology. As a result of this perception, in 1991, Marcopolo acquired a bodywork plant in Portugal. This first experience abroad had no local partners directly involved (that is, the investment was not a joint-venture and the plant was entirely controlled by Marcopolo). The idea was to have an "advanced observatory point" in Europe (benefiting from the agreements among countries of the European Community, which was about to be converted into the European Union) in a country which shares the same language spoken in Brazil. Moreover, there was the fear that the upcoming European Union could eventually impose restrictive regulations to imports and foreign direct investments (FDI) from non-member countries. Initially, Marcopolo in Brazil sent entire parts to be assembled in Europe, but after the company decided to develop local suppliers. In 1992, the company signed an agreement to transfer technology and export bodyworks to Mexico, and in 1998, Marcopolo's second plant abroad was installed in Argentina to assemble CKD vehicles exported from Brazil. These two investments might be considered the starting of a learning process, as the absence of local partners and the low levels of integration with local suppliers would be problems to be faced in the future. Besides, Martins (2008) argues that, in the case of Portugal, the product did not fit the local market.

In 1999, the third plant abroad (Polomex) was installed in Mexico and the previous agreement with that country was terminated. Although this plant originally resulted from an acquisition by Marcopolo and was 100% controlled by the company, in 2001, 26% of the shares were sold to DaimlerChrysler.²⁴ According to Martins (2008), "all the mistakes made in Portugal and Argentina were corrected in Mexico". Still in 1999, Marcopolo acquired the bus bodywork assembler Ciferal, in Duque de Caxias (in the state of Rio de Janeiro) and extended its presence to the Southeastern region of Brazil. In the 1990s, the company kept releasing new models such as the "low entry" and the "double-decker" buses.

24. The plant was originally installed in Aguascalientes and, after the joint-venture with DaimlerChrysler, was transferred to the latter's plant in Monterrey.

The 2000s mark the deepening of the company's internationalization process. In fact, in the beginning of the decade, new plants were installed in South Africa and in Colombia (Superpolo). In South Africa, a partnership with Scania was established in 2000 and, in 2001, a new plant ("Marcopolo South Africa") was established after the acquisition of a firm previously installed in the country. In Colombia, a joint venture with Superplus (Volvo) was established to create Superpolo. On the other hand, in 2001, the plant in Argentina was put in standby due to the strong economic crisis that took place in that country in the beginning of the decade. That same year Marcopolo tried its first incursion to China and signed an agreement with the Italian company Iveco to transfer technology and produce components. The plant in Russia ("Russia Buses Marco") was established in 2006 as a joint venture between Ciferal (controlled by Marcopolo since 2001) and Russian Buses (formerly RusAutoProm). The strategy of developing local suppliers was adopted in face of the increasing value of the Brazilian currency. However, this plant was shut down and nowadays Russian Buses Marco is only a dealer.

In India, also in 2006, a joint venture with Tata Motors was established and Tata Marcopolo Motors was created to manufacture fully-built buses and coaches for India and selected international markets (Mani, 2011, p. 20). Initial investments were estimated in US\$ 13.3 million (total investments are estimated in US\$ 70 million), and 49% of Tata Marcopolo Motors belong to Marcopolo, while 51% to Tata Motors. Again, local suppliers were to be fostered in this project. Tata Motors is responsible for providing chassis and for commercializing the buses, while Marcopolo provides the production technology and develops new products. Two associations – with Neobus, in Brazil, and with Metalpar, in Argentina – were formed in 2007. Marcopolo's shares in these investments were 45% and 33%, respectively.

GB Polo was established in Egypt in 2008 as a joint venture with GB Auto. This plant was intended to supply the European market after the closing of the plant in Portugal (Egypt has a free-trade agreement with European Union). Besides, Egypt is also close to the Middle East market. However, this plant is now in standby, due to the severe political crisis in that country. Finally, in December 2011, Marcopolo acquired 75% of the Australian Volgren, which manufactures buses in four sites in that country.

Besides these movements, by the 2000s, Marcopolo had already consolidated its position as a large bus exporter. Marcopolo's buses circulate in more than 100 countries.

Its presence in Portugal and Mexico, for example, allowed the company to benefit from free trade agreements in the European Union and in North American Free Trade Agreement (NAFTA) and to export to several more developed countries in these continents. The same happened in Africa, where the company could benefit from the Southern African Development Community (SADC).

After some failures in Portugal and Argentina, Marcopolo seems to have realized the importance of good partners, especially chassis producers, and the need to involve local suppliers. Moreover, its high levels of flexibility to produce buses adapted to customer's requirements and its capacity to develop new models allowed Marcopolo to export to countries like Saudi Arabia, where buses may fit some religious requirements. Box 1 summarizes the internationalization process of Marcopolo.

BOX 1

Marcopolo's internationalization process

Year	Country	Name	Strategy	Current status
1991	Portugal	-	Acquisition of a local firm. The plant in Portugal would be an advanced standpoint in Europe. No local partners directly involved.	The plant was shut down in 2009.
1998	Argentina	Metalpar Argentina	Greenfield investment for CKD assembling. No local partners involved. Low integration with local suppliers.	After a standby, the plant is active. Since 2007, the plant is a joint-venture with Metalpar Chile, but Marcopolo's is a minority partner.
1999	Mexico	Polomex	Acquisition of a local firm. However, in 2001, Marcopolo sold 26% of the shares of that plant to DaimlerChrysler.	Active.
2001	South Africa	Marcopolo South Africa (MASA)	Acquisition of a local firm. Joint-venture with Scania.	Active.
2001	Colombia	Superpolo	Joint-venture with Volvo.	Active.
2001	China	Auto Components	Joint-venture with Iveco.	Active, after a standby.
2006	Russia	Russia Buses Marco	Joint-venture with a local firm, RusAutoProm.	Currently a joint-venture with Kamaz.
2006	India	Tata Marcopolo Motors	Joint-venture with Tata Motors.	Active.
2008	Egypt	GB Polo	Joint-venture with GB Polo.	Standby, due to the political crisis.
2011	Australia	Australian Volgren	Acquisition of 75% of Australian Volgren.	Active.

Elaborated by the authors.

As a result, Marcopolo currently controls a fourteen productive units abroad and four plants in Brazil (Marcopolo Ana Rech, Marcopolo Planalto, Ciferal and Neobus),²⁵ as shown in map 2 below.

MAP 2
Marcopolo's productive units



Elaborated by the authors.

4.3 Sources of capability building

Marcopolo's sources of capability building are both internal and external. Internal sources may involve R&D and learning by doing, for example; external sources encompass purchasing of technology, joint-ventures and merger and acquisitions, for example. As one examines Marcopolo's trajectory, some aspects seem to characterize its sources of internal capability building, which are essentially related to R&D, although these activities have not always been conducted by a formal department. In fact, according to Cardoso (2000), R&D activities were considered, in the early 2000s, a transversal activity. Later on, according to Brandão et al. (2006, p. 84), a formal R&D area began to involve 60 employees and was segmented in three branches which work in sequence: development engineering (in charge of new vehicles projects), prototypes, and experimental engineering (vehicle testing and system validation). According to data collected during the interviews, in 2011 the company invested around US\$ 27 million in R&D. Although this number refers only to the investments done

25. As stated in the previous section, in 2007, Marcopolo acquired 39.6% of Neobus shares.

in Brazil, when the revenues are limited to the domestic plants, it is possible to estimate a R&D/revenues ratio of around 2% as shown in table 5 below:

TABLE 5
Marcopolo's R&D expenditures

	2008	2009	2010	2011
R&D expenditures in Brazil (US\$ million)	17.03	16.52	22.32	27.47
Net operational revenues in Brazil (US\$ million)	847.09	692.71	1,182,05	1,467,33
R&D intensity (R&D/revenues %)	2.01	2.38	1.89	1.87

Source: Marcopolo's data and financial statements.
Elaborated by the authors.

The average company's R&D intensity during the last four years (2.04%) is 2.5 times the average of motor vehicle body, interior and trailer manufacturing in Brazil (0.80%) and compatible with the average for automobile, light truck, utility vehicle, heavy duty truck and bus manufacturing (2.20%). However, for this last sector, R&D is still in the hands of multinational corporations (Malerba and Nelson, 2011, p. 1654).

In terms of prospective development of new products, Marcopolo's R&D may be divided in three major time spans: short, medium and long run. Starting from the latter, the company reported, during the interviews, that there are five researchers whose job is to think about major trends in bus manufacturing and its market, considering engineering implications of these trends. Medium run development is related to the need of changes or major adaptations in existing manufacturing platforms, which generally require new projects, prototypes and tests such as crash and stability tests. For aerodynamics tests, Marcopolo uses the wind tunnel of the Aerospace Technical Center (CTA) at the Technological Institute of Aeronautics (ITA) of the Brazilian Air Force, located in São José dos Campos, São Paulo.²⁶ Lastly, short run development is related to incremental innovations, such as new seats, windows etc.

External sources are mainly related to the relationship with customers and suppliers and benchmarking of the main competitors (by taking part in exhibitions, for example), but the company does not directly buy external technology. In particular, the relationship with customers and suppliers and the need for product adaptation to different market requirements and regulation standards worked as an important innovation driver. Castilho (n.d.) argues that product bus bodywork customization in Brazil began internally, as

26. São José dos Campos is the home of Embraer.

buses are largely used for short and long distance trips in Brazil and these vehicles must adapt to different conditions. According to Verol and Campos Filho (n.d.), the 1980s mark the beginning of the efforts to adapt products to external markets. In 1988, for example, Marcopolo exported the so called shuttles to the United States. These buses had to be adapted to a niche for medium distances (up to 250 km) and to match local standards. Still according to Verol and Campos Filho (n.d.), not only customers but also suppliers took part in these efforts, as new materials were required. This experience is reported as a very important source of learning and it served as a reference for future developments. Accordingly, the aforementioned case of buses exported to Saudi Arabia – which had to have separate sections in the same bus for men and women, for example – is another example of how requirements for exports created incentives for innovation. Interestingly, in the paper mentioned in the introduction of this paper, Malerba and Nelson (2011, p. 1,648) argued that catching up firms usually have a hard time trying to replicate the organizational, managerial, and institutional aspects of productive practices of benchmarking firms. In Marcopolo's case, however, the capacity of adapting to indigenous conditions was itself a factor which contributed to its leadership position.

In spite of its relatively high R&D intensity, linkages with universities and public laboratories seem to be less important sources of capability building. In fact, differently from Embraer, which strongly relied on a public university created to provide skilled labor and R&D services for the aerospace sector (the aforementioned ITA), Marcopolo and the other automobile companies in the Southern region of Brazil mainly preceded the supply of labor by local universities.

Moreover, there seems not to be a cooperative culture among companies located at the region, at least in the automotive sector. These companies are basically competitors and do not cooperate in innovative projects. In fact, some of these companies are spinoffs of existing ones and are not welcome by the previous incumbents.²⁷ As universities-enterprises linkages are rather weak in terms of innovative projects, cooperative innovative projects tend to be inexistent among companies of the bus body work sector since they are generally intermediated by local universities. The exception is the cooperation among companies that do not compete directly against one another. This is, for instance, the case of the cooperation between Marcopolo and Randon, a Brazilian road implements company. These companies share vehicle proving

27. When questioned about cooperation, some interviewed people even confessed that in practice the companies of the sector are neither friends nor partners.

grounds in Caxias do Sul, where both companies have industrial plants.

Besides product innovation, Marcopolo invested heavily in process innovation to combine increases in productivity with flexibility. The Japanese production model caused a strong impression on Paulo Bellini, who, after visiting Japan in 1986, encouraged the adoption of processes focusing on quality management.²⁸ According to Castilho (n.d.), Brazilian bus bodywork manufacturers combine mass production with some “tailor made items” or “special items” to comply with clients particular requirements. Still according to Castilho (n.d.), in order to achieve the necessary balance between commercial flexibility and productive efficiency, manufacturers rely on modularity and try to have product platforms and families of items so that customized bodyworks can be produced at lower costs and in a shorter time. In the case of Marcopolo, these principles have been strongly emphasized. In 2005, the company innovated to adopt the concept of modular production so that the bus bodywork is attached to the chassis using screws instead of braze. This innovation allowed Marcopolo to reduce product development time, increased productivity in 10% and brought advantages to clients as it simplifies parts replacement and reduces maintenance costs.

As the company’s trajectory discussed in the previous section shows, Marcopolo widely used acquisitions and joint ventures to spread its plants around the world, following a trend mentioned by Carvalho et al. (2010, p. 5), according to whom “Brazilian firms are reaching overseas markets in a large variety of ways, but acquisitions have been widely broadcasted”. However, there is no evidence that these movements were intended to acquire technologies. This perception converges with Carvalho et al. (2010, p. 20), who argue that among Brazilian internationalized firms “technology seeking investments are rather scarce”. In fact, acquisitions seem to have been used to speed up the process of entering in a given country and joint ventures seem to be a consequence of *i)* local governments’ requirements; *ii)* easier access to components such as chassis and motors; and *iii)* risk sharing with a local partner potentially better informed about local peculiarities. Especially after the strong appreciation of the Brazilian currency in the second half of the 2000s, Marcopolo suppliers were increasingly local ones. Exchange rates reduced from around 3.00 Brazilian Reals per US dollars in 2002 to 2.00 in 2006, reached 1.50 in the late 2000s and in 2011 went up again to around 1.80. Not surprisingly, the number of buses sold to the Middle East fell from 1,000 per year,

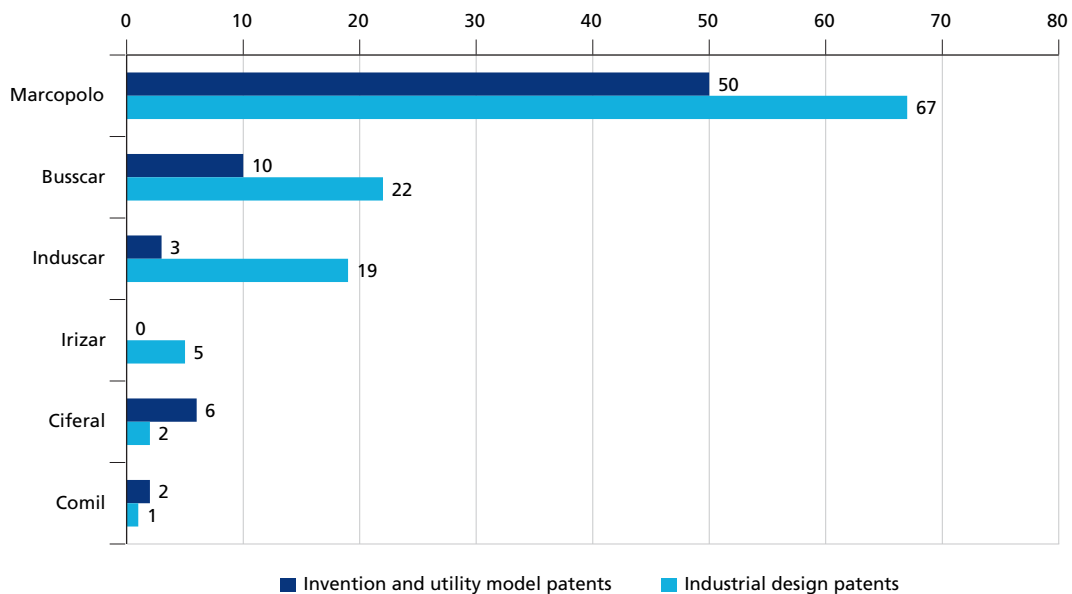
28. Available at: <<http://jcrs.uol.com.br/site/especial.php?codn=7894>>.

up to 2004, to 100 in 2006.²⁹ According to José Rubens de la Rosa (general director of Marcopolo), the company replaced the export of components by the export of people, so that more than 200 Brazilians are abroad to transfer production technology to the plants in other countries.

To guarantee intellectual property of innovations in aerodynamics, design and comfort items, Marcopolo used invention, utility model and industrial design patents. The company is by far the leader in Brazil, as shown in chart 1 below.

CHART 1

Number of patents granted at the Brazilian National Institute of Industrial Property (INPI), bus bodywork industry in Brazil



Source: <<http://www.inpi.gov.br>>.
Elaborated by the authors.

As shown in the chart 1, the number of invention and utility model patents granted to Marcopolo is five times greater than the number of invention and utility model patents granted to the second company (Busscar). Besides, the number of Marcopolo's patents is more than the double of the rest of bus bodywork companies in Brazil. The analysis of industrial design patents leads to a similar conclusion. These data make

29. Stal (2007) registered the comment done by one of Marcopolo's executives about the appreciation of the Brazilian currency: "we are being expelled from home".

clear the offensive technological strategy adopted by Marcopolo according to Freeman and Soete (1997) typology. Notwithstanding, one must consider that patenting and other formal strategies for intellectual property protection may disclosure technology, so they are not a perfect proxy for the outputs of technological activities from Marcopolo. In other words, on several occasions, Marcopolo prefers industrial secrecy as an intellectual property protection strategy especially when legal uncertainty is taken into account.

4.4 System factors

In spite of the adoption of lean production principles, Marcopolo is highly vertically integrated with suppliers. As aforementioned, vertical integration was the best response to the lack of local specialized suppliers in the segment. However, there is no vertical integration between motor and chassis producers and bus bodywork manufacturers in Brazil, as customization requirements and the lack of parts suppliers are barriers to the entry for Volkswagen for example, in the bodywork market. This environment is completely different from the European one, for example. In Europe, it is rather easy for a large auto manufacturer to become a bus manufacturer as well, since they may outsource many stages of production. Moreover, the market is not used to customization, which leaves room for scale production gains.

In fact, according to Zignani and Deiro (2011), Marcopolo integrates the production of nearly all parts used in manufacturing process (seats, foams, windows, doors, hydro-sanitary installations, handbag compartments, plastic components, air conditioning and audio and video systems). The exceptions are, of course, chassis and motor, which may represent from 50% to 60% of the bus total cost.³⁰ This ratio varies according to the type of bus: while urban buses have simpler (and less expensive) bodyworks, coaches usually have more expensive bodyworks. Bus bodywork assembling is different from motor and chassis production (as well as from light vehicles manufacturing) because of the customization requirements. In fact, bus bodyworks are usually commissioned and, as a result, products may greatly differ from one another. On the other hand, motor and chassis are usually produced in large scale. That makes bus bodywork assembling a different business and explains why motor and chassis

30. According to the bus dealer's documents, the final price of an urban bus (including taxes) in Brazil is, on average, around US\$ 215 thousand; in this case, the bus bodywork costs US\$ 100 thousand, while the rest refers to motor and chassis. A long distance coach may cost around US\$ 230 thousand, and half of this cost refers to the bodywork.

manufacturers very often do not integrate their processes with bodywork production to assemble the entire bus.

Putting aside chassis and motor suppliers, Marcopolo is in fact highly vertically integrated, as companies like MVC plastic components, Metalpar and Spheros (air conditioning manufacturer) are controlled by Marcopolo. Interestingly, companies like MVC supply components not only to Marcopolo but also to other automobile (such as Nissan) and aircraft (such as Bombardier) assemblers, and wind power companies, for example. That makes the company a sort of outsider in an industry where outsourcing is a clear trend (Collin, Bechler and Pires, 1998). According to Martins (2008), vertical integration is a requirement for internationalization, as local governments tend to require some level of local content for bodywork manufacturers and the use of local suppliers would imply some level of technology transfer and the possibility of having these parts supplied to competitors. Again, Marcopolo differs from Embraer, which, according to Marques and Oliveira (2009), has not been able to consolidate its supply chain within Brazilian national borders. While Embraer's internationalization led to an increase of its import content from 68% in the 1980s to approximately 95% in the 1990s, Marcopolo used vertical integration to consolidate its supply chain in Brazil. Besides, its international plants also rely of local suppliers.

During the 2000s, Marcopolo accessed credits provided by the Brazilian Innovation Agency (FINEP) in 2002, 2005 and 2007 and accessed fiscal incentives for R&D in 2006, 2007 and 2008. The company argues, however, that innovation financing depends on innovation projects, and their innovation projects suitable for FINEP's requirements do not happen on an yearly basis. From the company's standpoint, the public policy instrument most used by Marcopolo was credit at more favorable conditions provided by the Brazilian Development Bank (during the 2000s, this instrument was accessed all the years).

However, much more important to Marcopolo (and for the whole automotive sector as well) are buyers' credit, both domestically and abroad. Domestically, the National Equipment Financing Authority (Finame), a financial program aiming at the purchases of machinery equipment at more favorable conditions to buyers provided by the Brazilian Development Bank (BNDES), has played a very important role for

capital goods producers in general. Internationally, export financing through the Export Finance Program (Proex) has been crucial for the company's exports, since it equalizes borrowings' interest rates to foreign clients with international standards. Interest rates in Brazil have been traditionally high; hence, exporting firms without the support of a program like Proex would considerably reduce competitiveness from the financial side.

Apart from the aforementioned instruments, there is no evidence that government support and public policy instruments explain the leadership position of the firm. Not only these instruments are rarely mentioned in previous analyses of the company but also Marcopolo's technological development and internationalization seem not to have relied on them. It seems more appropriate to say that Marcopolo and the other Brazilian bus bodywork companies were, on some occasions, free riders of public policies originally designed to light vehicles manufactures, as in the case of the access to credit at more favorable conditions provided by the Brazilian Development Bank. As a result, at the national level, public policies may not be considered pro-active, as they did not push the birth of the leading company. It might be argued that public policies were reactive, as they supported Marcopolo once it had already emerged as a leader, but it seem more correct to say that the bulk of these policies was not aimed at this sector, and Marcopolo just took advantage of the availability of some instruments which in fact were not designed to bus bodywork manufacturing (as in the case of BNDES credits). In fact, Marcopolo used equity markets as a source of funding very early: the company went public as early as 1954 and 24 years later its stocks began being traded in Bovespa. This is a clearly atypical path for a Brazilian company, which up to the 2000s very rarely used capital markets and tended to rely on public banks.

5 MAIN FINDINGS AND FINAL REMARKS

The aim of this work was to analyze the factors that explain the industrial leadership of a Brazilian bus bodywork manufacturer. From a methodological point of view, the paper was a case study based on a bibliographic review and on in-depth interviews. Thus, the analysis was based on a theoretical review on industrial leadership (section 2) followed by a discussion *i)* of the bus bodywork manufacturing technological requirements and of the sector in Brazil (section 3) and *ii)* about the dynamics and evolution of Marcopolo's leading position (section 4).

Although one may argue that bus bodywork manufacturing is a relatively small segment in the auto industry as whole, Marcopolo's case is of interest because it is a global leadership case in a sector Brazil has no tradition. More interesting, Marcopolo's case is an interesting one for policy makers in Brazil, who since the mid of the 20th century implemented policies aiming at developing the light vehicles segment and did not succeed in creating a national leader, whereas in a relatively neglected niche of this industry, a Brazilian company plays an important role in the world market. Marcopolo's leading position was consolidated over time; one could hardly predict it would be a global player in the early days of the company. In fact, Marcopolo's leading position results from clearly riskier decisions and strategies that paid off, but one can only understand the company's current position through the combined and contextualized analysis of these decisions and strategies.

All in all, the main hypothesis of this work – that, at some point in the past, some idiosyncratic factors regarding Brazilian market led the large auto manufacturers to give up contesting Brazilian incumbents in the bus bodywork sector – was confirmed. In fact, lower technological requirements and higher labor intensity of the bus bodywork industry left room for the establishment and leadership of emerging countries like Brazil, India and China in the segment. From this point onwards, path dependency and capability building consolidated this leadership.

So, in short, what explains Marcopolo's leadership?

- The company rose in a specialized niche where it could dictate the customer-supplier relationships. Nowadays, Brazilian large customers of the segment (bus transportation companies) value customization possibilities, and developed their own maintenance structure over time. It means that if global heavy vehicle assemblers wish to contest the bodywork manufacturing market in Brazil by providing complete buses, they will face customers who value customization and flexibility and for whom after-sales services are not so important.

- At a first moment, the development of the company in an enclave where companies belonging to metal-mechanical segments agglomerated helped the development of technological capabilities. However, the company has increasingly relied on internal capabilities, so that cooperation with other companies of the same sector and the relationship with universities do not explain its current leading position.
- Some relevant sources of capability building have been vertical integration and the reliance on intramural R&D. Technological capabilities are related to allying lean production to flexibility, with low costs. The firm does not purchase technology, does not cooperate with universities and other firms in a relevant way and M&A were oriented by market reasons, in this sense, they were not critical for technological development. Although many firms of the metal-mechanical complex are located in Caxias do Sul, one may not consider they comprise a technological cluster; firms are located at the same region due to historic factors and cumulative causation.
- Internationalization process for Marcopolo was a trial-and-error process. One may say that internationalization strategy of Marcopolo is guided by a strong sense of entrepreneurship: most of times, the company has identified some high risk/high return opportunities in non-central countries, exception to the Volgren plants in Australia – which may be understood as a purchase opportunity resulting from to the world crisis. After some mistakes in Portugal and Argentina, the company seems to have found its own way, through acquisition of existing plants, joint-ventures and involvement of local suppliers. It is noteworthy that Marcopolo's most important positions abroad are located in BRICS countries (including South Africa).
- The company's strategies have been ahead of the public policy discourse or market trends. Marcopolo went public very early, started to export when it was not considered a national priority and was one of the first Brazilian companies to have plants abroad.
- Modularity and product platforms or families of items so that customized bodyworks can be produced at lower costs and in a shorter time – hence, process technologies – are the most important technological routes pursued in the near future, especially to face the possible threats of having large competitors in Brazil.

A threat for the company is the entry of large auto manufacturers offering complete buses, and not only providing chassis to Brazilian bodywork manufacturers. These large manufacturers may wish to contest the market due to the economic crisis in developed countries, and the Brazilian market is an attractive one. At first, customer's habit to customization could be a problem, but this could be compensated by lower prices due to scale intensive production. Whether it is the case, Marcopolo would additionally need to find other chassis dealers, or manufacture them.

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