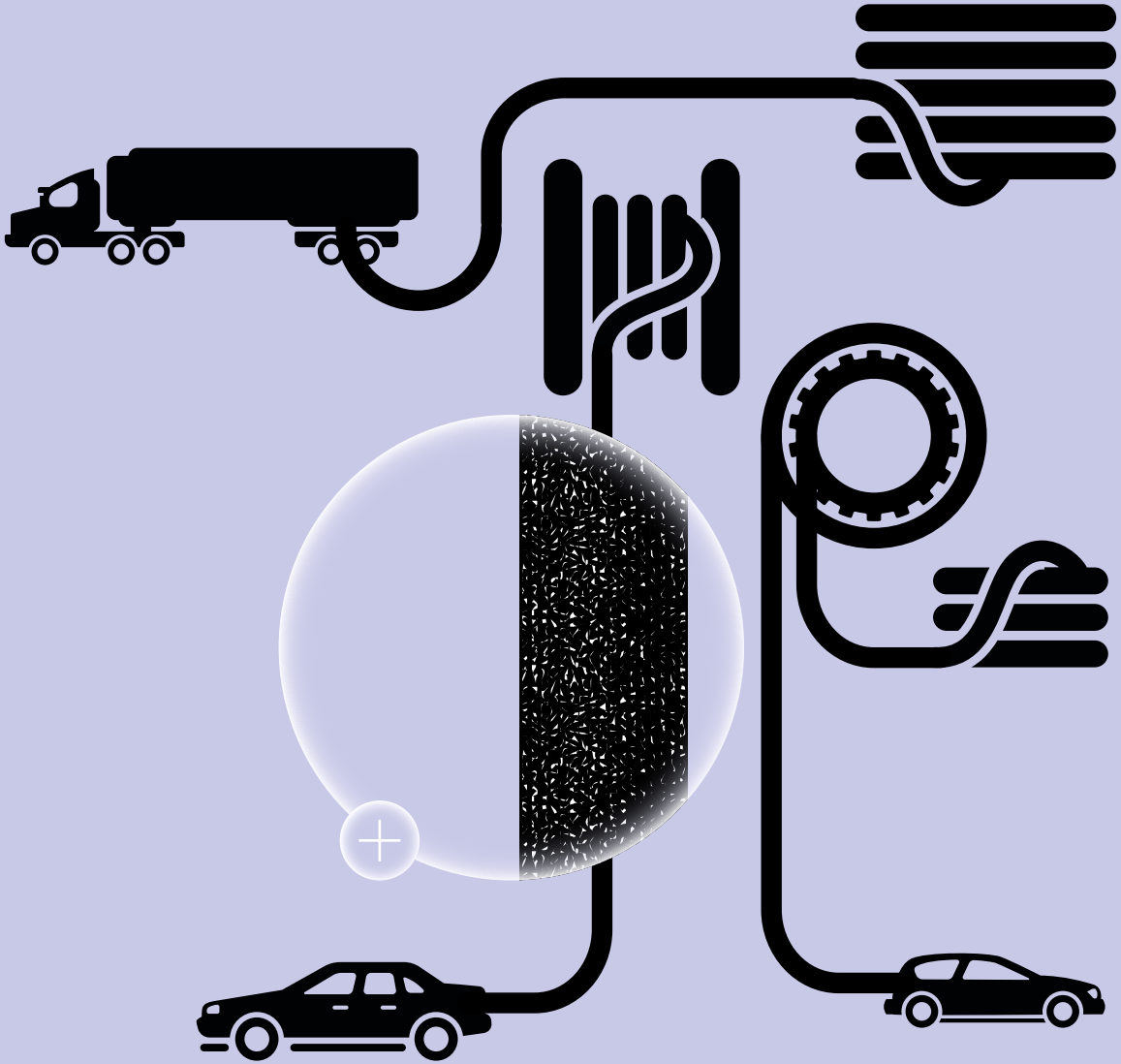
Case Study

Coficab Portugal

From supplier-by-demand to product innovator in the automotive industry

Vitor Corado Simões
Nuno Fernandes Crespo



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COFICAB

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Coficab Portugal: From supplier-by-demand to product innovator in the automotive industry

Abstract

Coficab Portugal is a remarkable example of how a subsidiary in a European peripheral country may contribute to transform a business group based in Maghreb (Tunisia) into an European leader and a major worldwide competitor in the cables and wires industry.

Coficab Portugal was founded in 1993, as a result of a joint venture between ***Delphi*** , one of the major automotive components companies (formerly part of the ***General Motors Group***), and the Tunisian ***Elloumi Group***. During the first years, the company was dependent of ***Delphi***'s demand. In the year of 2000, the end of the joint-venture put at stake not just ***Coficab***'s business model but also ***Coficab Portugal***'s role.

This entailed a strategic change: diversification of clients, locations, and products, with an increasing shift from low value-added products to innovative specialty products with increasing value-added.

The results were noteworthy: in 14 years the turnover of ***Coficab Portugal*** grew 7-fold, the number of workers grew 4-fold, and the company was the worldwide first-to-market with an innovative product: the FLMRY 0.13mm^2. The evolution of ***Coficab Group*** is even more impressive: the company has manufacturing or commercial facilities in eight countries, and its turnover increased about 30-fold.

The historical retrospective of the company is presented (focusing primarily the recent years) after examining the automotive industry framework and its value chain. The case concludes with a set of questions about strategic challenges that ***Coficab Portugal*** and ***Coficab Group*** will face in the near future in order to elicit students thinking on the subject.

Keywords

Coficab Portugal; Auto industry wires and cables; Subsidiary innovation; Subsidiary role; Process efficiency; Product innovation; New product development; Growth strategy.

Acknowledgments

This case was written by Vitor Corado Simões and Nuno Fernandes Crespo, of ISEG – Lisboa School of Economics and Management, University of Lisbon, for ***COTEC Portugal***, between May and June 2015.

Personal interviews were held at Coficab Portugal with Engº João Cardoso, Operations and R&D Director and Member of the Board of ***Coficab Group***, and the following executives (by alphabetical order): Fernando Santos (Plant Manager), João Pires (Financial Manager) Luís Fernandes (R&D Project Manager) and Rosa Santos (R&D+I Manager). Face-to-face interviews were held on May 20th and 21st and June 9th 2015, with a visit to the plant, technical center and other facilities. Selected quotes from those interviews are transcribed in the case. The interviews were in Portuguese language; the quotes were translated into English by the authors. To avoid overloading the reader with very specific information, no reference is provided regarding such quotes. We also benefited from interaction with Ana Domingues.

The authors thank the ***Coficab Portugal*** executives mentioned above for the information and the support provided. They have been essential to improve the quality of the final research.

Thanks are also extended to Isabel Caetano, of COTEC Portugal, for the spirit of cooperation expressed throughout the project. The comments by our colleagues Cátia Miriam Costa, Maria João Santos, Manuel Mira Godinho and Sandro Mendonça, also members of the Project Team, but not directly involved in this case study, are gratefully acknowledged.

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Introduction

The plane was preparing to land at the Tunis-Carthage International Airport. Although Mr. João Cardoso had landed there hundreds of times, he could not refrain from thinking once again how powerful Chartage had been to challenge the Romans for more than 100 years and to remind several visits to the remains of what was Carthage until 146 BC. But this was not the purpose of his visit. He was getting there to participate in a very important meeting of the Board of ***Coficab Group***, the Tunisian cable manufacturing group led by Mr. Hichem Elloumi.

Mr. Cardoso had been asked to present to the Board his ideas about ***Coficab***'s strategic development opportunities for the next five years. He had thought a lot about it, and was sure that tomorrow the Board would carefully listen to his words.

Manufacturing cables for the automotive industry is not an easy task. ***Coficab*** had been very successful so far, and the Group's recent international expansion confirmed the strategic intention to become a truly global leader in the industry. Now, there is a need for organizational rearrangement of the ***Coficab Group***, namely at corporate level, since the turnover of the Group grew about 30-fold in just 14 years, while the corporate and coordination structure had just a 3-fold increase. The challenges ahead for ***Coficab*** cannot be understood outside the context of the international automotive industry and their supply chain relationships, and without taking stock of the history of the ***Coficab Group***, and especially of ***Coficab Portugal***. This was founded in 1993, as a joint venture between ***Delphi***, the automotive components company then spinning off from the ***General Motors Group***, and the ***Elloumi Group***. Mr. Cardoso had joined ***Coficab Portugal*** still in 1993, shortly after getting his degree in Electrical Engineering.

The ***Coficab Group*** needs to be reinvented again, like in the year 2000 when the joint-venture that supported ***Coficab*** business came to an end. Back then, they had to define a strategy to survive. This time the reasons behind the reorganization are much different. They are the consequence of company growth: the ***Coficab Group*** is now the European leader and one of the most important cable manufacturers worldwide. What opportunities should the company follow, in order to be a truly global company in the future, and integrate innovation into its culture?

The automotive industry and their supply chain

The Automotive Industry

The automotive industry works at a global scale. The main players in this industry have operations in multiple countries and sell their products worldwide. The key assemblers of car brands or Original Equipment Manufacturers (OEMs) locate their manufacturing activities at a global scale. The number of OEMs worldwide is relatively small (less than one hundred) but, since this industry is very active in terms of mergers and acquisitions (M&A), joint-ventures and other forms of cooperation (licensing, joint product development and share of technology), the industry is even more concentrated in a small number of groups (less than 20)[1].

Besides the automotive manufacturers, the other companies operating in the industry are the suppliers of auto parts and subassemblies manufacturers. These suppliers, especially the direct suppliers (often called 'Tier 1 suppliers' as mentioned in the following sub-section), increasingly follow their clients worldwide and many of them have developed as "global suppliers". These two groups of companies, the automakers and the suppliers, have adopted a set of standards difficult to achieve by other companies; therefore the rearrangements of the industry deal mainly with alliances and mergers and acquisitions (M&A) within the industry (between OEMs, between suppliers, and between OEMs and Tier 1 suppliers)[2]. The number of independent automakers is marginal; they tend to be focussed on very small market niches, such as supercars, exclusive cars or electric cars.

1 · OICA (2015).

2 · Sturgeon *et al.* (2009).

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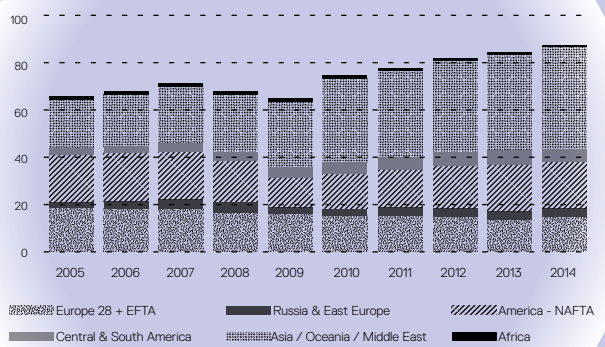
The economic crisis of 2008-2009, one of the most severe in modern history, had a major impact on the automotive industry. Actually, the automotive industry has been among those which have suffered the most, after the housing and finance sectors.. In fact, only the banking sector has been subject to larger government intervention than automotive industry[3]. After this difficult period, the worldwide automotive industry is again 'driving at high speed', exhibiting higher growth levels and annual sales have exceeded the prerecession figures. Even so, the various regions are driving with different 'accelerations'. Globally, is possible to assert that since 2010 the automotive industry has recovered from the world economic crisis that starts in 2008. The number of total vehicles sold worldwide recovered from the decrease of 8,4% felt between 2007 and 2009.

In 2014, more than 88 million of cars were sold worldwide, including passengers and commercial vehicles (Exhibit 1). Even though in the previous five years the number of cars sold increased more than 34%, from 65,6 million in 2009 to 88,2 million in 2014, this evolution is not homogeneous. The relative importance of markets is shifting. While in 2005 the European, North American and Asian markets exhibited similar shares around 30% of the number of vehicles sold, in 2014 the Asian market (Asia, Oceania and Middle East) was responsible for more than 48% of vehicle sales. The NAFTA countries accounted for 22% of the sales of vehicles in 2014, whilst they represented more than 30% in 2005. The Europe region also exhibited a declining trend: from more than 27% in 2005 to near 17% in 2014. Therefore, whereas the European and North American markets seem to be stable or contracting both in terms of both the number of cars sold and world market shares (in value), the Asian markets seems to be gaining ground, namely the Chinese market, in which the number of vehicles sold annually increased more than four-fold between 2005 and 2014 (from 5,7 million to 23,5 million vehicles)[4].

EXHIBIT 1

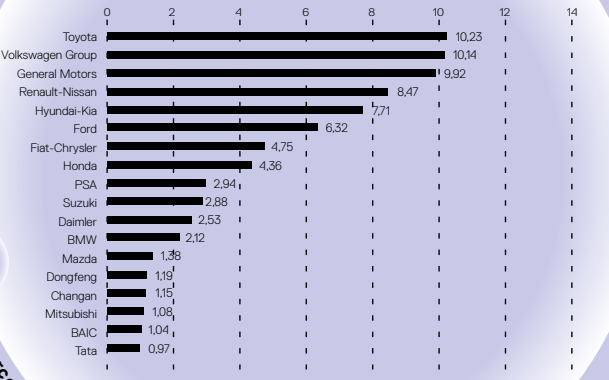
Evolution of Worldwide Sales
Passengers and Commercial Vehicles
(millions)



Source OICA (2015).

EXHIBIT 2

Leading Automotive Manufacturers Worldwide
Vehicle Sales (2014)
(in millions vehicles)



Source Statista.com (2015)

3 · Pavlínek, P. (2015).

4 · OICA (2015).

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In 2013-2014, the top 5 automotive manufacturers worldwide are ***Toyota***, ***Volkswagen***, ***GM***, ***Renault-Nissan*** and ***Hyundai-Kia***, either with respect to the number of cars sold (Exhibit 2) or in terms of market share calculated using the value of sales of passenger cars (Exhibit 3).

In financial terms the industry is also healthier, since the industry profits increased about 34% in five years: from €41 billion in 2007, the last pre-crisis year, to €54 billion in 2012[5]. The forecasts for the next years are also interesting, since it is expected that by 2020 the global profit could increase by other € 25 billion, to € 79 billion. Again, as shown on Exhibit 4, the trends in profits are not homogenous region-wise, and such differences are expected to increase.

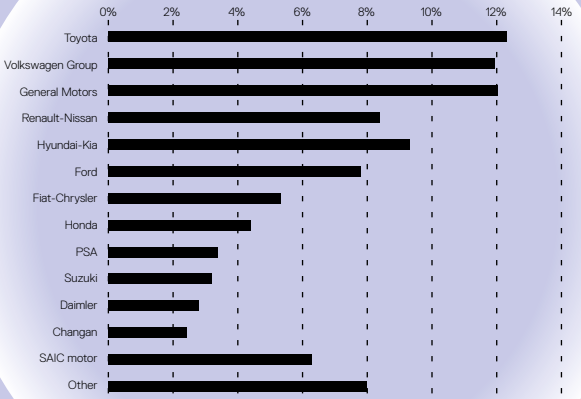
The automotive industry is very relevant for the European Union (EU) economy. It accounts for about 5.8% of EU employment (corresponding 12.7 million jobs in 2011: 2.2 million direct jobs and 10.5 million indirect jobs in EU27), and for about

5 · McKinsey & Company (2013).

EXHIBIT 3

Global Market Share of Largest Automakers

Passengers Cars (2013)

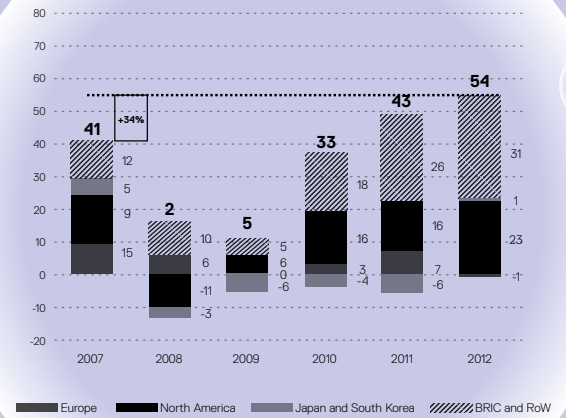


Source Statista.com (2015)

EXHIBIT 4

Global Passenger Car Profit Development by Geography

(EUR 1.000 million)



Source McKinsey & Company (2013).

6.6% of EU GDP (€ 843.4 billion in 2012). In 2013, about 19% of the total vehicles produced worldwide were assembled in Europe[6]. The relevance of this industry in Europe is also visible in terms of R&D investments: €41.5 billion in 2013. This figure places EU as the World's largest investor in automotive industry R&D. Furthermore, compared to other industries (such as pharmaceuticals & biotechnology, technology hardware & equipment, industrial engineering, electronic and electrical equipment and others), this is the one which exhibits higher R&D investments in Europe[7].

Even so, the automotive industry faces several challenges[8] that are likely to impact upon the positioning of the main OEMs in the 'board game' until 2020. The first challenge is related with the conflict between the increasing complexity of the vehicles and the constant cost pressure. The increasing regulations associated to environmental and

6 · ACEA (2014).

7 · ACEA (2014).

8 · McKinsey & Company (2014).

safety standards will increase costs, but also technological complexity. The growing number of models of cars based on same platform serving different vehicle segments and markets also raises complexity. Simultaneously, OEMs are investing in the development of alternative powertrain technologies with lower-emissions (the most relevant are clearly the electric and hybrid technologies), without knowing what will be the dominant technology in the future. Such complexities in the development of the vehicles contrast with the flat net price development and with smaller budget available for new features in the vehicles. Therefore, it seems that the differentiation between OEMs will be more difficult in the future.

The second challenge has been already highlighted in the previous pages: the shifting of markets. In the next years, the emerging markets will account for the lion's share of sales growth. Nevertheless, the present pattern on of manufacturing and supply bases location is not fully aligned with this development. Redefinitions of most OEM's portfolios of vehicles can be expected, since smaller vehicles exhibit much higher growth rates in the emerging countries than in the other regions of the world.

The third challenge is related to the digital channels. Nowadays, the digital channels are the primary source of information for customers, and may eventually evolve to increased online purchasing patterns. This evolution may be appealing for the present online retailers, and puts further pressure on existing dealership structures.

The future shape of the industry eco-system corresponds to the fourth challenge: in order to develop the new technologies, namely in terms of powertrain, the OEMs will require more value-added per car from suppliers; this is likely to lead suppliers to follow OEMs by shifting the production in order to meet demand changes. In Europe, the route is clear: to manage the restructuring of the industry is high in the agenda.

The fifth challenge is related to the green regulations. Carbon dioxide regulations are likely to keep tightening in Europe, US, Japan, and China. The direct result will be growing manufacturing costs, since the price of cutting the emissions is increasing. In fact, more electrification may not be an option but a necessity in order to meet the overall CO2 limits to the manufacturer's fleet. OEMs are pushed to invest more in e-mobility (electric and hybrid powertrains), namely in batteries, but also in lightweight and aerodynamic technologies.

Finally, the increasing importance of the connectivity raises its own challenges. Cars may experience an evolution similar to the mobiles phones[9]; they are being equipped with an increasing number of danger-warning applications, traffic information services and several entertainment and active safety features. This is an appealing area for OEMs achieve differentiation and increase profits: by delivering services in the car such as internet radio, smartphone capabilities, information services, entertainment services, driver-assistance apps or tourism information new sources of income may be generated.

These challenges may affect not only the profits of OEMs and their suppliers, but also their market positioning, since some of the challenges may affect the way the industry thinks about cars and mobility.

The Automotive Industry Value Chain

The major OEMs such as ***Toyota***, ***Volkswagen***, ***GM***, ***Renault-Nissan***, ***Hyunday-Kia*** or ***Ford*** are the most recognised face of the automotive industry, namely from the customer point of view. However, there are several other companies that supply these OEMs, playing also an important role in the industry. The supply chain structure is 'tiered', according to the proximity to the OEMs (see Exhibit 5).

Suppliers classified as Tier 1 are modular manufacturers, direct suppliers of OEMs, manufacturing the large or complex components or parts of the vehicles (for instance, the starter motors & generators, the chassis, seats or tires) or

9 · McKinsey & Company (2014).

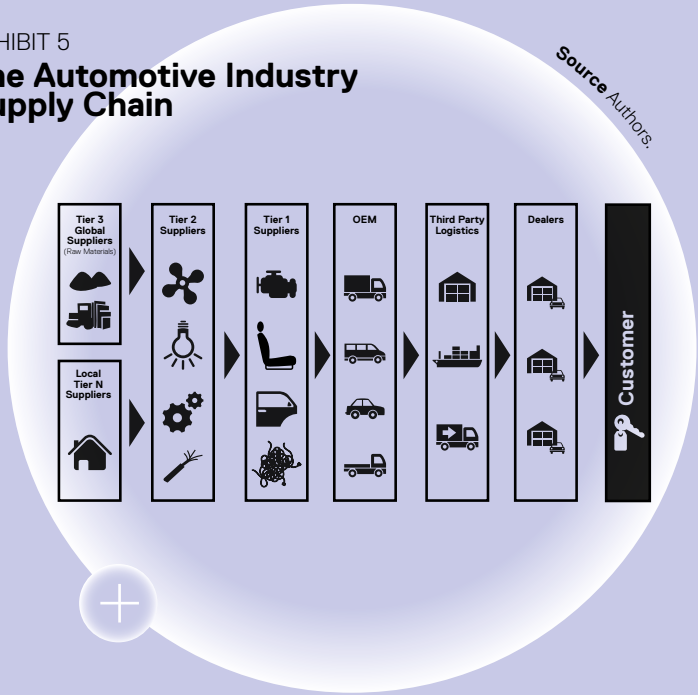
assembling particular sub-systems or systems of the car (such as the wiring harnesses, car multimedia or electronic systems). Tier 2 companies are suppliers to Tier 1 companies, and manufacture parts of the systems or products developed by those companies. Similarly, Tier 3 suppliers are the direct suppliers of Tier 2 suppliers; these may be classified in two groups: global suppliers of raw materials or small and local companies. Usually, these suppliers are not exclusively focused on the production of goods for the automotive sector.

Examples of products supplied by these companies are the metals (such as copper or aluminium), textiles or plastics.

Although the supply chain is clearly defined, the relationships between the players are not so straightforward. Due to the increasing relevance of R&D in automotive industry, several Tier 2 and even Tier 3 suppliers have closer relationships with the OEMs when developing new products; therefore, due to their specific knowledge, they may behave as Tier 1 suppliers on what concerns particular R&D and technical issues.

EXHIBIT 5

The Automotive Industry Supply Chain



Source Authors.

In terms of financial performance, the global automotive supplier industry follows the increase of OEMs sales. The latest forecast indicates that the revenues grew about 30.2% between 2007 and 2014[10]. In recent years their EBIT margin stood at about 7.0% (2012: 6.9%; 2013: 7.2%; 2014: 7.5%). The main drivers of this performance are "the still very strong rise in global car production [...] combined with a favourable segment mix, an even higher vehicle technology level, better capacity utilization worldwide (higher volumes meeting adjusted capacity) and moderate development in raw material prices"[11].

Available statistics suggest suppliers focused on innovative products with differentiation potential tend to achieve higher EBIT profitability, since the OEMs are more willing to reward the higher investment in R&D of these suppliers. On the other hand, these suppliers set up higher entry barriers through the use of intellectual property. In these segments (for example: fuel injection systems, turbochargers, driver assistance systems, etc.), the competitive structure tends to be more consolidated, with the global market leader getting a market share of 30 to 35%, and the top five competitors holding an aggregated market share of approximately 75%. Contrasting to the previous scenario, the suppliers that operate in segments in which the competitive advantage is mainly related to process specialization tend to present below average EBIT margins. These suppliers present lower degree of innovation among their products, and therefore also spend fewer resources in R&D activities. The core competence of these suppliers rests mainly on manufacturing process knowledge. The competitive structure of these segments (for instance, sheet metal parts, plastic components, passive acoustic components, etc.) is often more fragmented: the market leader may present a global market share of 15% and the top 5 competitors an aggregated market share around 40%.

10 · Roland Berger & Lazard (2013, 2014).

11 · Roland Berger & Lazard (2013, p. 3).

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When looking at the future evolution of the automotive industry suppliers some risks or challenges can be identified: i) the imbalances of the world market regions, ii) the requirement to have a global presence, iii) the price pressure, iv) the volume-based platforms and v) the entry of new players and business models.

In terms of risks related to the world regions, two main considerations emerge: the stagnation of European market and the maturing of Chinese market. In line with the trend of stagnation or retraction of sales of vehicles in Western European market, the relevance of this region as a production hub shows a decreasing trend, since the European OEMs are also relocating their manufacturing locations. This will have a strong impact in suppliers, namely in the ones with activities concentrated on European markets. They need to make a global relocation of activities to follow their clients towards more dynamic markets, such as China. The relevance of China as the biggest market for the automotive industry is categorical, with shares of 26% of total vehicles and 35% in passengers' vehicles in 2014[12]. Therefore the automotive industry is highly dependent of the Chinese market, which presents several specificities. Besides 'volume effect', Chinese premium customers prefer fully-featured models, which typically present above-average margins for the OEMs. The relocation towards China, through an OEM-following approach may be required, namely for Tier 1 and Tier 2 suppliers (especially for high weight items).

Also relevant for the suppliers is the global localization of the OEMs. This will be translated in two requirements for suppliers to maintain the business, without necessarily increase their profits: the intensification of the investment needed (R&D and location), and the increase of management complexity, namely in terms of global networks coordination efforts. Although the increased adoption of global vehicle platforms will simplify the supply chains, it will demand massive investments from some suppliers and may exclude others from the supply chain.

"There is less and less room these days for small, regional suppliers"[13] in the automotive industry nowadays. Taking into consideration the challenges of the industry previously presented, the suppliers are called to contribute in the relocation effort, as well as in the R&D investment and also to borrow technology from different nonautomotive divisions. Interestingly, the biggest suppliers, also called 'megasuppliers', continued to grow even during the crisis due to the increasing trend in OEMs purchasing strategy towards fewer and bigger contracts.

The pressure over margin that jeopardizes OEMs business has been transferred to suppliers. Essentially there is an increasing difficulty to maintain end customer price levels, namely in Europe and China. This is due to the shortening of the replacement cycles, the increase of the complexity and variety of automotive technologies and the increasing cost related to the proliferation of products. Due to the several recent high-volume recalls episodes, the warranty costs are also likely to increase.

Another aspect that sharpens the pressure on suppliers is the modularization or platform strategies followed by OEMs. These strategies enhance the model choice while reduce the vehicle architecture. By exploring economies of scale, OEMs increase the risk of suppliers losing some global platforms as a result of limited delivery capability. On the other hand, potential quality issues may result in 'fatal' costs and penalty fees.

Finally, in terms of new players and business models, the automotive industry is likely to evolve by including new suppliers of electric components, lightweight materials, information systems and connectivity systems. Due to the evolution of the 'internet of automotive things', on the side of OEMs, newcomers focused on this connectivity and information systems platforms may emerge.

12 · OICA (2015).

13 · Automotive News (2013, p.3).

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Coficab Portugal: From supplier-by-demand to Leading Innovator

The Birth of Coficab Portugal

Coficab Portugal is an interesting example of how a subsidiary in a European peripheral country may contribute to transform a Group based in the Maghreb (Tunisia) into an European leader and a major worldwide competitor in the cables and wires industry.

The history of ***Coficab*** starts with the ***General Motors (GM) Group*** spinning off their parts division into independent divisions, following the de-verticalization trend of automotive industry, in late 1980s/early 1990s. ***GM*** spun ***Packard Electric*** which, at that time, was the leading manufacturer of wiring harnesses and other electrical automotive components. ***Packard Electric*** had a partnership with ***Delphi*** and after 1995 it merged into ***Delphi Automotive Systems***, already one of the biggest suppliers of the automotive industry. In 2013, ***Delphi Automotive*** ranks 13th among global auto parts suppliers, with a total turnover of USD15,475 million[14].

Already operating in that segment, in the late 1980's, the strategy of ***Delphi*** was to keep the wiring harness activities within the company, while sourcing the wires and cables from other suppliers. At that time the ***Elloumi Group***, based in Tunisia, had some experience in manufacturing cables, power and telecom wires, as well as in designing and manufacturing household products. In 1985, ***Delphi*** and ***Elloumi Group*** established a joint-venture, called ***Cofat***, with the purpose of manufacturing automotive wiring harnesses for the Tunisian market. It was through this joint-venture that ***Coficab*** was created, in order to supply ***Cofat*** and ***Delphi*** demand for copper wires and cables. First, a plant was set up in Tunisia (called at that time ***Electric Cables***), in 1992, and later, in 1993, another in Portugal, called ***Coficab Portugal***.

Coficab Portugal was founded in Guarda, the highest Portuguese city with 1.056 meters of altitude, located in the interior centre of Portugal, to the northeast of Serra da Estrela (the largest mountain of mainland Portugal) and close to the Spanish border. Focussed to the production of automotive wires and cables, the plant location was the result of the increasing relevance of the automotive wiring industry in the Iberian Peninsula in the beginning of 1990s, including four ***Delphi*** plants in Portugal, one of them exactly in the same city. In fact, in the first years ***Coficab Portugal*** shared the facilities with the Delphi plant.

The professional history of João Cardoso is inextricably intertwined with that of ***Coficab***. Listen to his words:
"They are confused, my career and the history of Coficab. My first contract was with Delphi, because I was hired with the intention to integrate Coficab, but the company was not yet installed. I was hired in January 1993, and Coficab Portugal was only established in September of the same year. (...) The first phase of Coficab was only a relocation of the cable production plant from Wuppertal, in Germany, to Guarda, in Portugal. My job was to be responsible for the maintenance engineering, and my mission was to carry out this relocation, helping to close the production process of Rheinsager, bringing the equipments and installing them in Portugal".

In the first years, ***Coficab Portugal***'s production was mainly geared to supply ***Delphi*** plants, with marginal sales only to other clients. The products manufactured were developed as a result of the demand from ***Delphi Portugal***. This was then in charge of undertaking the international marketing of the products, mostly to respond the demand of ***Delphi*** plants in other countries. As Mr. Cardoso said:
"Although Coficab was a joint-venture between the Elloumi Group and Delphi, between 1993 and 2000, the Elloumi Group was largely absent from the management of the Portuguese unit. Delphi played the leadership role in Coficab Portugal."

During this phase Mr. João Cardoso took more central functions within the ***Delphi Group***. In 1996, for instance, he combined his job as responsible for maintenance engineering

14 · Automotive News (2014).

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at ***Coficab Portugal*** with the function of responsible for process engineering at ***Delphi Europe***, regarding its copper wires and cables manufacturing plants. At that time ***Delphi*** still had several plants in Europe, namely in Portugal, Germany, Italy, Belgium and Turkey. His main task was to implement new processes as well as ensuring the continuous improvement and standardization of processes. In 1998, he was also responsible to set up a cables and wires manufacturing plant in South Africa; this was a joint-venture between ***Delphi*** and a South-African firm. In 2000, he became the Operations Manager at ***Coficab Portugal.***

Turning a Challenge into an Opportunity

In the year of 2000 ***Coficab Portugal*** faced a serious challenge. Both partners of ***Coficab, Delphi*** and ***Elloumi Group*** wanted to acquire all the equity. After several rounds of negotiations, the final decision was the acquisition of ***Delphi***'s equity stake by the ***Elloumi Group***. So the joint-venture between ***Delphi*** and ***Elloumi Group*** came to an end, with consequences for both ***Coficab Portugal*** and ***Cofat***, the wiring harnesses business that existed in Tunisia. Although the commercial relationships were maintained with ***Delphi***, the relevance of ***Delphi Portugal*** in ***Coficab Portugal***'s business portfolio decreased drastically.

At that moment, the entire business model of ***Coficab Portugal*** had to be questioned. The management team, which included Mr. Cardoso, had a meeting that lasted for an entire week. In Mr. Cardoso words: ***"Back then, we planned the main strategic pillars of the development of Coficab Group:***

The first line of strategy was the integration of existing production, also in terms of branding, since at that time the Elloumi Group had two manufacturing units with two different brands, Coficab and Electric Cables.

The second pillar of strategy was the diversification of clients. Until 2000, Delphi accounted for approximately 95% of the turnover.

The third pillar of the strategy was the diversification of [manufacturing] locations. In the beginning of the years 2000s, the automotive industry started to exit from South European countries to relocate in North Africa and Eastern Europe. We choose to move with the tide.

The fourth pillar was to diversify the products, since the main products of Coficab were, back then, low value-added products or commodities, for which the most relevant variable was price. Therefore, we were compelled to develop products of higher value added, that at the time were produced mainly in Central Europe, by German or French companies (...).

Finally, the last pillar was to transform the Portuguese subsidiary into the pilot plant of the Coficab Group. The objective was to keep this plant as the smaller one, with a know-how centre for the development of new products and processes, namely special products, while using the other units as commercial spots. Then it was necessary to develop a strong R&D department.
It is impossible to start manufacturing special products without high technical knowledge and without the capacity to innovate."

In 2000, ***Coficab Portugal*** (Exhibit 6) had a turnover of about 26M€, while the corresponding figure for ***Coficab Tunisia*** (then called ***Electic Cables***) was around 5M€. Due to the proximity to several wiring harnesses players located in the Iberian Peninsula, the Portuguese subsidiary exhibited a higher growth than the Tunisian one. On the other hand, the main relationships with the ***Delphi Group*** and the knowledge about the wires and cables industry were mainly held by the Portuguese subsidiary. The reason for that was the double line of reporting that some of the ***Coficab Portugal*** managers had in the context of the former joint-venture. It was the knowledge about the business, the industry dynamics, the supply chain, and the OEMs that Mr. Cardoso had absorbed during the first years of work at ***Coficab Portugal***, but also at ***Delphi*** operations, that allowed him to play a key role in re-designing the business model of the ***Coficab Group*** as a whole.

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By the time, ***Coficab Group***'s foreign market knowledge was still very limited. The internationalisation of the ***Coficab Group*** as well as the ***Elloumi Group*** was mainly passive/reactive, taking advantage of the international knowledge and market position of the ***Delphi Group***, in cables and wires (with ***Coficab***) and in wiring harnesses (with ***Cofat***).

As a result of the process of political and economic change in Eastern European countries, occurred in the early 1990s, and the subsequent process of integration into the European Union, South European countries labour cost competitiveness has eroded. New opportunities for locating labour cost-sensitive component production developed in the emergent countries of Eastern Europe and even in North Africa. The automotive industry followed this trend of international relocation of production, and component suppliers followed their main clients, namely the suppliers of heavy products, such as copper wires and cables and wiring harnesses (see Exhibit 7).

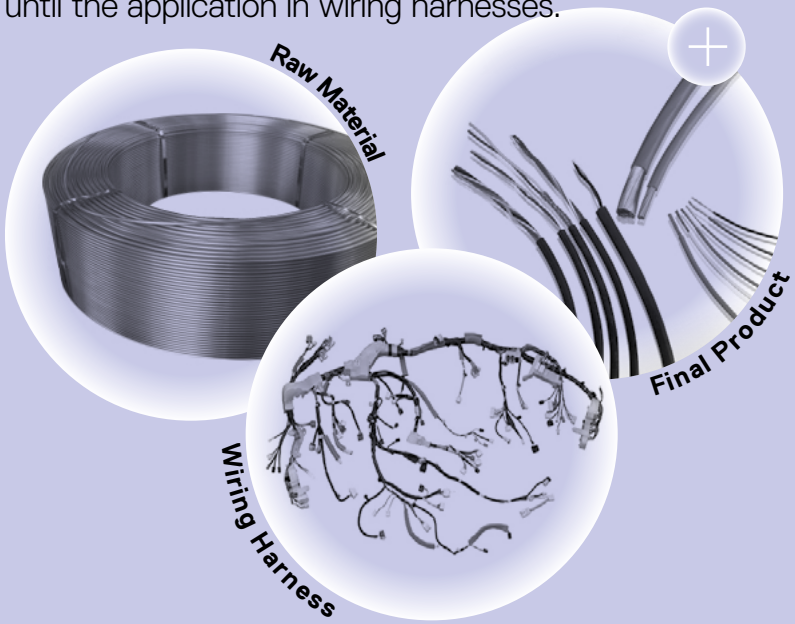
EXHIBIT 6

One of the Coficab's Portugal plants

Source Coficab Portugal

EXHIBIT 7

Copper wires: from raw material (8mm cable) until the application in wiring harnesses.



Therefore, the ***Coficab Group*** was driven to follow the relocation wave with the purpose of keeping its position in OEMs' supply chains. ***Coficab*** tracked the relocation wave, by developing a network of manufacturing units near the plants of the major clients (Tier 1 suppliers and OEMs). It was decided that all the plants of ***Coficab Group*** should produce the two most common families of wires. Since price was the most relevant variable for products' competitiveness, manufacturing activities should be carried out close to the demand.

But the market also needs specialty products. These are more technical and complex but simultaneously provide higher margins. Entering the special products market was a significant challenge for ***Coficab***, since it was then dominated by German and French companies. ***Coficab Portugal*** was assigned the role of developing and manufacturing such specialty products, what shifts the business model from production process specialist type to the innovative products type. This entailed, of course, the need for enhanced development

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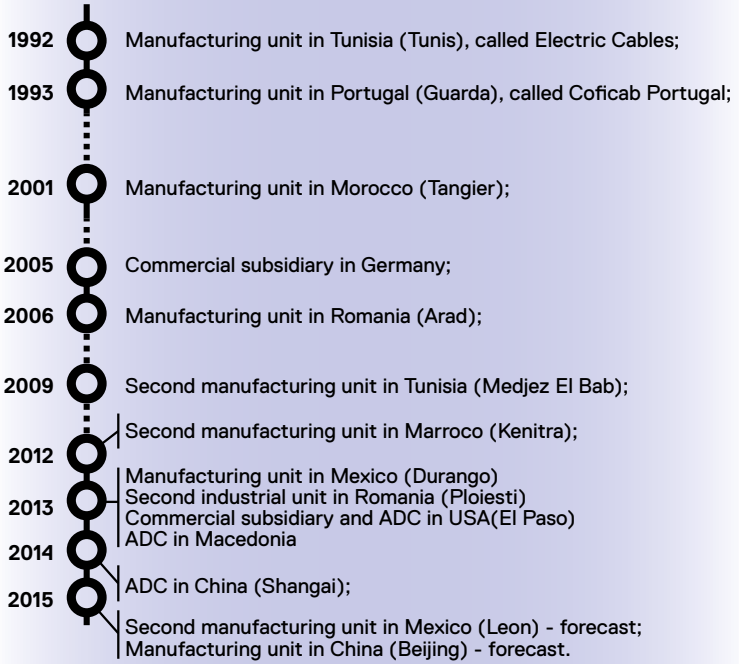
capabilities as well as maintaining the manufacturing efficiency.

Such products, while manufactured in Portugal, are supplied to the client by the ***Coficab*** unit closest to the client or the OEM concerned. Such an approach is also the result of the requirements and feedback of the clients in technical and commercial meetings. They prefer to assign larger contracts for complementary products to the same supplier than to establish several contracts with different suppliers. As Mr. Cardoso states:
"Almost every client asks to be supplied at the same point. Instead of picking up different products from different suppliers, the clients prefer to buy in the same place a larger set of products."

Since 2000, ***Coficab Group***'s growth was quite impressive, as may be seen in Box 1. From two industrial units only, it managed to set up six additional plants (two in Morocco, one in Tunisia, two in Romania, and one in Mexico), four ADCs - Advanced Delivery Centres (in USA, Romania-Macedonia, Tunisia and China), and two technological development centres (in Portugal and in Tunisia), in 15 years. The global turnover of the Group increased more than 30-fold: from 30M€ in 2000, to about 1,000 M€ in 2014. Nowadays, the ***Coficab Group*** is a relevant player within the automotive cables and wires manufacturing industry. In 2015, it was investing in a second plant in Mexico (Leon) and also in the first industrial unit in China (Beijing).

The company is the leader of the European market, with a market share of about 45%. Their products have homologation for the main automotive companies (OEMs), namely ***Daimler, BMW, VW, Fiat, Ford, Opel, PSA, Renault, Volvo, KIA, Hyundai, Nissan, Toyota,*** and also with Tier1 suppliers such as ***Cablelettra, Delphi, FCI, Lear, Leoni, Kromberg & Schubert, Sumitomo*** and ***Yazaki***. Even so, the European market share is different OEM-wise: ***Coficab*** supplies about 80% of wires and cables of ***Daimler*** and also of ***PSA***, 70% of ***Renault-Nissan***, 60% of Fiat, 50% of ***VW***, 40% of ***BMW***, and about 1/3 of ***GM*** and ***Ford***.

BOX 1.
New sites, new countries



Source: *Coficab Portugal*, 2015.

The ***Coficab Group*** declares to be the second largest wire producer worldwide, with a market share around 11%-15%.

COFICAB

Coficab Portugal in 2015

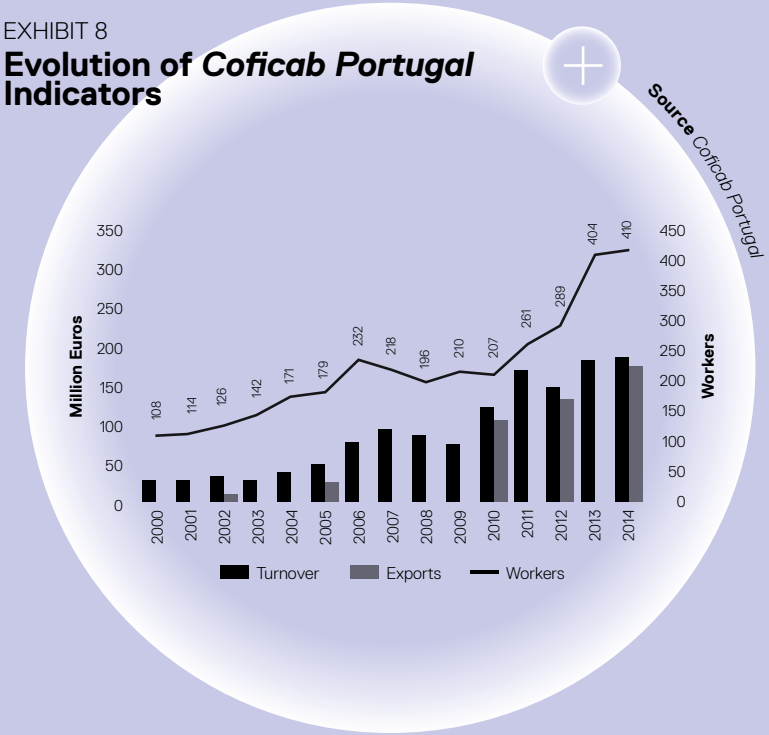
In contrast to the other plants of the Group, which are exclusively focussed on scale, manufacturing the most common types of products, ***Coficab Portugal*** is able to manufacture all the products offered by the ***Group***. Actually, due to the relevance of the Technical Centre, the new lines of specialty products are developed in Portugal, being also manufactured there. In a second stage, as these products mature, their production is transferred to other subsidiaries, but only if they obtain a mass demand. If the products are only for specific niches, production is exclusively undertaken by ***Coficab Portugal***.

Even though the business model of the Portuguese subsidiary is different from the other subsidiaries of the Group (more orientated towards innovation instead of production efficiency), ***Coficab Portugal*** is the manufacturing unit with the highest efficiency (77%) and the lowest rate of waste (4,9%), exhibiting indicators above the global objectives of the Group. Between 2000 and 2014, the development of subsidiary is evident in terms of turnover (about 7 times growth) and number of workers (about 4 times growth). In 2014 the turnover reached €184 million, mainly supported by high value-added products (see Exhibit 8).

The market dimension of these specialty products was superior to initial forecasts. This led to the expansion of the original plant of 12.000 square meters, and to the building up of two contiguous plants with more 4.000 square meters. The strategy of making this subsidiary as a 'pilot-plant', specialised in development and manufacturing of products with higher value-added, seems to have paid-off, as shown on Exhibit 8. Even though ***Coficab Portugal*** is not the biggest subsidiary of the Group (the bigger is the first Romanian plant, both in terms of turnover and shop floor), it is still the most important.

EXHIBIT 8

Evolution of *Coficab Portugal* Indicators



Launching a Worldwide Innovation: the FLRMY 0.13mm2

The Decision to Start the 0.13 mm2 Project

Usually the process of innovation is triggered by the evaluation of the trends of market and/or by the requests of the OEMs or the wiring harnesses industry. In the particular case of 0.13mm2 project both happened. On the one hand, Mrs. Rosa Santos, the R&D Department manager of ***Coficab Group*** is a regular member of the ISO Technical Committee for Automotive ***Electric Cables*** (ISO/TC022/SC03/WG04). By keeping abreast of the trends in the definition of world standards on cables for the automotive industry, the company knows beforehand in which directions innovation efforts should be pointed out. Until 2010, the smallest sections of automotive wires in the market were the 0.50 mm2 and the 0.35

mm2, but the standards for the 0.22 mm2, 0.17 mm2 and the 0.13 mm2 had been approved together with their technical requirements. On the other hand, several OEMs, when discussing technical issues with Mrs. Rosa Santos and her team, asked for smaller section wires in order to reduce both the volume and the weight of the wiring harnesses. As Mrs. Rosa Santos reminds: ***"OEMs were increasingly challenging suppliers, not just to the cable and wires and wiring harnesses suppliers, for developing lighter, miniaturized, and, if possible, cheaper products."***

Some of the most recent trends in automotive industry are related to the increasing cost pressure, as well as the growing complexity of cars, namely with the increasing importance of information and connectivity and the addition of a plethora of functionalities and electric components installed in the vehicles[15]. Therefore, not only the number of cars produced has increased about 7.5% between 2005 and 2014 (33.8% if the Chinese market is included), but the amount of wires and cables ***per car,*** both for electric function and for signal/information usage, significantly increased. Mr. Cardoso indicates that, for instance, ***"between 2000 and 2015, a mid-range car presents an increase in the total length of wires and cables required from 800 meters to 1500 meters"***.

In 2010, ***Coficab*** had a clear understanding that the OEMs demand trends would be for lighter and thinner wires and cables, in order to reduce the vehicle weight, and therefore to improve their efficiency. The challenge was to cut the volume (since the available space in the car to include the wires and cables is each time more reduced) as well as the weight (in order to reduce the fuel consumption).

By that time, the smaller cables had a cross-section area of 0.35mm2 (as previously indicated), and were made of bare copper. The reason for that minimum size was related to the mechanic characteristics limitations of the conductors of bare copper. Even so, since about 80% of the wires of 0.35mm2 used in a vehicle were used as conductors of signal, ***Coficab Portugal*** felt that there was a significant room for improvement: smaller section wires might guarantee mechanical characteristics similar to those of the 0.35mm2 wires, namely break force and bending strength (according to ISO 6722 standard). The first technical parameters of acceptance as well as the future norms were defined by the OEMs for the signal cables with 0.13mm2 and 0.17mm2 sections, namely in terms of the mechanical properties.

That was the rationale behind the decision of ***Coficab Portugal***, namely of Mr. João Cardoso and Mrs. Rosa Santos, to launch this risky and uncertain project. As Mrs. Rosa Santos recalls: ***"At that point, we knew that some changes will appear in the future... We made an analysis regarding the strategy that we will follow, the road that we will enter... We were at a crossroads with multiple choices..."***

This decision entailed several risks. These were related to the following aspects: i) the type of material could not be pure copper, and there was not an historic record of using copper alloys in the automotive industry; ii) the standard size to be adopted by the industry was dependent on the alignment of several partners in the supply chain, namely the suppliers of terminals and connectors parts, the wiring harnesses players, and the OEMs; and iii) the changes required to implement the new manufacturing processes involved not just ***Coficab Portugal***, but also its downstream supply chain (namely Tier 1 companies).

Although different copper alloys were already available in the market, they were not used by the automotive industry, especially in these smaller dimensions. Therefore it was necessary to know how these alloys would perform in terms of both the satisfaction of the required characteristics and the behaviour in the manufacturing process.

New Product Development

In 2010 ***Coficab Portugal*** decided to carry out a research project aimed at identifying and testing alternatives that might guarantee smaller section wires while exhibiting mechanical

15 · McKinsey & Company (2014).

characteristics similar to those of the 0.35mm2 wires. To achieve that purpose, the project included four phases: i) the identification of potential alternative materials for the conductor; ii) the definition of the product and adaptation of the process; iii) the homologation of the product for different OEMs; and iv) the commercialization process.

Phase 1
Identification of potential alternative materials for the conductor

As mentioned above, it was impossible to develop wires made with pure copper thinner than the 0.35mm2 standard. The only possibility was to use copper alloys that fulfil the mechanical thresholds defined by the ISO 6722 standard. ***Coficab Portugal*** undertook theoretical and empirical research on the existing alloys in order to identify their characteristics.

Knowledge development goes beyond the mere identification of the possible alloys, since they must be allow to avoid changes in the manufacturing process, that is, keeping it as similar as possible to the one used to produce pure copper wires. As Mr. Luís Fernandes (R&D project manager of 0.13mm2) remembers: ***"the difficulty was not to identify the possible copper alloys, but rather to understand whether they met the requirements and if they were amenable to be manufactured in our production lines".***

Therefore, during 2010 several experiments were made, in order to test the reactions of several copper alloys to the manufacturing and transformation activities (namely to the wire drawing process), as well as the knowledge about physicochemical properties (like crystal structure and binding processes). Three copper alloys were tested with different formulations: copper-magnesium, copper-silver and copper-tin. The process of selection of the copper alloy was not straightforward, since the three copper alloys identified have some advantages and disadvantages (see Box 2).

BOX 2.
Copper alloys in competition

	Advantages	Disadvantages
Copper-Magnesium	The best in terms of the technical requirements; Superior mechanical resistance.	More expensive than the price-goal; More difficult to handle; Few alloy suppliers; Less flexible.
Copper-Silver	Meets the technical requirements; Easier to handle than copper-magnesium;	More expensive than the price-goal; The minimum possible section was 0.17mm2;
Copper-Tin	Meets the technical requirements; Cheaper; The easiest to handle; More flexible; More alloy suppliers.	Lower mechanical resistance, but above the requirements.

Source: Authors, based on information supplied by *Coficab Portugal*.

Phase 2
Definition of the product and adaptation of the process

The interactive process between the R&D laboratories and the shopfloor and the analysis of the pros and cons indicated in Box 2 led the research team to select the copper-tin alloy.

After taking the decision on the copper-tin alloy, the first samples of the product were manufactured and sent to the direct clients, the wiring harnesses companies. Two main problems emerged when the product was tested in their production lines: spiral and crowning effects. The first one was related with the spiral memory that the cables maintain when they are unwound, which can stop the wiring harnesses production process. The second problem was associated to the wire-cutting process, namely

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Coficab Portugal

the flatness characteristics of the cross section of the centre conductor, which may hamper wire crimping.

To solve this problem, the production process of the new wire had to be redesigned again and again. An interactive process between the R&D Centre, the production facilities and the customers was established. The solution emerged after several adjustments in the manufacturing process, with impact in terms of geometry and architecture of the products as well as in the packing process. The final product, when compared with the traditional wire of 0.35mm2 weighs less 53% and has a volume 41% smaller.

Phase 3

Homologation of the product for different OEMs

The product was then sent to an independent laboratory, accredited by the main OEMs. The results confirmed that the required characteristics were fully met, and therefore the new product satisfied the conditions to be adopted by the automotive industry.

Phase 4

Commercialization Process

After the development process, the product was presented to the main OEMs, but the adoption process has not been instantaneous. This was due to three main reasons. First, it was necessary to wait for the terminals and connectors suppliers to develop the terminals for this type of wires and cables. Subsequently, the wiring harnesses players needed to adapt their assembly process and the OEMs needed to be convinced of the efficiency of the new solution. Therefore, the new product was introduced in the regular production lines in connection with new OEM projects only, namely new car models or new versions or restyling versions of existing car models.

The first OEM to adopt the new ***Coficab*** product was ***Daimler***, and the first automotive model to introduce this solution was the Mercedes S Class. The reasons for this choice were related, first, to the large number of wires that this model has for conductor of signal purposes only, and, second, to the fact that this is a premium niche model, making therefore easier and cheaper to react if some problem emerge.

The development of this product raised an issue: should ***Coficab Portugal*** protect the product with a patent? Mrs. Rosa Santos put the issue in the following terms, ***"In our industry is not usual to protect the products. The Coficab Group did not have any product protected through a patent or other type of industrial property rights."***

Regarding this issue, Mr. João Cardoso is more pragmatic: ***"The OEMs never accept, except in very, very special cases (in products that are technologically extremely innovative) to have one supplier only. So patents raise a problem for us. If we protect a new product with a patent, we are not able to sell to any client. The OEMs do not accept our segment of products to be protected by patents."***

Therefore, the product was not patented. Nowadays the competitors can imitate it, whereas ***Coficab*** can replicate products developed by other competitors. Even so, ***Coficab Portugal*** was the first-to-market, and expects this product to be responsible for 20-25% of its turnover by 2020. The difficulty to imitate the product is not mainly concerned with the product itself, but rather with the adaptations needed to the manufacturing process. Until the manufacturing of the FLRMY 0.13mm2 is widespread, ***Coficab Portugal*** may win several contracts, which allow it to payback the investment of this R&D project.

Currently the 0.13mm2 product is manufactured in ***Coficab Portugal*** plant only, since is still a high value-added product. When the demand requires more production capacity, and this product reaches the level of commodity, this product will be produced in other plants. Even so, due to the requirements in terms of manufacturing process, the implementation in other plants of the Group will be followed by ***Coficab Portugal***'s process engineering team. The product was later awarded the COTEC Product Innovation prize (2013), the most important prize to distinguish innovative products in Portugal.

The relevance of Innovation whithin *Coficab Group*

The Technical Centre

Since the reorganization of the ***Coficab Group*** in 2000, the need to invest in R&D and innovation became pretty clear. The challenges raised by competing in the international markets also contributed to make the ***Coficab Group*** aware that clients often demand specific developments of the current products. On the other hand, since until 2000 the company was manufacturing the most common products, for which competition is price-based, the focus on the high end of product range became imperative. As Mr. Cardoso explained:

"The challenge was not only to develop and manufacture the existing special products, but mainly to develop the products that will exist in the future, the ones that the clients were looking for."

The R&D department of ***Coficab Portugal*** was initially a very small unit at the rear of the plant. With three full time staff only, it was responsible by the engineering laboratory and quality requirements of the Portuguese plant. Afterwards the company felt the need to have an autonomous laboratory, which became insufficient due to the increase of the R&D team. After 2000, a second laboratory was built, but it quickly became small due to the growth of the Portuguese subsidiary, and the enhancement of the challenges that OEMs and Tier 1 clients raised to wires and cables suppliers. In the words of Mr. João Cardoso:

"This is due to the position that Coficab Portugal and their competitors have in supply chain: although the wires and cables companies have a Tier2 commercial relationship with the OEMs, their technical position in the supply chain is Tier1."

At present there is a pressure to invest in R&D and to present innovative products, since there is the conviction that OEMs recognize the effort of "product innovators", and may pay higher prices for these products.

The increasing relevance of the development of new specialty products, and the growing requirements for improvements in current products in terms of both core wires and coatings, stemming from the ***Group***'s expansion, a decision was taken to expand also the smaller R&D unit in Tunisia: in 2015, the R&D staff amounted to 17 persons in Portugal and 7 in Tunisia. The Portuguese R&D unit will be more specialized in coatings and the Tunisian in core wires.

In 2014 a new Technical Centre with state of the art facilities was built, with a total of 1.500 square meters of several laboratories and test facilities (see Exhibit 9). The new facilities are aimed at responding the increasing engineering demands regarding product competitiveness as well as allowing to test the products in conditions similar to those faced by direct clients (Tier 1). The need for this kind of facilities was increasingly felt as a result of the Group's move towards the development of specialty products. It is very relevant for ***Coficab Portugal***'s to meet OEMs specifications requirements, but also for the company to fine tune and respond the manufacturing conditions of the wiring harnesses clients.

EXHIBIT 9

Coficab Portugal's Technical Centre

Source Coficab Portugal

Therefore, some of the machinery that equips ***Coficab*** Technical Centre is similar to that of its clients. The development of new products sometimes demands changes not only on ***Coficab***'s process of production, but also in the manufacturing process of the direct clients (Tier 1). This was also a result of the learning process that emerges with the introduction of 0.13mm2 product into the market. During the commercialization process, and the pre-test of the product, some clients identified implementation difficulties. As Mr. Luis Fernandes recalls:
"When we sent the first samples of the product for the clients, they felt several difficulties to introduce it in their manufacturing process. They treated this product as if it was the same pure cooper product. We had to help them to adapt their equipments (...)"

Nowadays, when developing new innovative products, ***Coficab Portugal*** is very strict in testing the products' technical characteristics and requirements as well as in ensuring the viability of introducing them in the wiring harnesses manufacturing process.

And now what? Which wire to connect?

While taking the taxi to the hotel, Mr. João Cardoso reminds the issues to be discussed in tomorrow's meeting. He will deliver a presentation on the strategic guidelines for the next five years, in order to support the development and the growth of ***Coficab Group***. But he is also concerned with the opportunities and challenges this might raise for the Coficab Portugal. Four questions emerged in his mind:

- Should Coficab follow the earlier strategy, and launch a new R&D project to become the first-to-market with the 0.08mm2?

- Analysing the automotive industry trends, two lines of products appear as presenting a significant potential for development: wires of high speed data and specialized wires for electric vehicles. Should ***Coficab*** invest in these product segments to complement the existing line of products? Which might be the role of ***Coficab Portugal*** on that regard?

- Since there is a company within ***Elloumi Group***, ***Cofat***, specialised in automotive wiring harnesses, should ***Coficab*** promote a vertical integration strategy with ***Cofat*** in order to become a relevant Tier 1 supplier worldwide?

- Having in mind that the Chinese market is growing much faster than European markets, would it make sense to establish a fully-fledged R&D unit in China? Which might be the consequences for ***Coficab Portugal***?

He has clear ideas about this... But he would like to raise these questions tomorrow, in order to hear the opinions of the other Board members first.

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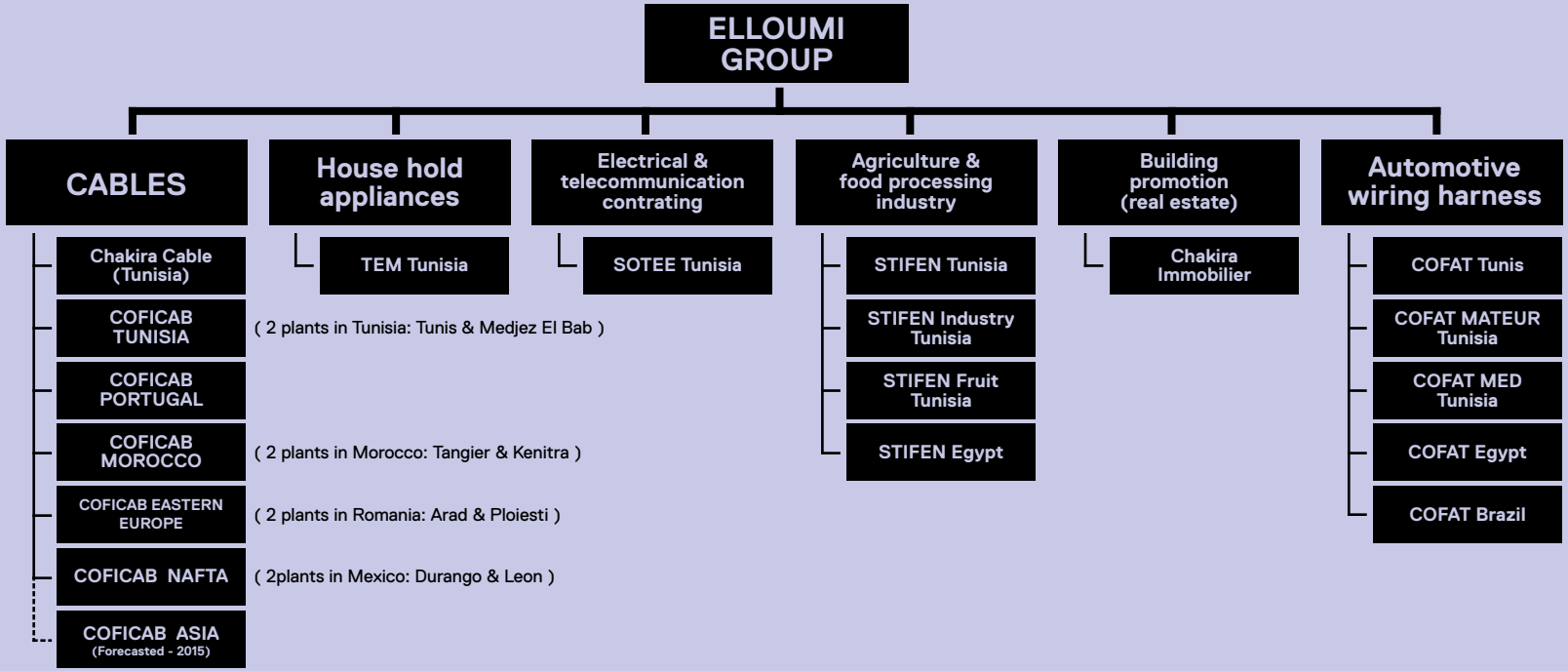
APPENDIX 1.

Corporate Structure of *Elloumi Group*



Souce: *Coficab Portugal.*

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