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Case Study

# Bluepharma

Re-starting-up an approach to innovative business development

Cátia Miriam Costa

Sandro Mendonça

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## Bluepharma: Re-starting-up an approach to innovative business development

### Abstract

Bluepharma is a Portuguese pharmaceutical company operating in what would seem the low-end of a high-tech industry. Bluepharma manufactures generic drugs for more than 30 countries. However, it does that for other companies or sells directly under its private label. The company has been committed to innovation from the outset, investing in in-house R&D, university linkages and its own spin-offs. Bluepharma was founded in 2001 through a buy-out of a manufacturing unit of Bayer, the well-known German multinational. Innovation and internationalization have been two basic pillars enabling sustainable growth in a business that is technological and global. It achieved this transition by adopting an entrepreneurial style of leadership and by relying on the available sectoral capabilities of the national system of innovation, which included a smart use of public venture capital for supporting new high-tech initiatives. The company has developed continuously and mastered the ropes of what is a dense regulatory environment and hyper-competitive global arena. Bluepharma combines a rich array of internal innovation processes with an external approach to business development.

### Keywords

pharmaceutical industry, generics, buy-out, innovation process

### Acknowledgments

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Management, for *COTEC Portugal*, between May and June 2015.

Personal interviews were held at Bluepharma with the following executives (by alphabetical order): Cláudia Sousa Silva (Chief Scientific Officer), Paulo Barradas Rebelo (Chairman of Bluepharma), Sérgio Paulo Simões (Vice-President, Business and Product Development of Bluepharma, Chairman of Luzitin). Face-to-face interviews were held on June 9<sup>th</sup> June 2015 with a visit to the headquarters. 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.

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

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## Introduction

### *Origins of the story*

“There is a number of ways of telling the story, isn’t it?” So, begins Sérgio Simões, Vice-President at Bluepharma since its foundation in 2001. In his corporate life he is in charge of business and new product development, but he never left the academic world. Since 1991 he has been Professor of pharmaceutical biotechnology at the Faculty of Pharmacy of University of Coimbra, the oldest academic institution in Portugal, founded in 1290. “We can tell it taking advantage of all the data we have today, and we’ll have an interesting story to tell,” he says as he sat down to the interview in mid-2015. He goes on, “How did it happen?”

Paulo Barradas Rebelo, the CEO, is probably the best person there is to supply a persuasive answer. He would agree the way Sérgio put it: “It is a story unlike most stories, but it did happen to us.” Paulo, his long-time friend, was the entrepreneurial force behind the efforts leading to the establishment of the company.

*“I was the owner of a pharmacy shop and president of a pharmacy shops cooperative when I learned through the newspaper about the closing of the Bayer plant if nobody bought it. Since I was a kid I dreamed about having my own industrial operation and immediately came to believe it was important to save that factory. And we got together in my pharmacy and we started to discuss the possibility of buying the production unit ... Then we decided to go for negotiation with Bayer. And it wasn’t easy.”*

The German-based multinational was active in pharmaceutical production in the country since 1972. A few friends from Coimbra, rallied by a long-time expert in the distribution part of the industry, reacted to the announcement. The factory was engaged in contract manufacturing and that was a very competitive sector. Bayer wanted to leave, shutting disbanding the assets if it had to. From the perspective of those seating in the backroom of Paulo’s pharmacy, Bayer was giving up one of the most sophisticated

BOX 1  
**The famous four**

PAULO BARRADAS REBELO    ISOLINA MESQUITA    SÉRGIO SIMÕES    MIGUEL SILVESTRE

The acquisition of Bayer’s facilities was made by four young and experienced professionals connected to the area. The negotiation process took nine months and involved beating about 100 other applicants (all international). Paulo Barradas Rebelo, a manager of drug distribution business, grandson of a physician and a pharmacist, Sérgio Simões, an academic at Coimbra, Isolina Mesquita, responsible for the operations of the factory of Bayer in Coimbra, and Miguel Silvestre, with a degree in pharmacy and the pharmacist manager in the voluntary sector. According to the own, a fifth “founding partner” was a fund, a Portuguese public concern through a venture capital initiative, SME Capital , which remained from 2001 to 2016, the end of the contract.

Source <http://pwc.to/1rbjStP>, <http://bit.ly/1i5hXuW>, <http://bit.ly/1WVhgny>

business units of the country. People would get unemployed. A depressing impact to the local economy was imminent. A small group of individuals decided against the impending fate (see Box 1).

### ***The knowledge-economy in peril***

These developments were also a slap in the face of the *zeitgeist*. This was the time of the New Economy and the Lisbon Agenda, politicians emphasised high-tech industries and commentators hailed the

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knowledge-based society. Paulo Rebelo recollects:

*“We were in 2000 and public policy moving in the direction of science and technology, and that was inspiring! Another inspiring thing was that when I returned to Coimbra there was a civic movement with politicians, businessmen and academic researchers and professors looking for a new way to reinvigorate the city and region. Someone said we could choose health as an excellence sector as we had many successful areas like ophthalmology, cardio-thoracic medicine, implant surgery, and so on. This gave some prominence to pharmaceutical sector. The tough standards of admission in the medical degree had the consequence that students who could not get into their first choice went into pharmaceutical sciences instead. This led very good students to this area. Both aspects combined were empowering the pharmaceutical sector.”*

A hand-full of highly motivated individuals, connected to the pharma sector from different angles (theory and practice) and steps in the value-chain (from research to commercialisation)

decided something should be done and could be done. High-minded as it was, this represented a high-stakes manoeuvre. Bayer’s shoes were big to fill (Box 2).

## **Profitability under pressure**

There were headwinds: the international competition was getting tougher by the day, as factories from different countries from several continents entered the low-end of the business. There were obstacles in the way: regulation was dense, and becoming more stringent by the day. And it was against the tide: the bet was on maintaining in Portugal a production business intensive in science and technology when the trend was delocalisation to India and China.

The pharmaceutical industry was (and is) technologically and institutionally complex. At the turn of the century prospects for the industry were fuzzy amidst signals of disruption. Debate was ripe. A forward-looking PwC’s 1998 report *Pharma 2005: An Industrial Revolution in R&D*<sup>1</sup>,

sounded the alarm. Advice to the young and the unaware: “a climate more hostile than anything it has previously encountered – a climate in which only the smartest managements will survive.” The challenges were driven by soaring R&D costs, sluggish sales growth for prescription medicines, shorter product lifecycles, shifting customer base, fundamentally different life sciences knowledge bases calling for new skills, historically high levels of return demands by shareholders, etc. Big pharma dominated the playing field and search for new drugs scratched the limits of human knowledge. The consultants and commentators, the industry would restructure. Of course, it would do so in ways that are not exactly predicted by then.<sup>2</sup>

How to find a way in such a sea of moving, indeed qualitatively evolving constraints? The trend was to have lower production prices whereas the costs of new

drugs were on the increase, something had to give. Staying with this business model would be a great risk to any prospect entrepreneur, let alone from a country with no reputation in high-end/large-scale manufacturing. Against this background the general aim was unambiguous: go international, be different and become innovative.

2 · From the early 2000s genomics and big data changed the research practice, emerging economies became demand engines for pharma products, annual output of new drugs flattened, harsher price and promotion controls were implemented by regulatory authorities. See PwC (2012), *From Vision to Decision Pharma 2020*, <http://pwc.to/1rbjStP>.

1 · <http://bit.ly/1En78Oz>

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## BOX 2

### Bayer, big pharma in a small country

Bayer is one of the traditional big pharma players: Johnson & Johnson, GSK, Novartis, Roche, Pfizer, Sanofi, Merck, AstraZeneca, Lilly, Bristol-Myers Squibb are other well known companies. Bayer was top 100 global company in market capitalization in 2015 and a top 10 pharma company in revenues in 2014.

The partnership giving origin to Bayer was established in 1863, in Barmen, by the dye salesman Friedrich Bayer and master dyer Johann Friedrich Weskott. From 1863 to 1881 the company had a remarkable growth performance in the working force (from 3 to 300 workers). Between 1881 and 1913 the company develops into a fully-blown player into the modern chemical sector as it grows its international operations. An industrial laboratory is developed in the headquarters of the firm (1878-1912), and is credited as being the pioneering in-house formal R&D department. In 1899 Bayer comes up with its greater market hit, the Aspirin. By 1913, less than 20% of revenues came from domestic sales in Germany. Its first great export market was the US, having established there a sales representative early on, but before World War I, Bayer established subsidiaries in other important markets like the United Kingdom, France, Russia and Belgium. Portugal was no exception and Bayer has a long history in the country.

In 1909, Bayer creates "Fed. Bayer & Co." in Portugal. Eleven years later the company enlarges its activity founding Anilinas Society with subsidiaries in Gouveia, Covilhã and Lisbon. In the early 1930s the medical sales representatives start their activity, approaching doctors and the pharmaceutical industry. Only by 1937, the symbolic representation of Bayer can be seen in the heart of Lisbon, but by that time Bayer already had almost 30 years of work in the country. A big advert was placed downtown Lisbon.

In 1952, Bayer organizes a marketing campaign, announcing "aspirin" all over the country. The next year, chemicals and dyestuffs are concentrated in the same factory, Quimicor. Three years later, Bayer Farma is formed. The 1960s and the 1970s are years of increasing activity and in 1972 a factory is created near Coimbra, in São Martinho do Bispo.

In 1991 Bayer opens new headquarters in Portugal seemingly decided to be deeper involved in the Portuguese market. In spite of this decision, only ten years later, in 2001, Bayer decides to sell Coimbra's unit. One year later Bayer begins a worldwide reorganization process.



Source Bluepharma

Source Meyer-Thurrow (1982), Wimmer (1998)

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## An innovator re-borns

### Hitting the ground running

A group of friends joined to take up the greatest challenge of their professional life: Bluepharma (see Box 3, Appendix 1). The hand-over was itself a baptism of fire. There were nine months of negotiations, with about 100 international companies interested in the deal; only one was a Portuguese bid. The Portuguese bidder reached the final stage of selection with two other candidates. And won, just to embark in a tough negotiation process.

Bayer showed a great concern with what the new shareholders wanted to do with the factory. The anxiety was at least partly related with the kind of motives for the buy-out. Real-estate speculation was alive back then and the company feared for the fate of the production unit. It could face demolition and the land for construction. But their project was another. They wanted to invest in knowledge and innovation; to add dynamism to where there was only a centre of

industrial production. The new owners-to-be wanted to develop a technological project that could contribute to the region and the country.

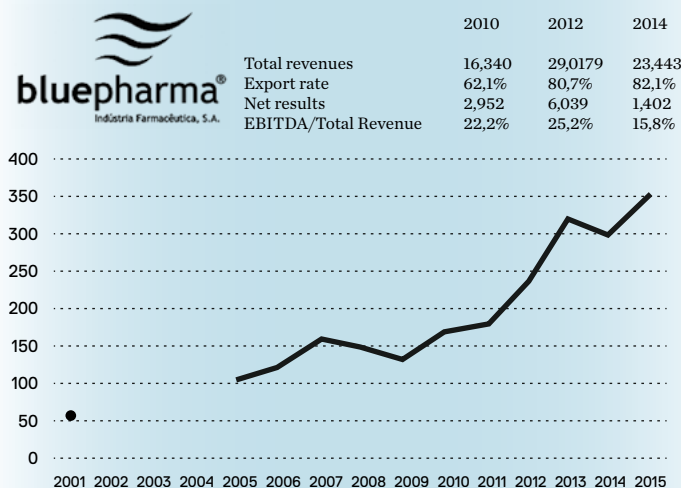
This was a risky ambition. At the time, the plant assured 34 different products, primarily for the domestic market with Bayer as monopolist. The agreement was they could rely on legacy buyer for a while. But they had

to gain speed fast for the take-off. It was settled that Bayer would absorb the production for a period of three years. Upon expiration would have to ensure the continuity of production ... by then, Bayer no longer. The new independent company had to be airborne. It also had to set its own course. There was more needed to keep the business going than business as usual.

#### BOX 3

### Bluepharma by the numbers

Bluepharma has grown steadily and has kept displaying sound performance figures. (All sources are company sources; euros are in 1000 euros).



### Getting one's bearings

A number of moves had to be considered, to protect the productive capabilities of the firm and to relaunch it in new directions. The agreement with the incumbent procurer was that it stayed for a while, but the new management was determined chart its own course. The industry was a mature one, but a new phase of globalisation was creeping through. Bluepharma was no start-up, it was a “re-start-up”; its leaders were new to manufacturing, but knew the science and marketing of it. And they were highly motivated. A collective reflection ensued; strategy had to be plotted.

The adopted policy was to maintain all the employees and to do two things: cutting costs and looking for new business and customers during the first year while Bayer was still absorbing all the unit's output. The company could not dismiss anyone as the labour force was already small (58) and their skills were what made the company tick, they personalised the company's know-how. Paulo says: “Starting to cut on personal would have taken us time away from finding

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new business and we would have destroyed the company”. The new management began to negotiate with suppliers to bring down prices of inputs. Some trust was inherited, taking over a Bayer’s plant represented a reputational spillover. On the revenue front Paulo and Sérgio started flying around the world. They began looking for new customers to deleverage the company from past dependences. More than costumer, they were trying to find partners.

Surveying the business models in the field they understood that the market for no-prescription drugs was small and with little value. They also realised that the hospital drugs trade was not remunerative, as buyers were mainly public and bad paymasters. But the generic drugs sector seemed very attractive. Thus, looking at the international environment they knew there were two big segments for pharmaceutical companies: “innovative” companies (Big pharma) and those focused on generic medicines. They went for the second path ... with an eye on the first.

## ***Reading between the trend lines***

Generics happen to be no ordinary copies. The market has no ultra-low barriers to entry, especially as far as new generic drugs are concerned. These drugs have to be as safe and as effective as the original version. It is up to the manufacturer to prove this is the case and to demonstrate that the product fits the therapeutically lock. This means that the company vying for such a positioning needs to spend money, time and muster the necessary competencies for the pharmaceutical development and obtain the market authorisation of the new products from the relevant authorities. Meeting the requirements set forth by the regulators, such as the Food and Drug Administration (FDA) is a demanding venture. In other words, developing a new medicine (generic) that is identical (or bioequivalent) to a brand name drug in dosage form, safety, strength, route of administration, quality, performance characteristics and intended use it is not an easy task. They call for hard work. For instance, when the first American client appeared and it was

necessary to be inspected by FDA. This federal agency of the United States Department of Health and Human Services is well-known for its high-standards. Bluepharma decided to take on the challenge and prepared the entire process. But, meeting these institutional challenges also becomes a valuable capability on its own as well as a signalling device. Earning certifications for safe standards in highly regulated sectors such as this is a pre-condition for entry in the market.

Displaying a peculiar combination of scientific confidence and entrepreneurial flair Sérgio, both Professor and business co-owner, asserts: “We thought we could innovate in the generic medicines.” Why? “Because this sector was growing at double digits per year. And this happened”, he argues, “because of the public policies on the drug sector.” Indeed, North Europe and the United States were moving towards the path of less budgetary resistance, that is to say, away from branded products. This meant that cheaper generics were not an outlier kind of product and not only for poor countries. They were going mainstream.

Becoming the trend in developed as well as in developing markets, and extending to other markets in between like southern Europe.

Paulo opens his eyes as his lips draw a smile. It was a path worth taking. “Generic drugs make a great contribution to lower the cost of health treatment”. And he adds, as if summarising the outcome of a calculated trajectory: “We are the main Portuguese exporter in this area.” Today the company has more than 60 drugs on the market, exports more than 80% of its production to more than 30 countries, sells products developed internally and has become a basis for creation of other independent companies. Even during the Troika years in Portugal, with austerity imposed by the European Central Bank, the International Monetary Fund and the European Commission during 2011-2013, the company followed counter-cyclical pattern: a turnover of 35 million euros in 2013, corresponding to growth of 20.5% from the previous year. Non stagnation, no decline; rather, growth and upgrading.



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## Doing well by delivering well

### ***Demonstrating operational competence, earning trust***

Under Bayer the Coimbra unit did not develop any medicine. Plus, no new stimulus would be coming from where no innovative procurement came in the first place. At the beginning Bluepharma was a CMO (Contract Manufacturing Organization). In this business-to-business activity the fit between the contractor and the customer is crucial. The capabilities of the manufacturer have to be matched, quickly and reliably, to users' needs which can be anywhere around the globe.

By the mid-2000s, the year that Bayer left as planned, Bluepharma launched three products. These products were based in a technology transfer process from the costumers; Bluepharma was able to absorb the technologies and carry on with a reliable response. It kicked out "Lamotrigine", an anticonvulsant drug indicated for the treatment of epilepsy. This was done on the same day patent on the molecule expired, and it raced to provide

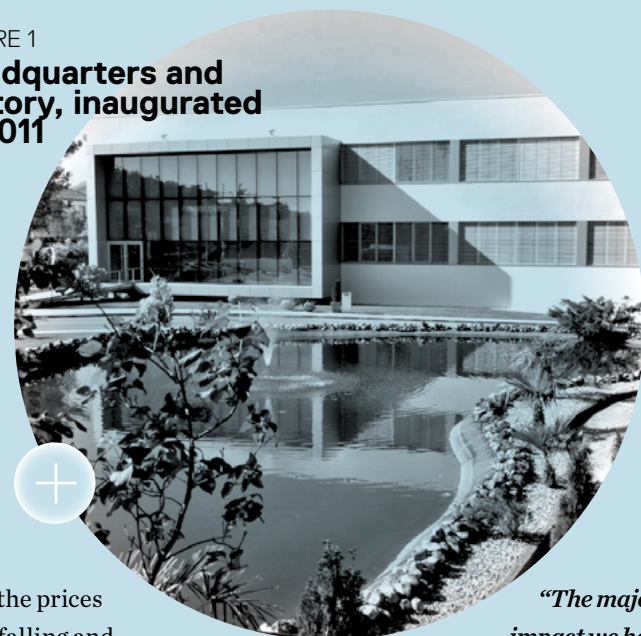
the product to customers from 14 different countries. Then it launched an anti-flu medicine, and in one year produced 60 million tablets for the French market. In September that year it launched "Sertraline", used to treat depression, also dispatched to France. This was a display of operational production expertise as well as practical capability to dispatch quickly.

Bluepharma has been keen to earn as many quality assurances as it can. It has begun a process of quality certification in different areas: ISO 9001:2008 (quality), ISO 14001:2004 (environmental management); OHSAS 18001:2007 (security, hygiene and occupational health); (EC) 761/2001 (eco-management and auditing); NP 4457 (research, development and innovation management).

### ***Fast on their feet***

Being ready when the right time came was not automatic. International competition in the generics segment was a problem. The trend was towards ever lowering prices. Bluepharma has to become more efficient faster

FIGURE 1  
**Headquarters and factory, inaugurated in 2011**



than the prices were falling and more flexible faster than the market moved.

But Bluepharma had some assets to complement its technological expertise: "soft skills". A bent to exceed the client's expectations, to go beyond what's the initial plan, to solve problems out of the schedule if needed, to be honest and rigorous with reports, to share the agenda and work in collaboration with the client, to promote forums with them, to invite them to join then in the laboratory. Openness and transparency worked to make clients see Bluepharma as a reliable partner:

*"The major impact we have in our clients is the fact we are reliable, they have trust relations with us."*

According to the company's records (2013) its generics arm made €6.153 million in EBITDA, a year growth of 24.1%.<sup>3</sup> Here the business model is business-to-business, with the exception of the link to the Portuguese pharmacies association. This group of shareholders, representing 400 commercial partners, has 22.2% of the capital of Bluepharma Genéricos. This business strategy is also new and

3 · Annual Report 2013, p. 30.

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unique in Portugal and it creates a stable commercial and financial relation allowing Bluepharma Genéricos to develop a very competitive price discount policy.

## ***From CMO to CDMO***

The owner-managers visited potential clients from the start, they felt the urge to know more about the industry itself. They knew if they wanted some kind of stimulus, they felt the need to embrace new challenges. How to do it? They found that only partners could help the company to achieve its goals. They started looking for international companies; they visited pharmaceutical fairs but also looked for agents that could assist in finding potential buyers. The agents started to tell them that the buzzword was Research and Development (R&D) and not Contract Manufacturing Organization (CMO). Usually clients do not change the production place of an old product if there is no problem, rigidity and inertia prevail.

Establishing and maintaining operational competence can be daunting enough. Bluepharma,

notwithstanding, was aiming higher. In order to breakthrough it had to invest in genuine novelty. Outsourcing was low-margin trade, and incumbents hard to displace. If it was to prevail in the generic products market Bluepharma had to differentiate itself. This meant looking for contracts beyond simple production: some degree of product development had to be added.

The solution was to reach a notch above in the value chain: from a CMO to become a CDMO (Contract Development Manufacturing Organization). In this scenario client companies own the medicinal product and try to register it in their target country; when they get this marketing authorisation they get back to order its production (typically from a source that already demonstrated the know-how for the manufacture of that product). If a deal with such a customer is stricken the result is a potential relationship, not just an arms-length/one-off transaction. Such a client can stay approximately 10 years with the supplier by including the research project plus licence for the product plus exclusivity of production

for more five years. At this stage a customer's is no-longer just a customer, it becomes a partner.

## ***Networking to upgrade, upgrading to network***

The next step was, thus, to offer not only the ability to produce (i.e. to be CMO) but also the capacity to carry out own development in the generic drug area (to evolve into a CDMO). Not just a one-directional actor in an unbalanced sub-contracting affair, but a co-contracting longer term cooperation.

By offering to their clients these two options customers could do more business with the same supplier and Bluepharma would increase their business portfolio (CMO+R&D). The CDMO's customer registers the new product resulting from the partnership in his target-market, but Bluepharma can also register in home-market or in other markets not in competition with the partner.

## ***From game player to card dealer***

So, Bluepharma began developing generic medicines in partnership with others but keeping the ownership of the technology.

In other words, it entered the field of technical services. And it did it without hollowing-out (becoming a virtual company such supplying services) or dumbing-down (keeping in the manufacturing trade only).

Bluepharma showed it was well equipped for this next step, innovation and knowledge-based partnerships. Drug development in the context partnerships means pooling capabilities, share costs and risks and, in the end, also sharing results. Today, as expressed in the annual reports,

*“Since its foundation, in February of 2001, Bluepharma has been synonymous of dynamism, competence and innovation, maintaining these pillars in its strategic course. Our values are excellence, ethics and responsibility, making of Bluepharma a leading international company, in which the customer confidence is its most valuable asset.*

*Throughout its history, the company implemented a business model that resulted in its transformation from a conventional drug manufacturer into a pharmaceutical company that develops and licences technology, promotes innovation, produces and*

# Bluepharma



*registers drugs in the international scene. This is the way Bluepharma is doing, looking for further differentiation throughout the value chain of the medical drug products.”<sup>4</sup>*

Bluepharma was a “turn-around”, with an Anglo-Saxon name and eyes set on the global stage. In a first stage Bluepharma was just a producer in an outsourcing-type contract. Then it became a contractor for sophisticated technical services. Now, in a third stage, they are technology owners, they have the rights over innovative technologies and can manage them. The plan was to evolve from selling industrial production and to selling knowledge, that is, build customer loyalty around the efficiency of the plant and then use those linkages to license new technologies.

*“Bluepharma offers an integrated approach on the process of drug discovery and development, including innovative research on new chemical and therapeutic entities (based on novel drug delivery platforms) as well as formulation development,*

*clinical research, manufacturing and commercialization of medicines.”<sup>5</sup>*

## No firm is an island, an innovative one even less so

### ***The business of socialising*** *(learning to connect)*

“Yes they could”. The following might have been said by a “community organiser”. Not referring to “civil society” but rather to the economic scene.

*“This is also my experience. I believe the economy rules the world, and economy belongs to multinational companies. But I always believed there was an alternative. And that alternative was the association of the little ones with cleverness to organize them and to network. If we achieve that we are unbeatable. When we are associated we can go faster.*

*But this kind of initiative gave us the possibility to absorb every information and methods that*

*others were using.”*

Paulo Barradas Rebelo shows himself a true believer in distributed approaches to secure market positions and carry out learning as time goes by. The benefits of partnerships are not only found in pooling resources and exchanging ideas. It allows the organisation to access the others’ networks. Indeed, less money is to be earned because it has to be shared; but the organisation always has a part of it. The more partnerships, the more revenue.

And diversification is developing also in terms of partners. Bluepharma is looking for new partners for new purposes. For reinforcing its ability as international and an innovative enterprise.<sup>6</sup> For instance, the company is engaged in the development of new generic medicines in partnership with European companies. The company is looking for new business areas to increase her competitiveness and trying to generate different offerings for their clients, having a more

diverse product and service portfolio. In the US Bluepharma is now creating a multilateral partnership, with companies from Greece, France, Germany and the US, where each one is a development company in different areas. All firms operate in the business-to-business model and now they are trying to create this partnership to have direct access to the final users.

In Latin America Bluepharma is also starting to have promising business. The most important partners are in Brazil and Colombia. The investments shall involve building new factories and also having a R&D operation there. Bluepharma is investing in human resources there but wants to invest together with locals and create results for all. The company is also establishing offices with their representatives in Mozambique and Angola. China will be important but still in preparation.

### ***Teaming up for new agendas*** *(connect to learn)*

As Paulo neatly summarises it “In the past a trade secret was at the core of the pharmaceutical

4 · Annual Report 2013, p. 2.

5 · <http://bit.ly/1JB66yr>

6 · Annual Report 2014, p. 28.



# Bluepharma



business; now sharing is the core of the business.” He means innovation as a collaborative affair. “Sharing in R&D is very important and in the international area we have partnerships with very different shapes. Partnership and sharing constitute our genetic code.”

From the start Paulo has been a multi-organisation man. He started out serving in a cooperative alongside his own business and still today carries out various duties in the associative sector such as president of the fiscal committee in the national pharmaceutical professional body (ANF). In 2010 he was a force behind the setting up of A2B, SGPS, S.A., a Business Angel focused in high-tech projects. He is also a jury in the João Cordeiro prize for innovation in pharmacy, award by ANF.

Connections can be also explicitly aimed at learning and capability acquisition. From the start Bluepharma integrated a number of business associations. For instance, it is part of the Coimbra Health Cluster, with the Coimbra Hospital Centre it aims to internationalise some

health services of this city. In 2011 Bluepharma joined, as an investor, Biocant Ventures (a framework partnership for promoting young entrepreneurs biotechnology industry dating from 2006 between Biocant Park, a biotech incubator park located in centre region of Portugal and Beta Capital, a private venture capital company). It was accompanied by Portugal Capital Ventures, the Portuguese government-owned venture capital company. Bluepharma joined COTEC Portugal (Portuguese Business Association for Innovation), in 2008, the Portuguese pro-innovation business association.

The academic environment was also important, because academic researchers started to understand that being in research with a company could be something very interesting and as scientific as working for the academy alone. It was also needed for the academic researcher to stay in the deadlines, manage quality and to understand the company research interest as something with its own value.

Another interesting area is connected with a subsidiary that trades generic medicines. This

a partnership with the retailing sector – pharmacies. Pharmacies are associated of the project and benefit the profits the company has. They are around 300 to 400 and they just have to buy an estipulate quantity per year (it doesn’t mean exclusivity). It’s called Blue Wave.

## The public partner

### *That very special sponsor*

The buy-out of the Bayer unit was a visionary, risky, entrepreneurial move. This would not have happened without an unusual suspect. Bluepharma was founded with the state as a shareholder. The Portuguese state took 30% of risk capital in the society, invested through the SME capital mechanism. The company developed a close relation with state representatives, especially with the managers for risk who came for meetings and interacted. This “partner”/“coach” left in 2006 being paid in full.

Three years later Bluepharma needed more capital to invest to enlarge the company. After

consulting the private risk capitals, again the enterprise was supported by public capital, now called INOV Capital. “As the public actor always earned money with us, it’s easy to attract them to our projects”, says Paulo.

Now they still have a relation with the state in the start-ups branch of activity of Bluepharma. Public risk investment, through Portugal Ventures, has a stake in Luzitin and Treat U. The benefit of being with public capital was that it was less aggressive, as Paulo Rebelo stated. As for reports they were quite demanding, which pushed the company to improve persistently.

### *Embedded in a web of state-shaped initiatives*

The pharmaceutical sector is well-known for its hyper-regulated environment. Regulators, however, can also be mediators. For Bluepharma, Infarmed (the National Authority of Medicines and Health Products) is its first formal stakeholder: the Portuguese drug agency, which issues guidelines to help them to keep all these areas under control. But, as this is a knowledge-intensive, business, they are

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stakeholders in the innovation arena in their own right. As a regulatory authority, Infarmed can provide the company with pre-competitive information, they may assist companies in fine-tuning problem-solving while being rigorous and impartial at the same time. This institutional hand was valuable. Regulators are not just hurdle managers. In the past two decades there was an important support to R&D by the Portuguese public sector. Government invested massively in research grants and PhD-training policies. Bluepharma acknowledges this. They say that if they compare things in Portugal with other countries the public sector overall is not less competitive than elsewhere.

Investment finance keeps on being helped by the state. Bluepharma has been smart in taking advantage of the means available. For instance, two QREN projects (the national program steering EU funding) have been approved recently: QREN SI Innovation (412 521€) for Blueclinical and QREN IDT Individual (373 072€). In 2012, Luzitin submitted an application to the System of Incentives to Qualification and

Internationalization of SME in the area of industrial property. Project number 30218 was also submitted for application to the System of Incentives QREN, and it was approved, receiving a global public support of €1 365 616.31. Luzitin: project number 5356, financed by QREN and implanted by Luzitin co-working with Bluepharma, had a total investment of €2 312 607.58 (1 387 957.18 are Luzitin's responsibility).<sup>7</sup>

The relationship is intense and goes both ways. For instance, in October 2014 Bluepharma installed an electronic game in the Exploratório Ciência Viva (Life Science Exploratory), named "Jogo da Vida" (life game) on eating behaviours. And Bluepharma is also editing the first number of the collection *Portuguese Pharmacopeia*, in a partnership with the General Library of the University of Coimbra. These are educative activities, public goods.

The link with publically-owned institutions goes further. BSIM<sup>2</sup> – Biomolecular Simulations: this enterprise is a spin-off resulting

of the scientific activity conducted in the University of Coimbra by two researchers.<sup>8</sup> In 2013, BSIM<sup>2</sup> continued the development of products started in 2011, with a QREN application, with a reimbursement rate of 69.1%.

The company has also participated in many official missions to foreign markets. For instance, it went on board in an official state mission to United Arab Emirates (Ministry of Foreign Affairs) and Mission to Saudi Arabia (AICEP).<sup>9</sup>

### ***Standing on the shoulders of human-capital public policy***

A big support has been the country's human capital infrastructure. Bluepharma also recruits people through IEFP (the Portuguese Institute for Employment and Vocational Training). In 2012 they received 108 new workers, including internships, a substantial part arriving through this system. In 2013 new employment contracts were in 60% of the cases for the area of R&D, 19 new professional

internships were through IEFP.<sup>10</sup> In 2013, there were 8 curricular trainees from universities, 31 professional trainees from IEFP.

In 2013 there were several PhD projects undergoing at the company. There were also new master projects in a partnership with the Chemical Engineering Department of Coimbra.<sup>11</sup> A new PhD project in business model research was started in a partnership with ISCTE - University Institute of Lisbon, an opportunity intermediated by COTEC Portugal.

### **Innovating yourself out of the maze**

#### ***Breaking the mould, smashing prejudices***

Some years ago, people in general and policy-makers in particular would think it would be impossible to have pharmaceutical industry in Portugal, but experience proved the sceptical were not right.

8 · Annual Report 2013, pp. 31-33.

9 · Annual Report 2014, p. 7.

10 · Annual Report 2013, p. 26; 2014, p. 30.

11 · Annual Report 2014, p. 30.

7 · Annual Report 2013, p. 30.

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So, a great splash is possible in a tough, globalised, high-tech industry. But this was not obvious at all in the beginning. Investment and know-how were the major aspects that made people suspicious about a possible success in this area. But with creative approaches it was possible. As Paulo says:

*“People thought I was lyrical believing it was possible to have industry in this area in Portugal, with production and research. Production was seen as a finished sector in Europe and research was seen as impossible in a country with small capacity to invest.”*

*“The situation today says the contrary: the need for the reindustrialization of Europe is on the table and the small companies are the ones becoming more innovative... so time gave us reason.”*

There was purposeful intent from the side of a new generation of willing entrepreneurs. Supporting institutions were there to provide an actionable background. And actual industrial practice also evolved.

## ***Building on national expertise, organically***

In 1996 Luís Almeida knew this by heart. He is a recent entry into the enlarging Bluepharma set of concerns but he has been in the industry for a real long time. He did many projects on medicine in Bial where he started to work that year, but most of them never arrived to market. But there was one which succeeded and it was the first Portuguese medicine. He was a researcher at Bial and he was the leader of the project leading to Zebinix (Box 4).

Bial showed it was possible. Bial, founded in 1924 as a small pharmaceutical laboratory, and an early pioneer in branded products, has been the largest Portuguese pharmaceutical company for a long time. The company musters the largest national R&D figures in this sector and is regarded as a key innovative company for the country as a whole (Carvalho, 2007).<sup>12</sup> In 2008, Bial completed the clinical trials of BIA 2-093 (Eslicarbazepine acetate), a

12 · Surely it also owes a lot to public incentives. It was the second largest receiver of industrial aid for innovation and internationalization between 2007 and 2013 (Expresso, Economia, 14 March 2015).

## BOX 4 **Vehicles for tacit knowledge build-up**

Luís Almeida is today one of the senior experts working in Bluepharma Group. He graduated in 1985 and started working in the pharmaceutical industry as part-time job. In the year Bial creates its R&D department, Almeida joined the research team. It was the first time a Portuguese pharmaceutical company was launching itself in this kind of activity. Almeida was involved in several R&D projects, but he was also one of the responsible for the first Portuguese drug in the market (integrating all the drug process). In 2009, he also founded the Pharmaceutical medicine course at University of Aveiro, three years later awarded as a centre of excellence by Pharmatrain. Some months after the creation of Luzitin, Almeida enters the firm believing in its ability to develop high quality R&D. By 2014 the first Luzitin drug was on clinical trials, being administrated to patients. What seduced Almeida to join Luzitin? He was persuaded by the challenge of a new high quality R&D project in the pharmaceutical area in his country. But maybe the most important question is: what did see Bluepharma Group in Luís Almeida? Certainly they found someone with the same ideals and way of working. Both believe in R&D work in Portugal and are enthusiastic about science developments in the country and the feedback universities are giving in the formation of high skilled researchers.

Source <http://bit.ly/1i0tt3A> , <http://bit.ly/1i7lg4h>

drug used for the treatment of adult epilepsy. Heralded as “the first 100% Portuguese drug”, Zebinix was introduced in the US market in April 2014.<sup>13</sup> The drug representing 15 years of research and more than 300 million euros

of investment is now marketed in more than 50 countries, including Spain, UK, Germany, and France.

He always maintained his own outside projects and was in the University of Aveiro, and he bolsters a unique experience and track-record in the country.

13 · <http://bit.ly/1E1YQGe> , <http://goo.gl/kCrogV>

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At a point he was invited to join Luzitin, a result from a spin-off of Coimbra University in collaboration with Bluepharma (see Box 3). In this moment, they already have a project which is in the phase II of clinical trial and already has an International Nonproprietary Names (Each INN is a unique generic name which is globally recognized and is non-proprietary, i.e. public property)<sup>14</sup>. It is the first oncological investigational new drug resulting from Portuguese research. It consists of a combination of a new generation photosensitizer with a specific infrared-laser medical device and constitutes a radical innovation. It is a novel approach since the new chemical entity is only activated in the area where the patient has the tumour. Advanced head and neck cancer is the focus of this first clinical trial. The aim is to go through clinical trials, the most expensive of the steps in the drug value chain.

## Gearing up for innovation at the global level

### Intensively incremental

Throughout its history, the company implemented a strategic path that resulted in its transformation from a conventional drug manufacturer into an innovative pharmaceutical company in its own right. A newcomer that develops and licences technology, produces and registers its own products in the international market (patents, trademarks), a company that dynamically reshuffles more than its product portfolio but also its own innovative of relationships. This is the way Bluepharma is doing, looking for further differentiation through value creation in the drug value chain.<sup>15</sup>

Incremental innovation is the backbone of it all as they themselves see it. The company brings to the market a medicine which is bioequivalent to an existing substance. Ultimately, the client of this product is under pressure of the pay-master, mainly the Governments who

design and implement the public health policies. The drive for lower costs in the health sector lowers prospects for the business as whole and has been a regularity (Figure 2). From the point of view of the manufacturer efficiency is an avenue, as well as business diversification. Under this nexus of constraints Bluepharma is pushed for operational productivity but also strategic renewal. How to accomplish this and sustain this drive?

Paulo says, “At Bluepharma we can count our values with one hand: invest to research, innovate

to internationalise.” So, dynamics is the rule.

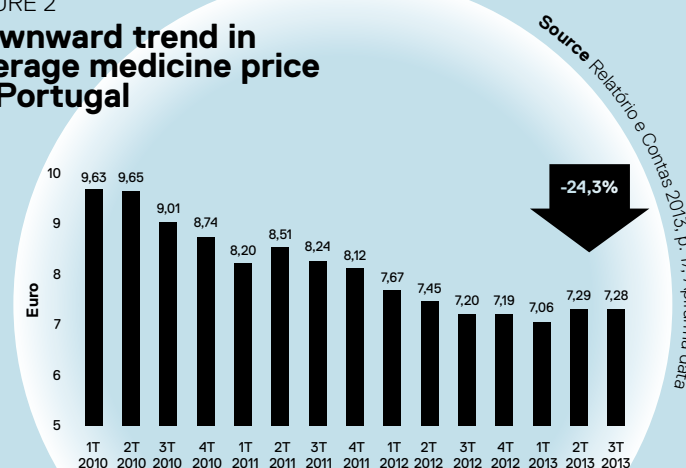
### It's Development then Research ... not Research before Development

Paulo Simões refers that the company was innovating from the start.

*“We're doing this without knowing exactly what it was. Only with COTEC Portugal innovation tool we realized what it really meant... but we had no innovation methodology in a protocol, it was something very natural for us to do.”*

FIGURE 2

### Downward trend in average medicine price in Portugal



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Having to think in terms of alternatives from the outset (new product streams, new customers) the choice was to bring new value to the market and create a research capability. Bluepharma would systematise its innovation approach. In 2003 it founded its first R&D lab, in 2005 it joined COTEC Portugal (Portuguese Business Association for Innovation).

Bluepharma looked for very specialized workers and employed people from the university and began the experience of hosting PhD students in the company. They had the public support via scholarships for these students/researchers and, in this way, they started to develop completely new technologies. The first PhD project was around 2006, but as a strategic perspective this option was established in 2010. Company also reinforced continuous training.

As a university professor Sérgio was used to contact with university world and outside research. This was an easy and convenient interface. “I knew people”, he says, “and was sensitive to their discourse and kind of language.” Today, 59% of the 277

workers have a university degree, 26% have a master and 1% a PhD.<sup>16</sup> The median age is 34. “Today, we have 10 people with PhD and they changed the internal behaviour of the company.”

Even with this model they consider their research area is still incremental, “as the disruptive one is mainly in the university setting” says Paulo. Bluepharma wants to know what is being studied and nurtures mechanisms to keep up with what is new, but they choose not to go further than that.

Nevertheless after having in-company PhD programs they started to have new ideas in a very small part of disruptive research. As a result they created room for more in-depth research; but this was outside the holding company through start-ups, vehicles for projects resulting from their talented associated researchers. In this respect, Bluepharma is shareholder of some start-ups (Luzitin, Treat-U, Biocant Ventures, Blueclinical, Technophage, BSIM2, Blueanalytics) but have other investors and shareholders.

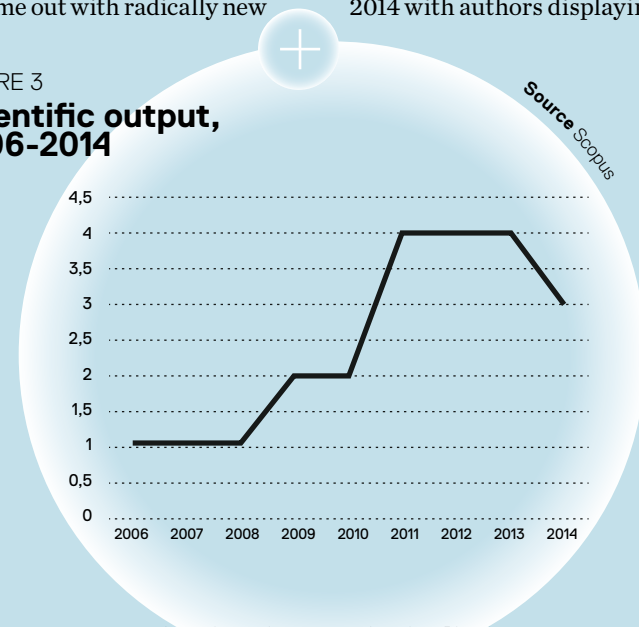
That is to say, Bluepharma had to be good in routine operations (process efficiency). It meant finding schemes to improve productivity in the labour organisation, input acquisition, output dispatch processes (because altering the production process itself meant that all regulatory approvals had to be renewed). Then, in parallel, it thought about adding unfamiliar products to its pipeline (product innovation). To existing products the company developed novel technical solutions around them. Although the managers see shy to admit, the company is now seeking to come out with radically new

products. Hence the deepening of the research dimension as well as the upgrading of the applied component of R&D in recent years. To do that Bluepharma reinforced its partnership mode of conduct. Indeed, new research and new forms of organising (a network governance structure) seem to come hand-in-hand.

## **Bluepharma's innovation muscle**

The company's scientific pedigree can, perhaps, be assessed through its international, peer-reviewed publications (Figure 3). There are 22 papers on record until 2014 with authors displaying

FIGURE 3  
**Scientific output, 2006-2014**



**Note:** papers are accounted for when at least one authors lists Bluepharma, or its associated ventures like Luzitin, as his or her affiliation.



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Bluepharma as an affiliation. The first article came out five years after the company was founded. After this inauguration there are no years without papers being published. There is a total of 121 authorships, meaning an average of 5.5 authors per paper when a Bluepharma researcher is involved. That track-record places Bluepharma as following the practice of substantially collective authorship; perhaps a little higher than average.<sup>17</sup> Bluepharma mainly publishes with academia as indicated by the structure of author's affiliation in 2006-2014: 39% Bluepharma, 55% university, 6% public laboratories. There are no other company's besides itself in the network of authors. Coimbra University dominates the university affiliations, but researchers from Polish and Spanish institutions also figure (less so Hungary and UK). What is more, from 2010 international co-authorships are continuous. This may be significant. This may indicate that Bluepharma's research agenda is becoming more significant and globalized, i.e. greater in complexity and international scope.

17 · <http://1.usa.gov/1PWMnKJ>.  
See also: <http://bit.ly/1NLwS9a>.

The patenting record also show that after the late-2000's the company was well in its innovative gear (Table 1). Its four patents were submitted in Portugal, Europe, the US and at the international level. The University of Coimbra and a

Hamburg based multi-product trader stand as co-applicants. Inventors range between three and six, almost all Portuguese. Both Bluepharma people and its start-ups are involved. The US is always a special case in the industry ("the market!", says

Paulo), in this case a substantial part of the patenting process carried out in the US, in Boston, where are the firms with more expertise in this area are located.

Surely, Bluepharma is brand-aware. But Bluepharma so far has

TABLE 1  
**Patent output to 2014**

#### 1. ORAL DISPERSIBLE FILMS

Inventor:	Applicant:	CPC:	IPC:	Publication info:	Priority date:
BORGES ANA FILIPA SILVA [PT] SILVA BRANCA MARGARIDA ALMEIDA [PT] (+3)	BLUEPHARMA [PT]	A61K47/14 A61K47/32 A61K47/38 (+3)	A61K47/14 A61K47/32 A61K47/38 (+1)	US2015038594 (A1) 2015-02-05	2013-07-31

#### 2. PROCESS FOR PREPARING CHLORINS AND THEIR PHARMACEUTICAL USES

Inventor:	Applicant:	CPC:	IPC:	Publication info:	Priority date:
PEREIRA MARIA MIGUENS [PT] MOREIRA LUÍS GUILHERME DA SILVA ARNAUT [PT] (+4)	UNIV DE COIMBRA [PT] BLUEPHARMA IND FARMACUTICA S A [PT]	C07D487/22	A61K31/409 A61P35/00 C07D487/22	PT2346874 (E) 2014-03-06	2008-10-24

#### 3. STABLE AND READILY DISSOLVED COMPOSITIONS OF CANDESARTAN CILEXETIL PREPARED WITH WET GRANULATION

Inventor:	Applicant:	CPC:	IPC:	Publication info:	Priority date:
GINDULLIS FRANK DR [DE] SIMOES SERGIO [PT] (+1)	HELM AG [DE] BLUEPHARMA IND FARMACEUTICA S A [PT]	A61K9/1617 A61K9/1623 A61K9/1652 (+4)	A61K31/00 A61K9/00	SI2165702 (T1) 2012-05-31	2008-09-17

#### 4. ENTEROCOCCAL PHAGE PEPTIDES AND METHODS OF USE THEREOF

Inventor:	Applicant:	CPC:	IPC:	Publication info:	Priority date:
DA COSTA GARCIA MIGUEL ANGELO [PT] VILELA PIMENTEL MADALENA MARIA [PT] (+1)	TECHNOPHAGE INVESTIGACAO E DESENVOLVIMENTO EM BIOTECNOLOGIA SA [PT] BLUEPHARMA IND FARMACEUTICA S A [PT] (+3)	A61K38/00 C12N2795/10111 C12N2795/10122 (+2)	A61K38/16	WO2011065854 (A1) 2011-06-03	2009-11-24

Source Espacenet

## Case Study

## Bluepharma



moved to protect with a registered trademark only its corporate identity and a product trademark (BlueOS). It has filled its name with five filings (two in Portugal and Europe and one in the US and Germany) (see Table 2). Following the Nice Classification system, established for classifying goods and services for the purpose of registering trademarks, is Class 5, a “goods” class, and this trademark category covers:

*“Pharmaceutical and veterinary preparations; sanitary preparations for medical purposes; dietetic food and substances adapted for medical or veterinary use, food for babies; dietary supplements for humans and animals; plasters, materials for dressings; material for stopping teeth, dental wax; disinfectants; preparations for destroying vermin; fungicides, herbicides.”* (see Appendix 5)

It is also telling when data regarding Bluepharma’s start-up trademarks are considered (Table 3). They appear from 2005 onwards, indicating how Bluepharma has been developing as a broader entity. It is also significant that new Nice Classes appear, this time pointing

TABLE 2  
Trademark output to 2014

Graphic representation	Trade Mark Name	Office	Application number	Trade Mark Status	Nice Classe	Applicant Name	Application Date	Trade Mark Type
	bluepharma	PT	000003631	Registered	5	Blupharma – Indústria Farmacêutica	24-05-2001	Combined
	BLUEPHARMA	PT	000367417	Registered	5	Blupharma – Indústria Farmacêutica	18-10-2002	Combined
	BLUEPHARMA	EM	003387644 003387644	Registered	5	Blupharma – Indústria Farmacêutica	08-10-2003	Figurative
	BLUEPHARMA	US	77862938 3918586	Registered	5	Blupharma – Indústria Farmacêutica	02-11-2009	Combined
	bluepharma	DE	3020120014828 302012001482	Registered	5	Blupharma – Indústria Farmacêutica	13-01-2012	Combined
—	BLUEPHARMA VET	EM	012299038 012299038	Registered	5	Blupharma – Indústria Farmacêutica	11-11-2013	Word

Source: TM View

TABLE 3  
Start-up trademarks output to 2014

Graphic representation	Trade Mark Name	Office	Application number	Trade Mark Status	Nice Classe	Applicant Name	Application Date	Trade Mark Type
—	TECHNOPHAGE	PT	389800	Registered	42	Technophage – Investigação e...	14-04-2005	Word
	Luzitin	US	85807020 4450198	Registered	5, 42	Luzitin, S.A.	21-09-2012	Word
—	Luzitin	EM	011207917 011207917	Registered	5, 42	Luzitin, S.A.	21-09-2012	Word
—	Treat U	PT	20170	Registered		Treat U, Lda.	12/02/10	Word
—	PEGASEMP	—	490845	Registered	5	Treat U, Lda.	04/11/11	Word
	Treat U	US	85375300	Ended	35	Treat U, LLC	19-07-2011	Word
	Blueclinical	US	85807045 4591087	Registered	5, 42	Blueclinical – Investigação e Desenvolvimento	21-09-2012	Word
—	Blueclinical	EM	011207974 011207974	Registered	5, 42, 44	Blueclinical – Investigação e Desenvolvimento	21-09-2012	Word

Source: TM View

# Bluepharma



to “services” categories, due to the star-up’s activities and representing its diversification process:

*Class 35 “Advertising; business management; business administration; office functions”;*

*Class 42 “Scientific and technological services and research and design relating*

*thereto; industrial analysis and research services; design and development of computer hardware and software”;*

*Class 44 “Medical services; veterinary services; hygienic and beauty care for human beings or animals; agriculture, horticulture and forestry services.”*

BOX 4

## Awards and distinctions

- 2003:** Almofariz award as year project.
- 2004:** European Prize for Regional Innovation as a project of the year.
- 2010:** International Quality Trophy in Geneva (prize awarded by the chambers of commerce and embassies).
- 2012:** COTEC-BPI SME innovation award.
- 2012:** SME Excellence prize, awarded by IAPMEI (the Portuguese SME state support agency).
- 2012:** INSEAD Entrepreneurship Award 2011/2012, awarded by the European Institute for Business Administration.
- 2013:** Outstanding Venture of the Year, by Portugal Ventures.
- 2013:** SME Excellence award in 2013, for the third consecutive year.
- 2013:** Bluepharma CEO receives the prize “Entrepreneur of the Year” in the XIII International Conference of Risk Capital and Entrepreneurship.
- 2014:** Best Portuguese exporter, European Business Awards 2014/2015.
- 2014:** Treat U, the start-up, is distinguished as the most promising enterprise in the area of Life Sciences in first International Investors Forum, promoted in Go4Venture and Portugal Ventures.

**Source** internal documents and publically available information.

Bluepharma’s work quality and product performance has also earned it a number of awards, which has boosted its reputation (Box 4).

## Innovation as identity

### **High-stakes commitment to innovation**

Innovation practice may have been ahead of comprehensive planning. Share and quality assurance are the instrumental value. And the money of the company is where their mouth is.

Business and Product Development department activities, trusted with bringing competitiveness and differentiation through its innovative products, are budgeted at 1 972 135€. Total R&D in 2012 reached €5 057 893, roughly about 10% of its annual turnover. This made it the 33<sup>rd</sup> company in national terms; the 6<sup>th</sup> company/group in the chemical, pharmaceutical and food processing industries; the 6<sup>th</sup> SME in terms R&D spending.<sup>18</sup>

### **An increasingly professional approach to innovation**

*(top-down control)*

There is a “System of Integrated Management” based on quality, innovation, continuous improvement and client satisfaction. Sharing knowledge and information, development of improvement actions and monitoring the relevant indicators is continually promoted, according to corporate records.

As Head of Research Cláudia Silva epitomise Bluepharma rational, documented, systematic approach to new-product oriented R&D. “We have two different phases to analyse the risk.” She explains: “The first is when we are evaluating new project ideas and we have a form which is completed since our certification in research, development and innovation.” Risk analysis is progressive and is present in every project phase. As Cláudia states the more innovative projects are, more risk is involved and more need for a systematic R&D practice. She explained the documenting process: *“When we are analysing an idea to develop a new product, the risk is analysed in terms*



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*of technical and scientific difficulties, if we have the means and necessary competencies, if there is competition (can mean opportunity or risk). The result is to know if the project can be developed, if it has market and if we have the capacity for doing it.*

*When we start the project we do a more specific and in-depth risk analysis. We try to detect and preview all the risks of each phase and to design solutions for the possible cases of failure. This kind of prevision is getting more accurate as we have more experience from previous projects. The more innovative projects are, more difficult is to determine risk, but we still try to do it in the best way possible.*

*Every project has a dossier with the compilation of all information and knowledge generated, including a final report of each project. We have a part dedicated to learned lessons and it is disseminated internally. We also are very concerned with deadlines and budget because it can determine how successful we are.*

*We also have a documentation management system according*

*with the pharmaceutical industry highest standards. In the form the project is codified, with the identification of the team, date of beginning, date of ending, evaluation of the project and milestones, global evaluation, when there are delays we must know if they are due to internal or external factors.”*

### **Pedestrian, bottom-up creativity (change is everywhere)**

The pharmaceutical industry is a high-tech industry and has played its parts in pushing life expectation to move above than 81 years. Interestingly enough it remains deeply conservative and with little appetite for risk and innovation. Risks are high, backlash from malfunctioning products may be tremendous.

Bluepharma can be said to have slowly built up an all-round corporate innovation system. It has become a culture. To start with, information circulates internally.

Bluepharma holds the forum for employees called FIQ – Forum for Innovation and Quality, where

someone presents a subject during 30 minutes, fortnightly. Human resources department organizes it and it can be about R&D or about quality. They also introduced another organisational innovation with seminars on transversal themes with interest for different departments. The participation in FIQ is decided by the worker, but the participation in seminars is broader and people are invited to be present. It takes one hour.

In 2011 the managers thought they needed to have more staff with knowledge in the strategy area. So they did an agreement with Porto Business School and did a course with a tutor who visited the company and developed a close relation with the students/workers. By that time they decided to extend the annual management meetings to workers representing the main departments.

Then, through the certification under NP 4457:2007, a Portuguese standard developed under COTEC Portugal aiming to reinforce business innovation competences, Bluepharma got a little further. It gave the possibility of any worker to pitch a business idea and present it during five

minutes in the annual meeting dedicated to discuss the strategy of the company. For this strategy meeting they should present a more formal idea for business. They have to fill a form and to have an internal “sponsor” who helps them do develop the idea. Then they present it doing a pitch. Good ideas have been acknowledged to have been submitted and this organisational device is also useful to screen talent, according to the Administration statements about this initiative.

Bluepharma also has other ways to stimulate creativity. They have an “Ideas Management System” by which any worker can apply with his idea in a digital platform. In 2015 it was about human resources and how to improve conditions for workers in the company. It is announced in the Christmas dinner and in the summer lunch.

Regarding process innovation there was “Rationalization Plan” for energy consumption approved for 2013-2020, including fuel substitution.<sup>19</sup>

# Bluepharma



## The company as incubator

### *Harbouring outside innovation*

Luzitin is the prototype of an answer to a new environment in the pharmaceutical area. This is actually a trend. Big pharma themselves become too big and complex with the headquarters and centres of decision far away from the research area. Spaces open for new entrants to develop their own niches.<sup>20</sup> So they have high cost for researching as they have to sustain a bureaucratic organization in every department. Getting higher cost, they started to look for new talents and projects outside their companies, buying the results of their research.<sup>21</sup> Luzitin is inscribed in this kind of logic.

And the big pharma enter when there is already a technology to be tested in clinical essays. With this business model the risks are

20 · <http://pwc.to/1loXA0i>

21 · See Ismael Rafols, Michael M. Hopkins, Jarno Hoekman, Josh Siepel, Alice O'Hare, Antonio Perianes-Rodríguez, Paul Nightingale (2014), "Big Pharma, little science?: A bibliometric perspective on Big Pharma's R&D decline", Technological Forecasting and Social Change, Vol. 81, pp. 22-38.

small for the big company, and all the shareholders accept to invest in a final phase of research. Their problem is not the volume of investment but the question if it will generate revenues or fail. Even big pharma are creating spin-offs as Lilly created Chorus. Outsourcing R&D and production became more attractive and safe for those big pharma who operate in the global market.<sup>22</sup>

The challenge today is to do research small groups, target with some specifications, so small companies with more adaptive skills are better doing this. Now the trend is that research should be patient-oriented.<sup>23</sup> As a result of this trend operators are having more feedback from the patients and focus on them instead of the usual and previous concentration on the doctor's opinion. The actual trend for medicine is the personalized medicine, adapted to each patient and pathology. This now is possible because there are biomarkers and technologies that can be applied to each patient. Even Luzitin's slogan is oriented for this new approach in the

22 · <http://pwc.to/1KSdHW4>

23 · <http://pwc.to/1APVvwx>

relation medicine/patient. That is why "Your wellness matters".

BlueClinical is a CRO (Clinic Research Organization). Bluepharma knew there was an expert in this area, Luís Almeida, who got out of Bial open to new collaborations and that this kind of enterprise was needed in Portugal. This company can work for Bluepharma and for other clients. BlueClinical R&D activities are involved in evaluation of projects resulting of spin-offs of Universities (University do Minho, Oporto, Beira Interior, Coimbra and Lisbon).<sup>24</sup> It also participated in two Horizon 2020 projects, forming part of an international consortium. With an Israeli company as client, started a clinical study in four public Portuguese hospitals. BlueClinical changed the name of its business unit from SMO (Site Management Organization) to CRP (Clinical Research Partnership), in order to better convey the type of cooperation established with the different unities forming part of the health national system.

24 · Annual Report 2013, pp. 31-32.

### *A firms of firms?*

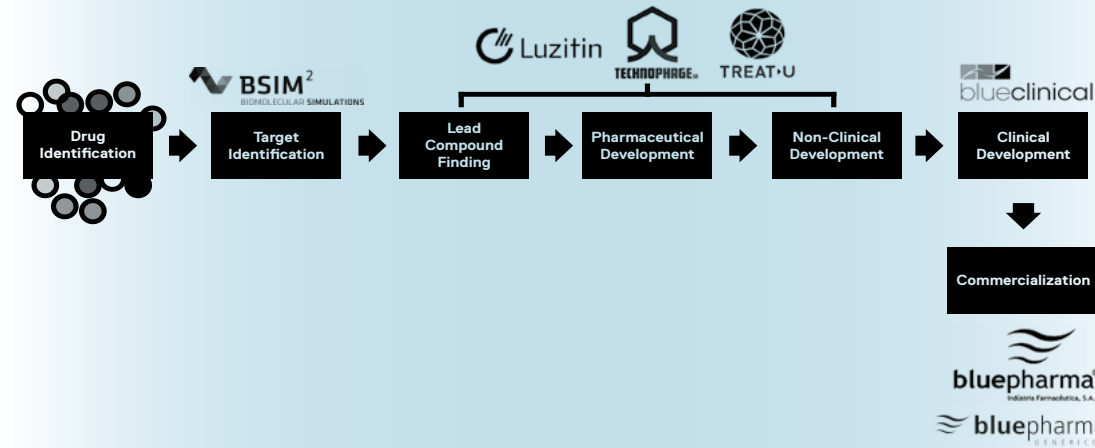
#### *What new directions in innovation governance?*

In this moment Bluepharma is connected to Luzitin, Treat U, BSIM2, Blueanalytics and BlueClinical. In Bluepharma group, Bluepharma Industry the CDMO (Contract Development and Manufacturing Organization) is still the most important operation in terms of revenue, but it is reinforced by the new product development area. There is a complementary dynamics to this approach.

*"The model is simple and intuitive: Bluepharma 'lends' the new company its valences in the quality management area, regulatory affairs, pharmaceutical development, human resource management, accounting and finance and management experience and international network, while promoters 'scientists' contribute with talent, scientific expertise and international network of scientific contacts. This is a complex and costly process, with a strong risk component and with some particular challenges. These challenges include the need to align R&D procedures*



FIGURE 4  
The drug value chain and Bluepharma's group strategy



Source: "Apresentação Bluepharma", 14-05-2015, p. 23.

*between teams of companies and university research centres, and alignment strategy, the specific objectives of the projects, and the management of time and resources. Difficult but fundamental is the establishment of effective communication between teams, which facilitates the management of generated knowledge and different expectations, particularly in terms of the protection of intellectual property generated and disclosure.*

*Bluepharma is in some ways a pioneer in this type of cooperation. We think that the results the next 5 years with these two companies (Luzitin and Treat-U) will determine the future of this type of partnership in Portugal.*<sup>25</sup>

Will the next step be the incorporation of the start-ups in Bluepharma? Solving the problem would certainly be of interest to the broader community of

global-oriented mid-sized up-and-coming firms.

In this moment within the Bluepharma universe there is already production, development, research and a company for clinical studies. They are completing the value chain. They can offer their clients different phases of medicine R&D and production, but do not have the active substances. So, they would like to have some in-sourced core raw materials for production, i.e. generating themselves some

of these basic inputs such as the active substances. If it cheaper to buy the raw materials it is out of question to own them, but if it is not, it's very attractive they say. In big pharma full vertical integration ran out of favour.<sup>26</sup> However, Bluepharma is pushing to be present in all phases of drug development.

As the company grows they become interested in what how others did it, so they look for references that might inspire them in the future. When they gaze around they do research on technology roadmapping tools, bibliometric trends, and case studies. They find other insurgent companies as the best examples, for instance Teva from Israel, an innovative generics company basing strategy on knowledge and patenting and which is now itself a company emulated by catching-up firms which emulate its approaches and challenge it with a taste of its on medicine. A shape of this to come?

# Bluepharma



## From the pharmacy shop to science-based pharmaceuticals

“In professional terms,” says Paulo, “I did the entire drug circle: from the standing pharmacy shop to wholesale distribution to industry to research and venturing.” And provides reminder of the industry level pattern: “All multinational drug producers started out in the same way.” Indeed, this was the way itself Friedrich Bayer started in the 19<sup>th</sup> century. The paths taken in the 21<sup>st</sup> century can be very different.

Bluepharma’s path has been a little treaded one. But what ways forward now? As the pharmaceutical industry is turned on its head the lessons Bluepharma learns are of relevance for the overall sector.

Globalisation is hitting a new phase of turbulence. Markets exhibit permanent mix signals, sharp falls are followed by rapid recoveries and vice-versa. Demography in the west and east point to ageing but the business landscape in

pharma is characterised by complex regulatory pressures by government willingness to cut costs in healthcare. What strategies should Bluepharma pursue? What markets can it target successfully?

Bluepharma has mastered the art of diversification and differentiation. But there are trade-offs. Should it keep increasing the number of products it is able to generate? What parts of its product portfolio should it sacrifice?

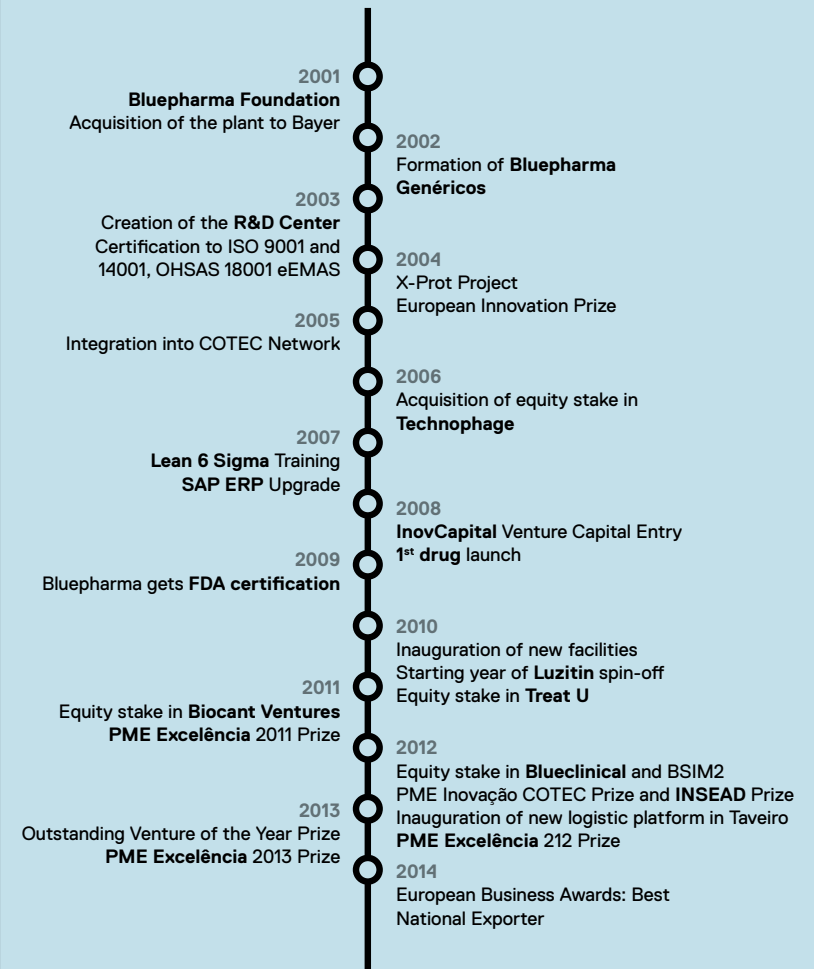
Vertical integrations seems to be order of the day. To what extent should this organisational drive be pursued? What are the costs and advantages? What decisions regarding scale and scope are there?

Bluepharma is becoming a fleet of firms. To what governance form should it adhere in the future?

And what happens if one day a Big Pharma presents them with an offer they can’t refuse? Is the rest of the industry ready to do full circle too?

## APPENDIXES

### Appendix 1.



Source: Translated from Annual Report 2014, p. 8



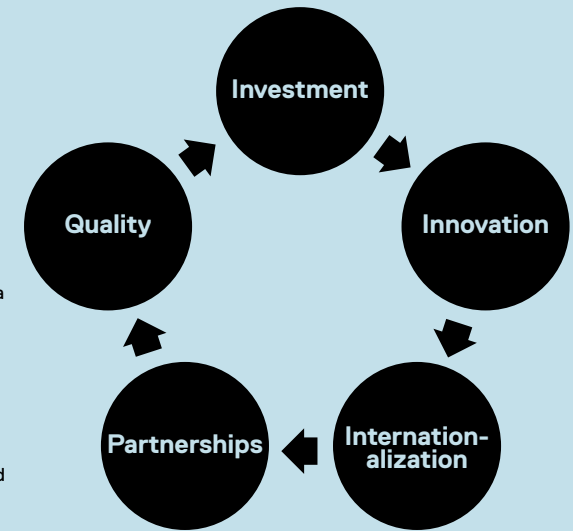
## APPENDIX 2. Bluepharma's mission (translated statement)

The Bluepharma's MISSION is based on providing pharmaceutical products of the highest quality and competitive prices, thus contributing to the rationalization of expenditure in the health sector while, simultaneously, improving the quality of living of people.

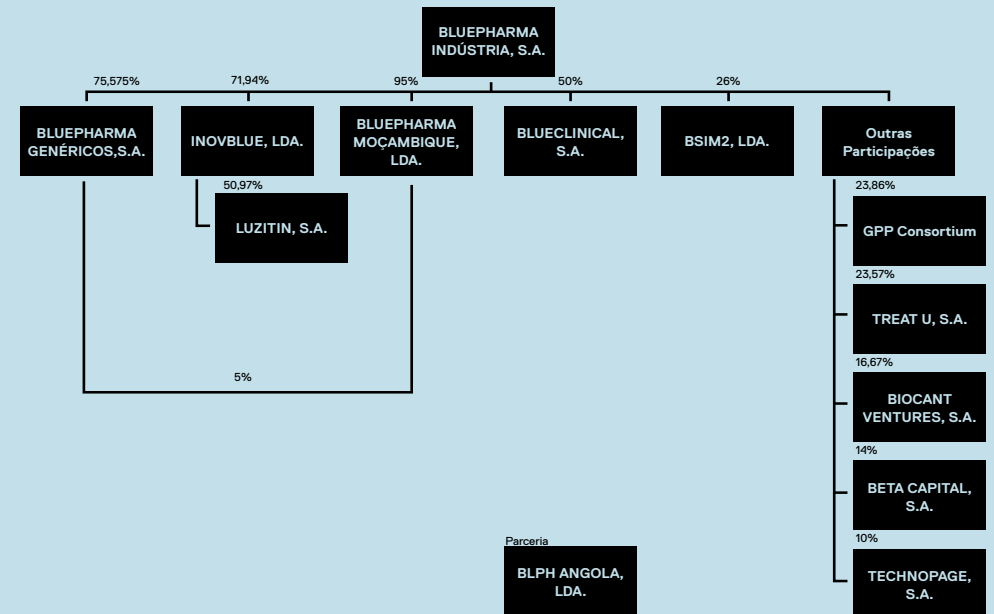
The excellence is the key success factor of the Bluepharma activity. The VISION of the company is based on the continued focus on **Investment** - in people, in facilities and new equipments - in order to **Innovate** and **Internationalize**. Thus, it was made a bet on **Partnerships** (national and international) and, in addition, the focus on **Quality** (know-how of Bayer, dynamics and innovation Bluepharma, the necessary professionals and the ability to "look out").

Source: Translated from Annual Report 2014, p. 9

- **Investment**
  - Carried out continuously, in people, in new facilities and in the acquisition of new equipments.
- **Innovation and R&D**
  - Own R&D Center
- **Internationalisation**
  - Export represent more than 80% of turnover (Europe, USA, Asia, Latin America and Australia)
- **Partnerships**
  - National and international partnerships with research centers of Excellence
- **Quality**
  - 1st pharmaceutical industry with integrated and FDA certification



## APPENDIX 3. Bluepharma's organisation structure



Source: Annual Report 2014, p. 10

# Bluepharma



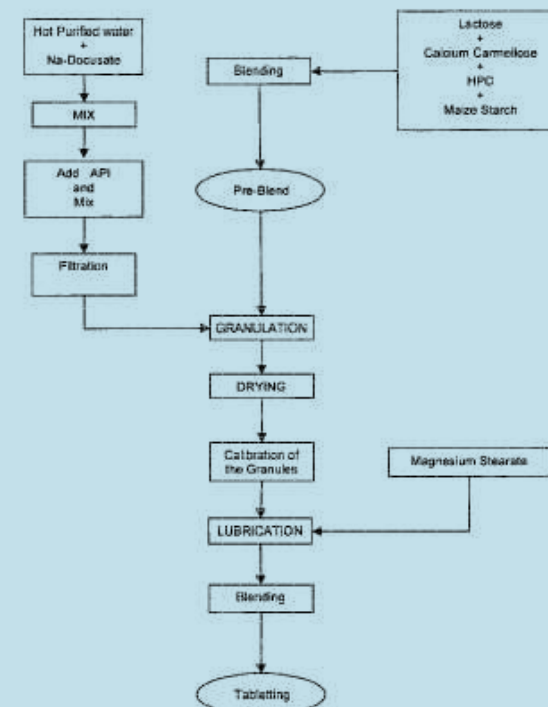
## APPENDIX 4. Bluepharma's patent, example

<b>Inventor(s):</b>	GINDULLIS FRANK DR [DE]; SIMOES SERGIO [PT]; LEITAO DA SILVA ALBERTO GABRIEL [PT]
<b>Applicant(s):</b>	HELM AG [DE]; BLUEPHARMA IND FARMACEUTICA S A [PT]
<b>Classification:</b>	
- international:	A61K31/00; A61K9/00
- cooperative:	A61K9/1694; A61K9/2013; A61K9/2018; A61K9/2054; A61K9/1617; A61K9/1623; A61K9/1652
<b>Application number:</b>	SI20080030536T 20080917
<b>Priority number(s):</b>	EP20080016396 20080917

### Abstract of corresponding document: EP2165702 (A1)

The present invention relates to new pharmaceutical compositions in which Candesartan cilexetil is contained in a stabilized form with enhanced solubility and from which it is readily bioavailable when applied in conventional pharmaceutical dosage forms, and a process for the preparation of the same as well as of kits containing such compositions. The pharmaceutical compositions of Candesartan cilexetil or of its combinations with other active ingredients can be used in methods to treat subjects suffering from cardiovascular diseases.

**Source:** Espacenet



## APPENDIX 5. Bluepharma's US trademark



<b>Word Mark</b>	BLUEPHARMA
<b>Goods and Services</b>	IC 005, US 006 018 044 046 051 052, G & S: Pharmaceutical products for the treatment of gastrointestinal acid related disorders, cardiovascular system diseases, inflammatory diseases and rheumatic disorders, alimentary tract and metabolism disorders, thrombotic disorders, cholesterol, bone diseases, genito-urinary system diseases, fungal infections, nervous system disorders, allergic reactions
<b>Mark Drawing Code</b>	(3) DESIGN PLUS WORDS, LETTERS, AND/OR NUMBERS
<b>Design Search Code</b>	26.17.02 - Bands, wavy; Bars, wavy; Lines, wavy; Wavy line(s), band(s) or bar(s)
<b>Serial Number</b>	77862938
<b>Filing Date</b>	November 2, 2009
<b>Owner</b>	(REGISTRANT) Bluepharma - Indústria Farmacéutica, S.A. CORPORATION PORTUGAL Sao Martinho do Bispo 3040-086 Coimbra PORTUGAL
<b>Registration Date</b>	February 15, 2011

**Source:** USPTO





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Carvalho (2007), *Inovação e I&D na Indústria Farmacêutica Portuguesa: Caso Bial*, Tese de Mestrado, Faculdade de Economia da Universidade do Porto.

Meyer-Thurow, Georg (1982), "The industrialization of invention: A case study from the German chemical industry", *Isis*, Vol. 73, No. 3, pp. 363-81.

Wimmer, Wolfgang (1998), "Innovation in the German pharmaceutical industry, 1880 to 1920", E. Homburg et al. (ed.), *The chemical Industry in Europe, 1850-1914: Industrial Growth, Pollution and Professionalization*, Kluwer academic Publishers, pp. 281-91. <http://bit.ly/1PWgP7z>

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Case Study

# Bluepharma



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**Bluepharma:**  
Re-starting-up  
an approach to  
innovative business  
development

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ISBN 978-989-95583-7-3



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Case Study

# Bosch Termo- tecnologia

Keeping the innovation  
track record

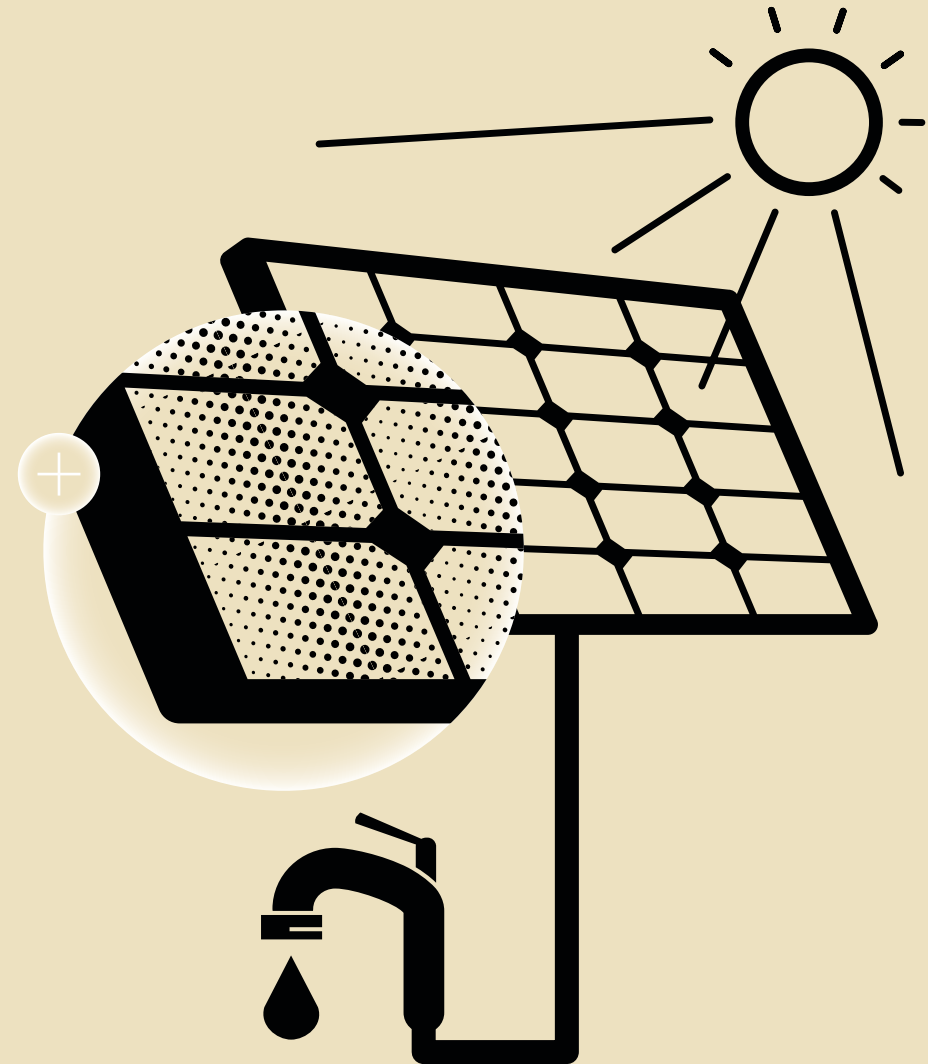
Vitor Corado Simões

Maria João Santos

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# Bosch Termo- tecnologia



ISBN 978-989-95583-9-7

## Bosch Termotecnologia: Keeping the innovation track record

### Abstract

This case is about *Bosch Termotecnologia's* process of capability accumulation and innovative performance. Located in Portugal, *Bosch Termotecnologia* is the domestic water heaters Centre of Competence of the German *Robert Bosch* Group, reporting to the Thermotechnology Division. It develops, manufactures and sells water heaters in more than 50 countries around the globe, with a turnover above 200 million Euros, and employs around one thousand people.

An historical retrospect of *Bosch Termotecnologia's* evolution is provided, including some landmarks in terms of product development. The company was created in late 1970s as a licensee of the *Junkers* division of *Robert Bosch*, and was able to launch technological, marketing and organizational learning processes to become, after the takeover by the German group, the main water heaters manufacturing unit and later the Centre of Competence for this business. The development of R&D capabilities played a key role in such process.

Then, the case delves into the main product development tools used by *Bosch Termotecnologia*, namely the 'Time to Market' project diagram and the 'User Experience' concept. These are illustrated with an important product development project: the Compact Advanced Electronics (CAE) Project. This was aimed at developing a new thermostatic water heater without recourse to electricity as additional technology source. The case discusses the main challenges and trade-offs faced in the product development process.

The case concludes with the challenges faced by *Bosch Termotecnologia* to keep its innovation track record with a view to foster company growth as well as to enhance its relevance in the context of the *Robert Bosch Group's* Thermotechnology Division.

### Keywords

Bosch Termotecnologia; Water heaters; Innovation Capabilities; Subsidiary initiatives; Centre of Competence; New Product Development; Subsidiary development challenges.

### Acknowledgments

This case was written by Vítor Corado Simões and Maria João Santos, of ISEG – Lisboa School of Economics and Management, Universidade de Lisboa, for COTEC Portugal, between May and June 2015.

Personal interviews were held at *Bosch Termotecnologia S.A.* with the following executives (by alphabetical order): Evandro Amorim (International Product Manager, International Product Management Department), Marco Marques (Director, Product Engineering Gas Appliances), Pedro Cardoso (Director, Quality Management), Sérgio Salústio (Vice-President, Engineering), Tiago Bandeira (International Product Manager, International Product Management Department), and Vítor Correia (HR Development and Recruitment Department). Face-to-face interviews were held on June 2015. Selected quotes from those interviews are transcribed in the case. The interviews were held in Portuguese with the quotes translated into English by the authors. To avoid overloading the reader with very specific information, no reference is provided regarding such quotes.

In contrast, for other quotes, the relevant sources are explicitly acknowledged.

The authors would thank all the *Bosch Termotecnologia S.A.* executives mentioned above for the information and the support provided. They proved essential to improving the quality of the final product.

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

# Bosch Termotecnologia



## Introduction

Aveiro, June 8th, 2012. Sérgio Salústio is proud of the **Bosch** Group tradition, a German combination of technical prowess, organisation and innovativeness. And he is also proud of the way how such tradition has been melded with the creativeness and the talent of Portuguese engineers and with the Japanese philosophy of continuous improvement. As Vice-President for Engineering at **Bosch Termotecnologia SA**, the domestic water heaters Centre of Competence of the **Bosch** Group, one of his main roles is to spur innovation. His office door clearly shows his *leitmotif*: innovation is there, in many languages, from Cyrillic to Chinese. **Bosch Termotecnologia SA** develops, manufactures and sells water heaters in more than 50 countries around the globe, with a turnover above 200 million Euros, and employs around one thousand people.

Looking at the different signs for conveying the word ‘innovation’, he recalls the 35 years of the company’s history. This successful history, started out in 1977 as the licensee of **Robert**

**Bosch GmbH** and went on to become the **Bosch** Group’s global Centre of Competence in the field of domestic water heating appliances. A unit is only labelled as a Centre of Competence when it has specific capabilities in a given field, and provides services to other units within its specific regard; some Centres of Competence, as is the case of **Bosch Termotecnologia SA**, have global product mandates for a given product scope.

Sérgio Salústio recalls several product development projects carried out by **Bosch Termotecnologia SA**, from the advent of appliances with electronic ignition mechanisms, the launch of compact water heaters, the CAE (Compact Advanced Electronics), which has won the prestigious **Produto Inovação COTEC Portugal**<sup>1</sup> prize, and the heat pump to the most recent, still underway: the fan pressurized (FP) water heater.

<sup>1</sup> The **Produto Inovação COTEC Portugal** is an award granted by COTEC Portugal, a private not-for-profit association aimed at promoting innovation, whose members include the largest companies in Portugal as well as innovative SMEs. The award is assigned to a product innovation, developed by a company located in Portugal, considered the most relevant in a given year.

EXHIBIT 1  
Sérgio Salústio’s Office Door



As he looks through the window, Sérgio Salústio recalls the title of a book by the Portuguese writer José Cardoso Pires (**E Agora, José?**), and turns the question to himself: **And Now, Sérgio?** Which new project to launch? Which new challenges to tackle? To justify its assignment as

Centre of Competence, **Bosch Termotecnologia S.A.** has to keep up a continuous and sustained innovation track record.

# Bosch Termotecnologia



## The global water heater industry: Trends and players

*Bosch Termotecnologia SA* leads the European water heaters market, and is ranked third globally in this sector. However, the world market is very far from homogeneous. Different national approaches to domestic water heating still prevail. For instance, in the United States, the use of water tanks is widespread, while in Continental Europe water heaters are the most common solution. In Japan, the market is dominated by local firms with some focused only on the domestic market. Growth prospects are mainly concentrated in emerging countries, particularly in China, Russia, Turkey and Brazil, with India still lagging behind<sup>2</sup>. The main features of the world water heating markets are provided in Annex I.

Energy sources wise, global water heater appliances can be broadly classified into seven categories: compressed natural gas (CNG) based water heaters; liquefied petroleum gas (LPG) based water heaters; propane base water heaters; electric water heaters; solar energy based water heaters; hybrid water heaters; and others. New energy sources are emerging. However, they still remain marginal due to cost/benefit considerations at the present level of technological sophistication and market breadth.

With regard to the technology, three main segments emerge: demand or tank-less water heaters; storage or tank water heaters; and heat pump water heaters. The increasing demand for tank-less water heaters is providing new growth opportunities for global water heater markets. In tank-less water heaters, water flows through a circulated large coil which is heated either by electricity or gas. Tank-less water heaters are more energy efficient compared to traditional tank based water heaters. The more sophisticated appliances also return better environmental sustainability,

and more accurate temperature control. However these features are not generalized. A definition of water heater energy consumption levels, similar to what already happens for domestic electrical appliances (refrigerators, for instance) is still under discussion and will furthermore take a few years to be implemented.

The main competitors of *Bosch Termotecnologia S.A.* include companies such as *A.O. Smith Corp.*, *Rheem Manufacturing Co.*, *General Electric Co.*, *Siemens AG.*, *Ariston Thermo SPA.*, *Bajaj Electricals Ltd.*, *Bradford White Corp.*, *Crompton Greaves Ltd.*, *Haier Water Heater Co. Ltd.*, *Heat Transfer Products Inc.*, *Noritz Corp.*, and *Rinnai Corp.* It is important to bear in mind, however, that most of these companies are specialized energy, technology or market-wise. For instance, *Rinnai Corp.*, which is one of the leaders in the Japanese market, is exclusively focused on the domestic market, after divesting from a joint venture with *Bosch* in China.

## **Bosch Termotecnologia SA:** From licensee to centre of competence

***The early years:***  
*from the licensing agreement to Bosch acquisition*

*Bosch Termotecnologia S.A.* is an outstanding example of a continued and consistent process of capability upgrading and development. In less than 30 years, the company has been able to change from a small licensee of the *Junkers Division of Robert Bosch GmbH* to the water boilers Centre of Competence of the *Bosch* Group at global level. According Mr. Mário Pais de Sousa, a former company CEO, and the driving force behind its early history, *Bosch Termotecnologia S.A.* development has been able to follow “A course, which includes as steps of its main itinerary, the absorption of licensor’s know-how, the assimilation and development of in-house capabilities in the

2 · See Persistence market Research, Water Heater Market - Global Industry Analysis and Forecast to 2020, December 2014, <https://www.linkedin.com/pulse/water-heater-market-global-industry-analysis-forecast-glen-hare> accessed June 8th, 2015.

# Bosch Termo- tecnologia



*manufacturing, marketing and management fields, the setting up of an R&D department and the carrying out of a globalization strategy of the domestic water heaters business”<sup>3</sup>*

The firm was established in 1977 as *Vulcano – Luso Ibérica de Termo-Domésticos, Lda.*, with the aim of manufacturing and marketing, especially in the Portuguese market, domestic gas water heaters. Portugal’s economic environment at the time was characterized by heavy import tariffs, which might reach from 20 to 30% *ad valorem*, thereby promoting import substitution strategies by companies. To profit from this context, a licensing agreement was established with *Junkers*, involving the communication of know-how and the provision of technical assistance to assemble and manufacture water heaters under the *Junkers* brand.

As in many licensees in the metalworking and machinery industry, *Vulcano* started out as an assembler of components imported from the licensor.

Mr. Klaus Domes, at the time Head of the *Bosch* Licensing Department, recalls how the agreement emerged. *Junkers* wanted to expand the market in Southern Europe, since Northern Europe was becoming mature. He presented a lively account of the dating process leading to the license:

*“[The Junkers division] had started to look for a partner to manufacture the products in Portugal. We wanted to have a strong position in the Portuguese market. We had identified some potential licensee candidates, but the opportunities found were not 100% satisfactory. Finally, we were approached by a gentleman who was on the board of a Portuguese manufacturing company, and who wanted to set up a new company and to launch his own business. He had marketing know-how, and his partner had an already established business and owned a piece of land where the plant might be set up. They wanted to launch a new business and [they were aware that] they had to invest a lot [for the business to*

*become successful]”<sup>4</sup>*

The account of Mr. Mário Pais de Sousa, member of the *Vulcano* founding team, was slightly different. A stronger emphasis was put on *Vulcano*’s initiative in approaching *Junkers*. He recognized, however, that *“the licensor already had a portfolio of information about other Portuguese and Spanish firms with stronger economic potential”* than *Vulcano* exhibited at the time. Be as it may, *Vulcano* was the final choice of *Junkers*. Personal chemistry and trust in *Vulcano*’s commitment played a part in the initial licensing decision.

Up to 1979, *Vulcano* sourced all the components needed to build water heaters from *Junkers*; the final product assembly and testing were carried out at a very small unit. Besides supplying components, *Junkers* also provided technological assistance, training, process improvement and surveillance of quality standards. In 1979, a new plant was built, providing

the appropriate conditions for starting a process of gradually increasing locally produced components. Again, *Junkers*’ direct and indirect support was important. An example of the latter concerns the disclosure of information about international suppliers able to solve *Vulcano*’s process difficulties.

*Vulcano* had, since the signing of the licensing agreement, a focus on assimilating the licensor’s know-how as well as on developing capabilities in the fields of management, manufacturing and marketing; this is expressed, for instance, in the recruitment of a couple of engineers fluent in German. *Vulcano*’s management philosophy also played an important role, as Sérgio Salústio underlines: *“the adoption, by Mr. Pais de Sousa [...], of a rigorous management style, based on management and quality indicators, has ensured a good economic performance and led to the strengthening of the relationships between the Portuguese and the German firms”*.

3 · Mário Pais de Sousa, ‘O processo de internacionalização da Vulcano’, *Economia & Prospectiva*, Vol. 1 no. 2, 1997, pg. 105.

4 · Personal Interview with Mr. Klaus Domes, at Bosch Licensing Division, Stuttgart (June 1991), by Vítor Corado Simões.



# Bosch Termotecnologia



Mr. Mário Pais de Sousa made a visit to Japan, where he became more aware of the advantages of applying a *Toyota*-style management to the water heaters assembling process. He was very successful in transplanting it to *Vulcano*, including the concepts of continuous improvement, *kaizen*, and lean production. Market growth was leveraged by the 1983 launching of the *Vulcano* brand in the Portuguese market<sup>5</sup>; at the same time, *Vulcano* started to supply water heaters to *Junkers*<sup>6</sup>. By the early 1980's, a small design and engineering unit was set up by *Vulcano*. With hindsight, Sérgio Salústio perceives that Mr. Pais de Sousa was “*a golden partner*” for *Bosch*.

In 1986, the 10-year licensing agreement was about to expire, and Portugal had just entered the European Economic Community. Looking at the future of its business, the Portuguese firm identified three options: to stand alone, following its own way; to renew the licensing agreement;

5 · Even today, *Vulcano* gains the highest awareness among water heater brands in Portugal.

6 · Mário Pais de Sousa, ‘O processo de internacionalização da *Vulcano*’, *Economia & Prospectiva*, Vol. 1 no. 2, 1997, pg. 106.

or to strengthen the relationship with the *Bosch* Group, enticing the latter to acquire an equity stake in *Vulcano*<sup>7</sup>. The third option was chosen. Portuguese managers thought that to respond to the challenges raised by European integration, namely the entry of competitors such as *Vaillant*<sup>8</sup>, a partnership with the *Bosch* Group was the best solution<sup>9</sup>. For *Bosch*, investment in *Vulcano* also made sense: there was a very positive track record of collaboration, and Portugal provided production cost advantages. Negotiations began and resulted in the creation of a new firm, named *Vulcano Termodomésticos*, in which *Robert Bosch GmbH* held a majority stake and in 1990 *Vulcano* became a wholly-owned subsidiary of *Bosch*. In retrospect, Mr. Pais de Sousa stated that “*without such a*

7 · Personal interview with Mr. Mário Pais de Sousa by Vítor Corado Simões (Aveiro, May 1991).

8 · The French firm *Vaillant* was second-ranked in the Portuguese market, based on export entry mode.

9 · Vítor Corado Simões and Pedro P. Nevado, *MNE Centres of Excellence and Acquisitions: Long Evolutionary Paths or Capturing Opportunities*, Paper delivered at MESIAS Seminar, Madrid, 2001.

*relationship, [today] there would be no company left in Portugal: it would have disappeared in the strong move towards concentration which took place in the industry*”<sup>10</sup>.

## Forging ahead: becoming the Domestic Water Heating Worldwide Centre of Competence of the Bosch Group

The origins of the *Bosch* Group date back to 1896 when Robert *Bosch* (1861-1942) set up a “workshop for precision mechanics and electrical engineering”. When it took control of *Vulcano*'s equity, the *Bosch* Group had just completed its first century in business. Such longevity<sup>11</sup> seems to be based on three main inter-related features. The first derives from *Bosch*'s culture of systematic innovation, encompassing significant R&D investments (around 8.1 per

10 · Personal interview with Mr. Mário Pais de Sousa by Vítor Corado Simões (Aveiro, May 1991).

11 · For a general analysis of the main reasons leading to company longevity, see Arie De Geus, *The Living Company: Growth, Learning and Longevity in Business*, London, Nicholas Brealey, 1997

cent of sales revenue in 2010), focused on developing innovative solutions to improve people's life (“*Invented for life*”<sup>12</sup>). In *Bosch*'s jargon, innovation has to meet four tests: (1) novelty; (2) uniqueness; (3) delivering new or improved tangible benefits to the customer; and (4) to be successfully established in the market<sup>13</sup>. The second has to do with the establishment of a global development, manufacturing and distribution network. The third concerns its governance model: 92 per cent of equity is held by *Robert Bosch Stiftung*. *Bosch*'s shareholding structure ensures the autonomy of the *Bosch* group, enabling long term planning, and the allocation of significant investments aimed at fostering future performance<sup>14</sup>.

By 1992, *Vulcano* became the European water heater market leader, with a share of

12 · Taken from *Bosch* logo.

13 · Presentation by Evandro Amorim (Bosch Termotecnologia) at the Workshop on ‘Open innovation, creativity and knowledge networks’, ISEG, July 2012.

14 · Taken from [http://www.bosch.pt/pt/newsroom\\_11/news\\_10/news-detail-pa-ge\\_53504.php](http://www.bosch.pt/pt/newsroom_11/news_10/news-detail-pa-ge_53504.php) accessed on May 30<sup>th</sup> 2015.

## Case Study

# Bosch Termotecnologia



20% as against 6% in 1988<sup>15</sup>. This achievement was based on a “sophisticated cost-based strategy”<sup>16</sup>. *Vulcano* has been able to change a labour-based cost advantage into an organizationally-driven cost advantage through the implementation of a lean production approach. Operational efficiency increased significantly, while management processes were improved, including performance measurement indicators. These initiatives led to a significant improvement in quality levels and key performance indicators. Recognising *Vulcano*’s behaviour and performance and taking into account the lower costs in Portugal, *Bosch* headquarters took the decision to close the water heater plant in Wernau (Germany) and concentrate the manufacturing of this product type in Aveiro.

15 · Mário Pais de Sousa, ‘O processo de internacionalização da Vulcano’, *Economia & Prospectiva*, Vol. 1 no. 2, 1997.

16 · Monitor Company (Michael Porter and associates), *Construir as Vantagens Competitivas de Portugal*, commissioned by the Ministry for Industry of Portugal, Forum para a Competitividade, Lisbon, 1994, pp. 79.

It was felt that increased manufacturing responsibilities, stemming from operational performance, had to be followed by improvements in product engineering capabilities. In fact, the closure of the German plant implied that responsibility for domestic water heating research and development activities was assigned to the Portuguese subsidiary. The director of water heater development was transferred to Aveiro; simultaneously, some ten development engineers came from Germany. The former product engineering unit was transformed, by 1993, into a Research and Development Centre (hereinafter, R&D Centre; an image is provided in Exhibit 2). This entailed a significant change in *Vulcano*’s responsibilities: from operational excellence toward a combination of operational excellence and state-of-the-art product development capabilities.

In 1994, *Vulcano* launched *Click!*, the first ‘smart’ water heater, with battery-powered electronic ignition. This became a landmark for the company, corresponding to the ‘acid test’ of the R&D Centre’s innovative capabilities. In 1996, a

## EXHIBIT 2 The R&D Centre Building



new, challenging project starts: RÁCIO 96. The goal was to reduce the cost of the water heater by 10%! Sérgio Salústio remembered: “*how to design a water heater with the same functions and performance, but with costs 10% lower?*”. As explained below, the challenge was met: by the turn of the century, a new product (labelled *Compact*) was launched as a result of this initiative.

By 1997, the R&D Centre had a staff of 16 people, of which 60% were engineers, mostly with a specialization in mechanical engineering with the German

expatriates gradually replaced by Portuguese engineers. The main challenges faced by the new department included not just the development of new products with increased performance standards and lower cost but also the adaptation of existing appliances to the new utilisation conditions, specifically installation regulatory requirements and changes in the gas supply. In this context, the introduction of natural gas to the Iberian Peninsula led to a significant increase in demand for water heaters: production output changed from two or three hundred thousand per year to

# Bosch Termotecnologia



about one million, mostly sold in the Iberian Peninsula and Southern Europe. Meanwhile, *Vulcano* has become the *Bosch* group spearhead to approach non-European markets in which the prospects for water heater demand were significantly higher than in Europe. It correspondingly established licensing agreements in North Africa (Morocco and Tunisia), in Turkey, Chile and Brazil<sup>17</sup>.

*Vulcano* was involved in the process of establishing a joint venture between the *Bosch* Group and local partners in Guangdong (Shenzu), responsible for the technical and economic analysis of the local partner as well as for all the product and process strategy<sup>18</sup>. This led to the transfer, in 1996, of a permanent team of three members of *Vulcano's* technical staff, then led by João Paulo Oliveira (*Bosch Termotecnologia* CEO<sup>19</sup>), to China. These

17 · Mário Pais de Sousa, 'O processo de internacionalização da Vulcano', *Economia & Prospectiva*, Vol. 1 no. 2, 1997.

18 · Mário Pais de Sousa, 'O processo de internacionalização da Vulcano', *Economia & Prospectiva*, Vol. 1 no. 2, 1997.

19 · Please remind that the case refers to June 2012.

developments further strengthened the influence of the Portuguese subsidiary in *Bosch's* Thermotechnology Division, and its recognition at the *Bosch* group level. However, the first years in China did not prove successful. As João Paulo Oliveira recognized, the products launched by *Bosch* in the Chinese market were over-engineered, with quality and security patterns which were "*not valued in the Chinese market*". Only when the strategy was changed, and *Bosch* started "*to manufacture in China products [similar to those] of the South America and North Africa markets*"<sup>20</sup> did the situation begin to be redressed.

At the same time, *Vulcano* was facing another challenge: to replace a Germany-based supply chain with a global one. This was a daunting task, taking into account the need for strict quality standards and the just-in-time, lean production system existing in the company. *Vulcano* established R&D cooperation in conjunction with international partners from Taiwan to the Netherlands. One relevant feature

20 · Quotes from *Diário de Notícias*, 'Vulcano chegou cedo de mais à China', May 18th, 2007.

was the setting up of R&D and technical cooperation linkages with academic organisations, such as Lisbon's Instituto Superior Técnico (IST) and Oporto's Instituto de Ciência e Inovação em Engenharia Mecânica e Engenharia Industrial (INEGI). The company acknowledges the role played by financial incentives under PEDIP I and PEDIP II<sup>21</sup> in this regard. Sérgio Salústio

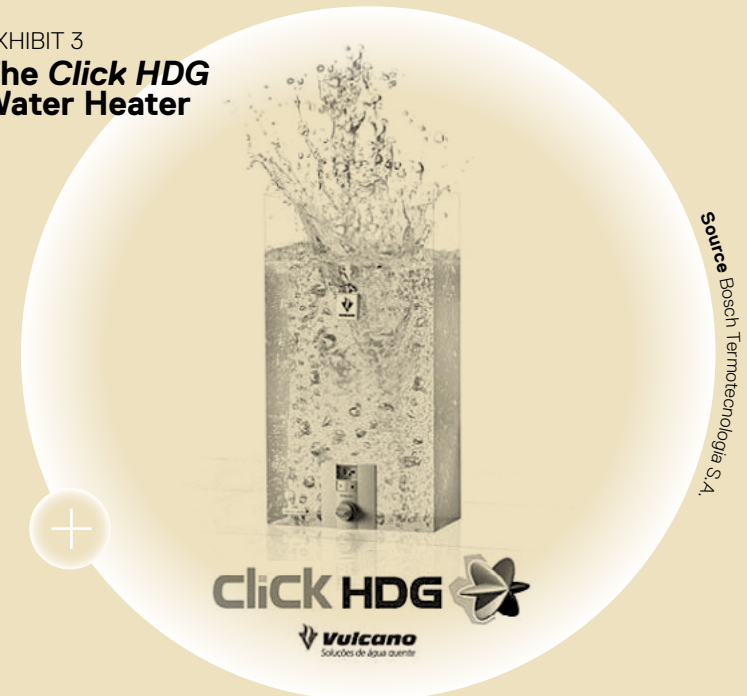
21 · PEDIP stands for Programa Específico de Desenvolvimento da Indústria Portuguesa (Specific Programme for the Development of Portuguese Industry). PEDIP I ran from 1988 to 1993 and PEDIP II, between 1994 and 1999.

remarked that this kind of public policy had a very positive effect, since "*it contributed to increasing Vulcano's awareness about the capabilities of local partners, thereby strengthening the connections with them*".

In 2001, *Vulcano* launched a new generation of compact water heaters enabling a 27% reduction in appliance size. Furthermore, in this same year, a new project was launched: the HDG. This incorporated an invention developed by the Portuguese

## EXHIBIT 3

### The Click HDG Water Heater





# Bosch Termotecnologia



Centre of Excellence, and globally patented by the *Bosch* Group: the smallest hydrogenerator in the world. The result has since been the launch of *Click HDG* (see Exhibit 3), which was awarded the international industrial design ‘IF’ design award.

As a result of this process of capability building, the *Bosch* Group assigned to *Vulcano*, in 2004, the status of Group Domestic Water Heating Worldwide Centre of Competence. *Vulcano* became responsible for coordinating the worldwide water heater design and development as well as for manufacture and commercialization. Although this corresponded to a de facto situation, it entailed the recognition of *Vulcano*’s merits and became paramount in enhancing the subsidiary’s influence in the Thermotechnology Division. According to Sérgio Salústio, *“the founding of the Centre of Competence did not stem from the need to create something new, but rather amounted to the recognition of an existing capacity”*.

## **Centre of Competence: Old and new challenges**

The assignment of the Centre of Competence statute had two main consequences. First, it contributed to leverage *Vulcano*’s relative position in the *Bosch* network. Second, it strengthened the company’s R&D commitment: *“since then, R&D started to be a systematic and organised routine”* (Sérgio Salústio). This commitment has been expressed in a stream of new product launches: the CAE (Compact Advanced Electronics), involving an electronic modulation of gas consumption, and entailing significant improvements in comfort and security, in 2008; the heat pump for sanitary waters, in 2011, followed by an improved version with outside air supply, in 2012; and the FP water heater platform, in which a fan pressures on the air in order to improve the combustion quality (hence, the FP: fan pressurized), thereby saving gas, whose market launch is expected for 2013.

On January 1st, 2008, the name of the Portuguese subsidiary was changed from *Vulcano Termodomésticos S.A.* to *Bosch Termotecnologia S.A.* to show a

clear identification with the *Bosch* Group. In January 2009, *Bosch* Termotecnologia was assigned the worldwide responsibility for the group’s sanitary hot water product line, reflecting the subsidiary’s performance and competence in the field.

Gradually, the R&D Centre underwent a silent change. Originally, most staff corresponded to mechanical engineers. In fact, water heaters were traditionally based on a mechanic-hydraulic platform and hence the dominance of the mechanical engineering field. However, with the gradual introduction of electronic components and devices to that platform, mechanical engineering knowledge alone was no longer sufficient to respond to new demand and competitive challenges. Therefore, the company has increased its recruitment of electronics engineers.

Looking backwards, Sérgio Salústio was very satisfied with the path followed by *Bosch* Termotecnologia S.A. as well as with its ability to change the knowledge base and the

perception of the water heater business. He recalls:

*“We underwent a significant transformation (...). We have carried out this transformation through people and organic growth. This is one of the greatest achievements of our organisation and I am comfortable because I feel that we are prepared to do that what we think best, defending new projects but without putting into jeopardy our mission and values. (...) We had the opportunity to set about organic change”*.

This has been undertaken through a process in which the skill content of R&D staff has changed, with electronic engineering gaining ground with regard to mechanical engineering. Following this line of reasoning, he imagines a future in which Portuguese engineering talent might be made available, at a competitive cost, to other subsidiaries in the Thermotechnology Division. Might this be an opportunity for *Bosch Termotecnologia S.A.*? Would it make sense to further expand the R&D Centre to respond to future challenges?

# Bosch Termotecnologia

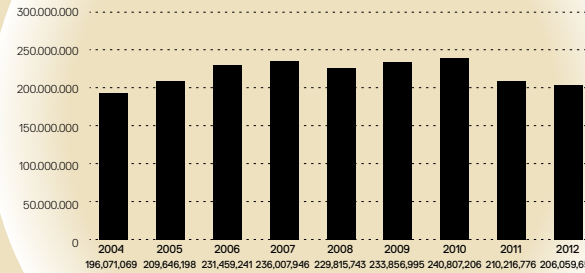


## Bosch Termotecnologia S.A. in 2012

The outcome of the process portrayed above is a healthy company, employing around one thousand people (964 in December 2012), including around 65 in the R&D Centre. The company's turnover for 2012 was Euro 206 million, of which 80% was exported. Turnover declined with regard to the previous year, especially due to the contraction of Southern European (Portugal, Spain and Italy) markets. Profits reached Euro 16 million in 2012, which corresponds to a profit to turnover share of 7.6 per cent<sup>22</sup> R&D expenditures in 2012 amounted to Euro 1.6 million, below the 1.9 million recorded for 2011. The ratio of R&D expenditures to turnover corresponded to 0.77 per cent (2012 figures). More specific information on the evolution of *Bosch Termotecnologia S.A.* turnover and employment as well as the R&D Centre employment is provided in Exhibits 4, 5 and 6. The balance sheets and profit and loss accounts for the fiscal years 2011 and 2012 are provided in Annex II.

EXHIBIT 4

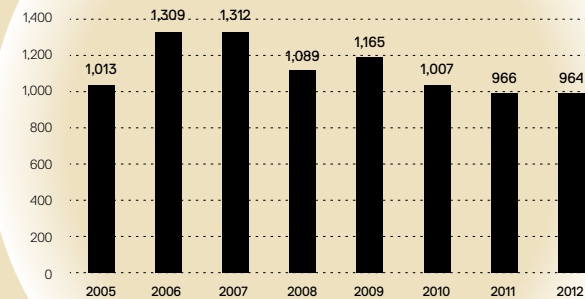
### Bosch Termotecnologia S.A. Evolution of Turnover (2004-2012)



Source Bosch Termotecnologia S.A.

EXHIBIT 5

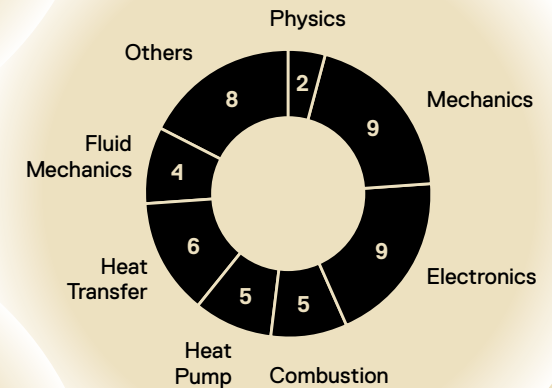
### Bosch Termotecnologia S.A. Evolution of Employment (2004-2012)



Source Bosch Termotecnologia S.A.

EXHIBIT 6

### R&D Centre Employment by Academic Field (2013)



Source Bosch Termotecnologia S.A.  
 Presentation by Marco Marques at the University of Aveiro, 2014

Inovação em Água Quente + Sustentável

# Bosch Termotecnologia



## Product development at *Bosch Termotecnologia*: the key tools

*Bosch Termotecnologia* adopts, in line with the *Bosch* group guidelines, an integrated perspective to New Product Development (NPD) and market launch. This might be envisaged as an NPD ‘blueprint’, and includes three main tools: the Innovation Process, which is mainly related to idea management; the User Experience approach, intended to identify new (or improved) product ideas from user observation and other feed-back; and the Time To Market (‘TTM’), which goes from product development to market launch. The following pages provide a brief explanation about these three tools.

It was shown above how operational efficiency has been a key factor in the *Bosch* Group assigning its Portuguese subsidiary with increased responsibilities. Nevertheless nowadays the challenge is not just operational performance. *Bosch Termotecnologia*’s prospects of maintaining and enhancing

its status in the *Bosch* group’s internal network are dependent on its technology development capabilities, and especially on its NPD performance. Systematic technology development and efficient NPD are at the heart of *Bosch* group international competitiveness. Not surprising, therefore, NPD represents a central competence in *Bosch Termotecnologia*.

### Innovation Process: From Technology Strategy to New Product Development through Idea Management

As mentioned above, the so-called Innovation Process focuses mainly on the emergence and management of new product ideas. It has also a role of ensuring compatibility and alignment between corporate orientations and subsidiary implementation. Its headlines are depicted in Exhibit 7 and developed in Box 1 below.

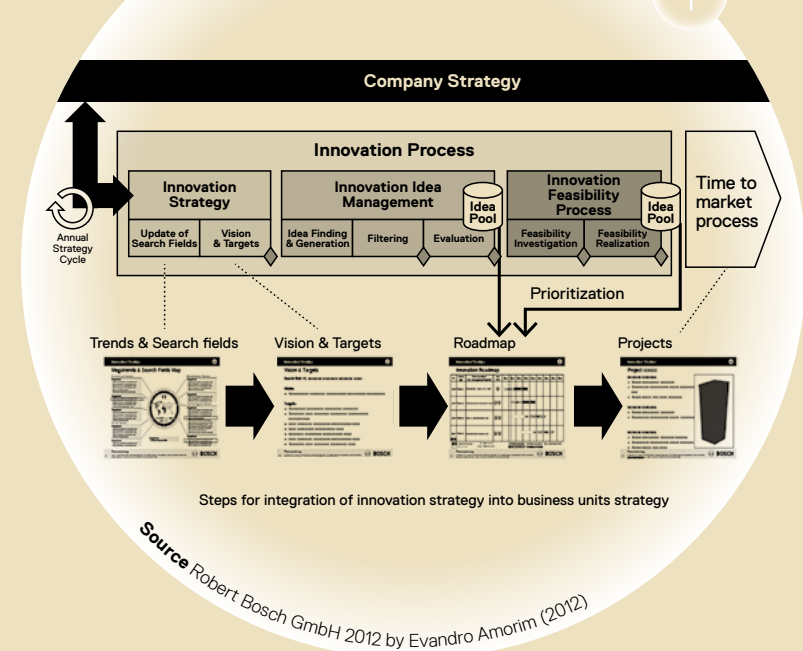
The innovation process should be consistent with the overall strategy orientations established at group level. These include nurturing technology with a view to “invent for life”: “At

*Bosch*, the main drivers of innovation are resourceful and highly committed engineers, a high-performance yet efficient research organisation, and a historical background that is both an inspiration and an obligation, driving us on to further outstanding achievements” . Headquarters also set up targets on turnover growth and profitability. Provided that it meets such strategic orientations, each Centre of Competence

enjoys, under the purview of its mission, autonomy to define its own development strategy. Such autonomy goes together with a process of systematic reporting of activities. Each year, *Bosch Termotecnologia*’s management team has two meetings with the Thermotechnology Division management to assess and review prospective orientations, roadmaps, technology development projects, investment plans and business plans.

EXHIBIT 7

### *Bosch Termotecnologia*’s Innovation Funnel



# Bosch Termo- tecnologia



Such a process is envisaged as a “funnel” going through a stage-gate approach. As explained in Box 1, the process starts out on the basis of the megatrends assessment carried out at the *Bosch* group level. The *Bosch Termotecnologia* innovation process draws from general group guidelines and is aligned with the overall *Bosch* group innovation strategy. As mentioned above, idea management, including the generation of new product ideas, their selection and prioritization, may be envisaged as the main focus of the Innovation Process. In connection with the Innovation Process, it is important to remark that being granted patents hold a particular relevance to the company. They feature on the balanced scorecard and are also considered in the employee performance evaluation system. *Bosch* patenting policy is centralised. Patent applications are managed at company headquarters: they are initially undertaken in Germany. Their international application scope (EPO, USPTO...) depends on the analysis of patent relevance carried out at *Bosch* headquarters. Although the individuals who developed the invention are the patent owners, they assign the patent rights to *Bosch*.

## BOX 1.

### The Innovation Process at Bosch

For Bosch, the Innovation Process precedes the New Product Development activity (called Time To Market – TTM). It encompasses three phases (Innovation Strategy, Innovation Idea Management, and Innovation Feasibility Process), each of them including sub-phases, as shown in Exhibit 10.

The Innovation Strategy phase is based on the definition of the megatrends identified at the Bosch group level. Subsequently, following a ‘cascading’ logic, each business, division and centre of competence identifies those trends which are more likely to have the highest relevance for, and impact on, its respective area of activity. This enables the identification of research fields and priority fields of action with a view to ensuring the future sustainability of the business. This analysis leads to the establishment of both the vision and the targets, which may concern financial and innovation targets.

The second phase (Innovation Idea Management) integrates the whole process of ideas and concepts generation. Internal and external sources may be mobilized. Regarding the former, an important role is played by the internal suggestions system that rewards the best ideas from employees and with workshops designed to solve problems. Earlier product development processes are another source of ideas for introducing new features on the appliances. In the case of external sources, the process draws on market studies and web tools for the gathering of ideas whether from suppliers or clients, and the analysis of user experience (this is detailed later in the case). The partnerships established with universities and companies for pre-development also take on significance given their role in contributing towards the generation of more mature ideas.

The ideas are then the object of sorting, aggregated and classified in accordance with their themes and maturity levels. Subsequently, they are subject to an evaluation taking into account various criteria including time, level of innovation, complexity and, fundamentally, their capacity to be adapted to meeting market needs. This generates an Idea Pool which is then complemented and checked against the Technology Roadmap and the knowledge about user experiences.

The result of this process leads to the third phase, the Innovation Feasibility Process. Ideas are subject to a more thorough evaluation, focused on their feasibility. As a result of this feasibility assessment, ideas are prioritized taking also into account the Technology Roadmap. The outcome of this phase is the identification of NPD Projects.

**Source:** Bosch Termotecnologia S.A., presentation by Evandro Amorim at the ISEG Conference “Open Innovation, Creativity and Knowledge Innovation” (3 July 2012).



## Case Study

# Bosch Termotecnologia



Most ideas come from internal sources and from the insights arising from the User Experience approach. But they may also have different origins, including technological solutions developed elsewhere in the Group. As Evandro Amorim, International Product Manager at *Bosch Termotecnologia S.A.*, mentioned<sup>23</sup>:

*“For example, we recently got a pressure sensor that is used in the automotive industry and that we switched over into our product to achieve a function for which we had not yet found a solution.”*

Just *“having innovative ideas is not enough”* as Evandro Amorim remarked. He added in a challenging mood: *“The idea cannot just be new and unique. The idea has to effectively generate added value for the client. Should the idea not return that added value, then that idea does not progress.”*<sup>24</sup>

User Experience was pointed out

23 · Evandro Amorim, presentation at the ISEG Conference “Open Innovation, creativity and Knowledge Innovation”(3 July 2012).

24 · Evandro Amorim, presentation at the ISEG Conference “Open Innovation, creativity and Knowledge Innovation”(3 July 2012).

above as an important source of new or improved product ideas. The User Experience analysis is a very important tool in *Bosch Termotecnologia*’s NPD.

### **User Experience: Listening to the Market**

The concept of User Experience (UX) was introduced more systematically in the *Bosch* Group after 2000 and has since become a central feature to its innovation process. As Volkmar Denner, *Bosch*’s CEO, underlined, *“in the future, we want to put the user on the center-stage, and get a better feeling for his wishes and needs”*<sup>25</sup>. UX is a tool intended to follow the “user’s route”, taking into account the life cycle of user contact with the product, from the collection of information before purchasing to after-sale maintenance and support services until the end of product’s life. Tiago Bandeira, International Product Manager at *Bosch Termotecnologia S.A.*, argued that *“it is not just a matter of interaction with the user”, but rather “to follow the whole process (...) to identify*

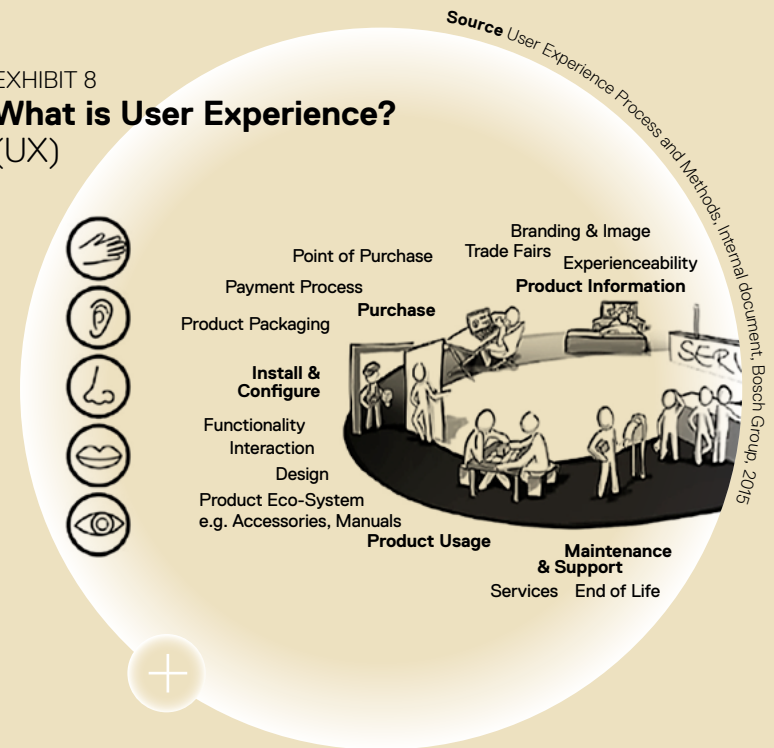
25 · Quoted from *User Experience Process and Methods*, Internal document, Bosch Group, 2015.

*stress points”*. Exhibit 8 depicts the headlines of the *Bosch* perspective on UX.

UX is based on two key principles. The first is an iterative consideration of the user, technology, and business (the market). The second interrelates with the “user-centered” approach espoused by *Bosch*. According to the company “human needs are mandatory starting point, process foundation and target topic” for NPD at

*Bosch*. Information is collected through interviews, direct observation, market research and assays. These may be take place at corporate or subsidiary levels, and may be carried out internally or commissioned to specialized service providers. Information is then analysed to identify critical aspects. UX may be envisaged as the driver for focusing innovation efforts and the NPD process and therefore translated into new products designs and key features.

### EXHIBIT 8 What is User Experience? (UX)



# Bosch Termo- tecnologia



The perception of user requirements is considered as the basis for developing products that “*excite and fascinate our customers*” (Volkmar Denner)<sup>26</sup>. User knowledge is complex, integrating three main perspectives. The first refers to an accurate understanding of user needs (for instance, efficiency, comfort, stability of water temperature, compatibility with renewable energy sources...). The second concerns the attention assigned to all users involved in the purchase decision chain. Technical people in charge of appliance installation are very important players in the chain since they have direct contact with the final customer and may have a strong influence over the purchasing decision. Marco Marques, Director of Product Engineering Gas Appliances, recalls how UX worked in the case of the fan pressurized model: **“Talking with installation people, we found that the adjustment of the appliance to fit installing conditions was an important concern for them, requiring a lot of time and effort. Based on such**

**user experience, we transformed an unspecified need into a product specification: the appliance should be designed so as to adjust to installing conditions”.**

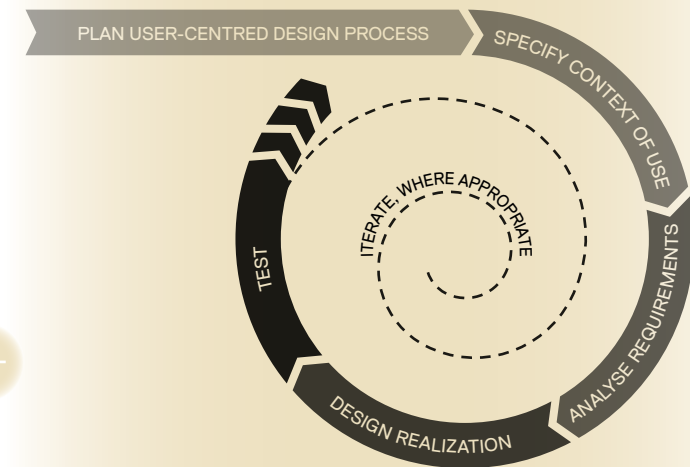
The third perspective is the definition of client profiles, taking into account not just the country or economic welfare, but also other factors (cultural or aesthetic) that may impinge upon the purchasing decision. The experience in China shows how solutions have to be adapted to local conditions and to user requirements and expectations.

UX information feeds and is factored into the NPD process. The translation of UX into NPD is summarized in Box 2. These actions become key elements for ensuring the effectiveness of specific NPD projects throughout what is called in the Bosch jargon, the TTM process.

BOX 2.

## From User Experience to New Product Development

The translation of User Experience (UX) into the New Product Development (NPD) process is envisaged as a spiral, which may involve, if needed, several iteration loops as a result of the user-centered design-test-redesign process. This is graphically illustrated below:



The basic process involves five steps: (1) Planning of the user-centered design process; (2) Specification of the context of use, involving additional interaction with key stakeholders (not just customers but also suppliers and installers, for example); (3) Analysing requirements, and their implications for product feasibility; (4) Design realization, transforming ideas into specific concepts, with a view to ensuring a fast translation of the requirements into prototypes; and (5) Testing the prototypes, including inter alia the observation on how users interact with the prototype, to derive inferences for changing technical specifications and further improvement rounds.

**Source:** User Experience Process and Methods, Internal document, Bosch Group, 2015 .

# Bosch Thermotecnologia



## The 'Time To Market' Process:

### New Product Development and Market Launch

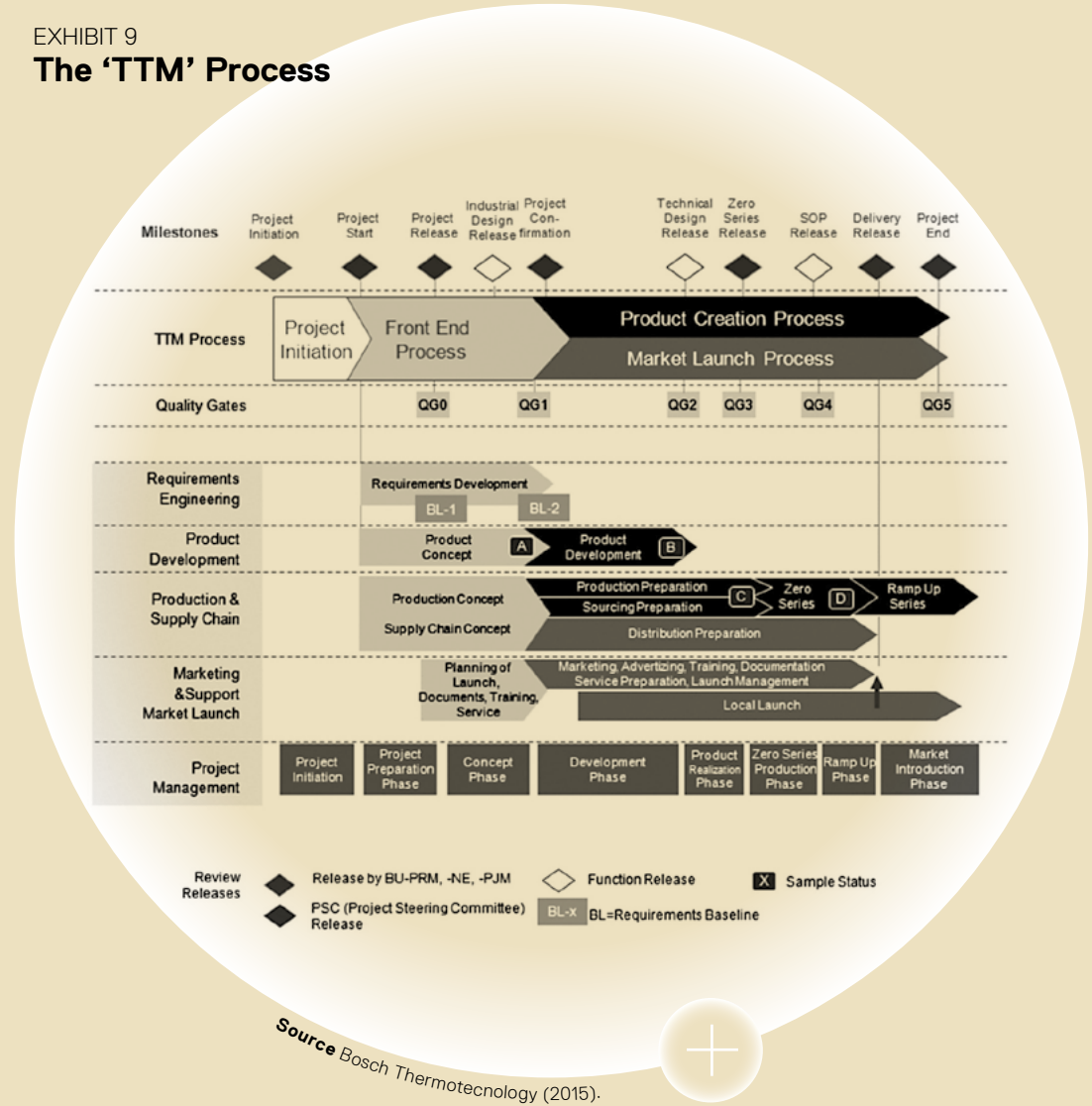
#### New Product Development and Market Launch

The UX is therefore integrated into NPD project applications. These need to get managerial clearance, including budget and time allocations, before being developed. The NPD development is based on a template established at the Bosch group level: the 'TTM' process. This may, however, be adapted, having in mind specific conditions and challenges.

The 'TTM' involves a stage gate approach, depicted in Exhibit 9. A more detailed description of 'TTM' is provided in Box 3 below.

'Time to market' is a stage gate routine process that provides the guidelines for NPD, clearly assigning responsibilities and defining the process flowchart. According to Pedro Cardoso, Quality Management Director and former project leader, this NPD template is *"appropriate"* and is a key tool for guiding the NPD. When the new idea generation (including UX) and the NPD processes are taken together, a logic of "disciplined innovation" clearly emerges. Another important facet of this process is the usage of NPD projects for learning at both the organizational and individual levels.

EXHIBIT 9  
The 'TTM' Process



Source Bosch Thermotecnologia (2015).

# Bosch Termotecnologia



BOX 3.

## The 'Time to Market' Process at Bosch Termotecnologia S.A.

As depicted in Exhibit 9, the TTM process includes eight stages and ten milestones, which correspond to decision gates. Both are briefly explained below:

**I. Project Initiation:** This is a preliminary phase, aimed at preparing the NPD project to be presented to *Bosch Termotecnologia S.A.* Management Board for approval. It encompasses the carrying out of a preliminary economic and financial assessment, an analysis of commercial feasibility, and an identification of target markets. Several issues are raised by the Board, in order to assess the soundness and relevance of the intended project. This phase ends with a Board decision (*Project Start*) regarding the budget allocated to the project as well as a time target for delivery of the new product.

**II. Project Preparation:** This phase involves the assignment of the project leader and the selection of the project team. A clarification of technical specifications and market requirements is carried out. Especially for more demanding projects, initiatives are taken to involve different players in the intended new product's value chain, namely the suppliers of key components, tools and specific equipment. The phase ends with a decision gate (*Project Release*).

**III. Concept Phase:** This is a very important phase, in which investments and the target product price are defined. The project team takes the formal responsibility for carrying it out in the target timetable. Key technical decisions may also be taken at this time. This phase includes on the definition and approval, in line with Bosch group guidelines, of industrial design concepts (*Industrial Design Confirmation*). The key criteria and features of industrial design are then established. This phase ends with the *Project Confirmation Decision*, taken by the project Steering Committee.

**IV. Development Phase:** This is specifically focused on product development. The purpose is to 'close' all the technical concepts, meeting the cost, security, user-friendliness and technological requirements established. A sample B of the final product is prototyped. Industrialisation requirements are also an important feature, demanding interaction with suppliers. Together with the Concept Phase, this is the most important phase of the NPD process. Product development ends with another decision gate, the *Technical Design Release*.

**V. Product Realisation Phase:** This is characterized by fieldwork, testing the sample B of the product in different conditions, with a view to solving emerging problems. This process leads to the developing and testing of sample C of the product. This phase also includes a further analysis of consumer patterns and behaviours, in line with UX guidelines. Another challenge of this phase is the appropriate and efficient working of the new production line at *Bosch Termotecnologia's* plant. To ensure appropriate industrialization, another Bosch tool is applied: the Bosch Production System (BPS). The NPD project has to work in close cooperation with Manufacturing Operations to ensure a smooth implementation of the BPS. This phase leads to another decision gate: the *Zero Series Release*.

**VI. Zero Series Production Phase:** After getting the Zero Series release, production starts on the basis of sample C. Upon confirmation that the product has no problems and the manufacturing process is ready, a decision is taken regarding the start of production, called *Start of Production (SOP) Release*. This decision is based on a report by the project leader regarding the status of the NPD process.

**VII. Ramp Up Phase:** The first units of the product are completed, and forwarded to the marketing and distribution department. If successful, the *Delivery Release* decision will follow. This paves the way for the market launch.

**VIII. Market Introduction Phase:** This phase starts with the Ramp Up series in the target markets. This phase usually extends for one and a half years. At this point there is the final gate, called *Project End*. This formally implies the dissolution of the project team, and the assignment of product responsibilities to the relevant functional departments.

**Source:** Bosch Termotecnologia S.A., 2015.



# Bosch Termo- tecnologia



## The CAE project: a landmark in company development

### ***The CAE Project***

The Compact Advanced Electronics (CAE) Project has been one of the most important NPD initiatives carried out by **Bosch Termotecnologia S.A.**. With a budget of about €10 million, it had significant direct and indirect implications for the company. The first was the launch of a new thermostatic water heater without recourse to electricity as additional technology source. The power comes exclusively from an HDG hydrogenerator, which has been developed in a way to enable total autonomy and to allow for the pre-selection of temperature. This innovation won the 2011 **Produto Inovação COTEC Portugal** award, and is now present in the international market under the trade name Sensor Plus (Exhibit 10). The main indirect implication, stemming also from the NPD concept adopted, was the setting up of the so-called CAE manufacturing platform.

The NPD process was carried

out in line with the Bosch template presented above, encompassing two main stages: market analysis and pre-development; and development and industrialization<sup>27</sup>. As stated by Pedro Cardoso, who was the CAE project leader, ***“I reached the conclusion that the methodology that we have at Bosch Thermotecnologia is a worldwide benchmark as regards project management. Throughout the life cycle, it ensures that the right questions get asked and the right tools are deployed to guarantee the project’s final success”***.

### ***Market Analysis and Pre-development***

Following the introduction of the first thermostatic water heaters, in 2003, **Bosch Termotecnologia S.A.** decided to deepen its knowledge about the users of this type of appliances, carrying out market research as well as research on technology trends, with a view to understanding

27 - This sections draws on the interviews carried out with several **Bosch Termotecnologia S.A.** executives, namely with Pedro Cardoso, as well as from the company's application to the Produto Inovação COTEC Portugal award, by Evandro Amorim and Laura Frias (April 2011).

consumer expectations. These initiatives, between 2003 and 2005, led to identify safety, economy and comfort as the key requirements to be met. Based on market forecasts, a preliminary assessment of financial feasibility was carried out, broadly confirming the scope of project opportunity.

Having passed the first hurdles, the focus turned towards the technical side. The new water heater should meet the following requirement: an electronic modulation of the water temperature at the level of Celsius degree without recourse to electrical power. Therefore, a pre-development phase was carried out between 2005 and 2007, focused on the analysis of alternative technological solutions. The outcome was a decision to develop from scratch a new electronic, instead of mechanical, system for controlling the gas stream, including a gas valve. This was a product innovation at the world level as nothing similar was available in the international market. The advantages of adopting a platform approach for the new product were also

identified at this stage.

Pedro Cardoso recalled how ***“we had the idea that if we were able to do the electronic modulation of the gas flow, we might be able to get to a higher level”***. But this would be no easy task. In his words, ***“The challenge that we set ourselves to achieve was not just big; it was really enormous. Doing this [selecting the temperature] without any electricity power supply (...). Technically, this meant that we had to design a 100 milliwatt system that would do all the gas control operations, supplying the valve, igniting the spark but with a tenth of the energy of that which was the state of the art at the time”***.

The ideas were mature enough to be transformed into a project application to be submitted to the Managing Board of **Bosch Termotecnologia, S.A.**, in line with the ‘TTM’ procedure.

## Case Study

# Bosch Termotecnologia



## Development and Industrialization

The project application was submitted to the Managing Board and approved on February 27th, 2007. It included not just the technical concept (see Box 4) but also a preliminary economic and financial feasibility study, an analysis of market feasibility, and the definition of the two initial priority markets: Portugal and Spain.

This project required a very high level of financial commitment by the company. Introducing a completely new and innovative concept into an already fairly optimised and standardised production process entailed significant changes in the testing systems, the setting up of new manufacturing lines, the development of new dedicated equipment and tools, and the recruitment of specialist technical staff or alternatively the engagement in partnerships for the design and the development of the gas valve.

At Project Start, it was decided to establish a multidisciplinary project team. The objective was to analyse the implications of

BOX 4.

### CAE Project: Product Requirements

- ▣ Non-electrical thermostatic water heater, with electronic modulation, powered by a water turbine;
- ▣ Direct ignition;
- ▣ No water valve: a stream sensor incorporated into the hydrogenerator;
- ▣ Digital interface; uploading system;
- ▣ Product capacity range: 11 l/min., 14 l/min. and 17 l/min.

**Source:** Bosch Termotecnologia S.A., Application to the Produto Inovação COTEC Portugal award, by Evandro Amorim and Laura Frias (April 2011).

each challenge from different perspectives as well as the identification of joint solutions. The size of the project team was variable along the project, ranging between 10 and 15 people.

The financial investment required by the project amounted to a level that authorisation, following the proposal from the project manager, had also to be gained from the divisional level (*Bosch Thermotechnology* Division), and not from the *Bosch Termotecnologia* Board level alone as is normally the case.

On taking the decision to advance with the project, new challenges arose. These were mainly related

to product specifications (for instance, compatibility with solar energy *versus* non-compatible solutions). As there were no market references for state-of-the-art low consumption valves, there was a need to identify alternative technological approaches regarding gas stream modulation. Three emerged as the most viable: (1) to develop a modulation motor; (2) to use piezoelectric micro-valves; and (3) to make recourse to micro servo-valves. Decision making on these alternatives was a critical process. Prototypes were made for the three possible solutions and, following analysis of the countless technical requirements that needed to be achieved (safety,

cost, intellectual property...), decision matrixes were worked out. Such complex matrixes have been very useful in assisting the decision making process. Sérgio Salústio warned, however, that *“the maximum number of criteria to be considered in such matrixes should not exceed eight to ten; with more than ten criteria, focus is lost”*.

This was one of the key decisions taken in the Project Confirmation stage. The solution chosen to develop the gas valve was subject to a quality assessment as well as to a FMEA (Failure Modes Evaluation Analysis) with a view to also assessing the implications for the whole product development system. A first sample of the gas valve was produced (called in *Bosch's* NPD jargon, an ‘A sample’).

A feature which proved to be particularly critical was the involvement of the main suppliers in the development of core product components as well as in the design of specific tools and production equipment. This took place as from the Project Release and Project Confirmation phases. Simultaneously, an engineering

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process was launched. This implies, however, suppliers fully understand the specific functions the components are required to perform. Supplier involvement and commitment were important not just in terms of production feasibility but also cost-wise: *“The decision was taken to integrate the suppliers into the development process right from the initial phase. This was indeed one of the factors that made the greatest contribution to the project’s success.”*<sup>28</sup>

In the Project Confirmation phase, the entire project team takes on formal commitments regarding the project timetable and budget as well as target product cost. One of the most difficult decisions taken in this phase revolved around whether or not to produce the gas valve in-house. It corresponded to one of the most critical of all components to the entire concept. Once again, Pedro Cardoso looked back at the decisions taken in 2007:

*“The platform was all developed*

*here. The gas valve, the electronics, the hardware, the software, all of it developed here. And that is an enormous strength that we have. As from the point in time when we master the competences to develop the key product components, a decision could be taken on the strategic alliances needed to bring about the industrial production of these components. From my perspective, this was the formula for success. We did all the development and industrial design of the key components either here at Bosch [Termotecnologia] or through long term partners”.*

Sérgio Salústio added that the decision to develop and manufacture the key components in-house is very important for raising barriers to imitation by competitors. When questioned about this, he pointed out that *“patents are important”* and *“the Bosch group assigns them a lot of weight”*. He adds, however, that they are not enough by themselves:

*“We combine them with two other factors. One is the verticalisation of production. We manufacture gas valves, electronic components*

*and burners by ourselves, in our plant. The second is lead time. We are continuously innovating. This provides an edge over competitors”.*

In the Industrial Design Confirmation phase, the CAE project industrial design was approved by the marketing department. This phase has also encompassed the adaptation of the technical concepts to the Bosch group’s “engineering for design” guidelines.

The Technical Design Release phase was one of the most work-intensive, and extended from September 2007 to March 2008. The project team had daily meetings on the development of the product as a whole. A specific team was assigned to the development of the gas valve in order to reduce the pressure put on the other dimensions of the development project. Focus has also been put on the development of the hydrogenerator. This entailed thorough analysis and experimentation with a view to achieve an appropriate *“energy budget”* (Pedro Cardoso). In the process, *Bosch Termotecnologia S.A.* cooperated with an old,

well-known partner, the Dutch company *Cinetron*. ‘B samples’ were produced, and the first market tests were carried out. Simultaneously, close cooperation with the supply chain was pursued to ensure a steady industrialisation process later on.

After ‘closing’ the entire technical concept, the project advanced towards the next phases: Field test, and Zero Series Release. In the Field test, the first ‘C samples’ were built to be tested in real conditions. The tests enabled the collection of consumer feedback. Design, performance, ease of use and human-machine interaction have been among the main issues subject to analysis. After six months of field testing, the project proceeded to the Zero Series Release. The key question here is the production process. This specifically involves the training of plant operation staff to deal with a new specific production line. It was aimed at confirming that such a production line satisfied the process efficiency standards defined by *Bosch*. An important tool in this regard was the *Bosch Production System (BPS)*. Designed at the group level, BPS establishes a set of

<sup>28</sup> · Quoted from *Bosch Termotecnologia S.A.*, Application to the Produto Inovação COTEC Portugal award, by Evandro Amorim and Laura Frias (April 2011).

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guidelines to be followed in order to ensure the proper working of the manufacturing process (see Box 5 below).

The Start of Production was approved by **Bosch**

**Termotecnologia S.A.**'s Management Board on October 8th, 2009. In spite of the care taken to achieve no-failure industrialisation there are always problems to be addressed. The project team was still on duty,

discussing with plant managers and operators the issues raised, and devising solutions to overcome them. The CAE project team was disbanded only when one and a half years had elapsed since the Start of Production. A thorough quality assessment of the whole NPD process, namely the whole 'TTM' procedure, was carried out to derive lessons that might be taken into account in future NPD projects.

Looking backwards, Pedro Cardoso, the CAE project leader, underlined how the advancement of project leadership capabilities is important for innovation-committed companies: *“Project working is highly interesting. There are many factors driving pressure but it is a fantastic school for [human and organisational] capability development. (...) I think that from the point of view of managerial leadership competences, project management is absolutely fantastic. I have worked a lot in this area and it is very stimulating. I have always done it with great pleasure”.*

## The product

The outcome of the project corresponds to two new water heaters (**Sensor** and **Hydropowerplus**). These are characterized by the integration of the hydrogenerator in the hydraulic block, thereby reducing the loss of power charge in the circuit, and making ignition easier. Its image is provided in Exhibit 10; the main characteristics of the product are summarized in Box 6.

**Bosch Termotecnologia** states that CAE is *“a revolutionary innovation: a combination of hydrogenerator with a low consumption gas valve to allow for an electronic selection and the modulation of hot water temperature (thermostatic system)”*. It further argues that “CAE technology is a world novelty”, since existing appliances needed to have an electrical power connection or battery support. “The thermostatic function combined with the use of hydrogenerator and solar compatibility enabled a smart use of energy”<sup>29</sup>.

BOX 5.

### Bosch Production System

The Bosch Production System (BPS) is intended to make lean production possible. It enables the stimulation of the market and to ensure “customer and employee satisfaction”. BPS is based on eight principles:

1. Pull system, supplying only what customers demand;
2. Process orientation, to ensure a streamlined response to customers;
3. Perfect quality, through faultless production;
4. Flexibility, to adapt to changing requirements and integrating a continuous stream of product system improvements;
5. Standardisation to enable reliable but flexible processes;
6. Waste elimination and continuous improvement;
7. Transparency, meaning “that everybody is aware of their tasks and objectives”; and
8. Involvement and empowerment “to utilise the creativity and extensive know-how” of Bosch’s employees.

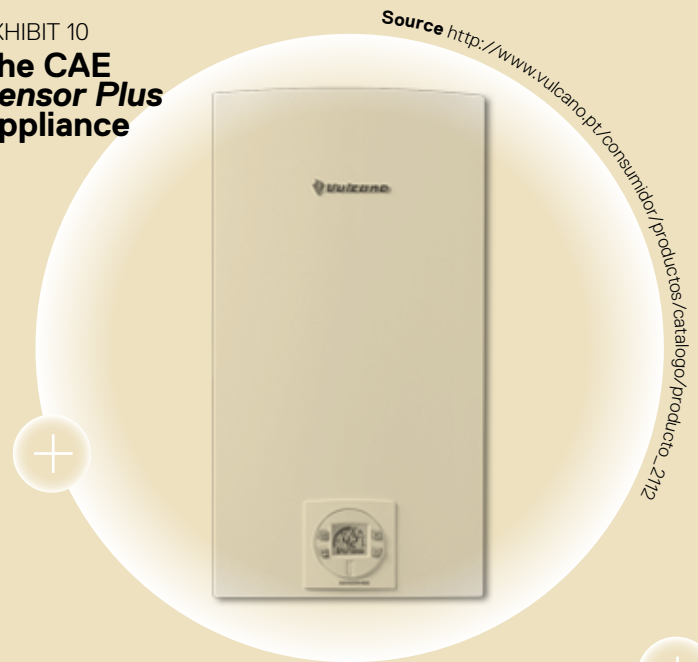
**Source:** Bosch Termotecnologia S.A., Lean Production – BPS, Internal leaflet, Robert Bosch GmbH.

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In October 2010, one and a half year after the Delivery Release milestone, the CAE project reached its end (Project End). This entails a process of assessment of the product characteristics and the success of market launch. It is also time to identify the main 'lessons learned', with a view to taking them into account in future NPD projects. Project End formally implies the dissolution of the project team, and the assignment of product responsibilities to the relevant functional departments.

## EXHIBIT 10 The CAE Sensor Plus Appliance



BOX 6.

### CAE Project: Product Characteristics

- ▣ Capacities of 11, 14 and 18 l/min., assuming a temperature increase of 25 degrees Celsius;
- ▣ Electronic ignition via hydrogenerator;
- ▣ Thermostatic temperature control (temperature selection with an accuracy of one degree Celsius);
- ▣ Compatibility with solar-powered systems;
- ▣ LCD display with temperature and watch;
- ▣ Natural exhaustion;
- ▣ Compact appliance: 580 x 310 x 220 mms;
- ▣ Advanced security systems: detection of flame failure; temperature control; gas exhaustion sounding lead, and temperature sounding lead.

**Source:** Bosch Termotecnologia S.A., Application to the Produto Inovação COTEC Portugal award, by Evandro Amorim and Laura Frias (April 2011).

## Evolution of new product development processes from CAE onwards

The CAE project was followed by a stream of other NPD projects, always aimed at responding to changing technological trends, regulatory frameworks and user needs and demands. The purpose was keeping the leadership in the international water heater market based on continuous innovation.

Sérgio Salústio reminded how less than three months ago, in April 2012, *Bosch Termotecnologia S.A.* had launched a new product: the water heat pump, addressed to the German and French markets. The company considers that this is the start of a new generation of heat pumps for sanitary waters. In fact, as Marco Marques pointed out, *“this project enabled Bosch Termotecnologia to create competencies about heat pumps”*. The pump is able to work over a wider range of atmospheric air temperatures and is compatible with solar energy systems. Technology-wise, the key improvement is the use of outside atmospheric air.



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And nowadays, another NPD project is underway, having reached the Technical Design Release phase. It is aimed at developing the first hermetic thermostatic water heater, ensuring an automatic adaptation to the installation conditions. It will have a digital interface. Sérgio Salústio expects that by May 2013 market launch in the target markets (Spain and Italy) will take place.

This innovation strategy, now broadly consolidated, has enabled **Bosch Termotecnologia S.A.** to achieve continuous growth and to strengthen its position in the context of both the Bosch Thermotechnology Division and the global marketplace. Sérgio Salústio looked over at his office's door and whispered to himself: *"Innovation does indeed pay off"*.

## ...and now, Sérgio?

Having proceeded to a review of the **Bosch Termotecnologia S.A.** history and landmark NPD projects, Sérgio Salústio took a look from the window of his office, and remembered that the June festivals were about to start. The next weekend would be Portugal's Day. He correspondingly thought: *"Vulcano lost its independence. Was this good or bad for the Portuguese economy? Being fully owned by the Bosch group, is Bosch Termotecnologia S.A.'s contribution to the Portuguese economy less or more relevant than Vulcano's was? How to appraise such a contribution?"*

But this is not his main concern. As **Bosch Termotecnologia** Vice-President of Engineering, he has to devise strategic orientations that might lead to new projects, thereby strengthening **Bosch Termotecnologia's** status as Centre of Competence.

One of the clearest mega-trends is the ageing of the Western population. Even in China, ageing is becoming a concern, as a result of the single child

policy. Therefore, designing and developing a specific line of water heaters for elderly people might be a good idea. Taking old people's UX into account, it might be possible to develop a basic water heater to fit elderly people's needs. However, a water heater has a long life cycle, and most old people's homes are already equipped with acceptable water heating solutions. Furthermore, market growth is elsewhere, not in Western countries. The United States is a different world, in terms of the domestic hot water appliances supply. The European market is relatively small. Would such a product be a potential 'winner'?

Why not address the issue from a different, more cross-cutting perspective? Why not profit from the experience gained from the development of the fan pressurised platform to design a new generation of easy-to-use, aesthetically appealing products? This might address every age cohort, while making the water heater an 'object of desire', capable of exciting and fascinating potential customers. However, this runs counter the dominant approach. In how

many kitchens is the water heater visible? Is it feasible to transform an appliance that is behind the curtain or inside the cupboard into an 'object of desire'?

Another challenge would be to design water heaters prepared for the 'internet-of-things'. However, in spite of some visionary speeches, in June 2012 the internet of things is still to materialize. But sooner or later it has to be factored in water heater development. What might be the implications for **Bosch Termotecnologia** of falling behind the (potential) course? If the challenge is taken seriously, should the company go ahead alone or cooperate with other **Bosch** units, more advanced on this regard? Be as it may, a strong bet on the 'internet-of-things' would require changes in the R&D Centre's competence structure, and the recruitment of more electronics engineers.

Engaged in a self-dialogue, Sérgio recalled a talk with Pedro Cardoso a few days ago. He remembered Pedro's question by heart: how can **Bosch Termotecnologia** translate its capabilities and the talent of

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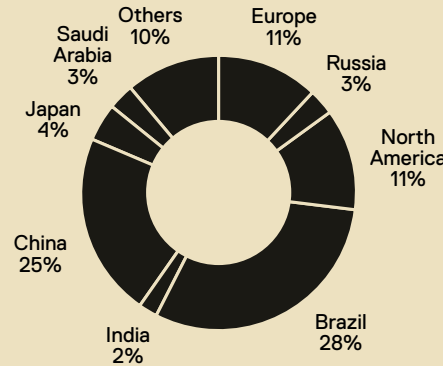
# Bosch Termotecnologia



Portuguese engineers in terms of company growth and its profit-and-loss statement? As a Centre of Competence for domestic water heating, *Bosch Termotecnologia* scope is limited. Competing against other subsidiaries to get a wider product mandate does not seem to be an option. It entails risks, and may downgrade the company's influence at the *Bosch* Thermotechnology division level. Increasing the stream of new product development may not be worthwhile, taking into account the market structure and the patterns of product purchase. *So what now, Sérgio?* Continuing to look out of the window, Sérgio began figuring out responses to the questions he is concerned with...

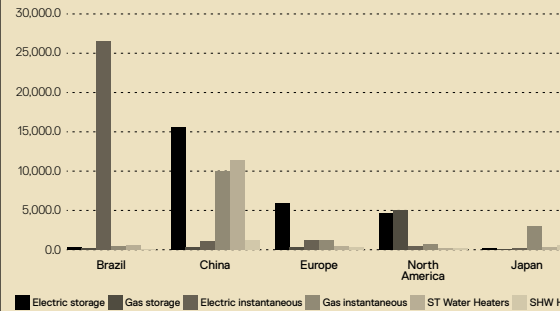
## ANNEX I World market data

### World Water Heating Markets 2013



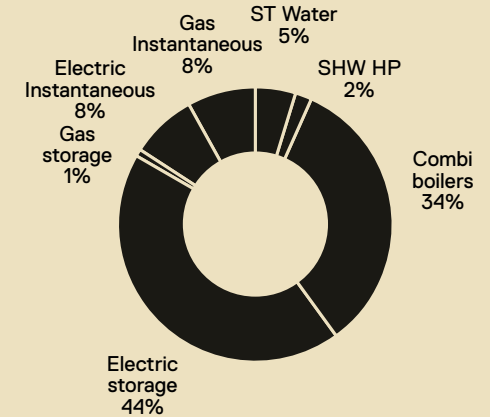
**Total: around 98.6 min units**  
(include ESWH, GSWH, EIWH, GIWH, ST WH, SHWHP)  
**Source:** Based on BSRIA market analysis for 44 countries

### Largest Water Heating Markets 2013



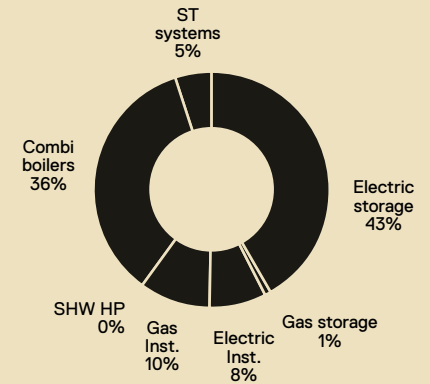
**Source:** BSRIA

### World Water Heating Markets by type of provision, 2013



**Source:** Based on BSRIA market analysis for 44 countries

### Water Heating Market by type of provision, 2010



- Electric storage have been the most popular product.
- The share of renewable WH systems is stable but SHW HP have increased at ST WH expense

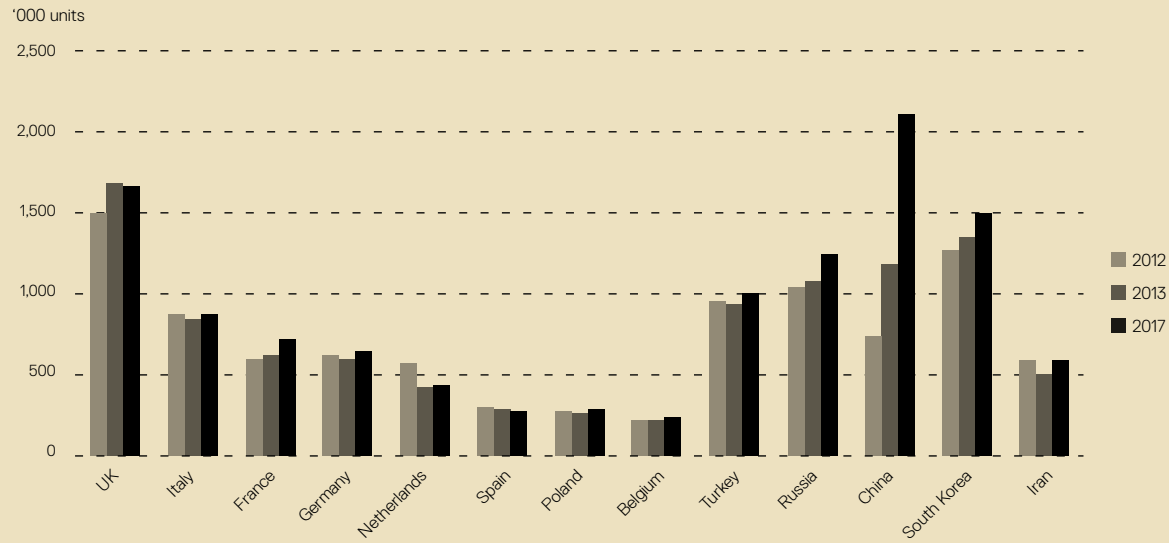
**Source:** BSRIA

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## Domestic boilers Main World Heating Markets



Source: BSRIA

# Bosch Termotecnologia



## ANNEX II Bosch Termotecnologia S.A. Accounts

### Balance Sheet 2011, 2012

(Monetary unit: Thousand Euros)

	2012	2011
<b>ASSETS</b>		
<b>Non-Current Assets</b>		
Tangible Assets	17.803,10	15.613,30
Intangible Assets	131,90	98,20
Deferred Taxes Assets	4.653,30	4.762,20
<b>Total of Non-Current Assets</b>	<b>22.588,30</b>	<b>20.473,70</b>
<b>Current Assets</b>		
Stocks	12.032,90	14.480,80
Clients	44.077,40	42.701,40
Down Payments to Suppliers	174,50	572,00
State and Other Public Entities	2.068,30	1.600,70
Companies of the Group	16.059,90	21.406,70
Other Accounts Receivable	895,50	1.794,60
Cash and Bank Deposits	7.365,30	5.743,20
<b>Total of Current Assets</b>	<b>82.673,80</b>	<b>88.299,40</b>
<b>TOTAL ASSETS</b>	<b>105.262,10</b>	<b>108.773,10</b>
<b>EQUITY AND LIABILITIES</b>		
<b>EQUITY</b>		
Paid-in Capital	2.500,00	2.500,00
Statutory Reserves	500,00	500,00
Other Reserves	24.432,30	24.432,30
Revaluation Surpluses	641,40	675,60
Retained Earnings	6.692,90	6.658,70
Net Profit for the Period	15.611,20	16.064,70
<b>Total of Equity</b>	<b>50.377,80</b>	<b>50.831,30</b>
<b>LIABILITIES</b>		
<b>Non-Current Liabilities</b>		
Provisions	19.455,10	20.951,80
Obtained Loans	378,10	1.070,80
Deferred Taxes Liabilities	0,40	4,80
<b>Total of Non-Current Liabilities</b>	<b>19.833,60</b>	<b>22.027,40</b>
<b>Current Liabilities</b>		
Suppliers	26.206,70	23.424,00
State and Other Public Entities	1.283,60	759,30
Obtained Loans	116,80	502,70
Other Accounts Payable	7.753,80	11.228,40
<b>Total of Current Liabilities</b>	<b>35.360,90</b>	<b>35.914,40</b>
<b>Total of Liabilities</b>	<b>55.194,50</b>	<b>57.941,80</b>
<b>TOTAL EQUITY AND LIABILITIES</b>	<b>105.572,30</b>	<b>108.773,10</b>

### Profit and Loss Accounts 2011, 2012

(Monetary unit: Thousand Euros)

	2012	2011
<b>INCOME AND EXPENSES</b>		
Sales and Services Provided	206.059,60	210.216,80
Operating Subsidies	91,20	90,20
Changes in Production Inventories	-1.232,00	-535,50
Costs of Goods Sold and Materials Consumed	-123.124,60	-126.203,70
Supplies and External Services	-35.488,10	-37.663,80
Personnel Expenses	-23.750,30	-25.256,00
Adjustments of Inventory	674,80	-330,40
Impairments of Receivable Debts	213,90	725,50
Provisions	2.190,60	3.484,60
Other Operating Income	4.352,30	7.056,90
Other Operating Costs	-4.831,70	-4.919,70
<b>EBITDA - Earnings before Financial Expenses, Tax, Depreciation and Amortisation</b>	<b>25.155,70</b>	<b>26.664,90</b>
Depreciation and Amortisation	-3.659,20	-4.271,20
<b>EBIT - Operational Results</b>	<b>21.496,50</b>	<b>22.393,70</b>
Interest and Similar Earnings	113,80	291,40
Interest and Similar Charges	-1.150,10	-564,80
<b>Earnings Before Taxes</b>	<b>20.460,20</b>	<b>22.120,30</b>
Income Taxes	-4.849,10	-6.055,60
<b>NET PROFIT</b>	<b>15.611,20</b>	<b>16.064,70</b>
Net Profit per Share	31,20	32,10

Source: Relatório do Conselho de Administração, 2012

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Case Study

# Bosch Termo- tecnologia



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**Bosch  
Termotecnologia:**  
Keeping the  
innovation track  
record

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Case Study

# Coficab Portugal

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

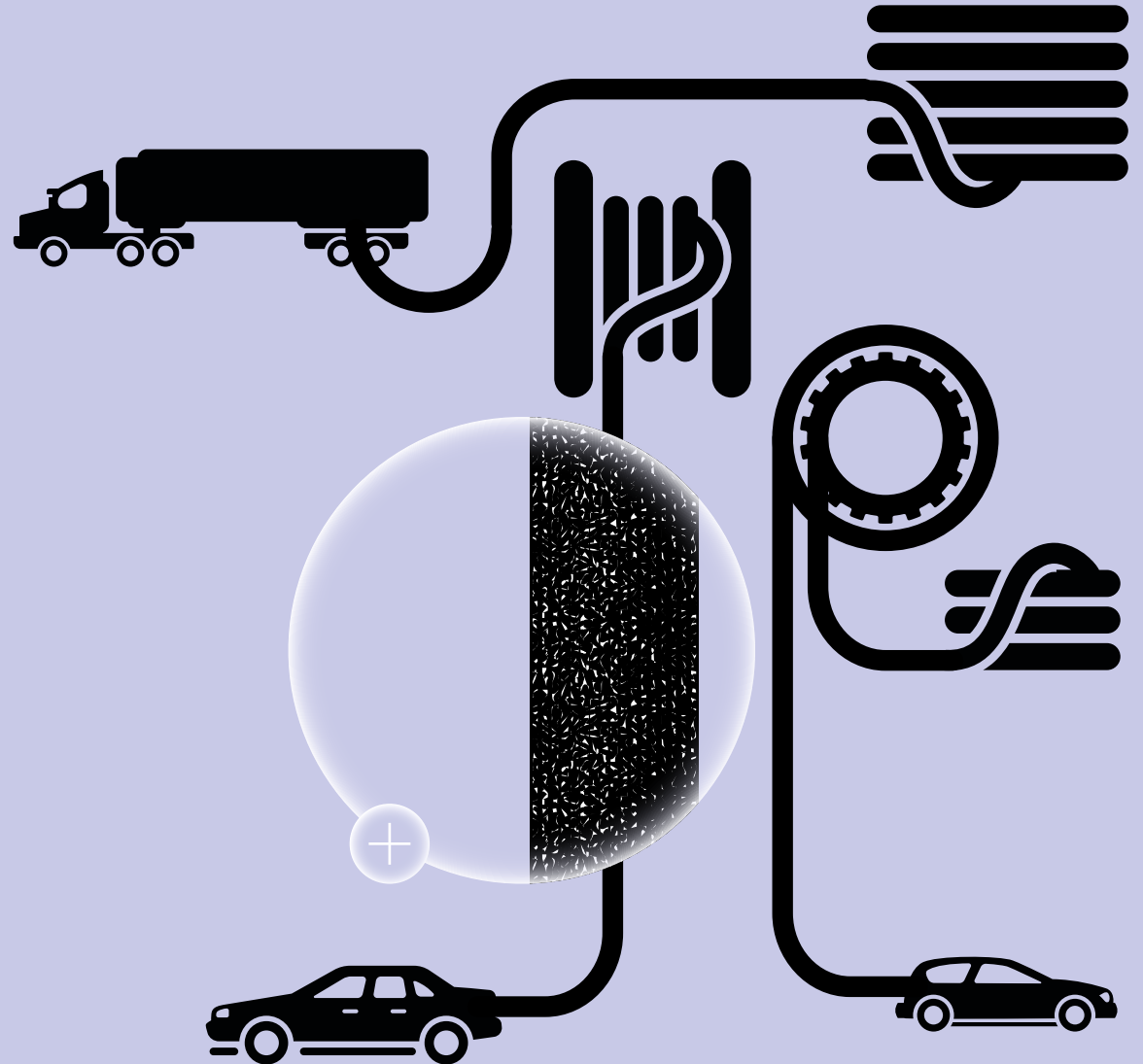
Vitor Corado Simões

Nuno Fernandes Crespo

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## Coficab 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 *Eloumi 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<sup>2</sup>. 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 Eng<sup>o</sup> 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 20<sup>th</sup> and 21<sup>st</sup> and June 9<sup>th</sup> 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.

# Coficab Portugal



## 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 Carthage 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)<sup>1</sup>.

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)<sup>2</sup>. 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).

Case Study

# Coficab Portugal

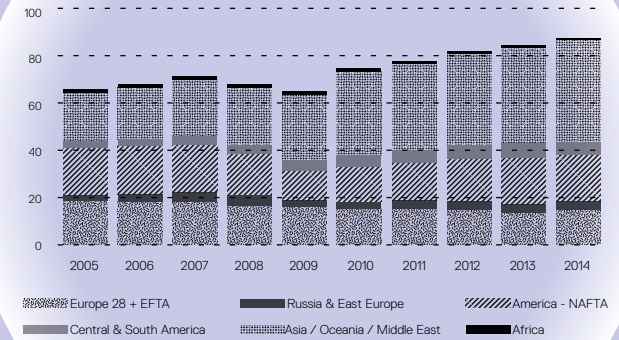


The economic crisis of 2008-2009, one of the most severe in modern history, had a major impact on the automotive industry. Actually, the automotive industry has been among those which have suffered the most, after the housing and finance sectors.. In fact, only the banking sector has been subject to larger government intervention than automotive industry<sup>3</sup>. 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

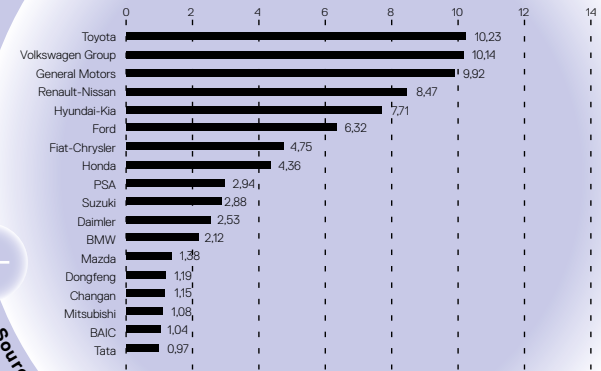
five years the number of cars sold increased more than 34%, from 65,6 million in 2009 to 88,2 million in 2014, this evolution is not homogeneous. The relative importance of markets is shifting. While in 2005 the European, North American and Asian markets exhibited similar shares around 30% of the number 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)<sup>4</sup>.

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).

# Coficab Portugal

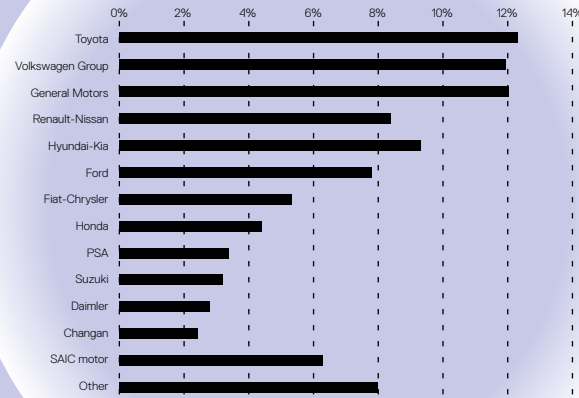


In 2013-2014, the top 5 automotive manufacturers worldwide are *Toyota*, *Volkswagen*, *GM*, *Renault-Nissan* and *Hyundai-Kia*, either with respect to the number of cars sold (Exhibit 2) or in terms of market share calculated using the value of sales of passenger cars (Exhibit 3).

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<sup>5</sup>. 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.

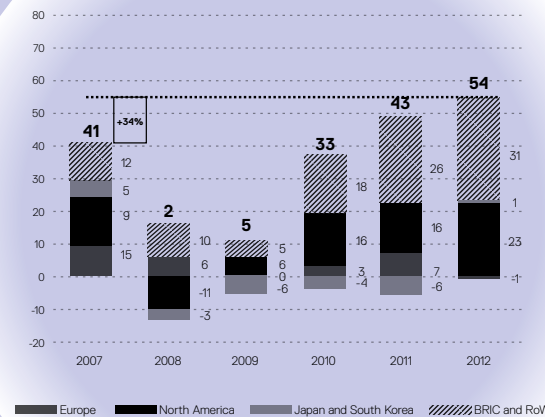
The automotive industry is very relevant for the European Union (EU) economy. It accounts for about 5.8% of EU employment (corresponding 12.7 million jobs in 2011: 2.2 million direct jobs and 10.5 million indirect jobs in EU27), and for about

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<sup>6</sup>. 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<sup>7</sup>.

Even so, the automotive industry faces several challenges<sup>8</sup> 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).



# Coficab Portugal



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<sup>9</sup>; 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, Hyundai-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).

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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

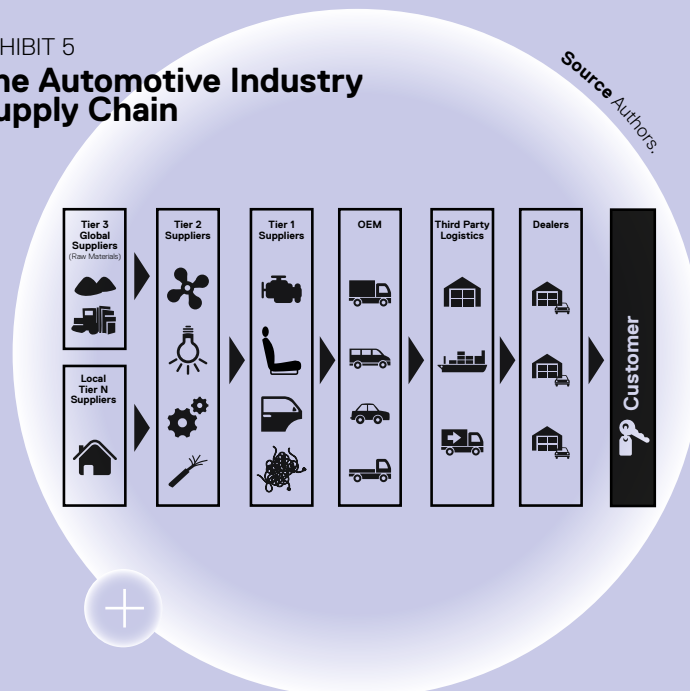
concerns particular R&D and technical issues.

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<sup>10</sup>. 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”<sup>11</sup>.

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%.

EXHIBIT 5  
**The Automotive Industry Supply Chain**



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<sup>12</sup>. 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”<sup>13</sup> 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.

# Coficab Portugal



## 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 13<sup>th</sup> among global auto parts

suppliers, with a total turnover of USD15,475 million<sup>14</sup>.

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

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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 *Electric 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.



# Coficab Portugal

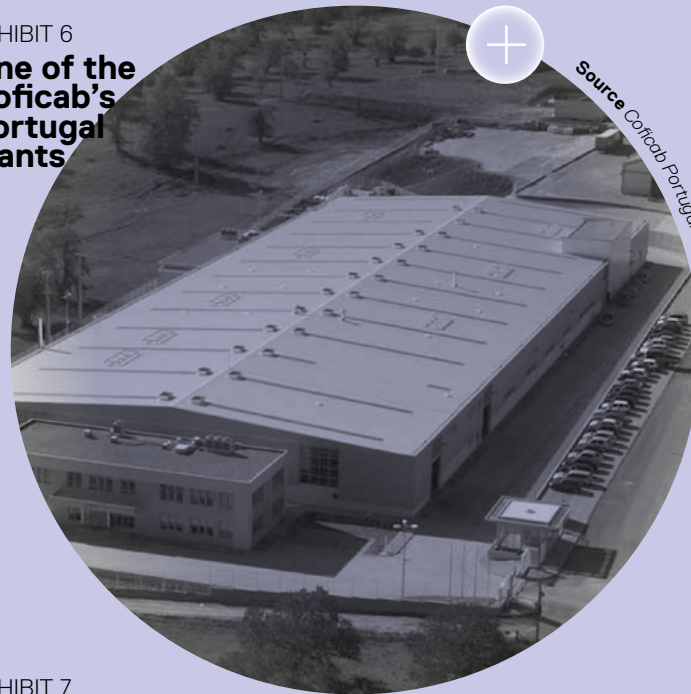


By the time, *Coficab Group's* foreign market knowledge was still very limited. The internationalisation of the *Coficab Group* as well as the *Elloomi Group* was mainly passive/reactive, taking advantage of the international knowledge and market position of the *Delphi Group*, in cables and wires (with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

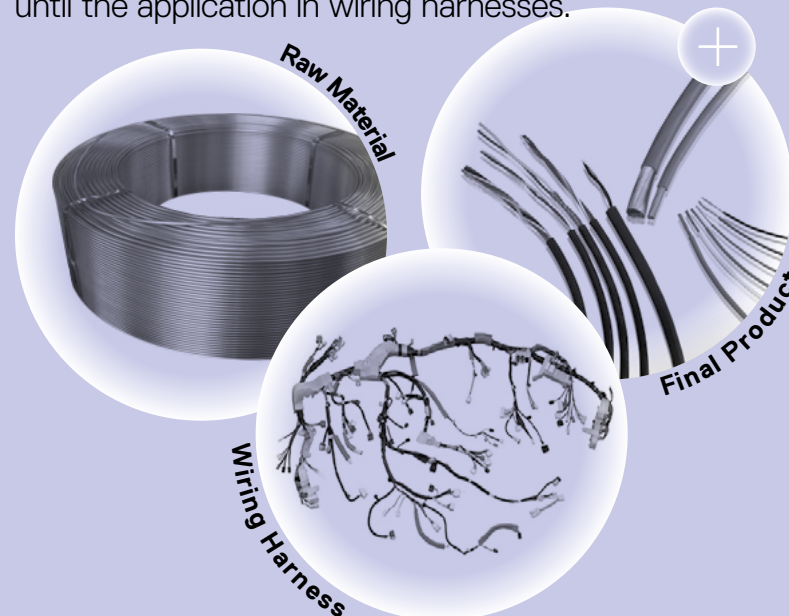
## One of the Coficab's Portugal plants



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



# Coficab Portugal



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.”*

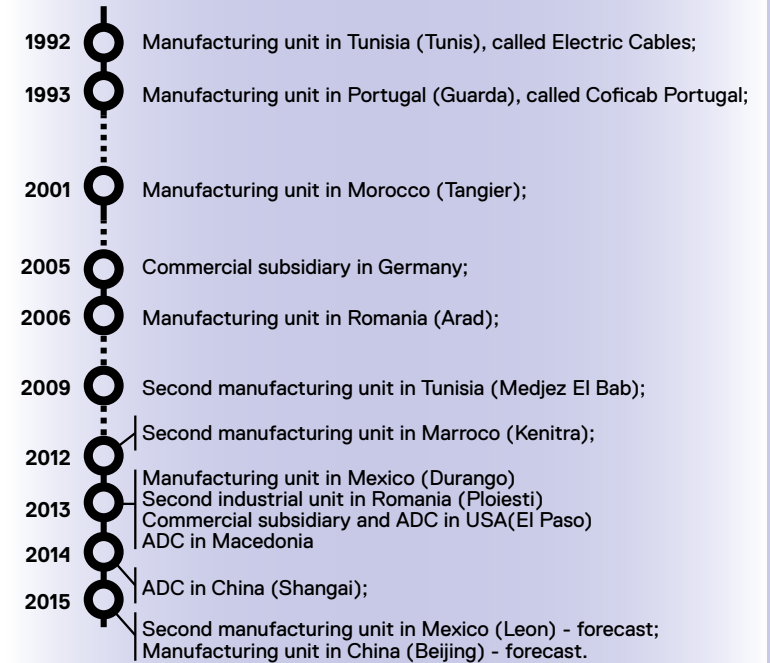
Since 2000, **Coficab Group’s** growth was quite impressive, as may be seen in Box 1. From two industrial units only, it managed to set up six additional plants (two in Morocco, one in Tunisia, two in Romania, and one in Mexico), four ADCs - Advanced Delivery Centres (in USA,

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 **Cablettra, 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 Portugal



## **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*.

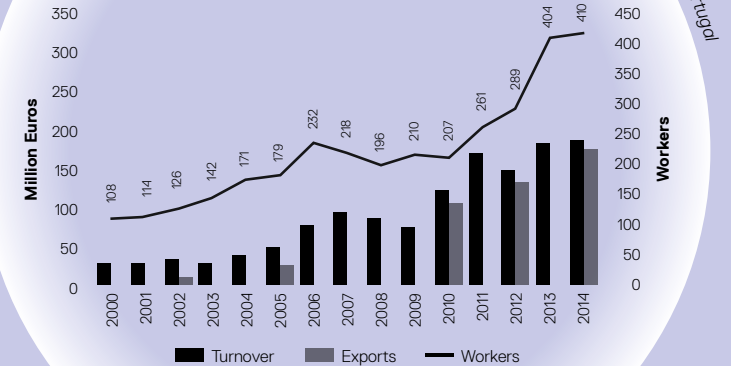
Even though the business model of the Portuguese subsidiary is different from the other subsidiaries of the Group (more orientated towards innovation instead of production efficiency), *Coficab Portugal* is the manufacturing unit with the highest efficiency (77%) and the lowest rate of waste (4,9%), 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

## Case Study

## Coficab Portugal



mm<sup>2</sup>, but the standards for the 0.22 mm<sup>2</sup>, 0.17 mm<sup>2</sup> and the 0.13 mm<sup>2</sup> 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<sup>15</sup>. 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 0.35mm<sup>2</sup> (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 0.35mm<sup>2</sup> 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 0.35mm<sup>2</sup> 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 0.13mm<sup>2</sup> and 0.17mm<sup>2</sup> 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

<sup>15</sup> · McKinsey & Company (2014).

# Coficab Portugal



characteristics similar to those of the 0.35mm<sup>2</sup> 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 0.35mm<sup>2</sup> 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 allowed 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 0.13mm<sup>2</sup>) 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 0.17mm <sup>2</sup> ;
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

# 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 0.35mm<sup>2</sup> 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 0.13mm<sup>2</sup> is widespread, **Coficab Portugal** may win several contracts, which allow it to payback the investment of this R&D project.

Currently the 0.13mm<sup>2</sup> product is manufactured in **Coficab Portugal** plant only, since it 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.



# Coficab Portugal



## The relevance of Innovation within 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



# 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 0.13mm<sup>2</sup> 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 0.08mm<sup>2</sup>?
- 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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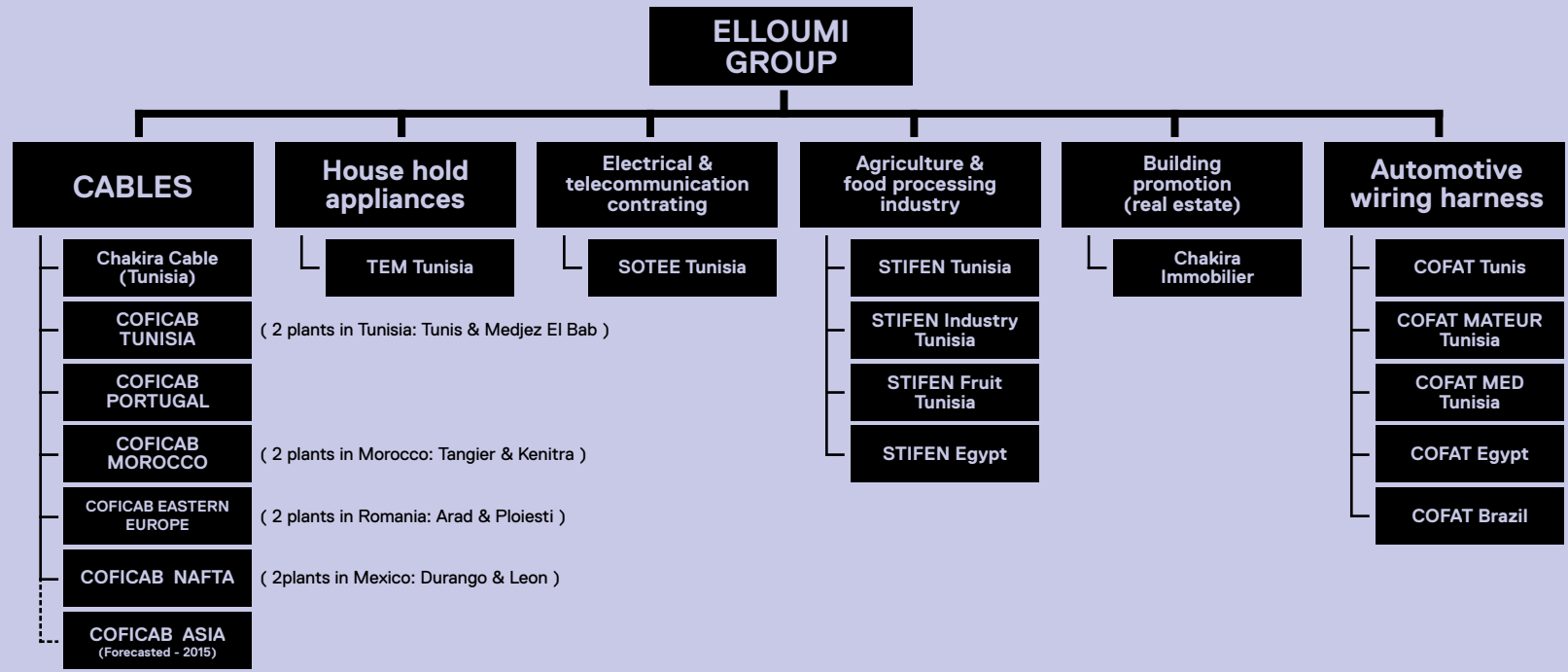
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**APPENDIX 1.**

Corporate Structure of *Elloumi Group*



Source: Coficab Portugal.

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Case Study

# Coficab Portugal

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## Coficab Portugal:

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

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ISBN 978-989-95583-8-0

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Case Study

# Malo Clinic

Innovation as an anchor  
of global outreach in oral care

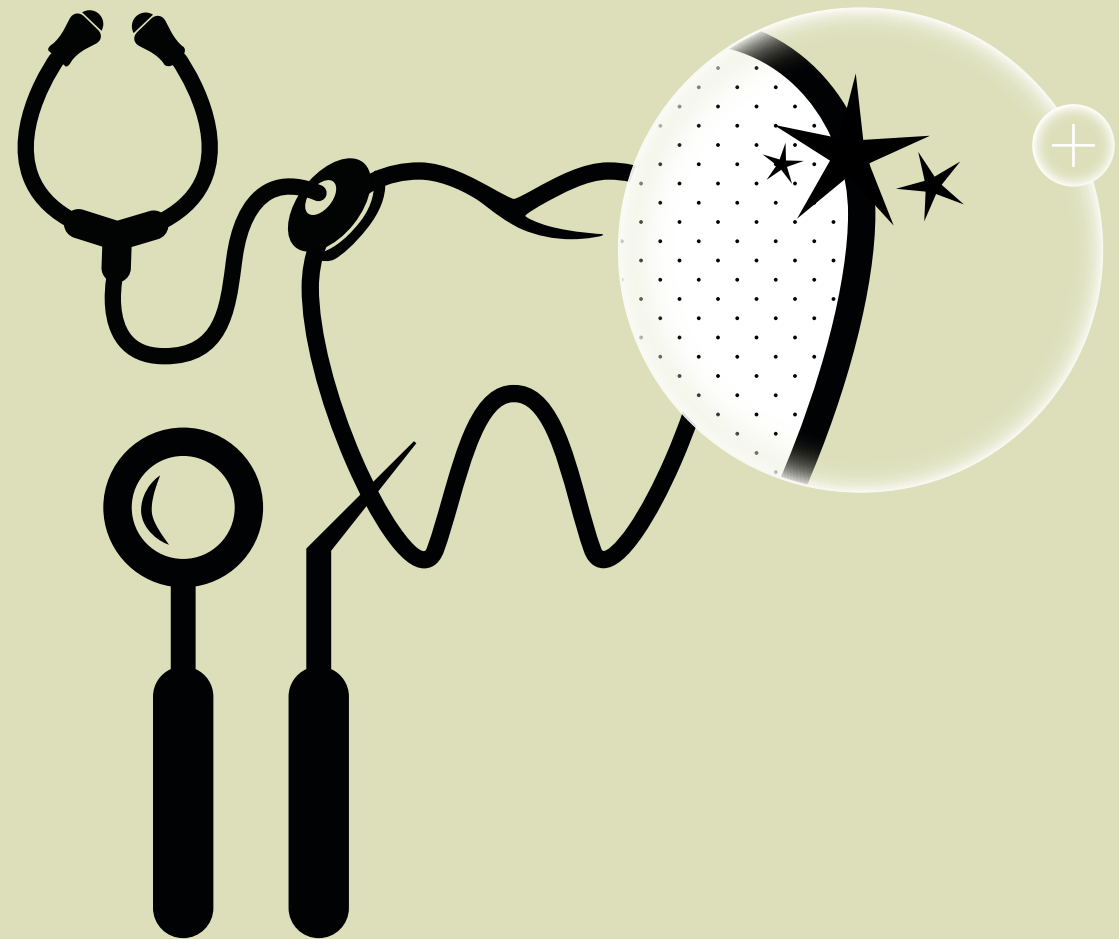
Cátia Miriam Costa

Sandro Mendonça

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## **Malo Clinic:** Innovation as an anchor of global outreach in oral care

### **Abstract**

Paulo Malo was born in Angola in 1961. At a certain point he decided to become a dental doctor. By the turn of the century his was one of the most innovative dental care operators and ten years after that it was the single most globalised venture in the field of healthcare. Malo Clinic is arguably the most technological advanced and largest operation in implantology and aesthetic stomatology worldwide. The key to interpreting the triumph of this project should be attributed to innovation. This has been the way to introduce pioneering processes (fast techniques and painless treatments) and innovative products (fixed prostheses of new generation and implants without surgery) reaching new markets (toothless patients and segments in the US, Brazil, China, etc.). The commitment to innovation can be seen as an investment in scientific and technological knowledge. But there is also a dimension “non-technological” namely the focus on clinic design and customer handling, creative strategies for building brand and design values, the investment in “spas” and “wellness” treatments, the performance of complex training courses, etc. The strength of this case as a basis for management and public policy lessons can be appreciated as an exemplary integration of science & technology but also marketing & organization.

### **Keywords**

service innovation, tradable services, intellectual property, research intensive education, marketing and design innovation

### **Acknowledgments**

This case was written by Cátia Miram Costa and Sandro Mendonça, of ISCTE – University Institute of Lisbon, for COTEC Portugal, between May and June 2015.

Personal interviews were held at Malo Clinic headquarters the following executives (by alphabetical order): Carla Costa (Marketing Manager), Marta Roquete (Communication Manager), Miguel Espírito Santo (Advisor to the Board), Miguel de Araújo Nobre (Director of the R&D Department and Oral Hygiene Department), Paulo Maló (CEO Malo Group), Ricardo Rolo (Malo Group Procurement, and Lab Director), Rita Freire (Malo Clinic Education), Rita Lacerda (Malo Clinic Communication Director), Susana Maciel (Human Resources Director). Face-to-face interviews were held on June 9<sup>th</sup>, 11<sup>th</sup> and 19<sup>th</sup> June 2015.

A visit was made to the Malo Clinic Macau on May 21<sup>st</sup> (Jorge Valente, Vice-President Malo – Macau, received us) and on the 11<sup>th</sup> June the headquarters’ laboratory was visited.

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.

The authors thank the Malo Clinic group for the information and the support provided. They have been critical to improve the quality of the final research.

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We also benefited from interaction with Adriana Esteves, Filipa Durando, Pedro Dá Mesquita and Victor Zhong.



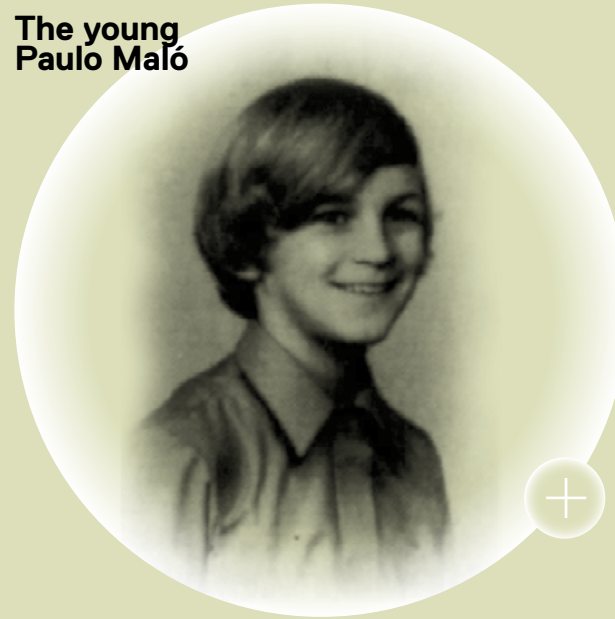
## Introduction

### *Warming up in Africa*

Paulo Maló is the main character of this story, Malo Clinic' Story. He was born in 1961, the first son of a landowner and his wife, a teacher. Baby Paulo Sérgio Maló de Carvalho has a personal inheritance to be considered, but also a geographical and historical one too.

His parents were settlers in the south of Angola. He spent his early years among the landscapes of colonial Africa, between cattle and melons.<sup>1</sup> He initiated in tasks pertaining to his family's day-to-day farmland and copper-mine dealings. He was used to give a help in these matters, earning his first pocket money this way. But he also exhibited a character at school, where he was on the outlook for good grades.<sup>2</sup> His grandmother nevertheless feared that he and his brothers were becoming too "wild", driving too young, handling weapons, walking bear feet in the woods. Perhaps autonomy and responsibility were early lessons. But no experience

### The young Paulo Maló



they as fathers would allow their own kids to have.

He moved to South Africa after the 25<sup>th</sup> April 1974 Revolution in Portugal and the ensuing decolonisation process. In the meantime he hoped back to Coimbra, Portugal, where his family had roots. In South Africa he was 13 years old when his parents entrusted him to take care of his brother and sister as they tried to salvage what they could in the turmoil of the handover. Then they settled in Cape Town, where he was to finish his secondary school. He learns English and is shocked by the black-white

segregation, members of his keen are mixed and cannot understand Apartheid.<sup>3</sup> He plays rugby and becomes a well-paid male model.<sup>4</sup> An appreciation for wellness and appearance mattered. Even today he is led to choose his hotels for their fitness centre facilities.

One day in an event organised to bring together teachers and students, he meets Christian Barnard, the famous surgeon who performed the first human heart transplantation. By this time he could have decided to be a veterinary, an agricultural

engineer, a marine biologist, and an astronaut. But the display of scientific skill over the human body surely impressed him. But things were going tougher in South Africa, and life in the Apartheid regime was not proving sustainable. Times they were changing again, and his family loses its wealth for the second time in Africa and decides to leave South Africa.

### *Moving into dental health*

Then Paulo Maló went to Portugal to attend Medicine at Coimbra University, he was 21. Still he worked on odd-jobs, like grilling fish in restaurants in the Algarve. He kept his well-paying model work, doing passarele and photo sessions, until he was 24. He earned money, he saved it, he behaved as if he had plans. And he keeps a busy sporting life, being part of Portuguese national rugby team. One of his uncles' was a dentist and he had a dentist clinic, and this would be a for-sure job. Paulo did not see himself in this profession at first, by then engineering and the sciences were attracting him the most, but dentistry presented an easy path for the future. Under this

1 · <http://bit.ly/1PEzh3Y>

2 · <http://bit.ly/1F5Ss18>

3 · <http://bit.ly/1fN2xcD>

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influence, but not very convinced at first, he considers studying to become dental doctor<sup>5</sup>. After a rugby match against the Italian national team he seats on the plane and thinks about his life: he decides to leave medicine, after four years and without completing his training. He enrolls in the Faculty of Dental Medicine of the University of Lisbon and graduates in 1989. At 28 years old is bit late, he admits today. But this would be his trade. And road of dentistry, as it were, will move along with him.

He opened an office in Lisbon, the usual step for a young practitioner. As a dental doctor, he soon revealed special interest for difficult cases. His colleagues saw in him a gift for manual dexterity. Some people they could not do anything with them, to the point they wanted to give them back their money since they kept coming back nagging them. They forwarded him patients with complex problems. So Paulo had appointments with the likes of old ladies who could not find comfort in their prosthesis, patients with severe malformations in the

mouth, young children who had accidents. Paulo saw patients every day as any other dentist. But he tended to be thrown selected cases. Paulo did not shy away new challenges, sometimes even extreme cases. Paulo is building up experience. But, with it, his frustration is also cumulating.

Paulo thinks there must be another way when conventional approaches are unsatisfactory. “We used glue to fix the prosthesis,” he recalls, “I couldn’t do bone transplantation to these people, either because of economic reasons, either because of health conditions.” This was a challenging puzzle. Paulo displayed an ability to concentrate hard and intensively to this day, seemingly forgetting others the in the room while ruminating possible solutions. And there was personal restlessness too. Paulo was growing impatient. “I was dissatisfied with this situation, and with my knowledge and creativity tried to create a solution”.

He was daring enough to think of new implant designs and ingenious enough to try out new modes of work. Paulo is the kind of person that is always

scribbling notes, he is the kind of person that jumps from bed in the middle of the night when strikes upon an idea. He tackles mouth phenomena from the perspective of an engineer.<sup>6</sup> If there are problems there must be solutions. Cold trained hands to fix problems, but also a creative spirit behind them. He is an imposing figure too: a talker, a well-built figure, towering from his almost 1.90 meters, and his blue-eyes are capable of a fix gaze.

In 1993, he first deployed his ideas for an alternative procedure. “I was shitting on my pants”, he recalls almost twenty years later. After the procedure he could not have any decent sleep and he phone the patient every single day. “Are you all right? Is everything all right?” He then became anxious to move on and to replicate the experiment. More trials. The approach gave all signs of being robust and Paulo is no longer a smart practitioner, he had become an innovator.

## ***And then Paulo made Maló...***

For Maló there were two lessons coming out of this moment. First, this was not a finished treatment protocol. It had to be validated. But it opened a precedent.

It could be exploited. But to capitalise on it his organisation platform had to be transformed. In a word: he had to go to the world.<sup>7</sup>

There was a window of opportunity that should be used; he had got a unique take on the problem and he decides to move beyond the confined space of standard dental office. The new approach has the potential for greater diffusion since he believed any aptly trained surgeon equipped with the technique and related ancillary components could do it. That is to say: he strongly believed he could build a business model around his techniques and devices. Money may not have been the trigger, but there was plenty of it to be made as Paulo’s approach promised durable solutions to people facing problems they cared plenty about. These solutions were cheaper and faster than any other available in

5 · <http://bit.ly/1hnFiXu>

6 · <http://bit.ly/1fN2xcD>

7 · <http://bit.ly/1fN2xcD>

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the market. The process was more efficient and the results had nicer aesthetical properties.

There were health as well as economic benefits for patients. But finance was hard to come by. He approached several banks for the capital he needed to purchase a large space in Lisbon. In the end it was a Portuguese publically-owned bank that made the difference. Here a manager listened long enough. Paulo Maló recalls: *“He believed in me. Passed 80% of the money I needed, plus a loan on the side for refitting works. He gave me all. Caixa Geral de Depósitos was a fundamental stepping stone in the creation of the Malo Clinic.”*

By founding Malo Clinic in 1995 Paulo launches a full-blown company venture in the medical area. This was an early example of technology-driven entrepreneurship. Innovation would be his “base camp” from which he could try climb his way up to new highs. But for that a new bank became a special partner, this time a private one, Banco Espírito Santo. This bank was instrumental for the company to scale up and spread up.

He was starting from the outset with an international outlook. Establishing a report with a multinational partner to register and sell the products corresponded to a new type of intensive work Paulo got into. He became an entrepreneur and an exporter at the same time. There was a larger dental industry out there, and Maló needed access to worlds’ markets. For that he needed a credible distribution platform. Since he was starting out he was not in a position to wave bargaining power. So he starts trading his designs and solutions for inclusion in their wide network. This company was Nobel Biocare, a big global player in the field of dental implants, restorative components, computer engineered prosthetics, biomaterials, etc. In time this relationship would become a more balanced and cooperative one.

The roots for future global success in research-based speciality medical services were now firmly anchored. Proving his way among his peers, however, will not be easy as the proposed innovation defied all prevailing paradigms for total edentulous patients.

## Innovation that works

### *Innovation by default*

“We don’t have any international benchmark.” Paulo Maló asserts. If there is an experienced dental practitioner he is the one, he travels the world plying his trade. He has covered in profession in time and space. Six years after graduating he set up his own firm, a departure from the simple stand-alone clinic that is still normal in the dental care professional practice. At first it was literally a dental treatment operation, today it is an expanding multi-disciplinary project present in both hemispheres, all continents. But the name of the game is not about just growth and quantitative performance; this is knowledge-based, innovation-driven activity. The very foundation of Paulo’s venture has been betting on quality and dynamics (see Appendix 1).

Malo Clinic can claim to be the worldwide leader in oral care, implantology and dental aesthetics. Simply put, twenty years after its foundation there are no other cases to go around, whereas Malo is present in many

places around the world. At the same time, today there is hardly any dentist or specialist who has not heard about Malo Clinic, its products and procedures. A global operation in the medical sector is a rare phenomenon. Moreover, the fact that Malo Clinic achieved it in the higher-end of his field of expertise is significant.

Malo’s speciality is in difficult cases. The Clinic maintains and continually develops a core focus on advanced oral fixed rehabilitation. It is known for handling successfully the most delicate and challenging situations, including patients that had severe defacing accidents and who suffer from jaw cancer. The unique know-how Paulo and his team developed concerns the treatment and rehabilitation of edentulous or nearly edentulous individuals. This is more than a niche of application (Figure 1). Almost 40% of the world’s population is above 60 years of age (~340 million people). This represents a big promise in terms of health and wellbeing.<sup>8</sup>

<sup>8</sup> - Malo Clinic estimates. See also <http://bit.ly/1Ud5INz> for the incidence and the impact of edentulism on general health. For the importance of reducing social inequalities in oral health see <http://bit.ly/1PEOL7W>.

# Malo Clinic

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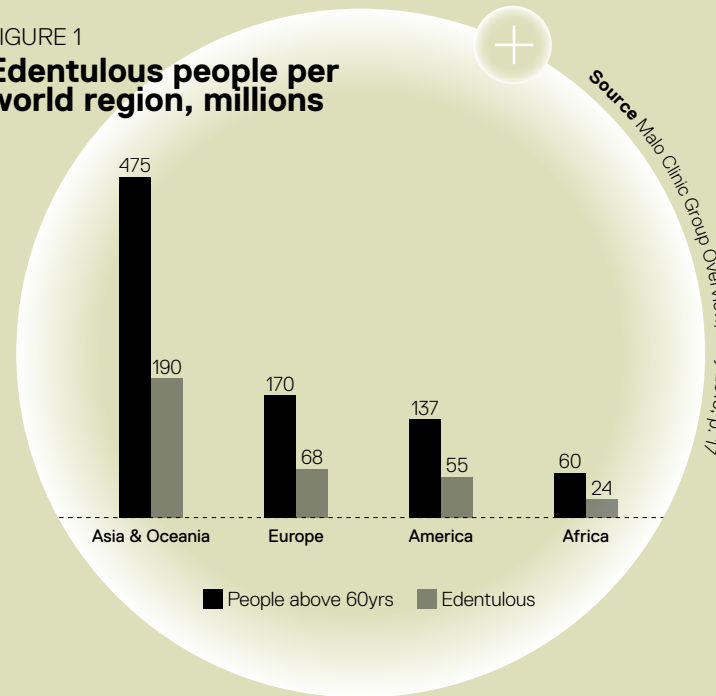
No minor value of proposition in an ageing global society.<sup>9</sup>

Maló himself with his teams have been attempting new pathways from the start. In his words “It was innovation of technique and products that made us known.” Paulo Maló imagined, articulated and pioneered concepts that made him stand out from ordinary practice and regular approaches. That gave him an edge. But that edge has been sustained. Today Malo Clinic has a fully organised R&D system functioning permanently, a tooth and implant laboratory in constant renewal, and team of surgeons and clinicians with expertise on new treatments. Continual development in technique and technology is the norm.

Innovation was the key determinant for Malo Clinic early success and is its most important

9 · The *Financial Times* by the mid-2000s noticed the dental care to be “a market with huge growth potential.” “People in the US and Europe are expected to spend vast amounts on cosmetic dental improvements as they age.” <http://on.ft.com/1ibvjW4>

FIGURE 1  
**Edentulous people per world region, millions**



driver for going global.<sup>10</sup>

### Hitting upon an “hit”

The dentist and the company are best known for a key innovation. The breakthrough was total oral rehabilitation with a simple surgical and prosthetic solution. Paulo Maló introduced it in a

10 · Let’s take a corporate powerpoint presentation from the Malo Clinic dated May 2015. The first adjective used is “innovative”, when characterising what the company does. And when the company lists its “distinctive factors” the word “innovation appears” to name the first of them.

pilot experiment in a real patient and, more than two decades later, it keep being as the state-of-the art in its class. But, as in all novel attempts, it was no certain affair. Paulo had been toying with the “immediate-function” approach since 1991<sup>11</sup>. When he moved to make his first pioneering attempt of 1993 he was scared and unsecure of the results. This was the All-on-4 treatment.

11 · <http://bit.ly/1fN2xcd>

The literature states that the practice and the supporting technology behind prosthodontics has “evolved tremendously”.<sup>12</sup> Prosthodontics is a complex speciality<sup>13</sup> since practice and training have to deal with oral and maxillofacial diagnostics, restoration and replacement of missing dental and bone structures, and the engineering and maintenance of dentures, bridges and implants. An extreme situation in this spectrum of possibilities is total tooth loss. And here enters Maló, who advocated a novel, indeed, radically new approach.

Maló’s technique for total rehabilitation of the edentulous is known as the “All-on-4” treatment. This is surgical and prosthetic procedure that was introduced and developed in the 1990s following the work and

12 · <http://www.ncbi.nlm.nih.gov/pubmed/25489155>

13 · In the US there are nine recognized dental specialties. According to the American Dental Association “Prosthodontics is the dental specialty pertaining to the diagnosis, treatment planning, rehabilitation and maintenance of the oral function, comfort, appearance and health of patients with clinical conditions associated with missing or deficient teeth and/or oral and maxillofacial tissues using biocompatible substitutes.”



## Case Study

## Malo Clinic

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analysis by Paulo Maló and his team. The first case was in 1998. Then advanced was carried out in cooperation with Nobel Biocare, the world's leading implantology goods manufacturer and professional services firm.

The "All-on-4" consists of an oral rehabilitation that is done in little time, with low uncertainty and by dispensing painful, costly and risky bone transplant. A totally or nearly edentulous maxilla and mandible is fitted with a fixed prosthesis by placing four titanium implants, two of them tilted, where jaw bone is available. A fixed prosthesis, or bridge of biocompatible materials simulating a perfect set of teeth, is placed over the implants immediately on the day of surgery. The concept is known as the Malo Clinic Protocol (All-on-4+MALO CLINIC Bridge) and is associated with an array over ten other products such as the NobelSpeedy implant (Figure 2).

That is, in a single visit with a minimally invasive procedure even for patients with virtually no bone volume can be treated. The result is a dentition with functional (chewing, phonetically,

FIGURE 2

## Malo Clinic Protocol, All-on-4system and NobelSpeedy implant

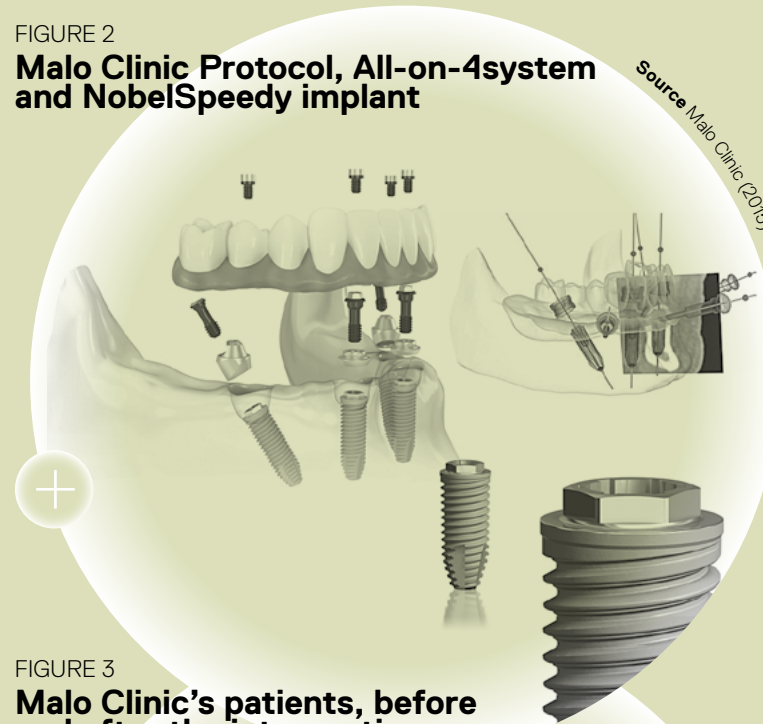


FIGURE 3

## Malo Clinic's patients, before and after the intervention



hygienically) and aesthetic qualities that lasts. In between one to two hours, in the hands of well-prepared professionals, the patient suffers a momentous transformation of appearance (Figure 3).

In Paulo Maló's own words: *"Our case was about innovation in the techniques and in the products. (...) That gave us the know-how and the capability to deal with cases with more success, more quality and less cost than our colleagues."*

*You see, a person then had to make a bone graft that was much violent in terms of surgical aggressiveness. It meant one year without teeth, almost a doubling of cost and a very low success rate in severe resorbed cases. If the patient was a lady above 75 years old the success rate is very low indeed.*

*We do cases with 94 years old, we place all the teeth in one day, for half the price and with a 98% success rate. It's tremendous because usually when we augment quality and the success rate the cost also rises, it's normal because we are offering a better service."*



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With Malo's protocol half the cost means less €8,000 or €10,000 depending on the country. This because a bone graft means one or two days in hospital and a group of oral and orthopaedic surgeons huddling over four hours of general anaesthesia. Before, overweight people or people with diabetes, osteoporosis or other health conditions that had little chance of success were faced with no solutions. The Malo approach changed all that:

*“This is what made us famous and a hook. We could do a thing that other could not do. This represented a window of opportunity. Or would wait and other would copy us or we go abroad and conquer our space while we are unique. What happened is that we kept developing new products that have put us years ahead our colleagues.”*

This couples with Swedish medical researcher and Professor Per-Ingvar Brånemark discovery of osseointegration (which means the fusing of titanium with bone and tissue) as the two major developments in oral rehabilitation since the mid 1970's.

However, the four implant approach to the maxilla is not the end of the story. Maló and his team were pioneers in immediate teeth loading, were early adopters of CAD/CAM in their dental laboratory for making the teeth, they contributed to immediate implant technology, modified the zygomatic implant and the abutment as well as the surgical protocol (see Box 1).

## BOX 1.

### Malo's advances

- 1991** Paulo Maló becomes active in the immediate-function approach
- 1993** All-on-4 treatment concept standard first protocol pilot study
- 1998** NobelSpeedy implant development
- 1999** MALO CLINIC ceramic bridge clinical studies, initial phase
- 2004** Nobelspeedy implant international patent.
- 2005** NobelGuide adaptation to the All-on-4 Treatment Concept
- 2005** Study of the All-on-4 Treatment concept hybrid and extra-maxilla, with zygomatic and pterygoid anchorage: initial phase.
- 2005** New zygomatic implant
- 2005** New zygomatic abutment
- 2005** New zygomatic drills
- 2005** All-on-4 treatment concept with extra – maxilla anchorage
- 2006** Internationalisation begins with an investment in a Polish branch
- 2010** The Macau Malo hospital span opens for business
- 2014** NobelParallel CC implant
- 2014** NobelSpeedy NP short implant

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## Hurdles of recognition

### ***Academically-based corporate scepticism?***

What Paulo Maló achieves with Nobel Biocare (Box 2), the world's largest developer and manufacturer of dental implant technology, is an example of persistence. We needed such a vehicle to scale up the usability of his ideas, a dental goods and instruments maker.<sup>14</sup> But it was not easy to establish the alliance.

Bo Rangert, a biomechanical engineer, would be an early leading expert to be persuaded by Maló. They had had a “good chemistry” from the start and would move along to help the Maló team to establish the results perfect the implant devices.<sup>15</sup> It was Rangert the one presented who first gave notice to Nobel Biocare of Paulo's designs. When they called Paulo they also convened a number of eminent professors in the field. Whereas Rangert asserted the approach worked the academics would laugh and ridicule it: “That is

acceptable in a naval shipyard, but not in the mouth of a patient.”<sup>16</sup>

They kept working, in spite of the negative feedback at the official corporate level. They studies the effects of using fewer or more implants, the length of the implants, the angle of attack. And Paulo set out to invent new implants compatible with it. The modified implants were designed to give more stability to the bone structure. This was the speedy implant, that Paulo developed in

1998 and pushing the agenda with his own money.

Surely he approached other firms, but these were even more brutal at dismissing the technology.<sup>17</sup> So Paulo kept approaching Nobel Biocare. For eight years he was going back-and-forth to Nobel Biocare with the results of his products and method. Each time the company would assemble a group of seven or eight academics, “university Professors with lots of theory but far clinical

practice”. At first they usually said more follow-up was needed. The following meeting Paulo had more follow-up time and more cases. Then they started to argue that the logic was missing and it only worked in Maló's hands, “it was not replicable”. It was only through the influence of an outsider, a lady experienced with medical technology start-ups, that a breakthrough happened. In a world of businessmen this lady dressed in red, wore red shoes and dyed her haired red. And notorious for here heavy smoking too.

Heliane Canepa was appointed as President and CEO of Nobel Biocare in 2001 and stayed until 2007. Canepa has been credited with steering the company into the world's leading position in the specialised dental care and restoration business.<sup>18</sup> Before coming to Nobel Biocare Heliane Canepa had been recognised already twice, in 1995 and 2000, as Swiss Entrepreneur of the Year and listed in 2005 by the *Financial Times* as the sixth of the 25 most successful business women in Europe. The newspaper credited her

16 · <http://bit.ly/1fN2xcD>

17 · <http://bit.ly/1fN2xcD>

### BOX 2. Nobel Biocare



Nobel Biocare traces its roots to 1952 when the first titanium implants were introduced in animal experiments. When implants were recognised by Swedish and US authorities in the early 1980s a partnership was established to industrialise the approach.

The company is named to Nobel Biocare in the mid-1990s. In the mid-2000 the Financial Times reconises it as the leading dental implants concern in the world.

In its communication material Nobel Biocare credits Paulo Maló as *the pioneer of the All-on-4 surgical protocol*. Straumann, Nobel Biocare's largest competitor, also credits Paulo Malo as the developer of the Malo Clinic Protocol in its commercial material.

**Source:** <http://bit.ly/1O2jviY>

14 · <http://bit.ly/1fN2xcD>

15 · <http://bit.ly/1hoSOu0>

18 · <http://bit.ly/1LJui41>

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for “brilliant marketing skills” and observed the Nobel Biocare seemed “buoyed by her energy”.<sup>19</sup> Canepa was committed to strengthening the links between research and business, keen to retune the company’s product range and to aggressively promote the company’s latest surgical innovations with conferences, workshops, hands-on demonstrations worldwide. She is the power-broker that would make the Maló dream a tangible success. One day she called him. “She believed my products and method,” he says “and she decided to go forward with it.” This was significant. Maló, goes on: *“She believed in the project. This was not pre-planned. She went to the chief research engineer and he said that the ideas were workable from an engineering point of view where scientifically they were valid too. And she as CEO decided against the advice of the wise men committee. The All-on-4 has since been released and is by far the most innovative product in the last 40 years. This product ensured that Nobel Biocare gained market share.”*

## **Friendly to users, but unfriendly to peers?!**

If Canepa was like a corporate godmother back the Nobel Biocare internal chief expert was like a scientific coach. Rangert had been involved the studies of biomechanical analysis. He was experienced in understanding and articulating why concepts worked the way they did. Rangert was used to take technical information and promoting treatments concept to clinical practitioners, mainly.

As Miguel Nobre, head of R&D at Malo Clinic, looks back he acknowledges the importance of these interactions:

*“He taught us many things. And when he died in 2007 I felt the need to move on and take my own masters in epidemiology. Only then we started to write all our studies ourselves.”*

R&D department of Malo Clinic had to deal several times with rejection when submitting papers with evidence. Working with Paulo since before the year 2000 he has experience of that. Winning the peers respect and confidence was not easy. The “all-on-4” was disruptive with the dominant concepts in terms

of dental implants. A decisive landmark was the publication of a paper in 2003 where Maló and his team fully articulated the new treatment concept, this was a full ten years after Paulo’s first hands-on clinical experiments.<sup>20</sup>

Miguel Nobre is reminded the day they received a rejection of a scientific journal signed by the editor. Willing to improve their text, Malo Clinic team asked what was needed to do to have the article approved, but it seemed not to exist an objective reason for that. The final editor’s answer was: “Because.” This kind of situations made Malo Clinic research team to reinforce their empirical studies and to get used to persistence.

## **Detraction and recognition**

It has been a somewhat up-ill journey for the Maló project in terms of recognition. His first experiments with the “immediate-function” approach were met with suspicion and even rejection. “They were calling me mad”, he recalled in an

interview.<sup>21</sup>

*“... we started to develop a technology called immediate function, it is my expression – we take out the tooth, we placed the implant in the cavity that is the hole the tooth leaves in the bone and we placed a new tooth above it. It was the beginning of our rise. They were calling me mad. I gave a conference in Miami and they told me it was a complete stupidity. In another conference in Gothenburg, two professors said it was ridiculous.”*

The standard procedures was different:

*“We took off the tooth; we let it pass four or five months for the bone to close. We made the hole and placed the implant. After having waited three, four or five months we placed the tooth on it.”*

There was resistance from the establishment:

*“As in everything in medicine there are dogmas and people who think they know everything. That was the classical way of doing it. But if I asked: “Why one does this way?, they would answer: “Because this is the way” and I*

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*hate to be told that. It gives me a mix of anger and challenge that makes me want to prove the contrary. If they do not explain it is because they do not know and if they do not know is because there is the possibility of doing in another way. But it was a war.”*

And he states “The fact I was a Portuguese did not helped.”

Meaning:

*“Being Portuguese does not bring credibility in the field of new technologies or very sophisticated inventions. If I set out to improve a wine or a cheese or some grilled sardine is all very fine.”*

More and more evidence was out that the approach was a viable solution. But it was also a fact that the dental care community did not absorb the innovation smoothly. Even after the Nobel Biocare involvement and the commercialization of these products all over the world, there were still some challenges to face.

Paulo Maló had his fair share of problems with the Portuguese medical body. At a point Maló was even inhibited for plying his trade for two months: “He was suspended for claiming to be the pioneer he

cannot claim to be, for saying he is the best and that is against the ethical rules.” said the Head Ethics Commission of the Portuguese dental medical professional body who he is also Full Professor of Malós alma matter.<sup>22</sup> However, he goes on to say:

*“I do not question the technique. There is no evidence of bad practice.”*

So what is the problem then?  
*“The problem is his bragging. Claiming to be the only able one is a lack of respect for his peers. That malicious advertising. He did not invented it, perhaps he has more cases behind him.”*

Paulo Maló and his head of research refer to scepticism as a constant, in Europe, as well as in the US.

Indeed, there is a dearth of scientific literature discrediting the approach or the surgeon himself. A recent book on oral rehabilitation, edited by a professor and consultant from Australia, cite Malo and his team in connection

to implant-supported fixed technology.<sup>23</sup> A recent book edited by a scholar of School of Dental Medicine of the University of Pennsylvania, refers to Paulo Maló and colleagues as the authoritative source for the description of the “All-on-4” approach.<sup>24</sup> Its advantages and popularity are recognised as well as its the short-term outcomes but mentions the need to substantiate the validity of the long-term results.

However, even more recent review work already reports evidence pointing in positive direction. One example is an editorial review organised by Harry Dym, the Chair of Dentistry and Oral Surgery at The Brooklyn Hospital Center and maxillofacial surgery at Columbia University College of Dental Medicine. Here we can see a report on the very high success rate over a 10 year period (99.2%) while also pointing to the immediate psychological effects

23 · *Oral Rehabilitation: A Case-Based Approach*, by Iven Klineberg and Diana Kingston (eds) (2012), John Wiley and Sons, John Wiley & Sons, p. 409. <http://bit.ly/1hnBwxi>

24 · Daniel W. K. Kao, *Clinical Maxillary Sinus Elevation Surgery*, John Wiley & Sons, Mar 26, 2014. <http://bit.ly/1KkPGwq>

on patients.<sup>25</sup> Here too the “all-on-4” is explicitly credited as a Paulo Maló design.<sup>26</sup>

## The company reaches out

### Sharpening the skills

Having called the attention of the international medical community but provoked some scepticism among dental researchers the idea became to invest in education.

One of Maló’s Clinic priorities is training their own staff. The education of dental doctors and the training of all the technical workers is also a way of combining technical capacity and individual empowerment with the culture of the company. All the people involved in technical and clinical service to the client has a preparation in the headquarters. The workers are also stimulated to circulate within the group, meaning that when a new clinic is

25 · *Implant Procedures for the General Dentist*, Harry Dym (ed.) (2015), Elsevier Health Sciences. (p. 467).

26 · *Implant Procedures for the General Dentist*, Harry Dym (ed.) (2015), Elsevier Health Sciences. (p. 427).

22 · <http://bit.ly/1F5Ss18>

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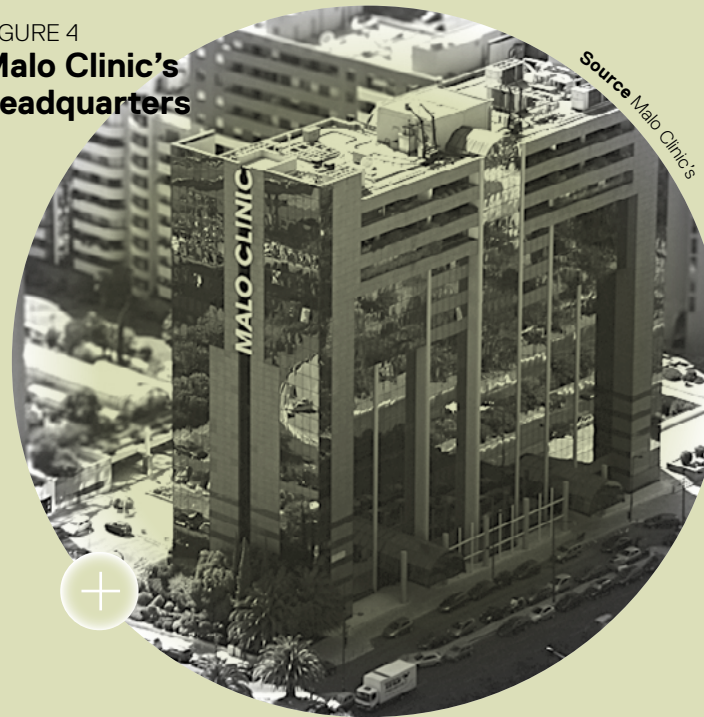
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open an internal call is made for those who might be interested.

But one of the most interesting practices on the training area is that today these very specialised workers of Malo Clinic are themselves the ones teaching the partners and even competitors through training courses and residencies the Educational department promotes (see Figure 4). It was established with its own trademark in 2005. The educational department develops 30 to 40 annual courses and residencies for approximately 3500 persons a year. This is the largest education centre in the world for advanced fixed rehabilitation and implantology.

Thus training is also a disclosure process. Why was this activity established as an operation in its own right? Training became a money maker, generate a revenue of millions. Revenue maximisation occurs while capitalising on already existing resources. For instance, the clinic does stop working and the staff is slightly reallocated to accommodate (i.e. students lean over when experts are operating key tasks). This is possibly the

FIGURE 4  
**Malo Clinic's headquarters**



biggest high-end dental education operation in Europe right now.<sup>27</sup> And, of course, the strategy whereas spreading knowledge allows Malo's surgery technique to penetrate in many markets. But there is also another issue: "the totally toothless person is a disaster ... This is not fair. That was the main reason for teaching it."

### ***What is exactly training for?***

Every person with education on dental medicine or even as a specialized technician can apply to participate in one of these courses, and then the clinical staff evaluates the applicant background. This person will see the normal functioning of the Clinic, including the surgery observation through a CCTV system, having contact with the clinical and laboratory areas. Partners are welcome, but also are newcomers. This

resulted in sharing know-how and techniques, increasing the number of peers interested in working or studying this method.

At the same time courses and residencies are available for the peers other complementary knowledge-transmission activities are carried. Paulo Maló presents the Malo Clinics' protocol in international conferences, seminars and workshops. In these events many doctors get interested by the method and came to Lisbon to receive training. Nowadays, one may say the Educational Department is also a tool in the internationalization of Malo Clinic.

But education was a sensitive issue at the beginning and it wasn't easy to make the kick off. It started in 2000 at a more national level but in 2004 it already functioned with a systematic program and was international. Before that and since the end of the 90s there was this internal discussion in the clinic if it was better to open the technology and method or to maintain it restricted. Both choices had positive and negative aspects.



Looking back Paulo states:  
*“Not to promote knowledge was to maintain the monopoly of the technique, but that would bring two problems: this technique had to be validated for colleagues around the world (peers), for the case of a treatment failure not having problems with justice or corporative professional associations. To obtain this critical mass we needed to more people publishing our method and not people directly dependent of Malo Clinic; another question was to make this products and method appealing for a company like Nobel Biocare we would need more people buying and using our technique and products”*

The result was the development of educational area and a specific protocol with Nobel Biocare for training of dentists and technicians. Today Malo Clinic has its own courses and tailor made courses for Nobel Biocare’s groups. Specialised education became a business operation in its own right. Malo Clinic is increasingly sought as training ground (see Figure 5).

Education revealed also an important mean to find new

FIGURE 5

### Asian trainees, news item in a Portuguese technical magazine



#### Chinese came to Portugal make training

The Malo Clinic received 60 Chinese professionals linked to dentistry for training. The Liaoning Stomatology Association and Private Dentist Association of Guangdong, from the Chinese Guangzhou region, sent their doctors for advanced training with the team Malo Clinic and Paulo Malo and acquire know-how ‘.

The large Asian presence is justified by the bet of the company on this market,

**Source:** Dentalpro, November, 2013, <http://bit.ly/1KtGRPt>

partners, most of them attracted by the success of all-on-4 technique, which still is the most known hit of Malo. When Malo Clinic signs a partnership

especially in Macau, Shanghai, Beijing and Guangzhou and, as well, the new partnerships with the Taivex Health Management and the Taipei Medical University Health System MedicalCenter two major health groups in Asia .

The international program “All-on-4 Treatment Concept” took place in the same way the Asian training but had 27 participants from countries such as Lithuania, Russia, the UK, Australia and India.

education is part of the deal, although the most complex cases are still done in the headquarters or by the senior specialized clinical staff of the headquarters

as a way to maintain a restrict control of quality. Paulo Malo himself stays most part of the year operating in the several international clinics.

Very recently and in the one of the most promising international market, Malo Clinic developed special partnerships in the education area. China has become the most dynamic market for the group and among other educational activities; there are study clubs and special residencies.

Having these courses and residencies spreads the Malo name and techniques. But it brought with it another challenge. They had to permanently innovate to be ahead of the ones receiving this training, because some of them might be competing with them. This demand justifies the activity the R&D department maintains and the involvement of all dental medicine staff in research. Led by the direct contact with the patient (knowing his needs) and by an organization oriented for innovation (with R&D department directly connected with the department following up the patients) the



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company assures its leading position in the “all-on-4” method. Again innovation guarantees the business success sustaining the place Malo Clinic has in the national and international market.

## Service and Communication

### *Designing oral care service*

Service design at Malo Clinic (see Figure 6 for an illustration) can be unpacked in at least three layers. There is a strategy for the front-office, how appearances and experience is moulded. There is a customer-centred set of operations for the treatment processes. And there are a number of underpinning back-office organisational capabilities in place.

Taking the pain and discomfort out of dental practice begins well before the therapy itself. Corporate identity and ambience design were critical dimensions in the business concept from the start. The philosophy and aesthetical signature of Malo Clinic’s brand image and clinics’ design were authored by

Alexandra Malo, Paulo’s youngest sister.

Throughout service design, Malo Clinic, intends to be different and closer to the client/patient. All the service is organized around the patient’s needs and experience. At Malo’s clinics one finds organized service, a clean decoration and functional spaces. While waiting patients are in a comfortable waiting room with a device which will give them the calling sign. During waiting time they can use different services at their disposal: a nice café, beauty treatments, shopping some products or just read magazines and newspapers available (Malo Clinic has an agreement with a media company, and this is included). Children have a playground place to play and have fun. The customer’s experience is not spoiled when waiting for a medical intervention. The clinic’s service begins by creating the sensation of not being in a clinic, but a leisure centre to take care of their health and wellness without syringes or hospital odours (Figure 6).

The operational routines and patient flow are also streamlined. Entering the doctor’s cabinet

FIGURE 6

### Curated environment of a Malo Clinic facility



Source: The authors, at the Malo clinic

the patient will be attended following the internal briefing based on the interconnection of dental area, verifying all clients’ needs, retrieving her historical record and activating the indicated services. This is an area that has been worked out in the sense of lessening the waiting time for the patient when she needs interventions from different departments. For instance, the laboratory department has been key in developing new routines for fast moulding ceramics and casting of implants. Under urgent services flexibility in lunch-time when the work is articulated

between the doctor and the prosthesis/dental implant technician in order to have always someone working with the patient. The patient shall never be alone while under treatment at Malo Clinic (Figure 7).

But this goal of providing an integrated and streamlined service does not happen only in at the level of the individual clinic. All the clinics are connected by an internal communication network, but also using social media as “We chat”, “What’s up?”, “Skype”, trying to maintain identical service output and outcomes in every clinic around

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the world. This allows Malo Clinic to have communication in real time throughout the organisation. Also they use visits and doctors and technicians exchange to promote discussion on the applied methods. When some service innovation is introduced (even if the idea comes from someone outside of the headquarters), it is trialled and validated at the headquarters. If it is proved to yield a service improvement it will then spread to all the clinics.

## Broadcasting Malo's way

The work of communication and marketing is mainly done at the headquarters<sup>28</sup>: they have marketers, communication technicians and designers. The website is a creation of their own. Externally procured tasks did not function as expected, so Malo Clinics tends to internalise functions. The head of the

28 · Rita Lacerda, Marta Roquete, Carla Costa. Communication and Marketing. Malo Clinic, Headquarters – 19<sup>th</sup> June, 3.50 pm

department, Rita Lacerda says that “we are closer both to the clients and to the technical work we have in the clinics.” So they persuaded the administration that outsourcing should be used only in very specific cases. In Portugal they are responsible for all the communication and marketing. They are a team of 13, but they were more sometime ago. In an area very strict in terms of communication and marketing, every promotional material has to be carefully studied. Comparisons cannot be done and treatments cannot be offered. So the company had the challenge of spreading the new concept of oral rehabilitation introduced by the clinic to an uninformed public. As an innovative method it was difficult to make everyone understand the process. So answers were found in unexpected proposals.

This was the case of some radio broadcasts (for instance in a local radio in Algarve, Portugal) and of the TV show “Portugal a Sorrir” (Portugal Smiling). They oversee and co-produce “Portugal a Sorrir”. Having a partnership with this TV show was not easy, as the issue rose some internal discussion on the

kind of public watched the show (it is broadcasted in the morning) and about the exposure the Clinic would have<sup>29</sup>. Although all the doubts things were easily and naturally going. The idea emerged from a personal case: to cover the story of a person with an oral cancer who needed a solution for her problem. It did not come out of an internal brainstorming or something the marketing team had planned by themselves. The patient was not finding solution and Paulo Maló decided to offer her the opportunity to have a treatment. She was living in London, but being followed by a Portuguese journalist. She spoke on a Thursday with Paulo Malo and got the operation the day after. The case was followed on TV with great success. Afterwards there was a new case about a man who had suffered shotgun shooting and again Paulo Malo did a surgery *pro bono*. In this case there was TV involvement.

Internally they were facing some resistance to these experiments. Not because of being *pro bono*, but because it was a popular slot

29 · Carla Costa, Marta Roquete and Rita Lacerda agreed on this point and shared it with us during the interview of 19<sup>th</sup> June.

FIGURE 7

All-round display of attention, the Malo team in action



Source: Visão, 2010, March 10, <http://bit.ly/1F5Ss18>

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that is not the prime customer target. But Paulo Maló and the communication and marketing team believed in this path. By that time a major TV show presenter had an “All-on-4” treatment (see Figure 8). This media star was very happy and became a fan, promoting Malo in a number of ways. He was toothless and “was so thankful and so furious at those who had told him his problem had no solution that he thought his own case had to be known”, tells Maló.<sup>30</sup> The TV show was monthly broadcasted, but having so much success that Paulo Maló decided to make it twice a month. Finally there was some sympathy at Malo towards this actions and the idea was adopted.

The show involves the Communication and Marketing department and the medical team doing the intervention. The participants are chosen by Malo Clinic according to their life stories and the fact they have low income. Then they make a before and an after, focusing not only in appearance, but mostly in

how people’s life changes. Their aim is to assure it is more than a physical change; it also results in a psychological transformation because people feel they have more success in socialising their experiences.

Today there is such a show running also in Poland, as a support for their operating there but in a slightly different format, as the media and advertising law in Poland is very different from the Portuguese.

FIGURE 8  
**The pivotal media figure**



Source Malo Clinic's

## New Knowledge is New Normal

### **The innovator in chief**

Malo’s is seldom on record claiming he invented it all. On the contrary, he is careful to position his claims. Regarding the “Speedy” implant *“I made from the drill to the implant, passing by the way of placing the prosthesis, I did everything to create a protocol. I did not invent the implants, I have changed them. I did not invent the total fixed prosthesis, I have changed it. I have changed those products to work without boon transplantation, with a higher success rate, cheaper, having the teeth in the same day. For half of the price.”*<sup>31</sup>

Miguel Nobre echoes this point: *“If we separate the main elements of the techniques we weren’t the first to use it. But in a combined way we were the first to deploy the four implants for immediate rehabilitation, using four angulated implants. So we were the first ones to do total*

*rehabilitation in just one day. We started by the jaw, because it was a win-win situation (there was quality and quantity bone to receive the technique).”*

Then, it was a learning curve: *“... in the beginning I was only doing this method to the younger patients, with very good bone.... Then we moved for the less perfect cases – older people, less bone, the ones needing take the teeth and place the implants at the same time...”*<sup>32</sup>

As the technique is more and more out in the open the issue seems to be keeping on learning; learning faster than competition, that is: *“I love competition – but until today no one was able to improve this technique faster than me.”*<sup>33</sup>

Malo Clinic kept on developing more and better products adapted to the technique, trying to improve every year. This is the story of NobelSpeedy (from Nobel Biocare) and its unique group of product, from which Paulo Maló received fees on the sales. Malo

30 · <http://bit.ly/1fN2xcD>

31 · <http://bit.ly/1fN2xcD>

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also offers the implant of 25 mm or the zygomatic implant, the one receiving COTEC award. With this design the maxillary bone to do implants is not needed, and that was a technical jumpy as well as a cheaper and quicker method from the point of view of patients.

The record of self-owned intellectual property has increased recently:

- Paulo Sérgio Maló de Carvalho. Fixed prosthesis supported on Metal- ceramic dental implants for prosthetic rehabilitation of edentulous patients. Utility model number 10759. December 12<sup>th</sup> 2012.
- Paulo Maló. Device for transferring the position of an angled abutment from a model to an implant. United States of America patent US8142192 B2. March 27<sup>th</sup> 2012.
- Paulo Maló Carvalho, Lars Jörneus, Henrik Petersson. Medical implant and method of implantation. International patent WO2010003433 A1. January 14<sup>th</sup> 2010.
- Paulo Maló Carvalho. Fixture

for anchoring in jaw bone. International patent WO 2004/091424 A1. October 28<sup>th</sup> 2004.

Recognition via awards and prizes kept powering in (Box 3).

### **Research it, evaluate it, do it all over again**

Miguel Nobre, Malo Clinic's chief scientist, says that:

*“When I started at Malo Clinic, 16 years ago, we were already involved in a partnership with Nobel Biocare for development of products. It was getting out the first implants with oxidized surface that became the standard of implantology. By that time Paulo Malo thought about creating the R&D department.”*

The key business of this R&D was to muster evidence behind the “All-on-4” technique. This means that Malo is awake to the business of publishing papers in authoritative journals (Figure 9). It is a credibility game. Establishing on paper what is already proven in practice.

There was much resistance in the dental medicine profession,

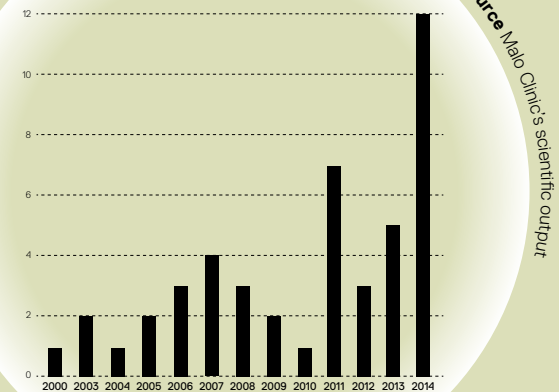
## BOX 3

### Awards and recognitions (sample)

- ▣ “Iberian award 2001 Clinic Implantology –SEPA e Nobel Biocare”
- ▣ “INSEAD’s Entrepreneur of the Year Award” – 2007
- ▣ “Produto Inovação COTEC UNICER 2010” -This award aimed to promote business innovation in Portugal, distinguishing the Implantology and Fixed Oral Rehabilitation surgical techniques and devices, All-on-4
- ▣ “Innovator of the Year 2011” from Mediazone Group assigned by the publishing “Hong Kong Most Valuable Companies
- ▣ Malo Clinic selected National Champion in the 2013/14 European Business Awards

FIGURE 9

### The pivotal media figure



so they thought about moving upward in terms of legitimacy proving scientifically the methods and the success rates of the techniques. Their main concern in terms of formal research is the clinical

epidemiology. The evaluation of dental applications has always a focus on the patients, so it is very practical and not aligned with the fundamental scientific research.



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## ***But to what else is research for?***

Malo's research has an empirical basis, it is applied and the endpoint is always the patient. It is about increasing their success through improving the technique and giving more life quality to the client. The R&D team is focused on the development of innovative products and techniques adapted to the approach they already master.

The concern is to be accepted by the peers and to face attempts at discrediting the methods that made Malo Clinic famous. But publishing and dealing with questions helps to perfect the technique and its presentation. The Malo researchers started doing a roadmap from the doubts and questions the method might raise within the dental doctor community. Each time there is a new product variation or a change to a part of the protocol, Malo Clinic goes for publication engaging directly with scientific stakeholders. Feedback is now a core input for continuous improvement.

But a key R&D work is now to follow up all the patients receiving

Malo treatments all over the world. A system for gathering all the data about their evolution and situation is now established. And this is a huge asset now, systematising patients histories and developments. Increasingly in Malo's work one may find studies with short follow-up but also for longer periods (the longest study was based on a fourteen year follow-up). It is not by chance that Miguel Nobre is directing both the R&D department and the Oral Hygiene Department. It is the easiest way to share the same protocol when analysing the patients and collecting the data needed to demonstrate the technique is applicable.

Nowadays, moreover, actors from the fundamental scientific research already come to Malo. These institutions are interested in developing partnerships as part of more fundamental agendas, for instance in the genetics area. This emergent type of research collaboration is grounded in PhD student projects.

Malo Clinic has already two partnerships in research with the Medicine Faculty (University of Lisbon) by the side

of Malo's headquarters. It was the Stomatology Service who proposed to Malo Clinic this cooperation. This partnership resulted in some of Malo's dentists starting a PhD in this faculty. Recently this kind of collaboration in research is unfolding. It is a win-win process as the university can help them in the area of pain treatment and, in exchange, Malo Clinic can teach their technique. Malo also considers the possibility of post-graduate courses to medical staff sharing some of their techniques, covering dentistry, aesthetics doctor and general physicians. But as the partnership begun recently it is not decided if it is going to be deeper or only maintain the present model.

Nowadays, moreover, other actors from the fundamental scientific research already came to Malo. They are interested in developing partnerships to push ahead more fundamental agendas, for instance in the genetics area. They have international standing and, however, and this new development is grounded in PhD projects we are nurturing.

## **Sustaining dental care business model**

### ***Human side, people management***

The Malo Clinic story begun by a need for solution of the most complex cases of edentulous people and continued with the need to prove the method was possible. This path obliged Paulo Maló to become more a more a team-assembler.

The company had to focus quality, rigour and a high skilled working force. And this is present in the enterprise organizational culture. Workers empowerment and motivation is based on the opportunity of working with the newest techniques in dental health sector, which allows them to be very skilled players in their area. As there are hyper specialized services, most of training is distributed according the specialization of each worker, exception made for general training courses.

### ***Human resources as a critical capability***

The exclusivity of workers is considered one of the pillars of

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internal work organization. This makes them concentrated in the philosophy of the company, and being available to work for improvement.

Although the company has some benefits for the workers like discount on services and facilities in payment, the major motivation seems to come from the idea of excellence and quality of work meaning to improve every day and to build personal and institutional capacities.

Human resources department is recent and appears with the boom of clinics in national territory and with the international expansion, and the consequent complexity brought by new partnerships under different models. All the services and departments were affected by Malo Clinic growing, but some like the clinical department were more prepared. For other services it was important to adapt. The ceramics laboratory is a good example of that, creating and adapting protocols and procedures permanently to improve the final result. It earned its own autonomous trademark in 2008, a community trademark

valid in all Europe as Malo Clinic Ceramics.

## Diversification dynamics

### *Qualities of service and quality of service*

As seen before, Malo believes health services should have a consistent association with wellness. Therefore the company developed some services integrated in the clinics' spaces. Although these services were not medical ones, they could complete the sensation of feeling well. The opening of a Spa in the same space as the clinics in Macau, the investment in the Luso thermal baths and the integration of a gymnasium in the same building as the Lisbon clinic represent this concept of integrated service clustering. At the Lisbon clinic, for instance, other services as performed such as a hairdresser, an aesthetics boutique or even a gourmet shop selling products like wine (Malo's wide, as a matter of fact). These services the function of making a clinic will be much more than experiencing

a cold medical service and this was the justification for this investment in surround areas that one may think are not directly connected with the dental health or health universe. But the Clinic itself created the traffic that helps reinforce the other operations.

But while inside Portugal expanding this way was possible it was not clear it would have the same results in other places. So focusing on its core business Malo Group found the way for internationalization: dental health was the area bringing recognition to the company and the reason why the name was known worldwide. This does not mean in the future Malo Group will not have prestige in other areas like wellness. But for the time being the idea is to reinforce the brand by beginning with the most known area of activity: the dental health solutions.

One of the main concerns of the geographical diversification, meaning internationalization, was the fact quality had to remain the same. Difficult cases are coming to the headquarters for treatment. Laboratory material and component are standardise

and sometimes produced at the headquarters so as to assure homogenous quality. Since Malo Clinic name was known because of advanced methods like the "all-on-4" or the NobelSpeedy it is deemed essential that placement methodologies and complementary materials are in line with the standard requirements.

Paulo Maló follows this perspective. That is why, he says, internationalizing services is more difficult than exporting his wine (he is a producer of wine). The main challenge is to deal with heterogeneity stresses. Keeping the quality and controlling its outcome in terms of customers' experiences.

### *Going global*

Internationalising in the health sector brings other kind of demands too. When it moved towards this strategy Malo Clinic changed its logo and applied for a large number of trademarks. Regulation is intense in the medical and dental care sectors. In some countries clinics have to be owned by locals (or having studied locally) or have to



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employ a high number of local doctors. The type of presence has to be calibrated to fit the particular laws and customs of target markets. For this reasons sometimes a foreigner cannot be owner of an establishment or a professional there.

Malo evolved a kit of approaches. Today there are three different models to internationalise: the company has its own clinics (like in Poland); the group has shared clinics with local partners (Colombia, Australia, Japan for instance); and, a new internationalization model. In this new model the brand is first licensed (in this way the market is tested), when the brand is well established in the country Malo Clinic's medical staff joins the local team (marketing and communications are articulated with the headquarters), then the company launches the clinic as full partner, as the market and the local organisation are already prepared for this.

Navigating these constraints, Malo Group decided to go forward and in less than ten years the company is present in all the continents (Figure 10).

Of course during this process they were learning and they had hard lessons to digest. A big hole in the map is like Brazil. Malo went for it, and failed. Looking back Paulo Maló says:

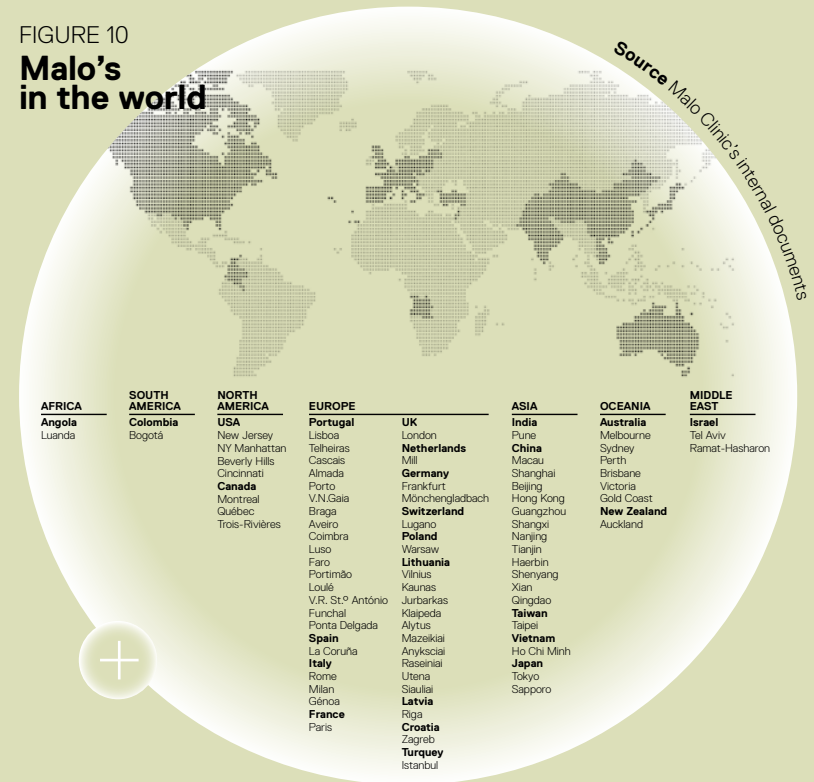
*“The Brazil failure became an enormous management success. We learnt things applied just to our sector... Things you can't find in the books. It taught us things we couldn't imagine they could exist... this is a service and we learnt all the difficulties a health service has to face to internationalize.”*

In this case language and culture did not help. Maló assumes being Portuguese was sometimes an obstacle to be recognized and respected at the beginning, mostly by his peers or by the industry. But the Portuguese footprint in the world was instrumental during the initial stage of the group's expansion through the world. Paulo Maló recognizes it:

*“The only good thing was to have a huge emigrant community who supported our work from the first time. They were our first clients abroad. It was like I was the ‘Cristiano Ronaldo’ of the teeth... they were proud of*

FIGURE 10

## Malo's in the world



*having a Portuguese as the best dental doctor. That was so in Switzerland, in Germany, in New Jersey, in Luxembourg, in London. It was important to have them there... we have one of the greater diasporas in the world and when we were going to a country we looked for the places where existed Portuguese communities.”*

The group took the risk of going out in places they believed it was easier to reach clients. Even

though there were bad experiences in Brazil and another one in the US (they had to shut down one clinic in California as they were not keeping with the standards) along the way, these made them improve the internationalisation process. Today they are recognized as a reliable brand and as a company with high business skills in dental health area.

Even though the commitment of the company with

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internationalization is deep, finding the partners to settle the clinics (with all its infrastructure and equipment) requires work and investment. Part of this investment is made directly by the company, meaning the results obtained in other areas are channelled for internationalization. One of these results are the fees from intellectual property. This finance is like a reinvestment as having more partners and clinics will increase the demand for and value of the technology.

Only through flexible partnering, ingenious use of intangible assets and the channelling of earnings into business development could Malo develop expand so rapidly and keep its internationalisation momentum. One key example is how Maló's business in China is developing. The first stone of a projected giant university campus was laid in 2015 (see Figure 11). There will be a Malo Clinic in the campus with full services and the latest high-tech gear.<sup>34</sup>

## Lessons

The Malo story starts in the early 1990s in a dental cabinet with a challenging problem and develops towards a worldwide known dental clinic. It all started with new therapeutic processes and dental products. "I am not a medical doctor," he says, "I am a mouth engineer."<sup>35</sup>

Today it has grown into a big operation. Here is one of the most significant events of the quarter of century in the complex dental surgery and restorative implants. Here is too a global commercial venture in medical services. This are considerable developments. The advances in procedures and designs Paulo Maló is associated with are at the

root of it. But Paulo's approach to dental problem-solving is heterodox. This meant many barriers, some of them social and institutional in nature, had to be negotiated, managed around or simply broken-through by sheer persistence or pure luck. Can, indeed, many of the strategies be read as a response to hurdles and organised resistance in the companies environment?

Innovation at Malo was at first the result of his intellectual curiosity and creativity, dissatisfaction with established procedures and devices, the cumulative acquisition of experience with difficult clinical cases and relentless entrepreneurial drive. "The inventor is an eternal dissatisfied", Paulo says. Malo's impetus and sustained trajectory that suggests that in his case this factors were self-reinforcing. How difficult, it may be questioned, was this mix of factors difficult to replicate by others. "Paulo is like a locomotive." Said his wife, who he met in the mid-1990s when he was doing a training course. "Either you jump and you go with him or you are left on the ground." She must know. She was his teacher before being his partner.

FIGURE 11

### Malo is expanding in China



Source: Malo Clinic's internal documents

<sup>34</sup> · <http://bit.ly/1Q25HX3> , <http://bit.ly/1Km9Wwh> , <http://bit.ly/1LDeLjm>

<sup>35</sup> · <http://bit.ly/1fN2xcD>

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The Maló story suggests that a commitment to innovation made him achieve in no other practitioner of dentistry was able to do. Scale up, spread out and dynamise structurally transform practice itself. And go beyond the individual dentist shop. His Malo Clinic is a singular case in size and geographical breath in the medical area. Innovation and internationalisation came hand-in-hand. In the process Maló showed how a final consumer-oriented could become research-intensive tradable service. To what degree was this success unexpected when, compared, say to standard firm-oriented knowledge-based professional services?

Opening fresh technical opportunities is one thing, but value extraction is quite another. By no means straightforward. Knowledge had to be refined and validated. Financial arrangements for growth in capacity had to be sought. It was necessary to enter into agreements with a big multinational that could work to open up market possibilities. Reputation had to be built and defended in a variety of fronts.

Certainly, not all entrepreneurs have the skill or the luck to persuade the wide array of actors needed to unlock the potential value latent in initial ideas. At the same time Maló never withdrew from the frontlines of innovation. He is the general fighting in the trenches. Was Maló's charisma that made the difference or the collective arrangement of forces he was able to assemble and channel?

Even after the initial success the issue is often how profits were re-invested in further science and business development. After 2000 a number of organisational novelties start to happen. Malo Clinic begins more fully internalising in-house research structures. R&D begins to be systematised by then. It is mandated to build a scientific shield around Malo's technological propositions. However, from it rents and secondary benefits are derived that can be appropriated profitably by the company as a whole. It allows the firm to better absorb feedback from users and to generate possibilities to coordinate with stakeholders hitherto difficult to enlist as allies,

namely individual academics and university institutions. Will this R&D capabilities (oral challenges appraisal and customer-oriented skills) and assets (Malo's enlarging case database) be further leveraged in the future, say, by entering the science services to dental equipment multinationals or to the university industry? Can Malo's intellectual property rights management and intangibles licencing contract design then match its innovation prowess?

Notwithstanding, a knowledge-intensive business already branched out. Training emerged as a business activity in its own right from Malo's internal training needs. Capitalising on Malo's sophisticated problem-solving capabilities, R&D resources and physical assets this has become a high-margin service. Providing in-depth and on-site training to others also feeds back into the reputational and internationalisation roles of the firm. This activity seems to strengthen the Clinics ability to better select future partners and set-up decentralised networks. How the community of Malo alumni can be further capitalised

in the future is yet to be seen?

Not all changes are based on dental expertise and engineering. Malo also introduces a number of organisation and marketing innovations, becoming more sophisticated in terms of patient catering, ambience design, back-office information management, and outward communication policies. Service management became more holistic, but also the routines supporting the service became more integrated, developed and technology-intensive. This industrialisation of such a sensitive and delicate trade as a medical service is a rare phenomenon. He operates in many cities, he takes pride in knowing all his direct employees, he keeps the companies culture and upholds its standards first-hand. How exactly this is to be sustained over time as the company expands is a challenge. Which service innovations will follow?

The diversification performance is also remarkable. Malo Clinic, after venturing itself into wellness (SPAs) and healthcare (specialised and general practice) seems to have stopped this drift.

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The challenge is now to focus on the expansion and consolidation of its global oral care operations. There is a talk against reinforcing the conglomerate character of the group. Narrowing the spectrum of themes is correlated with a deepening in the science and a stretch in geography. Is R&D and branding the optimal sources for reaping the static and dynamic economies of scale? Where will the limits to vertical integration be drawn?

So far Malo's operation is unique in the world. He stands out as an innovator and as an exporter in sophisticated services. For sure a remarkable experience for a country with notorious difficulties in creating world brands, let alone in science and technology or in the tradable consumer services. Paulo Malo spends much time flying. He happens to see himself as an African with Portuguese passport. He feels he belongs to the world.

From individual cases of oral distress and total dental absence Maló, the man, drew brilliant lessons about the workings of implants in general. Now, is he a notable exception or the first of

a new paradigm of knowledge-intensive consumer services? What general lessons can we, in turn, derive from his example?

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## APPENDIXES

### Appendix 1. Corporate identity

#### OUR VISION

To offer an innovative technique allowing for fixed (non-removable) teeth as a solution to a universal problem that affects a significant percentage of the world's population (the edentulous) in a single intervention lasting less than 6 hours.

In addition to routinely being accomplished on the same day, the technique can almost always be performed without the need for bone grafting and ultimately is more economical than traditional implant techniques used for full mouth rehabilitation. Lastly, it can be delivered on a global scale, thus reinforcing our leadership position in the field of oral rehabilitation.

To further develop medical services in strategic countries throughout the world that will include a complete health "check-up", away from the aggressive and potentially contaminated hospital environment, with a high standard of quality and in unmatched comfort, as well as to help increase the quality and life expectancy of our patients.

#### OUR MISSION

Ensure the provision of services of excellence in key countries, with bases on the following vectors:

- Improvement of techniques, processes and materials through continuous innovation;
- Disseminate the clinical protocols of the oral rehabilitation process to facilitate international development and expansion;
- Expand the network of MALO CLINIC into key countries, maintaining our standards in the quality of services rendered, the medical and diagnostic equipment used, and in the facilities and create barriers to the entry of other international players;
- Develop strategic partnerships which add value to the development plan, framed within our vision and standards.

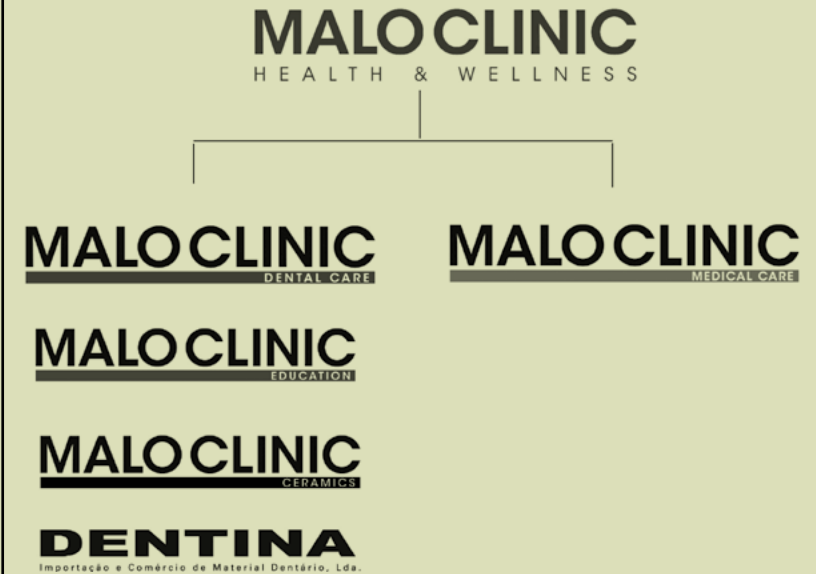
For the complete health "check-up" - To develop strategic partnerships with recognized and prestigious institutions in the healthcare industry, which complement the valences of the MALO CLINIC and allow access to the latest diagnostic modalities, best doctors and specialized entities of recognized quality, and make it possible to offer these services of medical excellence in a SP A environment.

#### OUR VALUES

- Treat patients with a continued focus on providing excellent medical care and customer service.
- Remain open to innovative processes and continued research in order to enhance the quality of our services and of patient's lives.
- Promote a culture that encourages teamwork, initiative, trust, goal-oriented work and the respect for others, in a pleasant and informal environment.
- Encourage the commitment to the Groups' values and objectives.

### Appendix 2. Corporate structure

The Malo Group, 75% owned by Paulo Maló, is an umbrella name.





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Case Study

# Malo Clinic

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## Malo Clinic:

Innovation as an  
anchor of global  
outreach in oral care

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## Case Study

# SISCOG

Combining general and client-specific knowledge to design optimisation solutions for railway and underground companies

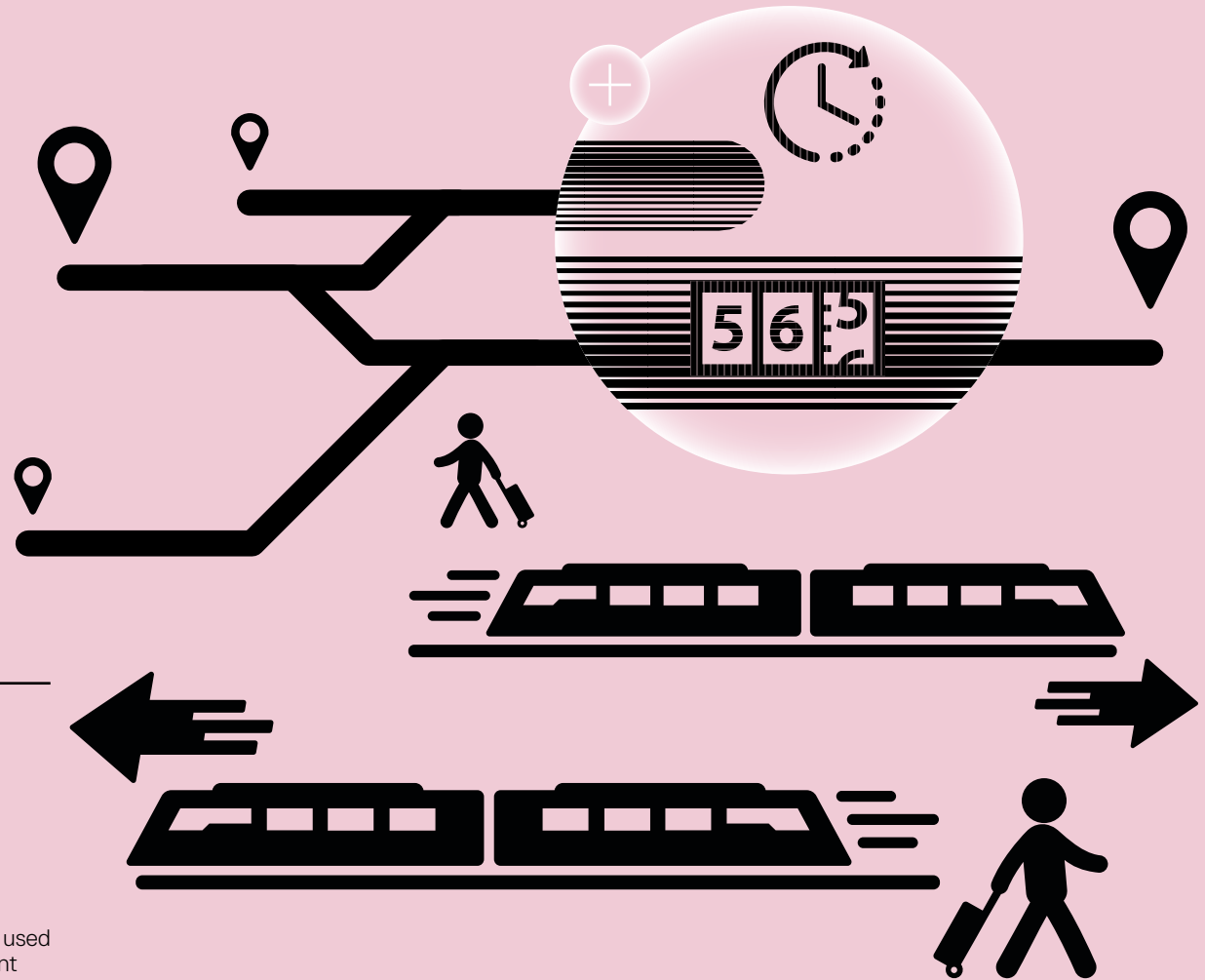
Vitor Corado Simões

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Nuno Crespo



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## SISCOG: Combining general and client-specific knowledge to design optimisation solutions for railway and underground companies

### Abstract

This case is about *SISCOG – Sistemas Cognitivos S.A. (Siscog)*, a software company, based in Lisbon (Portugal), specialised on resource management decision support systems for railway and underground transportation companies. The company turnover increased almost five-fold between 2007 and 2014. *Siscog* software is used by some of the main European railway companies, namely in the Netherlands, Denmark and Finland, as well as by the London underground. The case ends in 2015, when *Siscog* has just won the first contract outside Europe, with *Via Rail Canada*.

It is shown how a start-up created in the 1980s by two young PhDs in Artificial Intelligence was able to identify an application field for its scientific and technological knowledge, and how it forged ahead through a committed business focus policy.

A key thread is the purposeful combination of scientific knowledge with practical knowledge about the railway and underground businesses. Evidence about the process of knowledge accumulation followed by *Siscog* indicates that new standard products are developed, following a modular approach. Learning from specific applications is used in designing standard products. These are later adapted to the specific contextual conditions faced by clients.

A relevant change in *Siscog*'s knowledge base was the move from Artificial Intelligence to a combination of Operations Research and Artificial Intelligence. This was driven by the need to respond specific clients' requirements, providing an interesting example of dynamic capabilities.

The case concludes with references to the challenges faced by *Siscog* in the near future, eliciting students to identify the most appropriate actions to address them.

### Keywords

Siscog; Software for Railway Industry; Operations Planning and Management; Entrepreneurship; Company Development; Innovation Capabilities; Knowledge Application; New Product Development.

### Acknowledgments

This case was written by Vítor Corado Simões, Manuel Mira Godinho and Nuno Crespo, of ISEG – Lisboa School of Economics and Management, Universidade de Lisboa, for COTEC Portugal, between May and June 2015.

Personal interviews were held at *Siscog* with Professors João Pavão Martins and Ernesto Morgado, founders and Members of the Board, and the following executives (by alphabetical order): António Frazão (Head, Products Dept.), António Vasconcelos (Projects Dept.), Eduarda Ferreira (Head, Organisational Development Dept.), Liliana Pereira (Director, Quality Dept.), Natalina Magro (Head, Strategic Development Dept.) and Ricardo Saldanha (Head, Innovation Dept.). Face-to-face interviews were held on June 2015. 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.

In contrast, for other quotes, the relevant sources are explicitly acknowledged. The book *Siscog-Um Quarto de Século*, edited by *Siscog* on its 25<sup>th</sup> anniversary, and offered to the authors by Professor João Pavão Martins was extremely helpful in developing the case study.

The authors thank all the *Siscog* executives mentioned above for the information and the support provided. They have been essential to improve the quality of the final product.

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



## Introduction

### **Celebration time at Siscog!**

Lisboa, May 2015. *SISCOG – Sistemas Cognitivos S.A. (Siscog)* is a software company, based in Lisbon (Portugal), specialized on resource management decision support systems for railway and underground transportation companies. It has just signed a contract with *VIA Rail Canada*, a state-owned company operating all over the country, regarding the supply of two of its products (FLEET and ONTIME) to support the Canadian company operations. Even though *Siscog* had tried to enter the North American market since the late 1990s, this is the first contract there.

The company has grown in recent years, employing now 130 people, up from 60 in 2007. According to company estimations, it ranks third in the World market for railway crew planning systems. Keeping the team spirit is a key concern for *Siscog*: it belongs to the top-25 “Best Companies to Work” in Portugal.

The celebration dinner is taking place in Estoril, overlooking the

sea. Ernesto Morgado and João Pavão Martins, the founders of the company and still involved in its daily operations, had decided to take charge of opening themselves the first two bottles of *Legado* (Legacy), to express their greetings and recognition for the commitment of company’s social community in getting this relevant contract, expected to mark a turning point for *Siscog*. They had personally selected this wine, one of the icons of *Sogrape*<sup>1</sup>.

While opening the bottles and sipping the first glass of wine, Ernesto Morgado and João Pavão Martins could not avoid thinking about the company’s history and their own *legado*. They have launched *Siscog* in 1986 and transformed it into a key player in the European railroad operations software market. However, such a path has not been an easy one. A lot of commitment and effort was needed to make *Siscog* the healthy and sustainable company it is today.

1 · *Legado* is the testimony of Fernando Guedes, the creator of Mateus Rosé and founder of *Sogrape*. A family firm, *Sogrape* received in 2015 the best wine producer worldwide award, granted by the World Association of Writers and Journalists of Wines and Spirits (WAWWJ).

After more than 40 years working together, an eye glimpse was enough for each one to figure out what the other was thinking about. And they realized that both were heading on the same. The company is approaching its 30<sup>th</sup> birthday, and there is a shared view regarding its success. But also a common question mark is emerging about the future: Which will their legacy be? How could they prepare the required managerial change, now that they are approaching 65? How will the company’s “succession plan” apply to themselves?

## The early years: knowledge looking for applications

In the early 1970s, Ernesto Morgado and João Pavão Martins were both undergraduate students at Instituto Superior Técnico (IST), the main engineering school in Portugal. After graduating in Mechanical Engineering, they directed their interest towards the then emerging field of Artificial

Intelligence (AI). A couple of years afterwards, each of them got a Fullbright scholarship to pursue their doctoral studies in the United States. By chance, they were both accepted at the same University: the State University of New York, at Buffalo. The friendship links and the cooperation that had started at IST benches were strengthened on the other side of the Atlantic.

They realized that several of their American colleagues had successfully launched their own companies. Inspired by this environment, they decided to create their own company, upon coming back to Portugal with the PhD diplomas in AI. However, in the early 1980s in Portugal there was yet no market for AI applications, and there was a dearth of skilled professionals in this field.

Their eyes blinked in September 1985 when they read at a newspaper article that *Sperry*, then one of the main computer manufacturing companies, was betting on the development of AI. Less than two weeks later they were meeting Carlos Coelho, *Sperry*’s general manager in



## Case Study SISCOG



Portugal. Coelho was surprised by their knowledge and pluck: “*The kids are funny!*”. This was the starting point for a long-lasting cooperation with *Sperry*. It was agreed to launch three seminars aimed at increasing the awareness of potential customers about both AI applications and the hardware commercialized by *Sperry*, namely the LISP (*LIST Processing*) machine.

With the money paid by *Sperry* as compensation for the preparation of the seminars, they created *Siscog* in June 1986.

Throughout this process they had time to mature their ideas regarding company’s strategic orientations. They established four basic principles which have guided *Siscog*’s development, presented in Box 1 below.

The challenge then became: *how can we find the most interesting fields to apply our AI knowledge?*

Of course, there was no algorithm for this. *Siscog* followed a trial-and-error path. The idea of replicating the US approach of identifying decision-support systems for manufacturing

### BOX 1

#### Siscog’s Basic Principles

- ▣ To develop high quality systems: high quality and performance as a differentiating feature of SISCOG’s outputs;
- ▣ To focus on specific market areas: Siscog espoused, since the early stages, a niche strategy;
- ▣ To compete internationally: their stay in the United States and the experience got there had convinced Ernesto Morgado and João Pavão Martins that they should not bound the geographic scope of the new-born company; and
- ▣ To develop products: the purpose was to “create a firm with its own intellectual capital, which would be translated into a set of products (software tools) (...), instead of (...) providing software services”. As Ernesto Morgado put it at a press interview, “we intended to position ourselves not as another provider of information services, but as a company with its proprietary software, with a world approach”.

**Note:** This text, while reflecting the guiding ideas, does not correspond to the exact words used in the 1980s. The expression “intellectual capital” translates the *zeitgeist* of the early 21<sup>st</sup> century, and was not commonly used in the 1980s

**Source:** *Siscog: Um Quarto de Século*, pp.19-20.



companies was soon discarded: there was no demand for that in Portugal. The first opportunity emerged late in 1986 through a contact by an executive of *TAP*, the Portuguese state-owned airline, regarding the planning of airline crews. For *Siscog* this was very interesting issue, as it might be addressed through

AI. Since *TAP*’s annual budget for this type of projects was no longer available, an agreement was established to develop a prototype for free, financed by *Sperry* and *Siscog*. This was delivered to *TAP* in early 1987. However, this did not materialise into a contract. *TAP* suggested to carry out the development

of the systems in-house, by its IT department, *Siscog* being assigned a consultant role; this was not accepted by *Siscog*, since it was against its ‘*products, not services*’ principle. With hindsight, João Pavão Martins recognizes that *TAP* “*did not trust neither the technology nor Siscog’s capabilities*”, and adds “*but this has been a key step to test technological feasibility, and to develop our competences*”.

A few months earlier, in September 1986, *Sperry* and *Siscog* decided to raise a challenge to the audience of the seminars they were organizing: the first customer to head towards the development of a demonstration prototype would get the first three months of development free of charge. The state-owned *Banco Nacional Ultramarino* (then one of Portugal’s biggest banks), expressed its interest, and *Siscog* developed a prototype to manage the bank’s cash flow.

Word-of-mouth worked, and *CP*, the Portuguese state-owned railways, became aware that *Siscog* had developed a paid prototype for *TAP*. When *Siscog* presented such prototype at the



*Unisys*<sup>2</sup> center in Saint-Paul-de-Vence (France), in early 1987, two top executives of *CP* attended the presentation. They understood the positive implications that AI could have for the company. In one week, the *CP* Board decided to go ahead with the development of a paid prototype regarding the planning of trains' crews. One of the outcomes of this work "*still corresponds to Siscog's vision about the way how planning and management systems interact in a transportation company*"<sup>3</sup>.

In spite of the later exploration of applications in other areas, such as airline services, mining companies and statistics developments, *Siscog* had found the niche it was looking for since inception. The perception of the application niche emerged: software for railway operations. This choice was more the result of circumstances than of an intentional managerial decision. But it laid down the company's way for the future.

## Siscog's first 25 years of business development: a long march

### Relationships with the Portuguese Railways

Ironically, the contract signed with *CP* in December 1987 did not bear the fruits it was expected to. A cooperation process was launched, a prototype for planning train drivers duties was developed (labeled ESCALAS<sup>4</sup>) and revised, being followed, in 1991, by DEPÓSITOS<sup>5</sup>, dealing with the daily planning and management of drivers. Staff changes and organizational inefficiencies led to the relationship decline, and by 1993 the ESCALAS system was discontinued.

Meanwhile, together with the relationship with *CP*, *Siscog* invested in two activities. The first was the creation of a product, later named CREWS, embedding the knowledge acquired on applying AI to the planning process and crew planning decisions. CREWS

used three relevant aspects for transportation companies: "*The design of CREWS has three goals in mind: (1) it should be easy to modify, in order to enable experimentation with different scheduling strategies, (2) it should provide measures of the quality of the strategy being used, in order to enable the selection of the best strategy, and (3) the user interface should make use of graphical information, in order to reflect the concepts used in this domain, making it easy for the domain experts to operate*"<sup>6</sup>.

The second activity concerned the international marketing of both CREWS and *Siscog's* capabilities among transportation companies. This was intended to expand the company's market, in line with its international orientation. Presentations are made at international conferences, dealing with both AI and transportation management and technology as well as for specific potential customers (including German, French and Dutch railways). Talks were held with *Lufthansa* on the supply of a customised version of CREWS to airlines. However, at

the time *Lufthansa* was not ready to trust *Siscog's* capabilities: "*if it was an American company, we would source the system immediately; being a Portuguese company, things are much more difficult*"<sup>7</sup>.

### The Netherlands: The 'Promised Land'

In June 1991 *Siscog* got a contact from Marc Blasband, the innovative projects consultant at *Netherlandsee Spoorwegen (NS)*, the main Dutch railway company. *NS* wanted a crew planning system. *Siscog* understood that there were very few suppliers of this kind of system at international level. *NS* executives had attended *Siscog's* presentation at a colloquium and were impressed by *Siscog's* solutions. However, they were afraid of assigning the development of such a critical system to a tiny, unknown, Portugal-based company. Furthermore, ESCALAS was not operating at the Portuguese railways. In spite of this, negotiations proceeded. In April 1992, a presentation of the system was held in Utrecht for

2 · *Unisys* is a new company, stemming from the merger between *Sperry* and *Burroughs*.

3 · Quoted from *Siscog: Um Quarto de Século*, Lisboa, *Siscog*, 2011,pg.29.

4 · Escala means staff rostering.

5 · Depósitos means depots, meaning the place where rolling stock and staff are located.

6 · Infosys, 'Success story from Portugal', *Infosys Seminar on Artificial Intelligence*, 1988.

7 · Quoted from *Siscog: Um Quarto de Século*, Lisboa, *Siscog*, 2011,pg. 36.

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about 60 executives of *NS*. Again, the impression was very positive: most of the audience had casted a favourable vote for *Siscog's* solution.

However, *NS* kept looking for alternative suppliers. In late 1992 it approached *Siscog* to meet again regarding the possibility of carrying out a preliminary study on the development of the system. Kees van Krieken, a high *NS* executive, questioned *Siscog* founders about how the implementation of ESCALAS was proceeding at *CP*. The answer was honest: the system was not in operation. The reasons for this were explained. What Ernesto and João did not know was *NS* awareness about *CP* business. They just wanted to test *Siscog* trustworthiness. In January 1993, a preliminary study was commissioned by *NS* to *Siscog*. Shortly after receiving the above study, *NS* decided to proceed with the system. This opened a relatively long phase of negotiations. The contract was signed on early August 1993.

*Siscog* got its first contract abroad: a 30-month agreement regarding the long term planning of *NS's* drivers and guards.

After signing the contract, *NS* mentioned that, after “*undertaking a thorough assessment of the World supply of this kind of systems, [it] is convinced that Siscog has the competence required to successfully develop the system we aim at*”<sup>8</sup>. Another confidence was related to the concern with intellectual property: “*Siscog behaved as a Dutch company, I had never thought a Portuguese company would proceed this way*” (Kees van Kreeken)<sup>9</sup>.

*Siscog* had made a major inroad into the European railway market. This increased the company’s confidence in following the railway application path. *NS* (see Exhibit 1 below) provided *Siscog* with a key referral to approach other railway companies namely in the European market.

### EXHIBIT 1 NS Train



#### Looking for Godot...again?

In late 1992, the first presentation of *Siscog* system to *Danske Statsbaner (DSB)*, the Danish Railway Company, was held. *DSB* got a positive impression of the system. It was applied to solve a localised problem in South Denmark, but no longer term contracts were signed. This marked the starting point for a more proactive search of contracts in Europe.

However, most initiatives have not been successful. *Siscog* had ‘to kiss many frogs before getting a[nother] prince’. In 1995, *NS* launched a tender for the development of a system for long-term planning of rolling stock. Confident, after the 1993 contract, *Siscog* applies. But it was not successful. Later, *NS* explained the reason for not assigning the project to *Siscog*: the concern

8 · Quoted from *Siscog: Um Quarto de Século*, Lisboa, *Siscog*, 2011,pg. 52.

9 · Quoted from *Siscog: Um Quarto de Século*, Lisboa, *Siscog*, 2011,pg. 52.



with becoming too much dependent on a small Portuguese firm on two key operational fields.

The first approach to **VR**, the Finnish railways, also in 1995, was another missed shot. The project for long term planning of drivers was granted to a competitor, **ICL**, mainly due to lower price. Still in 1995, talks were held with **West Anglia Great Northern Railways (WAGN)**, to a large extent due to the good impression got by a high executive of **WAGN** (Chris Deal) from a presentation by **Siscog** at a Conference. However, developments miscarried, due to the forthcoming privatization of UK railways. Two presentations were addressed to the Norwegian and the Hungarian railway companies. In the first, Ernesto Morgado and João Pavão Martins got acquainted with Rolf Haugen, from the **Norwegian State Railways**, leaving a seed that will bear fruit much later. Communication problems endangered the second: nobody from the Hungarian team was able to speak English. Both approaches had no developments in the short term.

Also the deals with **Deutsche**

**Bahn (DB)**, the German railway giant, came to a dead end. Since the presentation at Saint-Paul de Vence, in 1990, contacts have been held, and **DB** was aware of the potential of **Siscog's** solutions. In November 1995, a feasibility study of the implementation of **CREWS** was commissioned by **DB** to **Siscog**. When the feasibility study was presented to **DB**, **Siscog** was informed that a tender regarding the development of the system was to be launched. In the forthcoming months, **Siscog** was surprised twice: first, when it found that the tender specifications corresponded to the earlier developed feasibility study; and, second, when it lost the tender to a relatively unknown German firm. Language barriers had, in fact, been a major hindrance in the relationship with **DB**: nobody from the **DB** project team was fluent in English; nobody from **Siscog** was proficient in German.

The inroads into the airline business had no better results. **TAP**, the Portuguese airline, had launched a tender for a system for long term planning and management of crew members. **Siscog** was among the three

selected contractors. However, due to the so-called 'Airbus scandal', **TAP's** administration was dismissed, and the tender was cancelled. Cooperation with the Spanish airline, **Iberia**, was carried out in the context of **TRUTH** project, the European **ESPRIT II** Programme (see Box 2, on **Siscog's** use of European R&D and Innovation programmes). The possibility to proceed further with the application in **Iberia** of the system developed under **TRUTH** was discussed. However, **Iberia** wanted to get all the documents regarding the system, and **Siscog**, invoking intellectual property protection, refused. Meanwhile, **Iberia** launched a tender on that topic, without informing **Siscog**. This had the perception of "*bluff from Iberia side*"<sup>10</sup>.

With hindsight, João Pavão Martins refers that in 1995 and 1996 **Siscog** "*crossed the desert, supported by the continuous development of the system for NS*". But it was also a time for learning, and for "*better understanding how the different European markets for railway*

*planning systems worked*". An important lesson was the need to adopt industry standards, for both hardware and software, to foster market penetration. This led **Siscog** to migrate **CREWS** from the Sun Solaris (Unix) to the Intel/Windows platform<sup>11</sup>. Another was the need to shorten development project time. Finally, Ernesto Morgado and João Pavão Martins learned that they could not take charge of everything at **Siscog**. There was a need for professional marketing staff, and for giving room to younger talented **Siscog** people as project leaders. The evolution of **Siscog's** organizational structure is provided on Annex I.

### **New International Customers**

While improving the company's organization, **Siscog** started, slightly more than one decade after the company foundation, to reap the fruits from its earlier investments in systems development and in business networking as well as from reputation stemming from the

10 · This was the second technological transition for **Siscog**, after the change from the **LISP** machine to **Unix**.





## BOX 2

## European R&D and Innovation Programmes: Experiments providing learning and reputation

Siscog has been involved, since inception, in European programmes aimed at promoting R&D and innovation. The founders' academic network and the links with Instituto Superior Técnico were very important for Siscog to keep acquainted about European opportunities for cooperative projects. Broadly speaking, European projects have been used for Siscog to investigate and experiment new technological approaches and applications, while Portuguese projects (see Box 5) have provided conditions for new product development.

A summary of Siscog's European projects is provided below.

- +
 ■ Construct (ESPRIT II): The project was developed in 1990-92; it was aimed at investigating constructive tasks, as planning, as opposed to non-constructive tasks, as diagnosis. Siscog the main contractor of the project, developed in cooperation with Renault (France) and the free University of Brussels (Belgium).
- TRUTH (ESPRIT II): Spanning between 1992 and 1995, this project was aimed at researching on the re-planning of time-critical tasks, with recourse to belief revision techniques; hence, its name 'Time-critical rescheduling using truth-maintenance'. Siscog focused on the development of a real time management system for airlines; this was Siscog's first inroad into real time operations management, providing a learning that would be later used in the development of CREWS RTD (Real-time Dispatcher).
- CERACON (ESPRIT IV): Project aimed at developing tools for supporting decision making in ceramics plants design and management. For Siscog, the goal was the research on the application of its knowledge base to a different industry. Running between 1996 and 1999, CERACON involved, besides Siscog, partners from Germany, namely Siemens, UK, Austria and Italy.
- PACER (ESPRIT IV): This project was focused on the development of an integrated decision support, management and planning system for industrial production companies. Siscog was responsible for the planning and managing components. The prototypes, tested in Pirelli (tyres) and Caradon (radiators) plants, were implemented on the basis of the CAPS (Computer Aided Duty Scheduler), developed by Siscog. Encompassing a wide range of partners (from UK, Italy and Germany, besides Siscog), the project started in 1999 and was completed in 2001.

**Source:** *Siscog: Um Quarto de Século*, pp.19-20.

achievements of the contract with *NS*. In fact, this led the American Association for Artificial Intelligence (AAAI) to assign *Siscog* the *Innovative Application Award* in 1997.

Contacts with *WAGN* were re-established after the privatisation process. A contract was signed in September 1997 to develop a planning system for train drivers' assignments. This was an important source of learning, since it implied increased knowledge about trains parking processes and conditions as well as about train and carriages 'attaching' and 'detaching'. Word-of-mouth regarding the results of the work with *NS* led *CP*, the Portuguese railways, to resume conversations with *Siscog* to update ESCALAS (labelled as ESCALAS II). A contract was signed also in September 1997. João Pavão Martins recognized that *"without the international success of Siscog, the relationships with CP would never had been relaunched"*. ESCALAS II was developed on the basis of an earlier version of CREWS on which CREWS\_ *NS* has been based upon. However, adaptations were required,





taking into account different operating procedures, labour laws, and managerial concerns. In early 1997, the *Norwegian State Railways (Norges Statsbaner – NSB)* disclosed the six companies which were selected regarding the mid-1996 tender on staff planning and management system. The six turned into three: a Norwegian company, the then Swedish *Carmen*, and *Siscog*. *Siscog* won the tender. It was subject to a thorough audit, before signing the contract in January 1998. This entailed, however, significant challenges for the company, going from the hardware and software platforms to task scope. This included not just long-term but also short-term planning, including the assignment of individuals to specified dates, a feature that was not, at that time, included in CREWS.

Step-by-step *Siscog* was progressing in the experience curve on how to deal with railways management processes. At this stage, AI knowledge was no longer looking for applications: the application was there. As *Siscog* staff was increasing acquainted with railway business people's needs, responding their

## EXHIBIT 2

**A Siscog team**

(Ernesto Morgado, Fausto Almeida and João Pavão Martins) preparing a meeting with *Swiss Railways*



Source Siscog

issues, knowledge about operations and business has deepened. *Siscog* got used to work in trains throughout Europe (see Exhibit 2). Furthermore, as Rolf Haugen, a manager at *NSB*, stated in a mail exchange, "*Siscog speaks the railway language*"<sup>12</sup>.

The above mentioned developments entailed a significant increase in Siscog's turnover. This increased almost ten-fold from 1993 to 1999, reaching slightly more than one million Euros. Taking 1995 as the starting point, turnover

12 · Quoted from *Público*, 'Inteligência Artificial em prol dos comboios', November 12th, 2001.

has doubled. Employment was also increasing, as shown on Annex II. Siscog appeared already to be travelling in a high-speed train!

**Financial Troubles and a New Growth Round**

However, being basically a software firm, *Siscog* was seriously hit by the 'dot-com bubble'. Portuguese banks curtailed credit to software companies, raising severe short-term financing troubles. For the first time ever, wages were not punctually paid. This raised several questions regarding the company's development path.

Several members of the staff argued that *Siscog* should move away from its niche strategy to espouse a more open approach to staff planning, thereby enabling the penetration in other industry markets and, therefore, further sources of income. Some people left the company, invited by other companies or looking for more secure jobs. However, top management decided to keep the focus, confident that it would just be a temporary turmoil.

After the missed shot in 1995, *Siscog* is selected as the winner of a tender launched by *Valtion Rautatiet-Yhtymä Oy (VR)*, the state-owned Finnish Railway Company, regarding the development of a system for the planning and management of train drivers' duties and rosters. The contract was signed in 2001, amounting to around €2.25 million (€1.4 million corresponding to the basic order, and €850 thousand to additional developments). The new system (VIP - Vr Integrated Planner), launched in 2003, was based on CREWS<sup>13</sup>.

13 · In 2007 and 2009 the system has been extended to include other staff, including ticket office staff.



One of the earliest contacts (*S-tog*, member of the Danish Railway Company group [*Danske Statsbaner-DSB*])<sup>14</sup> launched a tender for a staff planning system. This involved a complex procedure, *Siscog* being the only firm to fully respond the tender specifications. The agreement was reached in September 2001. It required an expansion of CREWS. In 2002, as a consequence of the good results achieved so far, *S-tog* applied contract options, extending *Siscog*'s systems to the planning of other categories of staff. Also, the holding company, *DSB*, applied another contract option to extend the system for the whole Denmark, planning the work of drivers and guards. However, in 2003, it was found that the extension of the *S-tog* system entailed unforeseen processing complexities. Together with various changes of *S-tog*'s project leaders between 2002 and 2004, and with *S-tog*'s demands for levels of optimization that were not contemplated in the contract, this raised some tensions in the relationship. The consequence was a delay in *S-tog*'s payments and a decision by *DSB*

14 · Remember that the first presentation of *Siscog* to *DSB* took place in 1992.

to keep the contract just for train guards<sup>15</sup>, increasing *Siscog*'s cash-flow problems.

However, the problems raised by the Danish *S-tog* had very positive consequences in terms of learning. To respond the challenges faced, *Siscog* started to combine Operations Research (OR) tools with its AI know-how to better respond optimization challenges (for details, see Box 5). *Siscog* founders recognize that, without the *S-tog* issues, **“most probably *Siscog* would never had undertaken the effort it put in the development of a new automatic mode<sup>16</sup>”**, enabling users to obtain an optimised solution by themselves.

15 · *Siscog* refers that this decision was influenced by the pressure of the Danish train drivers' trade union. See *Siscog: Um Quarto de Século*, Lisboa, *Siscog*, 2011, pg. 150.

16 · *Siscog* software products “offer users different levels of decision support, from just validating all the constraints pertaining the problem and performing helpful calculations while the users build the plan (manual mode), to pointing out directions for achieving a good solution (semi-automatic mode) or even achieving an optimised solution by just themselves (automatic mode)” (Quoted from ‘*Siscog*’ entry at Wikipedia, available at <https://en.wikipedia.org/wiki/Siscog>, accessed on 12<sup>th</sup> June 2015).

### **Green lights ahead: *Siscog* train is getting full speed**

The year 2005 heralds another turning point in *Siscog*'s life. Past troubles were waning, and new contracts (including revisions and renewals of contracts with ‘old’ clients) were agreed. Reputation-wise, the most important contract was signed with the *London Underground*. This has also enabled *Siscog* to enter an adjacent niche (underground operations planning) by the top.

*Siscog*'s approach to *London Underground* started in 1995. In 2000, it transpired that the contract it had with *Sabre*, an US company, was not running well. Someone who had attended earlier presentations by *Siscog* dropped this message: **“We are in the early stages of investigating several options regarding crew scheduling, some of which do not involve computers! When we have a clearer picture of our intentions we will probably be in touch with you”**. *Siscog* became even more alert for news from that side. In early 2001, *London Underground* published an advertisement: it was looking for planners. *Siscog* reacted, with a letter in which

CREWS applied for that job: **“I have high problem-solving skills and I have several years of experience as a scheduler compiler in European railways. References about my skills and competence may be obtained from Dutch Railways, Norwegian Railways, Portuguese Railways and West Anglia Great Northern Railway. I work very hard, never take breaks, never complain, and I am always eager to learn and to help. I analyse complex problems quickly, and I am extremely tolerant to stress and high work pressure. I am sure I will be able to help London Underground in finding better solutions for the rosters of its staff. (...). The main reason for my application is that I consider London Underground an impressive institution where anyone should be proud to work (...)”**<sup>17</sup>.

*London Underground* politely replied, informing “Mr. J. Crews” that his application had not been accepted. In September 2004, the company launched a tender for the supply of a staff planning system. Just before Christmas, *Siscog* received a ‘gift’: it was

17 · Quoted from *Siscog: Um Quarto de Século*, Lisboa, *Siscog*, 2011, pgs. 158 and 160.



pre-selected, and invited to reply to tender requirements at a meeting in early January. In mid-February 2005, *Siscog* delivered a staff planning prototype for two lines of *London Underground*. After less than two months of negotiations, the contract was signed in June 2005. Its implementation was not without difficulties: the application of the automatic mode required changes in the product as well as exhaustive tests.

After London, *Siscog* reached an agreement with *Metropolitano de Lisboa E.P.E.* (the Lisbon Metro). By the end of 2008, after two and a half years of negotiation a contract regarding the supply of an integrated planning and management system for drivers, rolling stock, and timetables (labeled PLAGO) was signed between *Metropolitano de Lisboa* and a consortium of three Portuguese firms (*Siscog*, *Link*, and *Tecmic*). This was the first experience of implementing the newly developed products FLEET and ONLINE at a client.

*Siscog* was growing fast: from around €2 million in 2004 to almost €6.5 million in 2010 (see

Annex I below). Profits increased even faster, from less than €2 thousand in 2004 to amounts consistently above €1 million in 2009-2010. Ernesto Morgado could no longer say, as he did in a press interview in 2001, that “*money-wise we are behind*” what was expected when *Siscog* was created. Now they were reaping the fruits of their investment and commitment. But they could still express the same enthusiasm with its capabilities: “*We would never expect to be able to develop so competitive a tool*” in international terms<sup>18</sup>.

## The 2010s: from Europe to the World?

### Recent Years: Keeping Speed

The main challenge for the new decade was to keep speed. The contracts established in the first decade of the 21<sup>st</sup> century are becoming operational now, thereby turning into a source of income.

18 - Quoted from *Público* (2001) ‘Inteligência Artificial em prol dos comboios’, November 12th, 2001..

Turnover experienced a two-fold increase between 2011 and 2014, slightly exceeding €9 million. As a result of the experience acquired, and in line with its ‘products, not services’ approach, *Siscog* improved its standard contract template. Each contract typically involves an amount between two hundred thousand and two million Euro, corresponding to the customization and the license for using the product, plus a 5-year maintenance contract of around 20% per year of initial contract value.

João Pavão Martins argues that “*selling and ensuring that the client comes to implement the system is the most arduous part* [of our business]; *upon implementation, it* [i. e., the client] *becomes ‘caught’*”. This seems to be the case, as one may understand from the following statement by Raimo Silvonen, *VR* project manager: “*We are and our users are satisfied for the features of the system. They have found new possibilities, which they were not aware of before this project and before using the system*”<sup>19</sup>.

19 - Quoted from *Siscog* website (<http://www.siscog.pt/> accessed on June 10th, 2015.

A relevant development was the clear definition of *Siscog*’s application field: Large Regular Rail Operating Companies (LARROC)<sup>20</sup> with more than 150 train drivers. Based in Europe, the company is increasingly focused on railway and underground operations in other developed countries in the World, including large, politically stable developing countries.

The main opportunities for business development are related to four factors. The first is *Siscog*’s optimization knowledge and references in both railways and underground operators in Europe. The second is the existence of a large potential empty market, since more than half of the firms has no recourse to sophisticated planning and management systems, using instead relative rudimentary self-developed tools. The third is the trend, associated to increasing public budget constraints in Europe, for governments to define basic requirements for the quality of transportation services, the absence of which

20 - Translation of the acronym in Portuguese language. GETROC (Grandes Empresas de Transporte Regular que Operam sobre Carris).

## Case Study SISCOG



entails non-compliance penalties; thus, operators wish to reduce operational troubles, being more open to acquire sophisticated tools. The fourth is related to globalization. Having reached a top-3 position for personnel planning and management systems in European railways and underground (see Exhibit 2), *Siscog* is increasingly looking at non-European markets to foster growth.

The main challenges faced by *Siscog* stem from three main

issues. The first is simultaneously the concentration trend and the ‘closure’ of railway companies. The mergers and acquisitions of the late 2000s, namely the acquisition of the Swedish *Carmen* by the US *Jeppesen*, increased the size of the players involved, making life more difficult for smaller independent firm like *Siscog*; however, the market structure is far from being crystallised, as the closure of *Jeppesen* railway service activities in 2013 shows. It is not easy to get new clients, since

contracts tend to have a long term nature (unless promises have not been fulfilled) and decisions tend to be relatively conservative.

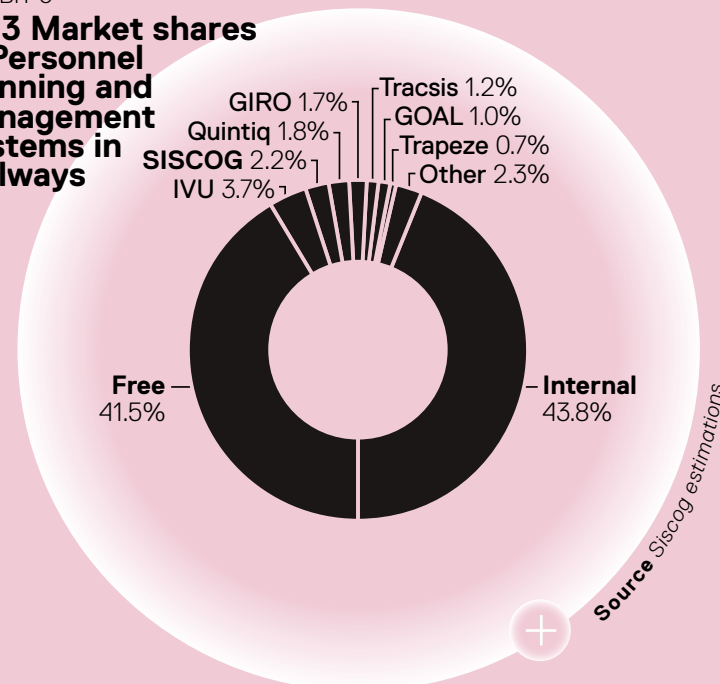
The second is related to Portugal’s image as a provider of sophisticated technological solutions. Portugal is not seen as a first choice for this kind of activities. The third challenge concerns the human resources pool. The supply of information systems professionals in Portugal is limited. *Siscog* has addressed that problem in 2010, with the opening of an office in Porto. In spite of this, *Siscog* still envisages the supply of skilled and talented human resources as a serious limitation to growth. The recruitment from other origins might be a solution; however, *Siscog* is very cautious about that, especially due to organizational implications.

The objectives for 2014-2016, as stated in *Siscog*’s strategic plan are the following: (1) Leadership in the LARROC field; (2) Geographic expansion; (3) Strengthening of the product range, namely through the introduction of new technologies in existing products and further

development of FLEET and ONTIME; (4) Increased speed, efficiency and scalability in project development; and (5) Feasibility (viability) in new fields<sup>21</sup>. An interesting feature of *Siscog*’s business perspective is the perception of “*public markets as potential triggers for innovation*”<sup>22</sup>.

With regard to geographic expansion, the main target markets are the following: United States (for the prestige and reputation it generates), Brazil, China, and India. Meanwhile, there were slight changes in the geographic approach. According to Natalina Magro, head of Strategic Development, India is in stand-by, “*since the market is less mature*”. In contrast, efforts are being made in the other three areas. The US has been long since a target for marketing initiatives *Siscog*; it may even be argued that starting business in the US would have a strong emotional value for the founders: marketing sophisticated products in the country in which they learned

EXHIBIT 3  
2013 Market shares  
in Personnel  
Planning and  
Management  
Systems in  
Railways







about AI. The approach to Brazil has been slow. In February 2015, *Siscog* decided to set up a partnership with the local firm Sysfer, already present in the railway business. For Natalina Magro the two companies are not competitors, and may provide users with “*complementary solutions*”. In the same vein, João Pavão Martins considers that: “*Sysfer was chosen for partner because it is a consolidated firm, operating in the areas of logistics and transportation and in the railway-underground field for more than 20 years. We believe that [in cooperation] with Sisfer, Siscog will be able to address the Brazilian market in a more effective way strategy-wise*”<sup>23</sup>.

The Chinese market has been on the radar since 2012. A service contract was established with a Chinese person working in the field to “*monitor the market with regard to public tenders*” (Natalina Magro) and to act as an intermediary, facilitating the approach to potential clients. However, *Siscog*’s stance

with regard to China is very cautious. Natalina perceives that the Chinese are “*thirsty for knowledge*”. Entering China may be a double-edged sword for *Siscog*.

### **The contract with Via Rail Canada**

Ironically, the first contract outside Europe did not happen in *Siscog*’s target countries but rather in Canada. In April 2015, *Siscog* established an agreement with *Via Rail Canada*, a large state-owned railway operator, providing services from coast to coast. *Via Rail Canada*, often referred to just as *Via*, “operates 497 trains per week in eight Canadian provinces (exceptions are Newfoundland and Labrador and Prince Edward Island) over a network of 12,500 kilometers [...] of track, almost all of which is owned and operated by *CN Rail*, [and] carries approximately 4.1 million passengers annually”<sup>24</sup> (see Exhibit 4).

*Via Rail Canada* published in 2014 a tender regarding the

#### EXHIBIT 4

### Via Rail Canada Train



redefinition of its system for planning and management of fleet and the definition of timetables. This was a superb opportunity for *Siscog* to enter the North American market. Support was asked from existing clients to provide references. A team was set up with recourse to an Italian specialist on trends in the railway and airline business. *Via Rail Canada* announced the selection of a short list of three companies, including *Siscog*. A few months later, *Siscog* got the

impression that the issue was in stand-by. The decision was taken to travel to Canada to make a demonstration of the potential of *Siscog* optimization tool using data from the Canadian company. This initiative enabled to gain a new momentum in the process. Incidentally, the involvement of the Italian expert proved to be very helpful since, during the process, a new manager coming from the airline business called the attention to the processes used there.

23 · Transportes em Revista, ‘Siscog reforça actuação no Brasil’, February 26th, 2015 (available at <http://www.transportesemrevista.com/Default.aspx?tabid=210&language=pt-PT&id=43928> accessed on June 19<sup>th</sup> 2015).

24 · Quoted from Wikipedia, ‘Via Rail’ entry (available at [https://en.wikipedia.org/wiki/Via\\_Rail](https://en.wikipedia.org/wiki/Via_Rail), accessed on June 18<sup>th</sup>, 2015)





Negotiations were hard, more due to project requirements than to cultural or financial issues (though a price adjustment was negotiated). *Siscog* had to show very high optimization capacity. A demonstration prototype was developed for *Via Rail Canada*; this played an important role in stressing the advantages of *Siscog*'s approach. Natalina Magro stressed that this was “*a key asset*” to win the contract. Ricardo Saldanha, the head of the Innovation Department, corroborates this idea: “*we have got the Via Rail contract because we had optimization capacity*”.

The contract's structure is similar to *Siscog*'s standard approach. The compensation involves three items: one for the license of the products (FLEET and ONTIME); another for the customisation to *Via Rail Canada*'s needs; and another for maintenance services. This contract is a landmark for *Siscog* for two main reasons. First, as mentioned above, it enables the company to enter the North American market. After a number of initiatives, since the 1990s, to court US firms, an agreement is reached with the biggest Canadian railway

passenger company. Second, it entails a significant challenge, since it is the first large-scale operation of FLEET and ONTIME (see Box 3 later) besides the PLAGO project for *Metropolitano de Lisboa*. In other words, this contract corresponds to a double diversification move for *Siscog*: geography- and product-wise. *Siscog* had good reasons to celebrate this achievement!

### **CREWS Users Group meetings**

A very important instrument for *Siscog* to strengthen its “*partnership*” (Ernesto Morgado) with clients, both business and personal, is the CREWS Users Group Meetings. They provide an opportunity for users to interact and to keep abreast of new developments launched in other railway companies. The first CREWS Users Group Meeting took place in Sintra (Portugal) in September 2000. Five meetings were held so far, the last one taking place in early June 2015 (see the programme on Annex III).

These meetings have also been a good marketing tool to promote long-term relationships with

users. The idea is to increase their immersion in the *Siscog* tools ecosystem, especially CREWS, by keeping them informed about recent developments while getting their views about new challenges and opportunities for software development. Furthermore, satisfied users provide the best referrals for attracting new customers. The European railway market is a small market in which there is an intense networking. Railway planners know themselves, and have frequent contacts. Another important feature is the fact that “*around 50% of the market is still open, in the sense that companies still plan rosters in-house and do not contract for external planning services*”, as João Pavão Martins pointed out. Therefore, good experiences with *Siscog*'s products might spread by word-of-mouth, leading less advanced companies to rethink their planning approaches (as was the case with *London Underground*).

Paradoxically, while aimed at building up a team spirit among *Siscog* systems users, unsatisfied customers may profit from these meetings to voice their unease, to suggest different approaches

or even to boycott actions. This happened for instance in the second CREWS User meeting (2002), with the problems being faced with *S-tog*. Together with financial problems, this led to postpone further meetings, until 2009.

However, when assessing ‘pros’ and ‘cons’, *Siscog* stresses the positive side. Some troubles are the ‘other side of the coin’ of meetings which are intended to provide the opportunity for openly expressing opinions and suggesting improvements. These meetings, together with satisfaction surveys and working contacts with clients (in the context of the maintenance contracts, in which some coaching support is provided), enable *Siscog* to identify latent and articulated needs that may foster the development of new products.

According to António Vasconcelos, a member of the Projects Department and a *Siscog* veteran, CREWS Users Group meetings have four-fold advantages. First, they provide “*an excellent opportunity to understand the client (where to it is evolving in business*



terms) as well as to figure out its difficulties and wishes". The second advantage is related to "the presentation of Siscog, namely the product developments introduced" and the contribution these may have for developing clients businesses. The third feature is the possibility for users to interact themselves and "to share their own experiences". It is interesting to underline on this regard that Siscog approach is not a 'hub-and-spoke' but rather a matrix approach in which direct relationships may be established between all players. Finally, the meeting enables "human conviviality", relevant for the establishment and strengthening of personal connections which may be mobilized to share knowledge and solve unexpected problems.

## Developing, Improving and Adapting software products: a platform approach

As mentioned above, Siscog was born as a company looking for AI applications. Its application field is clearly defined: LARROC. And it is no longer just focused on AI: optimisation challenges led to merge AI with OR.

### **The Products: CREWS, FLEET and ONTIME**

In mid-2015, Siscog was marketing three main products: CREWS, FLEET and ONTIME. They are all inter-connectable, and allow for the combination of the optimization software with the possibility of manual intervention. These products are briefly presented in Box 3 below.

### **Product Development Approach**

The development of these products provides an interesting story, in which market challenges and in-house company product development interact. This happened since the firm's

inception. The work carried out to develop the first ESCALAS for CP, the Portuguese railway company, together with a parallel project developed in-house, led to introduce, in 1988, significant changes in the scheduling process used in the prototype formerly designed for TAP. A new product, labelled CREWS, based on heuristic search methodologies, was created. The improved financial situation stemming from the contract with CP, enabled Siscog to carry out the in-house development of a new version of the product, called CREWS 3.0. In a press interview in 1993, Ernesto Morgado summarised Siscog's product development approach so far in the following way: "We have not invested large amounts of money to create an ideal tool that we would later launch in the market. We have always been led by specific market needs. We aimed at identifying a specific need, then focusing our work on it"<sup>25</sup>.

Since 1994, however, Siscog started to pay increased attention to the distinction between generic and specific functionalities.

The former corresponded to Siscog's basic products, and might be required by several clients, while the latter were addressed to meet the particular needs and requirements of a given client. This approach led to more structured initiatives aimed at further developing product platforms; it also had organizational implications, with the separation between Innovation, Products and Projects departments (see Annex II).

While Innovation<sup>26</sup> and Products departments are mainly concerned with the development of new products, the Projects department is focused on client-specific product adaptations. In a new product development process, the Innovation department is typically responsible for the optimization module, while the Products department is in charge of all other aspects of the product. The cooperation between the three departments is, however, very close. Besides this, António Frazão, the head of the Products

<sup>26</sup> · The Innovation department is mainly concerned with the development of optimization solutions to be integrated in Siscog's products. It plays also a scientific intelligence function, through the following up of the state-of-the-art in optimization literature.

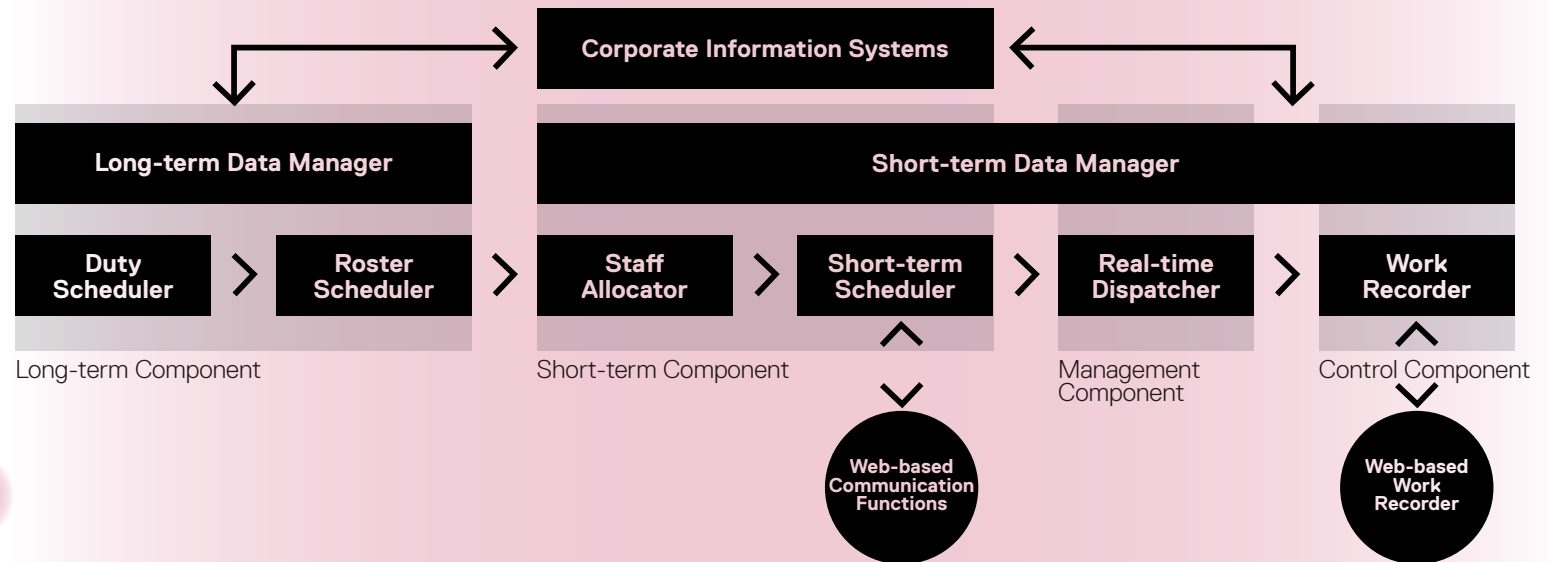
<sup>25</sup> · Quoted from Expresso, 16<sup>th</sup> October, 1993.

## BOX 3

**Siscog's Product Range**

CREWS has already been time and again mentioned above. It is *Siscog's* basic and most well-known product. According to the company's literature, "CREWS, the award-winning product, provides solutions to this core problem that transportation companies face today – effective planning and management of the work of crew members. CREWS addresses, in an integrated way, all phases of the planning and management process – long-term planning (duty and roster planning), short-term planning (staff allocation and changes to the plan), real-time management, and controlling the work done. CREWS enables quick and efficient planning and management staff, provides fast responses to train and crew changes, minimises crew-related train disruptions, and provides evaluation of strategic options."

CREWS has now a modular structure, enabling railway companies to proceed through a step-wise adoption of the system. In mid-2015, it included the following: Duty Scheduler, Roster Scheduler, Staff Allocator, Short-term Scheduler, Real-time Dispatcher, Long-term Data Manager, and Short-term Data Manager. They interact as displayed below:



FLEET is similar to CREWS, but addressed to equipment planning and management. "It allows the creation of routings considering infrastructure limitations and the forecast of passengers or cargo along the timetable services as well as the rostering of routings, balancing vehicles along the week and taking in account maintenance needs". The creation and updating of timetables of transportation services to be executed over a transportation network is the issue addressed by ONTIME. *Siscog* claims that "it allows the allocation of the network throughout time, considering the defined services and all the operational constraints such as network capacity".

**Source:** *Siscog: Um Quarto de Século*, pp.19-20 ; and *Siscog* website, <http://www.siscog.pt/>, accessed on June 10 2015. The figure and all quotes were taken from *Siscog* website.



department, product development has *“to be based on the knowledge of the concrete problems of railway operations”*.

Being a knowledge-based firm, *Siscog* actively promotes innovation. Collaborators are encouraged to contribute with new ideas, based on their own working experience or on reflection about technological challenges. Creativity, experimentation, tolerance with failure and commitment are important elements of company’s culture. Interactions and occasional encounters are stimulated. As Liliana Pereira pointed out, *“the bar is traditionally the meeting place”* for ‘Siscoguians’, and care has been taken to replicate the same approach in the Porto office, opened in 2010. Annually, the ‘Innovation Oscars’ are awarded to recognize outstanding contributions towards innovation.

New product development initiatives are aimed at improving and adapting existing products (for instance, enabling the migration towards higher performance technological bases) as well as at introducing

new functionalities in existing platforms. As António Frazão explained, *“usually the knowledge about railway operations generates ideas for the development of a generic product which is later customized, thereby leading to new ideas for improving generic products”*. Typically, for partial financing of the projects aimed at the development of generic products, *Siscog* makes use of the R&D and Innovation support systems available in Portugal. A summary is provided on Box 4 below.

The challenges stemming from the requirements of Dutch *NS*, in fact the first user of a CREWS-based system, have played an important role in the development of CREWS. The application entailed several adaptations, and a thorough redesign of the system prototype. Again, the combination of different knowledge streams was relevant for successful product development. The introduction of such changes was based on the combination of earlier experiences with would-be customers, in-house development efforts, and the involvement in ESPRIT Programmes

(CONSTRUCT and TRUTH). CREWS 3.0 was subject to change. The carrying out of the contract with *NS* led to the decision to differentiate two products: the planning of schedules (which became CREWS Duty Scheduler) and the connection with, and checking of, data coming from other systems (CREWS Data Manager).

The setting up of new contracts is different national contexts, as in the UK (*WAGN*), Norway (*NSB*) or Finland (*VR*) gave rise to further adaptations. For instance, *NSB* required a system dealing with long term planning and short term schedules simultaneously, a feature that was not available in CREWS at that time. This led to develop CREWS Roster Scheduler and CREWS Short-term Scheduler. The approach was improved and systematized through a project under the European SME Initiative (Box 4). The basic AI foundations had so far proved sound enough to accommodate the requirements of contextual changes.

The troubles stemming from the contract with *S-tog* were the trigger for a new approach

to optimisation. The doctoral research carried out by Ricardo Saldanha, feeding from specific programming challenges faced by Siscog and leading to his 2003 Doctoral dissertation *“Crews scheduling: A global restrictions propagator for roster generation”*, was a step to respond *S-tog* demand. The original idea was to further extend the application of AI method. However, in literature review carried out for his dissertation, Ricardo Saldanha *“found results showing the successful application of OR to the same problems”*. *“Problem complexity implied that the quality of the solution [provided by AI] was not satisfactory, and was taking too long”*. This convinced him that OR and AI might be combined to achieve better optimization solutions (see Box 5).

It was found that AI, while enabling to explain how optimization solutions were obtained, was not able *“to solve large size problems”* alone (João Pavão Martins). With recourse to OR, more appropriate and fast solutions might be achieved, than with AI alone. Therefore, *Siscog* recruited OR experts to work with



## BOX 4

## Portuguese R&D and Innovation Programmes: New product development projects

As mentioned in the text, *Siscog* has consistently profited from the successive public support programmes to promote R&D and Innovation set up in Portugal, with European Union financing, to carry out new product development projects. A summary is provided below.

- ❑ **Scheduling Libraries:** Project carried out in 1993-1995 under STRIDE\*; it was aimed at developing libraries enabling the building up of prototypes for planning and generating staff rosters and schedules in railway companies, on the basis of generic and reusable models.
- ❑ **Migration of CREWS DS and CREWS DM to Windows:** This project was supported by PRATIC, the Programme for the Creation and Consolidation of Technological Support Infrastructures, under PEDIP II\*\*. Running between 1997 and 1999, this project enabled Siscog to carry out the migration of CREWS from the Sun Solaris (Unix) to the Intel/Windows platform. The project was also used to implement a quality management system in accordance with ISO 9001, and to develop the institutional image of Siscog.
- ❑ **Development of a Short-term Staff Planning Tool (1999-2001):** Financed under the European SME Initiative Programme, this project was intended to proceed to the further development of the CREWS STS (Short-term Scheduler). According to Siscog, this development project was carried out in a more systematic approach, profiting from the earlier experiences.
- ❑ **Development of FLEET Long-term Scheduler:** Carried out in 2007-2008, under SIME I&DT\*\*\*, the goal of this project was to development of a product enabling the long-term planning of railway rolling stock. The result of the research project was the FLEET Long-Term Scheduler.
- ❑ **Development of FLEET Short-term Scheduler:** A new module, the Short-term Scheduler, is added to FLEET, again as a result of a public-supported project ; this was undertaken under the Individual Company R&D Projects\*\*\*\* ('Compete' programme) Research and Technology Development Support System.

### Notes:

\*STRIDE is the acronym of Science and Technology for Regional Innovation and Development in Europe. This initiative was aimed at increasing the capacity for innovation and technological development of the European less developed regions.

\*\* PEDIP is the acronym of the Specific Programme for the Development of Portuguese Industry.

\*\*\* SIME ID&T stands for Company Modernisation Support System dealing with research and technology development.

\*\*\*\* The system of Individual Company R&D Projects was aimed at supporting R&D initiatives carried out by just one company. Its objectives and conditions broadly correspond to SIME I&DT. See M. M. Godinho and V. C. Simões, *ERAWATCH Country report 2008 – An assessment of research system and policies Portugal*, Luxembourg, European Commission, 2009 (EUR 23766 EN/8 2009).

**Source:** *Siscog: Um Quarto de Século*, pp.19-20, and authors' research.

Ricardo Saldanha. In his words, the aim was to “*develop hybrid models that might provide the best of the two worlds*”. The main restriction is that, contrary to AI, which corresponds to “a white box”, OR is like “*a black box*”: “*it does not enable us to show how the result was achieved, in a way that the user might understand it*” (Ricardo Saldanha). As in earlier occasions, cross-fertilisation between responding market demands and in-house research initiatives proved to work.

In 2007, another module was added to CREWS: the Real-time Dispatcher. The goal was to enable a real time management and follow-up of railway operations, to enable planning change in face of unexpected circumstances. It soon became part of *DSB*, *S-tog* and *NS* operations. This facility, included in the automatic mode of CREWS, has proved essential for *NS* to withstand the significant disturbances in train circulation as a result of the heavy snowstorms in Northern Europe during the 2009-2010 Winter. The CREWS Real-time Dispatcher was later distinguished with an honorable mention under the COTEC Product Innovation





## BOX 5

**Combining Artificial Intelligence with Operations Research**

Both are considered as decision support technologies. They provide distinct ways to deal with similar challenges. Artificial Intelligence (AI) is much wider than Operations Research (OR) ; this is mainly focussed on optimisation issues. While OR is chiefly geared towards Mathematics, AI pertains to the Computing Sciences domain.

According to Carla Gomes, of Cornell University,

“Solving large real-world scheduling problems has so far been almost exclusively the domain of OR, but recent developments in constraint satisfaction techniques have shown that they can be competitive on real-world problems. The constraint-satisfaction approach brings a novel perspective to planning and scheduling. Constraint-based methods provide a richer representational formalism compared to the traditional OR methods. Furthermore, constraint satisfaction techniques have developed powerful inference methods that lead to efficient variable domain reductions, [with field] applications, in areas such as manpower and service scheduling, airline scheduling, cutting-stock in the steel industry, manufacturing scheduling for the auto industry, supply chain management, etc. Companies such as *SAP*, *Peoplesoft*, and 12 leading developers of software solutions for managing human resources, accounting, materials management, distribution, and manufacturing, across different industries, combine different optimization techniques such as constraint programming, mathematical programming, and local search methods. [This] (...) created a unique opportunity to investigate the integration of AI, primarily constraint-satisfaction methods, and OR techniques”.

To respond the challenges faced, *Siscog* started to combine OR tools with its traditional AI know-how to improve the responses to optimization challenges. AI is a ‘white box’ while OR is a ‘black box’ (João Pavão Martins). OR may be used to develop optimisation solutions for bigger problems (with large numbers of observations or agents) which exceed AI’s scope. In this vein, one of *Siscog* research paths has been to explore the use of AI local search to improve an OR-based duty planning optimizer that uses additional constraints.

**Source:** *Siscog: Um Quarto de Século*, pp.19-20 ; Siscog (available at <https://en.wikipedia.org/wiki/Siscog>, accessed on June 12<sup>th</sup>, 2015) ; Carla P. Gomes, Artificial Intelligence and Operations Research: Challenges and Opportunities in Planning and Scheduling, *The Knowledge Engineering Review*, Vol. 15 no. 1, 2001 ; and F. Morgado, R. Saldanha, J. Roussado, L. Albino, E. M. Morgado and J. P. Martins, ‘Using AI Local Search to Improve an OR Optimizer’, *Proceedings of the 24<sup>th</sup> Innovative Applications of Artificial Intelligence Conference*, 2012.

Award, the most prestigious instrument to distinguish innovative products in Portugal.

Meanwhile, in 2006, the focus was put on the management of rolling stock. A development project was launched in that field; again, available public support was mobilised to reduce the need for self-financing. The result was the FLEET Long-term Scheduler. This was applied two years later in the carrying of the contract with the Lisbon Metro. These were the early seeds of what FLEET is nowadays. Later, in 2009, as a result of another public-supported project, the FLEET family gains a new member, similar to what existed in CREWS: the FLEET Short-term Scheduler.

Besides its in-house development projects, *Siscog* has cooperated with outside partners, including R&D organisations and clients. With regard to the first, the eTEAM project, carried out with the University of Porto and *INESC-ID*<sup>27</sup> in 2013-2015,

27 · INESC-ID stands for *Instituto de Engenharia de Sistemas e Computadores - Investigação e Desenvolvimento* (Institute for Systems Engineering and Computers-Research and Development).



deserves a mention. The project was aimed at developing a system for electronic timetabling, equipment and staff management as well as combining the know-how of the three organisations. For the second, the most striking example is the cooperation with *NS*, the Dutch railways. The two companies have also undertaken joint research projects (also in cooperation with Erasmus University), with a view to develop more customized approaches to optimisation problems. It was in the context of such cooperation that a joint team, led by Ricardo Saldanha, developed a system enabling to optimize, in just one session, the weekly duty roster of all *NS* train drivers. More recently, in 2015, a paper by H. Snijders, from *NS*, and R. Saldanha won the ‘Best Practice Paper’ Award at the 2015 Conference on Advanced Systems in Public Transport (CASPT)<sup>28</sup>, held in Rotterdam. *Siscog* is proud to be **“recognised by our peers for**

28 · H. Snijders and R. L. Saldanha. *Security crew scheduling at Netherlands Railways*. Paper presented at CASPT 2015, Rotterdam, July 2015. The paper will be published at the *Journal Public Transport*. See also <http://www.portugalglobal.pt/PT/PortugalNews/Paginas/NewDetail.aspx?newId=%7BD3C4A29D-F08A-4672-879F-514C8DD1E952%7D> (accessed on 19<sup>th</sup> June, 2015)

**our innovative work in the field of planning railway companies’ personnel”.**

In line with the objective of continuously improving organization performance and innovative attitudes and behaviours, *Siscog* has implemented a Research, Development and Innovation Management system, in line with the Portuguese NP 4457:2007<sup>29</sup> standard. This was intended to further streamline the carrying out of *Siscog*’s research and innovation activities while enhancing organizational support capabilities.

29 · NP 4457:2007 is aimed at defining the rules to set up, record, implement and keep up a system for managing research, development and innovation and to ensure a sustained improvement of its performance. This standard, published in 2007 by the Portuguese Institute for Quality (IPQ), has been adopted by almost 200 companies in Portugal and is one of the results of the Sustained Development of Company Innovation Initiative launched by COTEC Portugal.

## Thinking about *Siscog*’s future

The contract with *Via Rail Canada* comes like icing on the cake at a moment when *Siscog* is approaching its 30<sup>th</sup> anniversary. The company has been able to achieve a sustainable position, being one of the biggest World players in the railway and underground planning and management business. It has made a first inroad in North America, opening new growth opportunities in that area.

The lunch is over, but the celebration is still going on. The *Siscog* community seems to be happy with the new contract, in spite of the increased work duties it will entail. Ernesto Morgado and João Pavão Martins take a break, going outside to breathe some fresh air and the sea breeze. Ernesto, the pessimist, raises the question: **“we have several issues ahead that we need to deal with, João”.** **“Yes, I know, but I am sure that we will solve them in a satisfying way”**, replied João. **“Not optimizing?”**, questioned Ernesto, ironically.

## Diversifying towards other transportation fields

The Canadian deal is very important for *Siscog*. However, the company is still far from turning its *motto* of **“optimizing the resources of the World”** closer to reality. If such *motto* expresses an ambition, its achievement would require *Siscog* to diversify towards other business fields. If the ambition is true, railways and underground are too limited an application field for *Siscog*’s capabilities.

Such a diversification would be consistent with *Siscog*’s mission statement: **“To continuously create adapted solutions to respond customers’ needs in decision support and optimisation systems in fields requiring specialised knowledge, namely resources planning and management, to achieve a leadership position in the international market for information systems, with recourse to AI and OR”.** Furthermore, the assessment of the viability of entering new domains is already pointed out in *Siscog*’s 2014-2016 strategic plan. The **“adjacent possible”**, to use the biologist Stuart Kauffman



concept<sup>30</sup>, would logically be other transportation activities, namely the airlines and trucking businesses.

Ernesto and João are not fully convergent on this regard. The first argues that *“there is the possibility to extend [Siscog’s activities] to other transportation areas”*. He adds that the company *“may apply [its knowledge base] to other areas, but not exactly with the same product [range], although this requires more investments”* than the entry into other transportation businesses<sup>31</sup>. João expresses a different view: *“Extension to other domains is in our horizon just reactively, not proactively; we have limited resources which are short to respond our present demand; why should we disperse resources towards other areas?”*. The recent contract with *Via Rail Canada*

30 · See Stuart Kauffman, *Investigations: The Nature of Autonomous Agents and the Worlds They Mutually Create*, Oxford: Oxford University Press, 2000. See also Steven Johnson, *Where good ideas come from: The natural history of innovation*, London: Penguin, 2010.

31 · Interview by E. Morgado and J. P. Martins to the Seis Estrelas (Six Stars) TV programme, in Portuguese (available at <http://www.rtp.pt/play/p1658/e173935/portugal-6-estrelas>, accessed on 12<sup>th</sup> June 2015).

puts an increased pressure on existing human resources, while opening a new geographic field for expansion in the LARROC market. In contrast, *Siscog’s* competences might be more extensively exploited, opening wider avenues for company growth. But, is this step worth to be taken?

### Improving Project Development

One of the goals pointed out in *Siscog’s* strategic plan for 2014-2016 is “increasing the speed, efficiency and scalability in project development”<sup>32</sup>. The main rationale behind this objective is the overall improvement of project work.

According to António Vasconcelos, the main issue is *“to shorten the time going from the signing of a contract and the delivery of a client-specific system ready (in line with client’s logic and requirements) and implemented, that is, put into current operation”*. He envisages the scalability goal from a

32 · From *EEN IS Innovation and growth potential assessment - Siscog*, Innovation Scoring and Innovation Intake Check, 2014.

three-pronged perspective: *“the first is replication speed, the second concerns the amount of data allowed for the system to operate”*, and the third is related to the user group size.

The issues raised above may apply, however, to both client-specific and general new product development projects. Going further, Ernesto Morgado argues that besides this, *Siscog* should strengthen its approach of providing *“an integrated product offer”*<sup>33</sup>. Both João and Ernesto agree that, faced with resource constraints, *Siscog* should improve process and product deployment efficiency. The issue then becomes, how to achieve that? Which steps should be taken on that regard?

### Canada: a spearhead to penetrate the North American market?

The contract with *Via Rail Canada* raises a strategic question for *Siscog*: does it make sense to set up an office in Canada as an

33 · Interview by E. Morgado and J. P. Martins to the Seis Estrelas (Six Stars) TV programme, in Portuguese (available at <http://www.rtp.pt/play/p1658/e173935/portugal-6-estrelas>, accessed on 12<sup>th</sup> June 2015).

advanced post to foster marketing efforts in North America and to turn the long-cherished desire to enter the US railway and underground markets into a reality?

The idea to use advanced posts to speed internationalization had already been discussed at *Siscog*. A decision was taken not to establish any office abroad without getting first a contract in the country concerned. The main rationale for this was the potential loss incurred by investing in a country without a return guarantee. Supported by a contract, such an initiative might be seen as an affordable loss, associated to the both the provision of support to the client and business development. As Ernesto Morgado remarked, this is a special type of business. Clients usually do not decide on the basis of marketing initiatives: *“the clients only go ahead when they feel the need”*<sup>34</sup>.

The setting up of the office in Porto in 2010 corresponds to a

34 · Interview by E. Morgado and J. P. Martins to the Seis Estrelas (Six Stars) TV programme, in Portuguese (available at <http://www.rtp.pt/play/p1658/e173935/portugal-6-estrelas>, accessed on 12<sup>th</sup> June 2015).



first experience of operational delocalization. As mentioned above, *Siscog*'s presence in Porto has been motivated chiefly by the extension of recruitment opportunities. However, since inception, it was also envisaged as an experiment for internationalization. In fact, a project called 'Pilot Project for Internationalisation' (PPI)<sup>35</sup>, led by the manager of the Porto office, was launched. The idea was to profit from this experience to establish the guidelines for future offices abroad. It may be argued that *Siscog* aimed at replicating the US firms pre-internationalisation leaning process: multiple operating sites in the country before venturing abroad.

With this background, it makes sense to consider the possibility of locating an office in Canada, close to *Via Rail*'s headquarters in Montreal. This decision would be a logical follow-up of the PPI project, and might be likely to play an important role in fostering *Siscog*'s presence in North America. The issue might be discussed at

*Siscog*'s Management Board<sup>36</sup>.

The advantages of such a decision are five-fold. The first is the proximity to the client. The activity of the project team in carrying out initiatives of both corrective and adaptive maintenance will be improved; this would be of course positively assessed by the client. The second is the fact that Canada may provide a good environment for initial internationalization and learning, since it is closer to European behavioural patterns than, for instance, the US. The third is the opening of a new recruitment field, not just for 'importing' talents for headquarters but also for fostering internationalization. For a knowledge-based company as *Siscog*, international growth has to be matched with increasing international recruitment. Fourth, presence in two continents might enable to take profit from different time zones for collaborative project work. The fifth argument is related to geography. Having a launching pad in Canada, the possibilities for

entering the US increase. Tighter linkages are established with the railway and underground social community in North America, thereby making the diffusion of word-of-mouth easier. Being geographically close would be an advantage for contacts with US companies, providing them more confidence on *Siscog*'s support capabilities.

There are, however, several 'cons'. The investment required, in terms of both financial and human resources, comes first. Establishing an office in Canada involves non-negligible set up and operating costs. Although *Siscog*'s financial position is sound, the extra resources required may entail the recourse to external financing. The second problem is related to the large leap forward: being in another continent involves significant coordination capabilities: will *Siscog* be prepared for them? In fact, going to Montreal is significantly different from going to Porto. This leads to the third issue: the challenges to *Siscog*'s cohesiveness. One of *Siscog*'s main advantages so far has been the cohesiveness of its social community. This was

mainly due to the relationship to the example instilled by the founders, the relationship to the IST *alma mater* (many of the staff have been students to João Pavão Martins and/or Ernesto Morgado), and collocation. Even though a couple of *Siscog*'s veterans might be in charge of opening the Canada office to share the company's culture and knowledge, the cohesion factors may be endangered.

The decision is not easy, but *Siscog* needs to address the issue, preferably sooner than later.

### ***The Legacy: How to prepare Siscog's Future?***

This is the keener issue faced by *Siscog*. It was the main reason for the eye exchange between Ernesto and João when they opened the bottles of *Legado*. Both are proud of their achievements. They were able to build a firm which is now a reference in the European railway market, creating an image of technology sophistication and reliability. But time has come to prepare the future. They are approaching 65 years old. Both are still very

35 · *Siscog: Um Quarto de Século*, Lisboa, Siscog, 2011, pg. 218.

36 · The Management Council is a collective body which includes the founders and the heads of the various departments of *Siscog*.



active, and involved in current management. Their offspring is already working at *Siscog*. Filipa Morgado is a software engineer who has already published, as first author, articles on knowledge fields relevant for the company. Leonor Martins holds a degree in Philosophy, but has also shown her capabilities in operational terms. As João Pavão Martins recognized, “*Philosophy provides a broad range knowledge that may be applied in different dimensions*”. They have already discussed the issue in private.

Both of them know that the issue is already being voiced inside *Siscog*’s social community. Collaborators, especially *Siscog*’s veterans, are waiting for, and concerned about, their decision. While recognizing that *prima facie* it pertains to themselves, as equity holders (in a 50-50% venture), questions are raised about the final decision and its consequences for the company. The track record provides a good basis for confidence: there is a belief that the decision will be matured, and will take into account both family links and *Siscog*’s interests.

For the good and for the worst, *Siscog* has since inception been characterized by a “Janusian” management<sup>37</sup>. For decades, João and Ernesto have developed a personal chemistry and a working approach that is not easy to replicate. They have been working together for almost forty years. They have similar legitimacy, and are equally responsible for company affairs, without any assignment of special functions or areas. They complement themselves: the optimist and the pessimist; the shy and the exuberant; the focus and the wider perspective. To some extent, they embody the very contradictions of management.

Therefore, succession will not be easy. It is true that *Siscog* has developed organizational routines and a professional management style that enhances company resilience. The collective Management Council, encompassing the founders and the heads of department, is a factor of stability. But several questions remain. Should an

intra-families approach be taken, assigning the administration to Filipa and Leonor, there is no guarantee that the management style and intra-firm balances will be maintained. People are different, and the young generation might naturally wish to put their own footprint in company’s management. Since *Siscog* is a knowledge-based firm, another option might be to allow for *Siscog* veterans to take a limited equity share as recognition of their commitment to the company. However, this would also raise some problems. For instance, how to draw the borderline for collaborators to qualify for equity shares? Which might be the consequences in terms of dispersion of power? Might this risk to further exacerbate the difficulties of the day-after ‘Janusian’ management?

Be as it may, João and Ernesto will leave an extremely positive legacy. The issue is how to further strengthen the company to respond managerial changes and increasing competitive pressures.

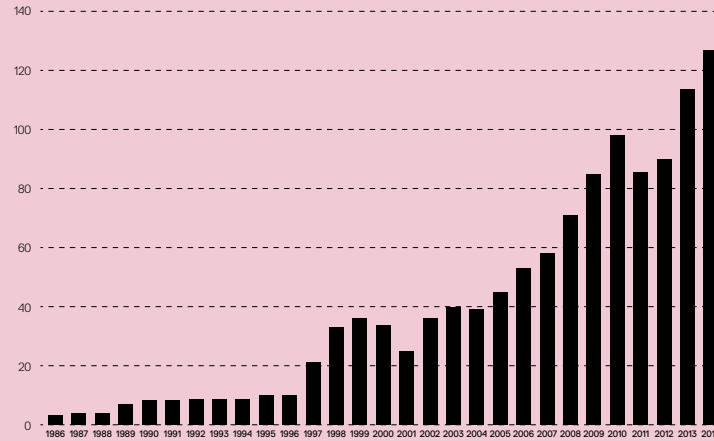
37 · The idea of ‘Janusian’ management was taken from Albert Rothenberg, *The emerging goddess*. Chicago: University of Chicago Press, 1979.





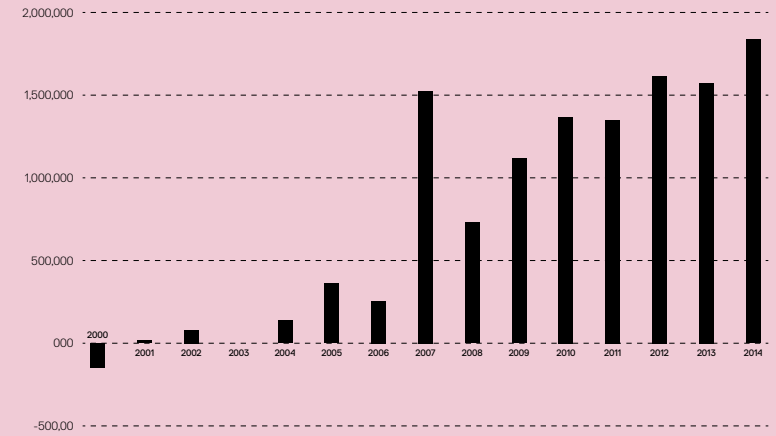
**ANNEX I**  
EMPLOYMENT AND FINANCIAL DATA 1986-2014

**Employment**



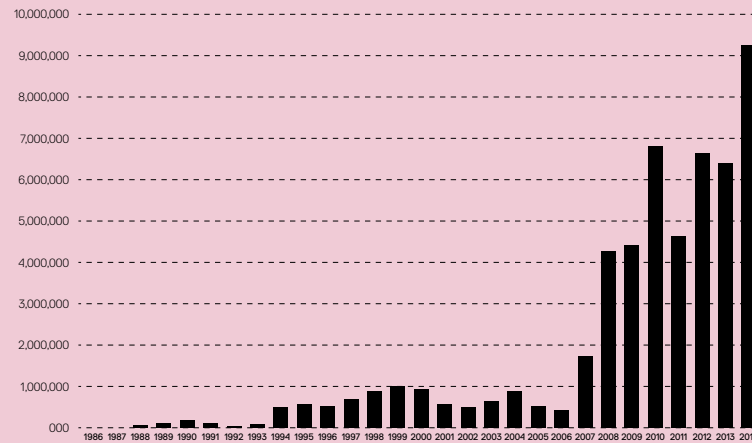
Source: Siscog

**Profits** (Unit: Euro)



Source: Siscog

**Turnover** (Unit: Euro)

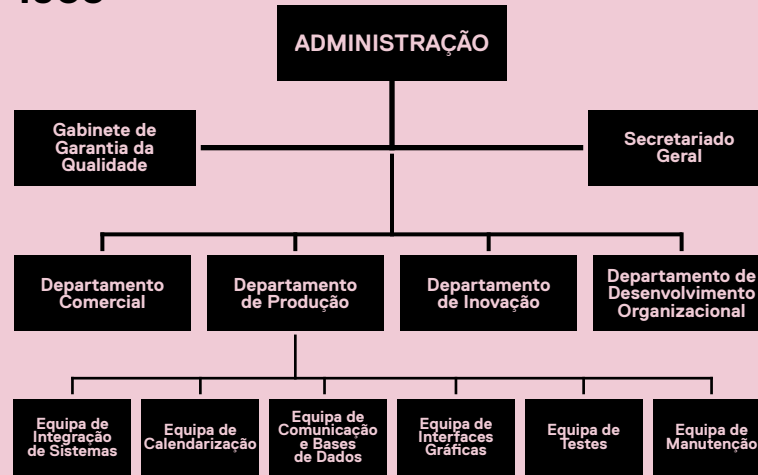


Source: Siscog



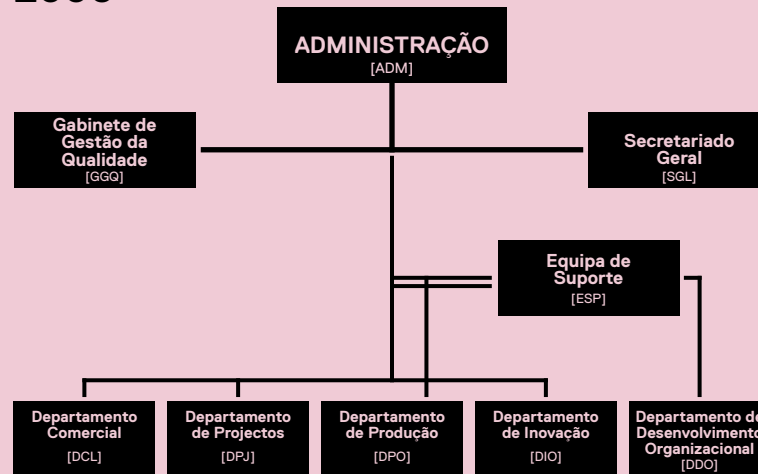
# ANNEX II EVOLUTION OF SISCOG'S ORGANISATIONAL STRUCTURE

1988



Source: Siscog

2006



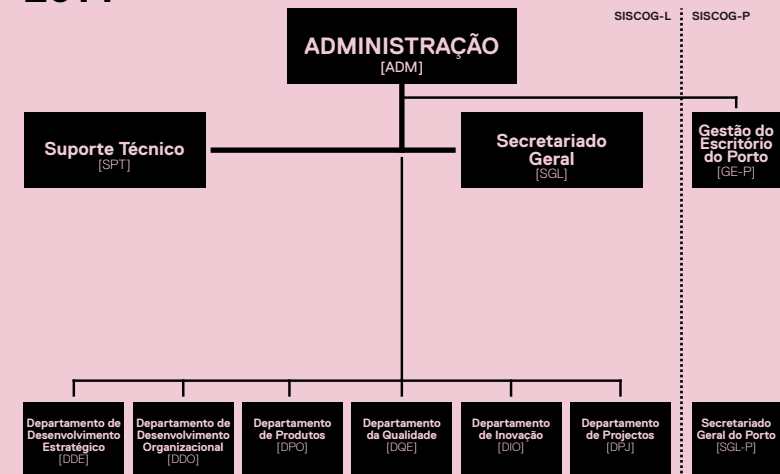
Source: Siscog

2010



Source: Siscog

2014



Source: Siscog

# ANNEX III

## FIFTH CREWS USERS GROUP MEETING


**SISCOG**  
SISTEMAS COGNITIVOS

**5<sup>th</sup> CREWS**  
**Users Group Meeting**  
 The Yeatman Hotel • Vila Nova de Gaia • 3-4 June 2015

Program

**June 3<sup>rd</sup>**

9:00-9:15	<b>Opening Address</b>
9:15-9:45	<b>SISCOG – Where we are</b> Speaker: SISCOG SISCOG's evolution as an organisation in the last years and goals for the future, current developments and projects.
9:45-11:00	<b>SISCOG Products</b> Speaker: SISCOG CREWS, FLEET and ONTIME products' status, new modules and functionalities.
11:00-11:30	Coffee-break
11:30-12:30	<b>CREWS beyond crews</b> Speakers: SISCOG, NS, NSB Explore what other personnel, beyond crew members, CREWS can address, how and with what effect.
12:30-14:30	Lunch
14:30-15:15	<b>Empowering users through cognitive development</b> Speaker: SISCOG As the complexity of planning evolves, the focus becomes on how to maximise the use of CREWS for complex problem solving needs and decision support. We will explore how users learn to connect and master both CREWS and planning.
15:15-15:45	Coffee-break
15:45-16:30	<b>Optimising the resources of the world</b> Speaker: SISCOG Recent advancements on optimisation support incorporated in CREWS and other SISCOG products.
16:30-17:00	<b>TPO – 10 years in full production</b> Speakers: SISCOG and NSB Celebrating the occasion.
17:00-19:00	Meetings / Demonstrations (Optional)
19:30	Cocktail
20:00	Gala Dinner


**SISCOG**  
SISTEMAS COGNITIVOS

**5<sup>th</sup> CREWS**  
**Users Group Meeting**  
 The Yeatman Hotel • Vila Nova de Gaia • 3-4 June 2015

Program

**June 4<sup>th</sup>**

9:00-10:00	<b>Sharing testing experiences</b> Speakers: SISCOG, DSB/Stog, NS, NSB, VR Experiences and challenges in testing activities.
10:00-10:45	<b>Moving towards nationwide usage of RTD in the Netherlands</b> Speakers: SISCOG and NS Overview of this major experience, from the defined goals up to the final achievements.
10:45-11:15	Coffee-break
11:15-12:00	<b>Using business intelligence to improve crew plans</b> Speakers: DSB, NSB, VR How companies are collecting raw data, converting it to useful information, and analysing it with the purpose of improving crew plans and the way they are produced.
12:00-13:00	<b>The 3 top wants</b> Speakers: DSB/S-tog, NS, NSB, VR Find out and discuss what is pointed out as being most desired regarding the evolution of SISCOG's products, services and relationship.
13:00-14:45	Lunch
14:45-15:45	<b>Mobile interaction with CREWS</b> Speaker: SISCOG, NSB Benefits and gains in efficiency from the integration of mobile technologies in CREWS.
15:45-16:15	Coffee-break
16:15-17:45	<b>CREWS Roadmap</b> Speaker: SISCOG The plans for CREWS' evolution: directions, future developments.
17:45-18:00	Closing Address

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Case Study

# SISCOG



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## SISCOG:

Combining general and client-specific knowledge to design optimisation solutions for railway and underground companies

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ISBN 978-989-99460-2-6

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Case Study

# Vortal

Using the crowd before  
crowd phenomena

Renato Pereira

Paulo Bento

Marcio Amaral-Baptista

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## **Vortal:** Using the crowd before crowd phenomena

### **Abstract**

Vortal is a Portuguese company operating in the Information and Communication Technology (ICT) industry, one of the few sectors where the country actually has world-class players (such as Altitude Software, Critical Software or Alert). Vortal is an e-commerce platform provider with an extraordinary track record and an inspiring innovative success story. Basically, every step of Vortal's way has been a challenge that the company has addressed with innovation, management and vision. The company started to operate in 2000 with one e-marketplace for construction industry and one decade later it runs 4 vertical eMarketplaces for different industries and has been considered one of the top 5 most relevant world players in eTendering platforms.

### **Keywords**

Vortal, Innovation, Portugal, Information and Communication Technologies

### **Acknowledgments**

This case was written by Renato Pereira of the Business School of ISCTE-IUL; and Paulo Bento, and Marcio Amaral-Baptista, from both INDEG-IUL and the Business School of ISCTE-IUL for COTEC Portugal, between May and June 2015.

Personal interviews were held at Vortal headquarters, in three different occasions, with Nuno Milagres, Head of Marketing and Innovation, and Miguel Sobral, Executive Vice-President for Marketing and Business Development. Face-to-face interviews took place on May and June 2015.

Selected quotes from those interviews are transcribed in the case. The interviews were conducted in Portuguese language; the quotes were translated into English by the authors and were subject to interviewees' confirmation and a final proofreading by an independent third party.

The authors wish to thank Vortal's Board of Directors for the information and support provided to this case study. Miguel Sobral's and Nuno Milagres's contribution was exceptional and far beyond our expectations.

We extend our gratitude to Isabel Caetano, of COTEC Portugal, for constant support and assistance throughout this project.

We also thank Helena Pinto de Sousa for valuable comments and important insight.

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## Background

Back in 2000, the Portuguese economy was doing well and the computer software industry was one of the critical levers for that success. In the international press, the country was described as the perfect student of the European integration process: nominal economic convergence with EU's average economic indicators, huge public projects financed by EU funding programs, and high technology companies developing in different industries such as pharmaceutical, biotechnology, semiconductors, and above all, information and communication.

The basis of a solid ICT cluster had been growing and consolidating since the late 1980s, with both hardware and especially computer software players engaging with highly reputed universities, like *Instituto Superior Técnico* in Lisbon and *Faculdade de Ciências e Tecnologia from Universidade Nova de Lisboa (FCT-UNL)* in Almada.

Companies such as Altitude Software, MobiComp, and Novabase are icons of that

period. Altitude Software was the worldwide leader in call center software products, with customers in 33 countries and almost concluded an Initial Public Offer (IPO) process at Euronext Amsterdam. MobiComp was the first Portuguese company to be acquired by Microsoft, after 8 years showing a solid track record in mobile apps, a niche business in those days. Novabase was one of the few successful IPOs in Euronext Lisbon in this industry and 15 years later its turnover reached 300 million Euros.

In the midst of the internet turmoil of those days, where e-commerce was the strongest basis of stock capitalization, another promising company was incorporated with the purpose of taking advantage of the large yet highly fragmented construction sector: Vortal. The basic rationale was to exploit a clear business opportunity consisting of bringing buyers and suppliers together to carry out business in a single emarketplace.

Under the brand *econstroi.com* (in English it would be ebuilding.com), Vortal provided construction companies with

access to the digital economy. Many players in that industry had underdeveloped technology infrastructures and were completely unfamiliar about the Internet. At a time when large buyers worked with a limited number of preferred suppliers, Vortal brought innovation into the market by creating an e-commerce platform that completely changed the way things were done in this industry.

This new business model was a great opportunity to bring transformation and value to this market. First of all, it included both large players as well as small contractors. By extending the service offer to new providers, buyers would get more purchasing options, and suppliers would access a greater number of potential buyers, in other words, a win-win solution. Additionally, this was a dynamic platform, supporting proposal and counter-proposal processes, under a logic of asynchronous communication. This meant that any buyer could present a counter-proposal to best proposal suppliers, including elements from the various proposals received by competing suppliers. Of course, suppliers

were allowed to reformulate their original proposal, in as many iterations as necessary until the buyer was satisfied.

At the end of the 20<sup>th</sup> Century, 20 rival companies joined to create the foundations of a new business – electronic markets. Nothing would be further away from their core business, though, and Vortal continued to gather acceptance and endorsement from the market. As early as 2002, *econstroi.com* was already the 'leading business *emarketplace* in Portugal's construction sector' achieving impressive recognition scores: 4,528 registered users, 10,192 Request for Proposals (RFPs), 1,260 daily users, and 25,000 daily page views.

One of Vortal's management pillars has always been its decentralized performance assessment processes, which are based on clear targets and metrics, and carried out twice a year. Employees have exclusive access to the beVORTAL portal where they can find all information about internal procedures, forms and information, including 'Ideas Submission' features.

## Case Study Vortal



The first electronic public procurement procedure in Portugal emerged from Vortal's initiative. The municipality of Campo Grande, one of Lisbon's most relevant neighborhoods, wanted to build a gym, and this was the perfect showcase for *econstroï.com*. Proposals were delivered both in hard copy and electronically, through the platform. A real time comparative and transparent report was automatically produced and contracting time was dramatically reduced. And thus Portugal became the first country in the world to have electronic public purchasing procedures.

In addition, because bidders had to submit an official electronic document with their power of attorney, redundantly and repeatedly each time they entered a tender for a public procedure, Vortal developed 'Representation Certificates', an obvious yet quite useful innovation.

Later, and with the collaboration of industry representatives, Vortal created 'VORCAT' (Vortal Categorization), a tool to categorize suppliers, matching business opportunities to

companies' commercial interests and boosting competition. In 2003, around 18,000 companies duly organized according to materials, equipment, services, etc., were categorized in a short period of time, within *econstroï.com*. Finally, opportunities were made available to properly categorized companies, and only to the relevant ones. Vortal's first milestone was met, products and services categorization standards were established, and were in place to improve interoperability with any potential user.

### The early days

On December 27, 2000, some of the most relevant Portuguese construction players incorporated Vortal. The partnership included key construction companies – Mota & Companhia, Engil, Somague, Soares da Costa, CME, Zagope, OPCA, Construtora do Tãmega, Jaime Ribeiro & Filhos, Novopca, Monte & Monte, Adriano, SOPOL, Alberto Martins de Mesquita & Filhos, H. Hagen, Etermar, Gabriel A.S. Couto,

Rosas Construtores, Amândio Carvalho – ICT companies – PT Prime Tradecom, Sol-S, BES.Com – and one individual shareholder – Rui Dias Ferreira.

Vortal's headquarters are located in Lisbon. By May 2001, an initial team of 18 people had developed the basic features of *econstroï.com* focusing on 'Order Management', 'Works in Progress', and 'e-Noticing of Public Tenders'. Vortal revamped deal prospection by creating a network of agents on the field, who gathered information about works in progress. More than just a compilation, this innovation offered suppliers permanent updates about all relevant data: work owner, architect, main contractor, sub-contractors, and project details. The online e-marketplace services included key components of the Directory of Companies, Proposal Request (RFx), Proposal Submission, Catalogues of Products and Company Website Services. An innovative feature of the platform was the 'Savings Calculation Method', an algorithm returning the amount saved in each request for proposal (RFP) channeled through *econstroï.com*,

transaction by transaction. Given that few companies were actually connected to the Internet, especially in construction sites where decision makers were located most of the time, Vortal's challenge was to ensure that basic e-commerce conditions would be in place so that people could indeed use *econstroï.com*. This was done through a partnership with key Internet provider Telepac, who then offered a discounted Internet package with faster connections. The platform's website attracted an average of 200 daily users and 200,000 monthly page views. In 2 months of commercial activity, *econstroï.com* reached 98 active customers. After 6 months of operations, 200 companies had signed up for pre-membership status. Accenture, together with local financial newspaper *Diário Económico*, elected Vortal as the company that created more value added on the Internet for the construction industry.

In 2002, *econstroï.com* was already the 'leading business e-marketplace in Portugal's construction industry' achieving significant recognition levels. But Vortal continued to make a

## Case Study

# Vortal



conscious effort to permanently introduce innovative features both at the product and the organizational level, improving relationships with shareholders and stakeholders at large.

At the product level, adopting an eplatform was still a big deal for clients because of task duplication, system redundancy, etc. 'VORTALconnect' was the answer: synchronous system integration would enable applications to communicate with each other without human intervention. An 'Accelerated Growth Initiative' was put in place generating over 1,000 new users.

Another totally innovative initiative was focused on the company's relationship with its shareholders. Vortal refunded shareholders with their mandatory capital injections in exchange for increasing *econstroi.com* use through the number of RFPs placed in the platform. In addition, from 2002, Vortal introduced the practice of systematically surveying its stakeholders and began a 'Leaders Committee' meetings program. This program brought together Procurement Officers of 20 rival

companies to share knowledge and experience. Nothing like this had ever been done before in this industry. These two initiatives created the basis for an active community of users, partners and stakeholders.

The following year, *econstroi.com* invested on gaining international exposure through the release of various press contents, such as articles, interviews, and advertisements in priority foreign markets. It also approached e-marketservices where e-markets rankings are managed.

New products and services were released and integration with IMOPPI<sup>1</sup>, the construction industry regulatory agency, was achieved. This integration, unlikely yet fundamental, was a facilitator to the credibility process of new suppliers. By accessing Vortal's and IMOPPI's integrated directory, as well as a feature that categorizes suppliers, purchasers can identify those suppliers that are adequately prepared to respond to their RFPs, and they can access suppliers' certificates

in real time. Additionally, the 'Company CV', a sort of *LinkedIn* for suppliers, was made available to increase suppliers' visibility and credibility. This feature later leveraged 'VORTAL Suppliers Finder', a kind of digital headhunter that includes a smart search and recommendation engine, structured according to buyer needs, and enabled by Company CV information and extra-support of social networks.

At the same time, Vortal added a Direct Debit System to *econstroi.com*, transforming the platform into a utility where yearly contracts are invoiced and paid on a monthly basis. This was another innovation with significant impact: when many claimed that B2B Direct Debit System (DDS) would be impossible, the company facilitated higher repeated sales rates and more treasury comfort to suppliers. Because true and virtuous change comes from inside the organization, Vortal created what would eventually become known as a 'cloud', in order to completely replace all paper documents and fully become an online company. This led Vortal to implementing 'Sinfox', a system in which all documents, approval and

access workflows are replaced by e-files, which are digitally stored. Turnover in 2003 reached nearly 2,5 million Euros and *econstroi.com* achieved the impressive mark of 1,875 active customers, roughly 80,000 transactions, and 330 Million Euros in business transactions. Additionally to the surveys and Leaders Committee, Vortal now had an Advisory Board holding periodical meetings. 14 independent individuals with different backgrounds met every 6 months to discuss key strategic issues. Not many private companies under 100 Million Euros have such a governance mechanism in a country like Portugal.

2004 was a year of significant growth. RFPs more than doubled compared to 2003 and business transactions reached approximately 500 Million Euros. The number of active users was now 2,276; 34,000 tenders and 145,000 proposals were submitted through the platform. Leveraging on B2B DDS, Vortal comes up with yet another innovation: digital invoicing. Generating 12 invoices per year and per customer represented a huge administrative effort and cost, which created momentum for change, with the

1 - Instituto dos Mercados de Obras Públicas e Particulares e do Imobiliário.



additional benefit of reducing environmental impact.

Moreover, Vortal launched the reward program *constroi*. *PONTOS* (in English, build. SCORES), which consisted of applying a typical B2C loyalty strategy, enhancing best use practices at *econstroi.com*. Buyers were motivated to use the platform in a more transparent way by inviting more suppliers to submit proposals. Suppliers were evaluated based on project quality. For both groups, positive challenge response is rewarded with 'scores' convertible in material things such as travel or product vouchers.

An important event that took place during that year was the agreement signed with CaixaWeb for developing a web portal specialized in municipal public procedures management. Vortal also expanded its operations to Spain, opening an office in Vigo and adapting the platform to this new market. The company successfully attained Microsoft's Gold Certified Partner status for ISV / Software Solutions and Business Process and Integration Solutions.

## Consolidation and profitability through constant innovation

A curious innovative initiative carried out inside the company was the creation of a fund for outdoor activities. One day, suddenly, coffee was no longer for free. But that money was not used to pay for coffee supplies. Its purpose was to finance physical outdoor well-being activities along with corporate social and environmental responsibility activities.

Throughout time, Vortal developed several different solutions for a number of construction companies' challenges. So why not aggregate those tools to create an integrated solution for marketing department needs, including market prospection, market notoriety, customer segmentation, and product advertising? That is how *SIM* (in English, YES) was invented.

Another important innovation was the creation of two different customer profiles, according to geographical region, business

focus, service levels and business volume. Differentiation was created through 'Local User' and 'Dedicated User' profiles. Local User is for customers-suppliers requiring information only for those specific regions. Dedicated User is designed for suppliers that depend on a small number of large construction companies and who wish to have priority on RFPs from those companies.

When the company realized that the best way to increase platform use was to scale up *econstroi.com* adoption among small and medium size contractors and sporadic users, Vortal launched 'FastBuy', a pay-per-use solution allowing for market consultation on a volume basis. Later, 'FastSell', a product that used the same principles but was specifically designed for suppliers, was launched. It was targeted at those who believe that only a small number of opportunities are of interest.

Vortal also addressed the specific challenges of contractors that are also buyers. The company offered an innovative service whereby customers can access RFPs issued by buyers using their specifications in order to

prepare their own RFPs for the materials or services required to put together the most competitive proposal possible.

Long before the *Groupon* era, Vortal came up with an *e-Bay* for construction companies. 'Offers and Promotions' was a way for suppliers to present their products and services, speed up inventory, and communicate promotions. The innovation was that all this was possible before a RFP was actually published. Suppliers would not need a tender to communicate an opportunity.

'Rides' was another innovative initiative created by Vortal on *econstroi.com*. Whenever a subcontractor participates in a tender for its specific categories, under request, it may communicate availability to send it to another general contractor participating in the same RFP. On the suppliers' side, this means facilitated prospection of new customers and higher success rates for their proposals. On the buyers' side, it enables faster access to more complete market prices.

'Purchase Performance Monitor' was designed for buyers to





obtain detailed understanding of acquisition performance per category through reports on RFPs, awards management, prices per item, etc. This is perceived as an excellent tool for management efficiency.

One of the biggest needs among *econstroi.com* supplier users was the status report of submitted proposals: Have they already been visualized, and by whom? Have they been shortlisted or not? What was the buyers' assessment? Vortal provided an answer to this challenge through 'Total Feedback'. To complement it, Vortal also developed 'Timeline', a visual online tool to identify the status of the tender timeline and current phase, including all the remaining milestones to conclusion. 'Timeline' supports additional relevant events included by users.

To participate in a construction tender, bidders would typically need to buy an expensive set of printed documents. With the advent of e-tendering, bidders stopped getting printed documents but smaller companies did not have the necessary software to work on drawings. Printing was

still necessary and was seen as barrier for these companies that could not work on their estimates based on electronic documents only and were not able to print large formats in-house. With 'VORTALprint', it became possible for suppliers to select online the documents they wanted to print and get them printed by a qualified printing company, including delivery service.

Usability has always concerned Vortal. When the company realized that most platform users did not have the time or the culture to systematically consult software manuals, Vortal created 'Smarty', a virtual assistant that answers critical usability issues as well as legal questions, in different languages.

Pending Patent PAT45669/12 is for 'Multi-criteria Evaluation', a tool for buyers to support their tendering evaluation. This tool works like a scorecard, it computes different evaluation criteria, different scales, and different scores, generating a more objective and transparent hierarchized list of bidders.

In addition, pending Patent

PAT45670/12 is for 'Company Docs', a tool that was designed to speed up bureaucratic processes, by rapidly and automatically selecting and uploading all relevant and mandatory tender documents, according to specific RFP, country, etc.

The use of templates became ordinary with computer profusion. However, using templates to support agile construction tenders is totally different. And if those templates are smart, dynamic, and collaborative, even better. That is what 'Purchase Template Library' does.

In the online world, including e-marketplaces and broad social networks, issuing recommendations is a common attitude that helps individuals and companies select trusted partners in a very impersonal environment. Based on these principles, Vortal developed 'Company Rating', aimed at increasing small contractors access to emarketplaces.

'Procedure Profile Configurator' is a configuration language created by Vortal to translate and reproduce all public tendering,

from every country and company, in a very simple way. This means dramatically reduced platform time to market.

We live in a mobile world. To be online is not good enough, though; one must have permanent access to relevant information, available online. That is why Vortal developed 'VORTALmobile', which allows permanent access to the e-platform from a smartphone or tablet. Anytime, anywhere!

In 2005 Vortal became profitable for the first time. An indirect sales channel was built on the back of Vortal's partner community, fostering expansion and growth across the country. A new platform for electronic public procurement procedures – VORTALgov – was successfully released attaining 17 million Euros of bid value in that same year. *econstroi.com* was now a consolidated brand and attracted over 1,000 people to its 1<sup>st</sup> Users Congress in the charming town of Estoril. Large construction companies, contractors, market authorities, and the Government have since participated every other year to discuss *econstroi.com* use and benefits. The

## Case Study

# Vortal



platform's reputation is also significant overseas and is often considered a world-class leading B2B e-commerce initiative by specialized international press. Significant international e-commerce recognition comes from Accenture, who placed **econstroï.com** in the top 3 of Europe's most relevant initiatives. Vortal is now active in both private and public markets, using the same technological platform for both. An important partnership for the development of a Municipality Portal was established with Portugal's largest bank, Caixa Geral de Depósitos, who had just launched CaixaWeb, a highly skilled web player. This portal aimed at managing key processes such as RFPs, content, and purchase catalogues with transparency and productivity.

TABLE 1

	2004	2005	Δ
Revenues	3,123.9	4,375.1	40%
EBITDA	457.3	1,490.3	226%

Figures in k€

Source: Vortal's Management Reports 2004 and 2005

2006 was clearly a year of expansion through product

diversification. The company launched new e-markets for Government/Public Administration supplies, Industry, Energy, Utilities and Office supplies under the brand of VORTAL. The **econstroï.com** logo was restyled. Vortal initiated a certification process to standard ISO 27001 – Information Security Management, which demanded reinforced internal processes as well as new information exchange procedures with customers. Vortal consolidated its market leadership as a G2B2B service provider. An important partnership was signed with Construdata 21, a 1,000 customer company, to provide a Work in Progress web service for the Spanish market. The company also launched Guaranting™, a financial transactions web service. The innovation here was that it guarantees secure payments as early as the negotiation phase, immediately after award, and throughout the whole contract. 2006 was also the year when Vortal filed its first patent (in the United States) and when the company created an Innovation and Development Lab to ensure a permanent and sustainable flow of technology

and product development. Vortal has always believed that innovation is the best way to create value. This means believing in outside-in challenging, never disregarding active search for new ideas and solutions for the company's business. With this mindset, the Vortal Innovation Lab was conceived as a customer-oriented center transforming ideas into useful products as well as business processes. Initially setup at FCT-UNL facilities, today it is located in the science and technology park of Porto University with a team of 45 talented professionals, including software designers, architects, developers, and testers.

TABLE 2

	2005	2006	Δ
Revenues	4,375.1	4,816.5	10%
EBITDA	1,490.3	1,288.7	-14%

Figures in k€

Source: Vortal's Management Reports 2005 and 2006

2007 was quite an achievement year. The company concluded the ISO 27001 certification process, the first one approved in Portugal for e-commerce. Having that certification means

total confidence on information privacy, something that is quite critical for e-commerce and audited on a yearly basis. At the same year, Vortal was distinguished with an honorable mention under the COTEC-BPI SME innovation award, the highest innovation distinction for SMEs in Portugal. Vortal organized the 1<sup>st</sup> National Congress of e-Tendering simultaneously to the 2<sup>nd</sup> **econstroï.com** User Congress, both with significant success in terms of number of participants and enthusiasm. Vortal definitely became a key e-commerce player and was recognized for its role in public tendering transparency and efficiency enhancement. In the context of the Deloitte European Technology Fast 500 EMEA program, Vortal ranked 210<sup>th</sup> in the ICT category. The team's headcount was now 70.

TABLE 3

	2006	2007	Δ
Revenues	4,816.5	5,544.7	15%
EBITDA	1,288.7	1,714.5	33%

Figures in k€

Source: Vortal's Management Reports 2006 and 2007



In January 2008, an extensively reviewed Public Contracts legislation came into force in Portugal. It transposed the European Directive on public procurement to the Portuguese law and established a 6-month deadline for all public entities to choose their contracting electronic platform. Vortal aimed at market leadership but did not have the internal resources to reach every public actor in the country before competition. The answer was to develop, with only a short delay, an indirect channel based on agreements with dozens of local players. The company's platform vortalGOV was fully compliant with the new law requirements and it experienced unprecedented commercial and financial performance. 2,444 new users joined the platform's new Universal Access service. The company launched a new platform for health services – VORTALhealth – immediately used by 13 public hospitals and accounting for some 400 procedures before year-end. To deal with the lack of professional training offer in the Portuguese market for public e-procurement, the company launched the European Vortal Academy.

For the first time, with this innovative initiative, buyers and suppliers, public powers and companies, were brought together to share and acquire knowledge on public tendering. Vortal's partner community increased to 35 companies. According to a survey promoted by the company, *econstroi.com*'s satisfaction rate was at 90.3%, an exceptional figure in the industry. Vortal's technical support department now included an exclusive call center to properly handle the growing number of users and using issues. This helpdesk had an innovative approach: why not consider customers' phone calls as selling opportunities? But the true innovation was turning the contractor into a true business partner. In the context of these partnerships, operational decisions are taken by both parties, bonuses and career plans are established based on performance, and contact center team building activities are performed on a regular basis. Contractors successfully perform salesforce activities for Vortal.

TABLE 4

	2007	2008	Δ
Revenues	5,544.7	7,319.9	32%
EBITDA	1,714.5	2,526.6	47%

Figures in k€

Source: Vortal's Management Reports 2007 and 2008

In its 10<sup>th</sup> year of business activity, Vortal's turnover approached 10 million Euros and headcount reached 90. The company opened an office in Madrid and acquired 30% of Construdata21. A new phase of expansion was outlined with the decision to open an office in the UK. Over 10,000 users now operated on Vortal products. These platforms hosted 66,000 procurement procedures with a total bidding amount of 1,2 billion Euros.

Vortal entered Gartner's radar in the first half of 2010. The company was referred to as one of the three leading companies in a report called 'Cool Vendors in Procurement Applications' and the only European company in that top 3. Gartner (2010) described Vortal as a player capable of addressing the challenges of vertical markets,

creating solutions with a high return rate. Later, in the report 'Strategies for Public Sector Investment in Procurement Applications', Gartner ranked Vortal in the top 4 most relevant world players in e-Tendering platforms.

Vortal had over 20,000 registered users developing their activities in the company's electronic platforms, supporting several market verticals. Vortal, now a true multinational company, decided to adopt English as its official language. This meant that all documents, specifications, reports, and formal meetings were held in English. Less successfully though was the recruitment of 10 foreigners of 6 different countries for director positions in the company.

By 2011, Vortal operated 4 e-commerce platforms in different vertical markets – vortalGOV, vortalINDUSTRY, vortalOFFICESUPPLIES, and vortalENERGY&UTILITIES. In large business groups and conglomerates, frequently the same user would interact with the platforms for different companies. 'Multi-presence User' was the

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answer. With a single login, users would navigate between platforms, being active in all companies they represent at the same time. This was a significant interoperability achievement.

That same year, Vortal entered into an agreement with the Government of the Czech Republic for e-platform services. The specific needs of this customer led to the development of an innovative feature, called 'Tender Automatic Selector'. A decision tree algorithm was embedded in the platform allowing it to smartly suggest the most adequate tender to the user, based on parameters such as entity type, service/product type, and contract amount.

## Business Strategy

### Identity

With 6 active platforms, Vortal sees itself today as a high-performance collaborative cloud-based e-Sourcing and e-Commerce player.

### Vision:

To enable e-business-to-business to connect with an unlimited number of business partners in the simplest and quickest way possible through world-class functional and usable software in a very efficient software as a service (SaaS) total cost of ownership (TCO) logic.

### Business Model:

ICT is a highly fragmented industry where business models have evolved significantly since the 1980's 'one fits all' licensing models. As a collaborative cloud-based SaaS player, Vortal applies a Cloud & Network business model which is a significant strategic endeavor in the industry landscape.

### Operation Overview:

e-Tendering platforms are B2B channel-oriented and revenue is both supplier and buyer-driven. These could be segmented as follows:

**SMEs:** non-regulated segment with proprietary software and usually concerned with outsourcing, generally not looking for e-Procurement solutions;

**Corporate-Cloud:** high flexible companies concerned with cost effectiveness and process agility;

**Corporate-Proprietary:** both security and agility-driven companies;

**Public-Cloud:** political and legal dependent segment using e-Tendering for purposes of transparency, tender management and contract effectiveness;

**Public-Proprietary:** security-driven public players with customization needs;  
C2B Individuals: residual highly fragmented segment with huge growth potential;

**Suppliers:** high volume segment with issues of over-fragmentation.

### Key success factors:

- 1. Product Innovation:** Vortal developed a set of e-marketplace platforms both buyer- and supplier-driven, cloud-supported, but flexible enough to target customers with proprietary concerns;
- 2. Brand awareness:** Vortal's brand awareness is significant, both in domestic and foreign markets. It ranks 3<sup>rd</sup> in e-Sourcing Business Brands;
- 3. Shareholder base:** Vortal's shareholders are important players in the company's markets, providing the company with knowledge, insight and lobbying power. At the same time, they provide the company with a solid and performing corporate governance model;
- 4. Technology Know-how:** Vortal has been able to recruit, train, and develop a human resource pool that is highly specialized in core business technology, from software development to digital marketing. This is uncommon in the ICT industry in Portugal;

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**5. The Crowd:** Vortal is a network care specialist, particularly effective in engagement management, triggering platform adoption, and expanding a worldwide community;

### 6. Public Tendering know-how:

Vortal's knowledge in public cloud sourcing is a critical

VRIN<sup>2</sup> resource. The company has consistently managed to proactively anticipate regulatory issues connected with public tendering, making its emarketplaces quickly up-to-date with any legal changes.

2 · VRIN stands for Valuable, Rare, Inimitable and Non-substitutable.

## Innovation Management Model

Innovation is a critical management challenge for any ICT company. This is the type of industry where it is not possible to see a competitive company without significant investment in innovation teams, roadmaps, and processes.

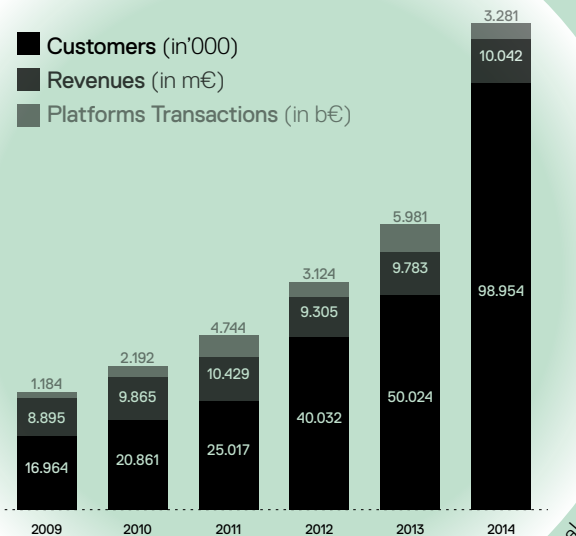
Vortal decided to be unique not only in its market approach, but also in innovation management. It built a model based on the following challenge: How to get the most innovation possible out of existing resources and structure, while spending the least possible amount and, at the same time, producing cutting-edge technology?

First, Vortal invested a significant amount of time and attention in building a solid and lasting innovative culture. Following the company's internal values, it fosters shared creative thinking to develop new solutions and encourages risk-taking combined with common sense and pragmatism. Vortal employs an innovative attitude to overcome

all challenges whilst consciously evaluating and incorporating risks. According to Miguel Sobral, Vortal's Executive VP for Marketing & Business Development, "Vortal's only cultural route is to be a pioneer. No one does it better than Vortal in this industry: a continuous and open innovation company". António Lima confirms this view in his 2010 Master Thesis on organizational ambidexterity presented at Porto University: "The main conclusions were that the company is an example of organizational ambidexterity. It has a culture where innovation is a constant, where in fact many innovations were a result of exploitation activities, such as improvement in products, processes and organizational structure. Other innovations instead came from exploration activities, disruptive innovations in new markets and derived products".

Second, innovation was placed in the organizational structure together with marketing. Innovation is to be product and market oriented. However, fundamental innovation is also developed through partnerships

### Vortal's evolution



Source: Vortal



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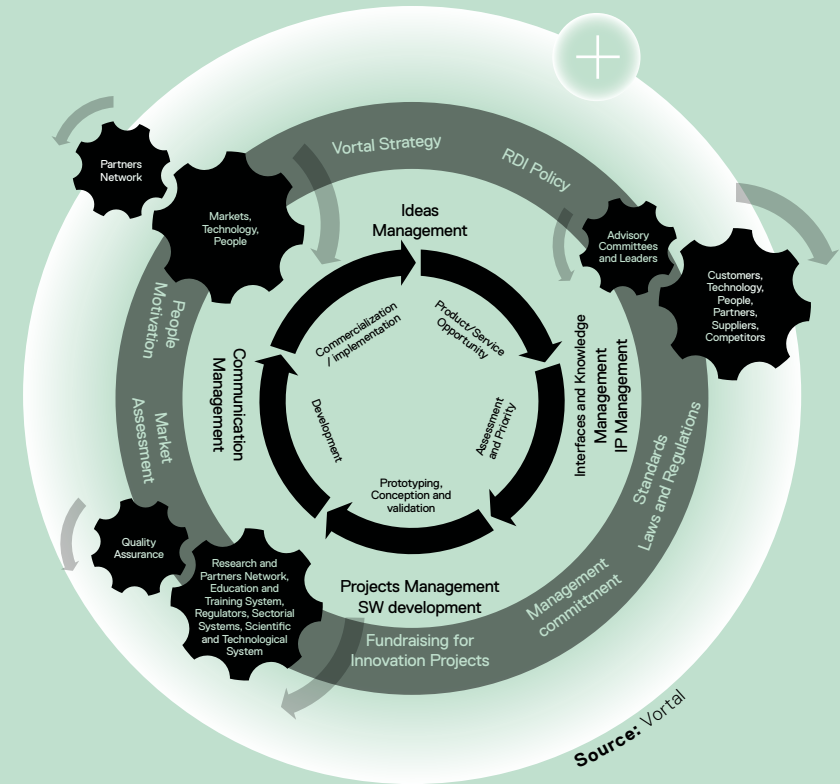
with the most accomplished universities in the country. “The innovation brought by *econstoi.com* on the market affected transactions’ structure. The development of online reverse auctions has created innovative ways of conducting transactions. Value is created through the connection of previously unconnected parties, eliminating inefficiencies in the buying and selling process. Buyers, as well as suppliers, have more choices and more options to develop a purchasing/selling strategy” said Alina Petrescu in her Master Thesis on eMarketplaces, in 2007, at Porto University. “The service’s true innovation is not paying bills, but rather guaranteeing payments when negotiating the sale and knowing beforehand that agreed payment deadlines will be met. The innovation brought by the platform has created innovative ways of conducting transactions, increasing efficiency and reducing costs”, adds Alina.

According to Nuno Milagres, Head of Marketing and Innovation, “Vortal became a specialist in getting the most out of everything we have. We use the crowd, we use our champions,

we use our headcount, and we use our advisory board as sources of innovation. Nothing is left behind!”. In this company, everyone considers him/herself an innovator. Because everybody has innovation-based key performance indicators, Vortal has a real time way of tracking contributions to innovation.

Perhaps the most critical procedure that was put in place to implement the innovation model was the ‘gamification’ initiative. Employees are encouraged to submit innovative ideas and later develop those ideas into products just for internal public recognition. No money-related prizes are granted in this initiative. The ‘innovator of the moment’ is just like the ‘employee of the month’ or the week in other companies. According to Nuno Milagres, “almost all internal innovation is generated without spending money. Relying on our human resources and our champions made us generate possibly the cheapest innovation in this industry!”

When discussing if such a model, based on immaterial rewards, can compete with material-reward



Source: Vortal

based models used by most ICT companies, especially by the giants in this industry, Miguel Sobral is very pragmatic: “We get more innovative ideas from our community than we can possibly manage! For the true innovative person, to see an idea actually being validated by a large, demanding, and expert community of individuals and getting the respect from this crowd is actually quite an achievement!”

“Of course, none of this would work if the management team were not able to handle this over innovation flow” claims Nuno Milagres. “This company excels in what most completely overlook: cooperation! With our Crowd we have created a fully win-win, fantastic ecosystem. This completely changed my vision of business strategy as battle field”.

This innovative way of managing innovation is



nonetheless complemented with solid process management. “No good idea becomes an actual product in the market without significant sweating!” highlights Nuno Milagres. Innovation management is all about establishing processes, decomposing those processes into routines and implementing the necessary control systems to make sure that the whole thing works properly and permanently. “The interesting thing is that most of our intrapreneurs are actually quite familiar with a structured view of innovation” says Miguel Sobral. “In an era where venture capital’s approach is the subject of several TV shows, people fully understand the difference between ‘risk’ and ‘calculated risk’. Innovation is a mature subject at Vortal” claims Nuno Milagres.

The challenge for Vortal is how to use this model as the company becomes more and more international. How to remain a differentiated player in sophisticated western markets with SaaS, unlimited platform scalability, and automatic functioning?

## Conclusion and Findings

Vortal is an amazing case of a proactive, customer-driven innovative business model company, operating in one truly global and highly competitive market.

This case study has described Vortal’s story and listed an impressive number of innovative initiatives developed by the company in three different categories: Market, Management, and Product.

This case’s key finding is the understanding of the successful path of an e-commerce innovative entrepreneurial venture in a small yet very dynamic country for the ICT industry.

Innovation lessons learned could be summarized as follows: always put yourself in the shoes of your customers, learn to use the crowd to get market feeling and feedback, stay in touch with your market at all times, and always double-check when you think you’re close enough!

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Case Study

# Vortal



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## Vortal:

Using the crowd  
before crowd  
phenomena

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ISBN 978-989-99460-0-2

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Case Study

# WeDo Technologies

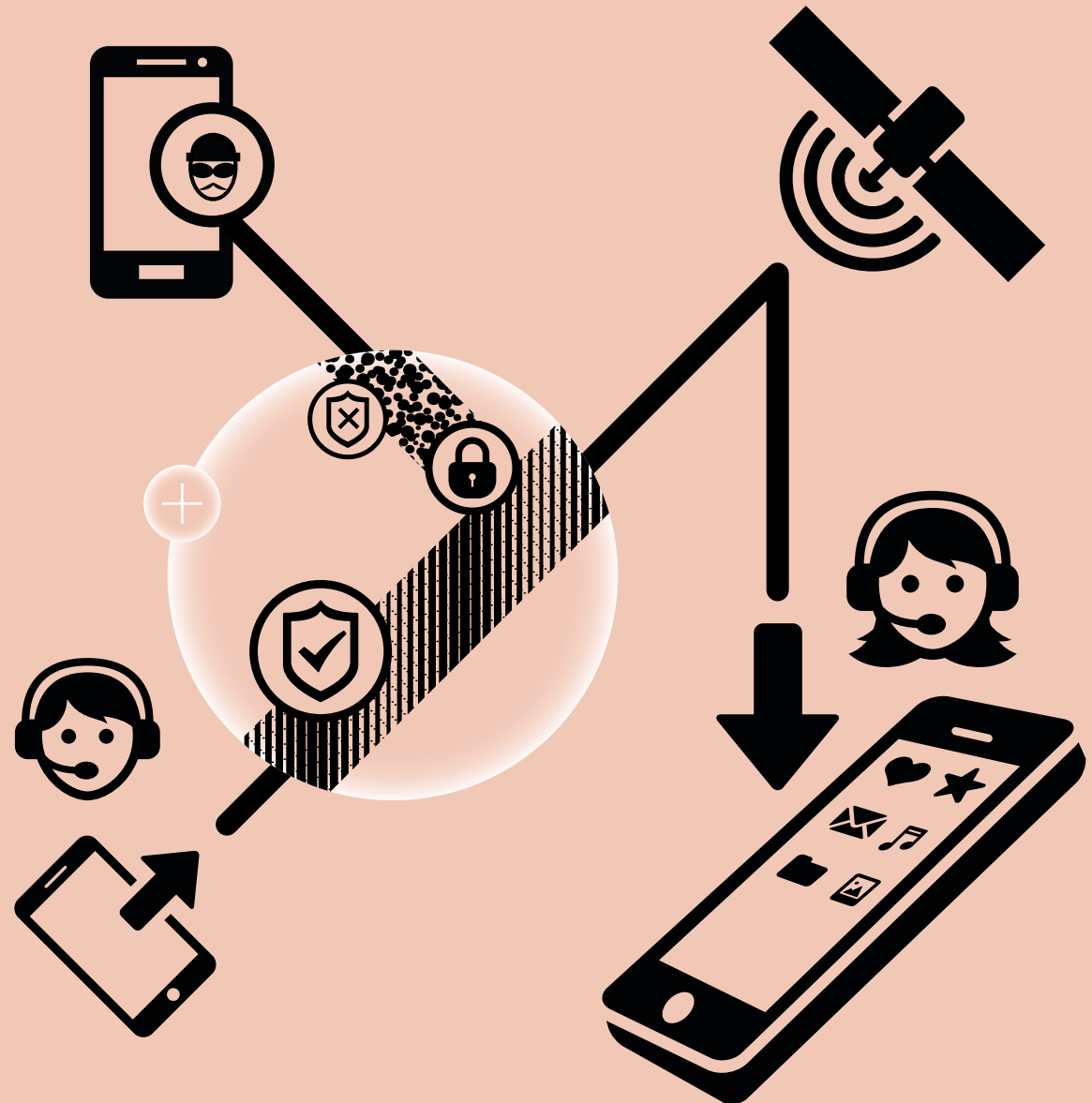
A new step in the affirmation  
of a born-global company

Marcio Amaral-Baptista

Paulo Bento

Renato Pereira

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# WeDo Technologies



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## WeDo Technologies: A new step in the affirmation of a born-global company

### Abstract

This case study tells the story of WeDo Technologies, a Portuguese software and services company with a process-driven vision for growth. This spin-off from one of the three mobile operators in Portugal had life before birth and its early days were very unusual compared to “normal” startups. In just over a decade, WeDo developed its main product from a revenue assurance into a business assurance concept, it rebranded its corporate name (WeDo Consulting until 2008), it moved from a focused into a diversified strategy, it switched from pure organic growth to a combination of organic growth with acquisitions, and it achieved remarkable success in terms of international presence and income. Despite all these accomplishments, WeDo recently decided to implement a product-oriented strategy via indirect channels to penetrate new vertical markets and scale the business. The case explores the key questions and dilemmas faced by the company as the new strategy unfolds.

### Keywords

growth strategy; strategic fit; multinational firm; innovation; product development

### Acknowledgments

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# WeDo Technologies



## Introduction

On May 2015, WeDo Technologies (henceforth WeDo) gathered over 400 client and partner executives in Lisbon, Portugal, for its 10<sup>th</sup> WeDo Worldwide User Group (WWUG). WeDo is a Portuguese company ranked by the Gartner Group as the world's leader in providing revenue assurance (RA) and fraud management (FM) software and service solutions to the telecommunications market (Exhibit 1)<sup>1</sup>.

On the occasion, founder and CEO Rui Paiva, along with his management team, were overjoyed. There was a lot to celebrate: RAID, the company's main product, was the number-one enterprise business assurance (EBA) software used by telecom incumbents worldwide. In 2014, WeDo had increased its order volume by 6% to a record €63 million with 24 new clients, spread across 21 countries and served by a global organization

(Exhibits 2 and 3). Equally important, 15% of its 190 clients (Exhibit 4) came from “new” target industries such as retail, utilities, healthcare and financial services – a strategic objective for the company.

They were also thrilled as the event conveyed a paramount message to clients, integration partners, industry analysts, and themselves: the company's recent diversification strategy to new vertical markets was up and running at full throttle. Dependence on telecom operators had been challenging WeDo for some years, and the company's response until recently had been moderate. By the end of 2014, WeDo had defined a new vision for its future: to become the leading provider of EBA software for many industries. Almost simultaneously, a bold decision was made to accelerate the transition: WeDo would set up a network of integration partners to act as indirect channels to sell and implement its RAID solution in non-telecom clients. The rationale behind this shift was clear for Rui Paiva and his management team, along with a straightforward implication: WeDo was betting

its future on a product-enabled strategy.

Thus, and with good reason, excitement, eagerness and anxiety shone in the eyes of Rui Paiva and his colleagues as the prolific WWUG 2015 event came to an end. Could WeDo become Portugal's first true global leader in the “pure” software industry? Would the company be able to reinvent itself yet again? In the process, would WeDo be able to leverage and sustain its distinctive capabilities?

## What WeDo does: the enterprise business assurance concept

WeDo's value proposition is centered on the concept of EBA. As such, WeDo defines itself as a “quasi real-time audit and control specialist”, a niche positioning that differs from the broader aims of larger business support system/operational support system (BSS/OSS) providers such as Oracle or SAP.

The underlying logic in EBA is that companies with complex settings are prone to operational leakages that can be converted into profits if detected and handled in a timely fashion (Exhibit 5). The concept can be compared to the dashboard and sensors of a modern car. Whenever the car sensors detect abnormal activity in a critical component, a warning is reported back to the dashboard and an alert is displayed to the driver. Likewise, EBA software institutes automated controls in existing business support systems data to enable continuous monitoring of potential losses and to improve performance. According to each company's strategy and legacy systems' architecture, a layer of EBA software is embedded into departmental systems in areas such as billing, collections, sales, human resources and marketing. A dashboard with a host of “warning lights” is then designed to depict the overall status of the company, trigger corrective actions and follow-up on progress.

In the six years leading to 2015, WeDo evolved from a revenue assurance and fraud management focus into a more comprehensive

1 · Gartner Group's report “Market Share: Telecom Operations Management Systems (BSS, OSS and SDP) Worldwide, 2011-2012”, published in June 2013.

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perspective on business control, encompassing additional areas of risk management such as compliance, internal audit and security. The software industry evolved accordingly, as the major players in the revenue assurance and fraud management space improved their products to incorporate additional features.

## The first seven years: leading the revenue assurance concept in telecommunications

“WeDo Consulting” was launched in February 2001 as a spin-off from Optimus, a Portuguese mobile operator, which in turn was owned by Sonae, the largest conglomerate in Portugal. Sonae had a history of supporting spin-offs from internal departments of the largest companies in their portfolio. According to Rui Paiva, “the Sonae Group is probably the best corporate entrepreneurship school in Portugal, a heritage from its founder Belmiro de Azevedo.”

Yet, WeDo had begun to operate nine months earlier. Back then, Rui Paiva worked as CIO for Optimus. Along with six Optimus coworkers, Rui prepared a business plan for a start-up in specialized IT services for telecom operators and presented it to Paulo Azevedo, at the time CEO for Optimus and Sonaecom (one of Sonae’s subholdings). A fast decision was made and Sonaecom became WeDo’s first investor (and sole owner), while Optimus became its first client, awaiting to be served.

Those first nine months were spent in a non-traditional way. The founding team engaged in the task of preparing and documenting the new company’s organization, processes, rules, methodologies and systems, in parallel with their functions at Optimus. Thus, when operations started, the company already had a structured backbone of processes and systems. Crucially, this included fully functional enterprise resource planning (ERP) software modules in finance and human resources. The very same process backbone has been annually updated ever since (Exhibit 6) and has

materialized into an advantage for the company’s expansion. According to Rui Paiva, “in 2001 we had it all prepared before the first order came in and this was fundamental to support our global ambition. Even today, whenever we set up a new international operation, either organically or via acquisition, we start with a structured management model. The only required adaptations are legal and fiscal. This accelerates our international growth and helps to implement our model and culture more effectively.”

Support received from Sonae was key during this period. By providing backoffice infrastructure, shared services and support systems (such as the ERP software), Sonae enabled WeDo to kick-start its business. Conversely, Sonae’s shared service teams also benefited from WeDo’s expansion, by gaining experience in dealing with the challenges involved in the company’s internationalization path.

In terms of scope, WeDo aimed at developing and implementing software tools to streamline telecom operators’ IT

infrastructures. The company started off as a relatively diversified software and systems integrator, with business units in customer relationship management (CRM), business intelligence (BI), software development, and systems integration. After the decline of several Internet and IT companies in the aftermath of the dot-com bust, and with its accumulated experience in a major segment such as telecommunications, WeDo’s positioning was then perceived as distinctive. Within their product portfolio, the revenue assurance software RAID soon became the company’s main offer. RAID monitored whether a telecommunications operator actually billed all the services provided to its customers. The client would then be able to act on detected billing leakages and recover lost revenues.

The very first RAID sale was made in 2002 to Oi, a major Brazilian telecom operator. This resulted from an early strategic decision to grow internationally. The reasons were twofold: first, the Portuguese market alone would not sustain expected growth. Second, given that WeDo and Optimus were

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part of the same corporate group (Sonaecom), selling RAID to other Portuguese telecom operators was nearly impossible. WeDo's internationalization was initially constrained by a country of origin effect. As Rui Paiva mentioned, "Portugal was not well perceived as a technology producer, in much the same way we hardly ever consider buying IT from a developing country. Portugal is known for great weather and golf, but not for technology. One of our main credentials to overcome this hurdle was our technology background and experience from large multinationals such as HP, Unisys, Xerox and Digital Equipment. Had we not come from these companies, we probably would not have made it internationally."

WeDo's internationalization into fast-moving geographies, coupled with its process-oriented culture, allowed for a fast topline trajectory during its formative years. By 2004, WeDo was physically present in five countries with annual revenues of € 20 million and 270 employees.

The main international growth driver was the revenue

assurance solution, adopted by several communication service providers. In line with its vision, WeDo offered a full-service approach comprising RAID, its integration with the clients' legacy systems and the solution's implementation. The company was organized into unified teams of sales and delivery. Within a typical project, 80% of the revenue came from integration and implementation services. Both the process driven approach and the methodologies designed by the founding team were instrumental and enabled a solid track record in implementing an operational solution on time, on quality and on cost. In light of this, the management team soon decided to refocus the company's strategy on selling and delivering implementation of the RAID revenue assurance solution to telecom operators.

In the following three years, WeDo pursued this focused strategy at full speed and obtained impressive results. A key milestone in the new strategy's implementation was the company's rebranding from "WeDo Consulting" to "WeDo Technologies" in 2008. Growth

was mostly organic and geared towards establishing foreign sales and service subsidiaries to serve new international telecom clients. A few acquisitions of smaller companies were made to sustain RAID's competitive position and to expand its functionalities in areas of fastgrowing demand such as fraud management (Exhibit 7).

One particular acquisition in 2007 was an exception and a landmark for WeDo. Irish company Cape Technologies was one of WeDo's main competitors. It had a similar turnover, 120 employees and operations in Ireland, the UK, Poland, Australia and the US. It operated as a software solution provider for the global telecommunications and content industries and had a number of world-class clients. Further to Cape Technologies' 100% acquisition, WeDo's headcount increased to 370 employees in 11 international offices, serving 60 clients in 35 countries. In practice, this acquisition awarded WeDo with the world's leading position in the telecom revenue assurance software niche.

Sonae's role as shareholder was instrumental in supporting WeDo's acquisitions strategy. With a view to building a global category leader, Sonae provided extensive process and managerial support to enable the acquisitions, in addition to required capital expenditure and working capital investments.

## Core product evolution: RAID development strategy

The company's flagship product, RAID, is at the core of WeDo's capabilities. From the beginning, the product was conceived to process very large amounts of data, thus becoming a precursor of the big data trend. Currently in its eighth major release, RAID has evolved continuously almost since the company's inception in 2001, mostly by means of innovation-driven development but also through the addition of selected complementary products from acquired companies. WeDo's target industries are very

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dynamic and therefore product innovation capabilities are key to anticipating and keeping up with their requirements. The company's research, development and innovation (RDI) management system (Exhibit 8) was conceived to monitor the market for trends, foster ideation, score and select viable innovation opportunities and feed the product evolution strategy.

RAID was designed to continuously scan client operations for potential deviations, instead of relying on monthly control points, and to trigger real-time alarms should any critical issues call for a prompt response. The product's aim is to ensure that the business is constantly monitored and that clients will receive warning if anything goes wrong.

RAID consists of three layers. The first is a data extraction and transformation engine that can handle, correlate and validate billions of records in a very efficient and quick way. The second layer is a powerful business rules engine whose job is to identify situations that are not occurring as expected

in the company's operations. A visualization and data analysis layer comes third.

These three layers evolved at different paces over the years. The capacities of the first two (data transformation and business rules) were evident since the early releases of the product and were fundamental to help telecom operators and companies with a large customer base make sense of large amounts of data. On the other hand, the visualization functionalities were deemed to be below par before the launch of RAID 7.0 in 2013. The visual component plays an important role in product demonstrations and in the usability of the solution. Therefore, showcasing a product that was not visually impressive to end-users was a limitation to sales. To address this, a high-priority project was commissioned to the product development team in 2011 to redesign the product's front-end. The new functionalities were launched in 2012 with a sleeker, user-friendlier interface supported by industry best practices. For example, data visualization components could now be segmented for different

audiences, allowing C-level users to view information and use the system in a much simpler way than a data scientist or analyst would. These enhancements enabled the company to leapfrog the competition and many players in the data visualization space, as several state-of-the-art visualization components were incorporated and seamlessly integrated with the new product suite.

While previous versions of RAID had focused on the revenue cycle, its major functionalities evolved cumulatively from revenue assurance to fraud management and subsequently to a number of business processes and cycles, in line with the overall EBA concept. In order to enable clients to act on different kinds of deviations beyond the revenue assurance and fraud management departments, RAID was upgraded to include auditing tools that increased real-time monitoring coverage to several organizational areas and processes. Auditing tools that were previously available to revenue assurance teams were packaged and made available to other groups and functions, including partners and incentives

management, sales and customer care units. By incorporating a case management and business modeling component, the new product release allowed client teams to delegate tasks, share information, and collaborate to solve complex business situations.

As of today, WeDo's product development strategy is to remain at the forefront of the EBA vision. The company is currently working on three priorities within its core product development roadmap. The first is to expand its ability to leverage the power of big data, in a two-pronged approach. On the one hand this involves supporting the Hadoop ecosystem, an open-source software library that allows distributed processing across thousands of commodity low-cost servers. On the other hand, support is also given to evolving technology spinoffs that address time-stringent massive data processing tasks, such as Spark. The second priority is embedding more sophisticated analytics and data mining algorithms in the product, so as to improve its ability to real-time detect problems that may be leading to losses. Finally, WeDo plans

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to scale the solution in a cloud environment in order to respond to a pervasive virtualization trend. While very important for communication service providers, these developments at core product level are critical to meet the present and future needs of new target markets such as retail, utilities, healthcare and financial services.

## The following seven years: growth in telecom and diversification attempts

Back in end of 2008, the rationale for diversification into new industries started to become clear for WeDo. The company was the worldwide leader in its telecom niche but growth prospects in that industry were limited. In addition, the core product itself could leverage the company's entry into new industries. From a technology standpoint, RAID was easily exportable into new markets due to its platform architecture and

ease of adaptation. In the words of CTO João Resende, "we are convinced that the technological needs of our telecom clients in terms of making sense of huge amounts of data are very similar to those of clients in other markets. Our product was born and raised in the telecom world, where value chains and system architectures are very complex. The technological challenges to serve other highly demanding markets are within our reach. In terms of core product, the bulk of the investment needed to diversify into new markets has been made."

An entry strategy into new markets entailed numerous questions beyond the advantages at core product level. Over the years WeDo had earned a strong reputation among telecommunication service providers for integrating and delivering a full monitoring solution on time, quality and cost, using internal resources. Should the company build on these capabilities and offer turnkey solutions to clients in new markets as well? Would this value proposition resonate in retail, financial services, healthcare and

utilities clients as well as it had done in telecommunications? How should WeDo fund the investment needed to scale up the resources required for expansion?

In mid-2010, Rui Paiva and his team presented a growth strategy and plan to the company's shareholders and a decision was made to implement it immediately with internally generated funds. The plan relied on balancing three key objectives: (i) to protect market share, capturing product replacement and upselling opportunities in the telecom market; (ii) to gradually expand the EBA vision into selected clients in the retail, financial services and utilities markets, with a business model similar to the one used in telecom; (iii) to internally develop both the product and the implementation capabilities required to serve new clients.

By 2014, the company had managed to sustain its growth trajectory, but mostly due to organic growth in the telecommunications market. As for new markets, the management team agreed that WeDo could have gone farther, in spite of

some achievements. For instance, WeDo was able to sell business assurance solutions to reference clients in retail such as 7-Eleven (Mexico) and Dufry (Brazil), as well as in energy, such as EDP (Portugal and Brazil), Cemig and CPFL (both in Brazil). In addition, Sérgio Silvestre (Marketing VP) noted that "we sold 27 RAID licenses to telecom incumbents in the first seven years of the product (2001-2007), generating sales of €26 million. In the following seven years (2008-2014), we won 12 non-telecom clients generating €10 million in sales. This means that we were able to get a very positive acceptance from new markets, with comparably less effort than in telecommunications."

Yet, the top management team analyzed the reasons why the initial diversification strategy had not progressed faster and identified a few vital issues. The first of them is related to a single-industry knowledge base, nurtured since the company's inception. The company had over 500 employees, 90% of which were telecom specialists or had telecom background, including all the founders. A major shift in the



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company's knowledge pool had to be made in order to enter new markets. As illustrated by João Resende, "our core product is very robust, but to get the most of it in a retailer, for example, we have to incorporate the business rules that are key in a retail operation. In terms of capabilities, our development and implementation teams need to know these rules very well from a business standpoint, as we do in telecom." Developing a critical mass of knowledge and specialists in other markets would entail higher capital expenditures and risks at levels that the company was not ready or willing to commit to. A number of new employees with experience in other markets had been hired and others had been trained, but some of them had not stayed with the company.

The second issue was the need to activate and educate clients from non-telecom industries. The need for revenue assurance and fraud management is well known by telecommunication operators, and much of WeDo's business with them came from winning requests for proposals with the help of RAID's competitive features and the company's track record

in that market. On the other hand, retail, utilities and other prospects had to gain awareness of the advantages that a business assurance solution could deliver. In addition, the company was not as well known and did not have strong relationships with decision makers in these sectors, as was the case with telecommunications. Internal marketing and sales resources were insufficient to respond to these challenges. Moreover, as the prospects from new markets were not mature enough to write a request for proposal, WeDo had to engage on longer sales cycles supported by demonstrations. As previously discussed, the earlier releases of the RAID product did not perform well in demonstrations due to its below-par visualization features, a problem that was not resolved until 2013.

Overall, the team concluded that a go-alone diversification strategy without a significant increase in capital expenditures did not prove to be the best strategic option, either financially or operationally. According to Rui Paiva, "we decided to preserve an acceptable level of EBITDA. Thus,

in order to enter new segments where our know-how and our people were not fully developed, expansion had to be gradual and done on our own. In following such an approach, we and our shareholders have learned and gained the confidence over time to adjust, reshift and move forward."

## The next move: specialize to diversify

In mid-2014, management and shareholders gathered to discuss possible options to accelerate expansion into new markets. It soon became clear that WeDo would have to outsource part of its go-to-market strategy and business model to integrators, in order to speed up the transition while balancing capital expenditures and risk. However, how far up in the value chain should WeDo go in serving new markets? Should the company: (1) focus on the core software platform and allow integrators to design the data model and business rules for

each vertical market, then sell and implement the solution at the client? Or alternatively, (2) should the integrators act only as distribution and implementation channels, while WeDo would advance the product to include market-specific business rules? Would these alternatives be attractive to the larger, more reliable system integrators?

Both alternatives represented another major shift for WeDo. For the last 14 years, the company had thrived by delivering a full solution to its clients. Occasionally some telecommunications clients would ask the company to work with their integrators, but as a general rule, WeDo would sell the software and implement it.

The management team and Sonaecom SSI, led by CEO Cláudia Azevedo, agreed that internalizing the development of market-specific rules would force the company to focus on one initial new market and thus delay the rollout to the others. Thus, in October 2014, a decision was made to implement alternative 1 in order to minimize time to market.

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To gain momentum, several strategic actions were set in motion almost simultaneously. A certification program was launched to prepare consultants from the integrators to sell and implement the RAID platform. In addition, a comprehensive hiring program was implemented to internalize new competencies in key areas. For example, several indirect channel business development specialists were hired from companies such as Microsoft. In order to incentivize integrators to add value to the core product and develop marketspecific business rules, instead of selling the software “out of the box”, a revenue-sharing policy with payment of royalties is being considered. After developing the business rules for one vertical market, integrators will be able to resell them to other clients in that market.

At present, the heat is on at WeDo. The team is energized by several encouraging signs. For instance, the certification program has been well received by a number of high-profile integrators that the company was able to sign up with. To date, 27 professionals from three major multinational

integrators were certified within the new program.

Another evidence was the record-breaking annual conference held in Lisbon for clients and partners in May 2015, the 10<sup>th</sup> WeDo Worldwide User Group (WWUG). Aside from gathering 400 attendants from 100 large companies operating in 45 countries, an increase of 60% over the 2014 edition, several integrator partners also came to Lisbon to attend the conference.

The management team knows that engaging the right integrators will be key and to do so, stakes must be unprecedentedly high. In order to engage a community of top-level integrators, it is important to be perceived as a global standard and the team feels that WeDo and the EBA concept are gaining momentum. As Sérgio Silvestre puts it, “without the clients from new markets that we won in the last years, integrators could have paid less attention to us. Their decision to invest valuable time and resources in certifications is evidence that they are on board. Now we must demonstrate that we are serious about this strategy. It is crucial to

help them promote the business assurance vision and close the first deals. They may be willing to co-invest with us, but we need to take the lead. More than that, we will win some deals ourselves and then hand them over to the integrator.”

At the present time, keeping the pace is important and CEO Rui Paiva knows it well: “By the end of 2014 I gave the team a very hard mission: to prepare the foundations to implement the indirect channel strategy by the end of 2015. Our results will suffer a bit because of the investment that was made, the topline must be preserved, but we will be ready by year-end.”

## Present and future: challenges ahead

These are exciting and restless days for WeDo. After years of a successful trajectory, successive transformations and lessons learned, the team’s dominant feeling is that all bets are off

again. The indirect model seems to be taking off and excitement is shared among integration partners and prospective clients.

The team is convinced that the product-oriented business model with indirect channels is the best compromise to balance potential growth and scalability, time to market, internal capabilities, capital expenditure restrictions and value creation. They are confident that it can be done. In fact, WeDo has managed to transform itself significantly over its short life of 14 years, in a variety of product and market configurations. In the words of Rui Paiva, “two important features of our culture are frugality and a we-do, can-do attitude. We know we can deliver a lot with very little, and the fact of the matter is that we have always done it many times in our history.”

The future is clear for Rui Paiva: “We will become a true world-class software company, thus foregoing the integration business at some point in time. To do so, our network of integrators must be fully operational and this transition will be completed when the resources generated

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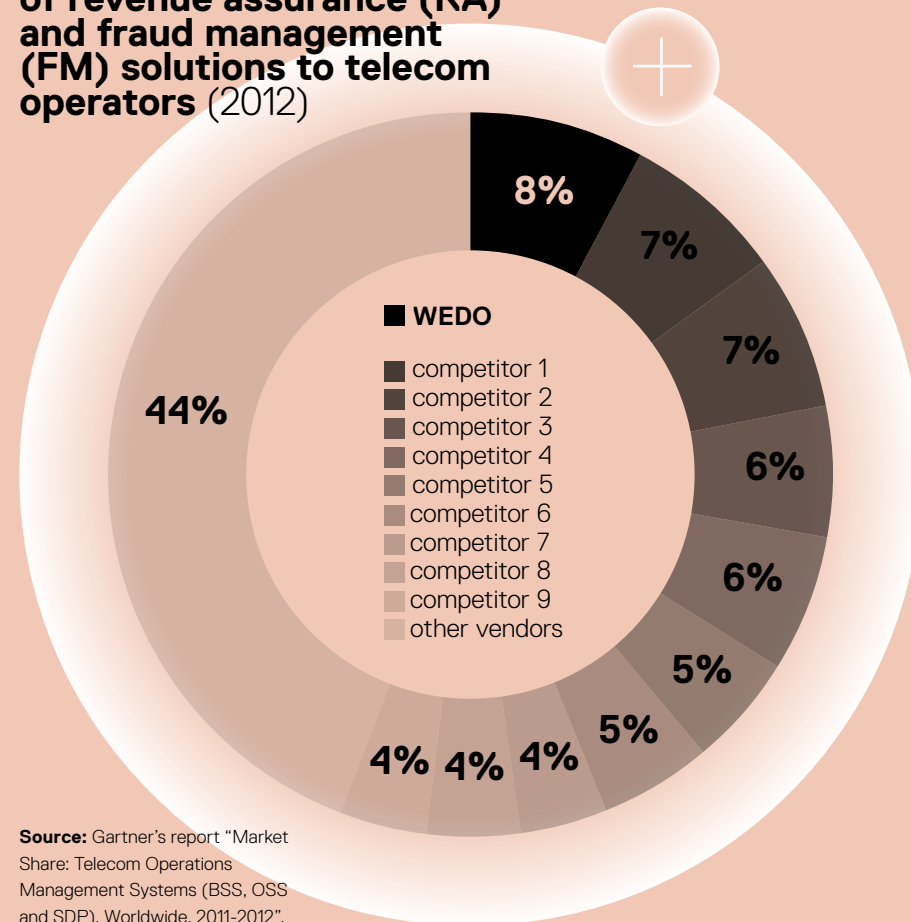


by sales of new software licenses are higher than those from our integration business. By then, our mindset will have to be 100% oriented to produce software. Eventually, our employees in the integration and professional service departments will be transferred to our integrators. My dream is that WeDo becomes the SAP of monitoring, a market standard for EBA just like SAP set the standard for enterprise resource planning (ERP).” He also adds: “To transform this business, either the integrators will make a strong commitment to this strategy or we will leverage it ourselves with the help of investors. The time is now and there is no way back.”

At this point, however, the key questions and dilemmas in the minds of Rui Paiva and his team are very much grounded on the present: Will integrators really engage? Will they stay if sales take longer than expected? Will others follow in relevant geographies? Should there be more investment in order to accelerate the transition? Will the company be ready to accept the underlying trade-offs of the full product-oriented strategy?

EXHIBIT 1

## Worldwide market share of revenue assurance (RA) and fraud management (FM) solutions to telecom operators (2012)



Source: Gartner's report "Market Share: Telecom Operations Management Systems (BSS, OSS and SDP), Worldwide, 2011-2012".



EXHIBIT 2

## WeDo's geographic setting as of 2014 year-end

### OFFICES AND ORGANIZATION

#### Regional Offices

- WEDO AUSTRALIA
- WEDO BRAZIL
- WEDO EGYPT
- WEDO FRANCE
- WEDO IRELAND
- WEDO MALAYSIA
- WEDO MEXICO
- WEDO POLAND
- WEDO PORTUGAL
- WEDO SPAIN
- WEDO UK
- WEDO USA

#### Software Houses

- USA (BETHESDA)
- PORTUGAL (BRAGA)

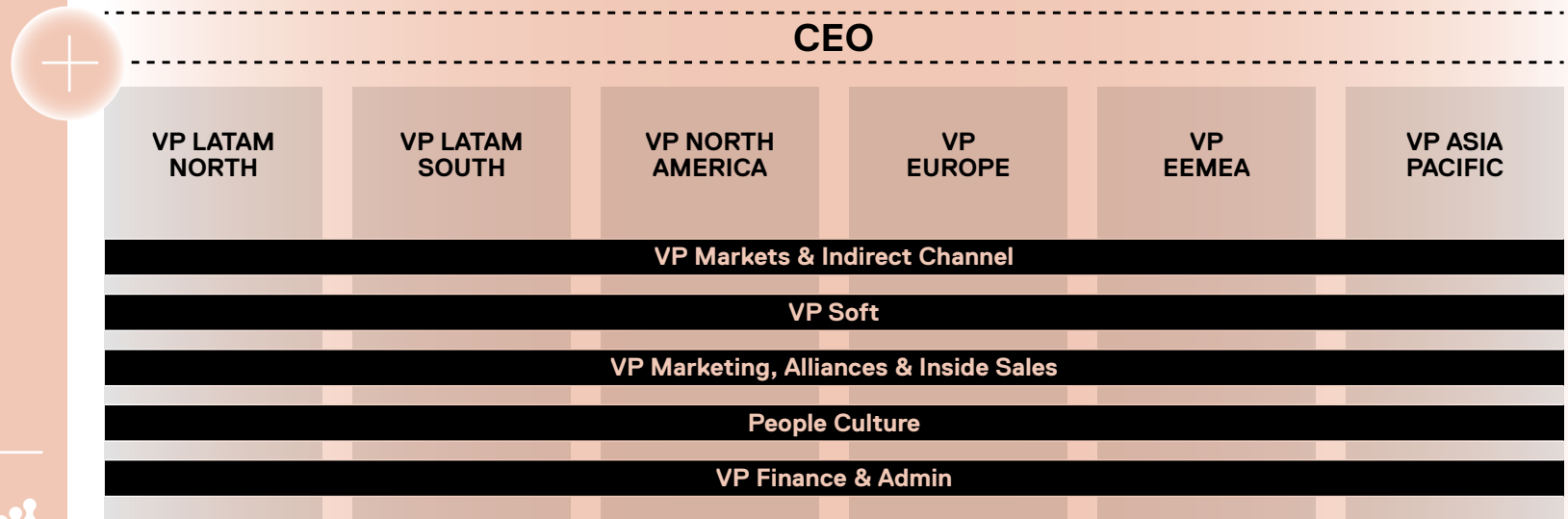


12 countries  
05 continents

Source: WeDo Technologies' "White Book", February 2015.

EXHIBIT 3

## WeDo's organization chart as of 2014 year-end



Source: WeDo Technologies



## WeDo's major clients

# CUSTOMERS IN 90 COUNTRIES. MORE THAN 200 CUSTOMERS WORLDWIDE

### Telecom



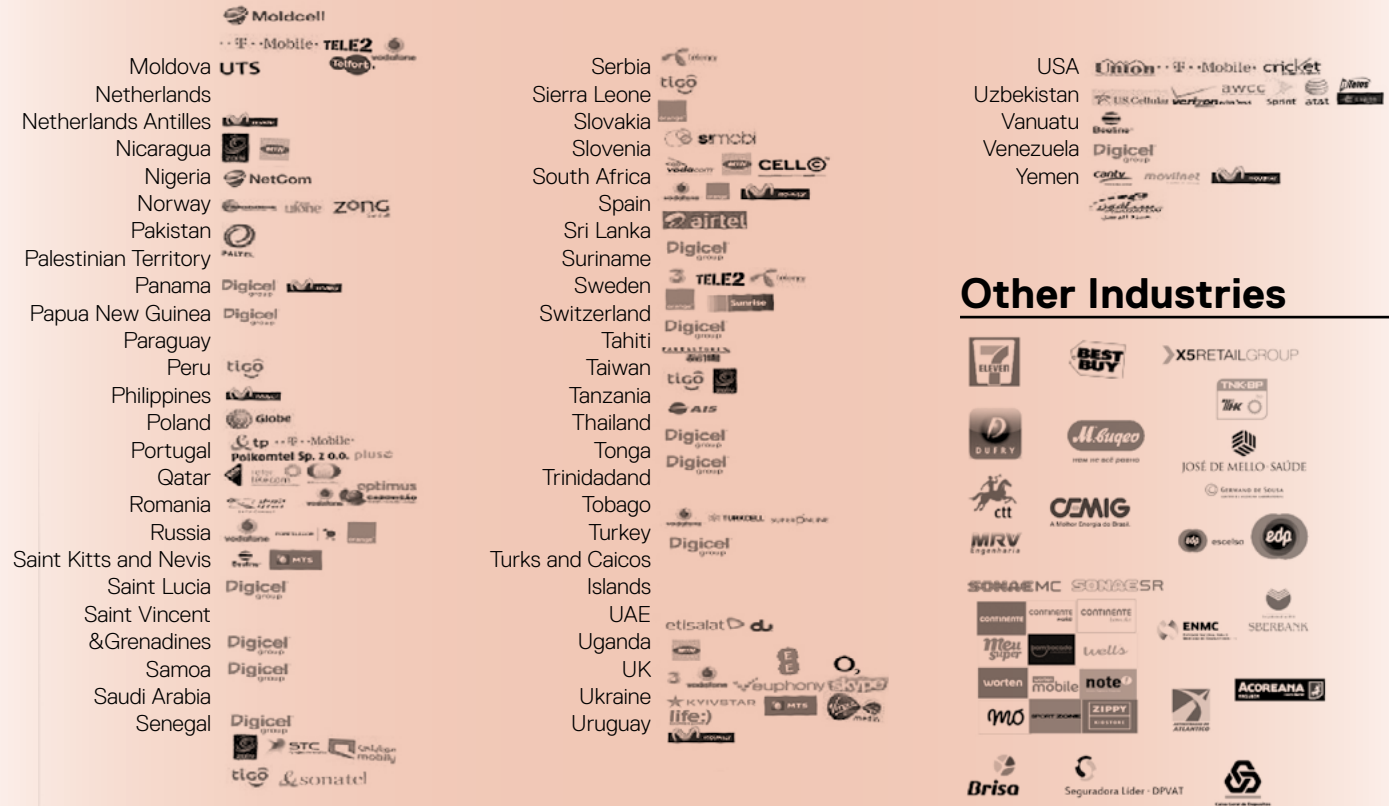




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### Telecom

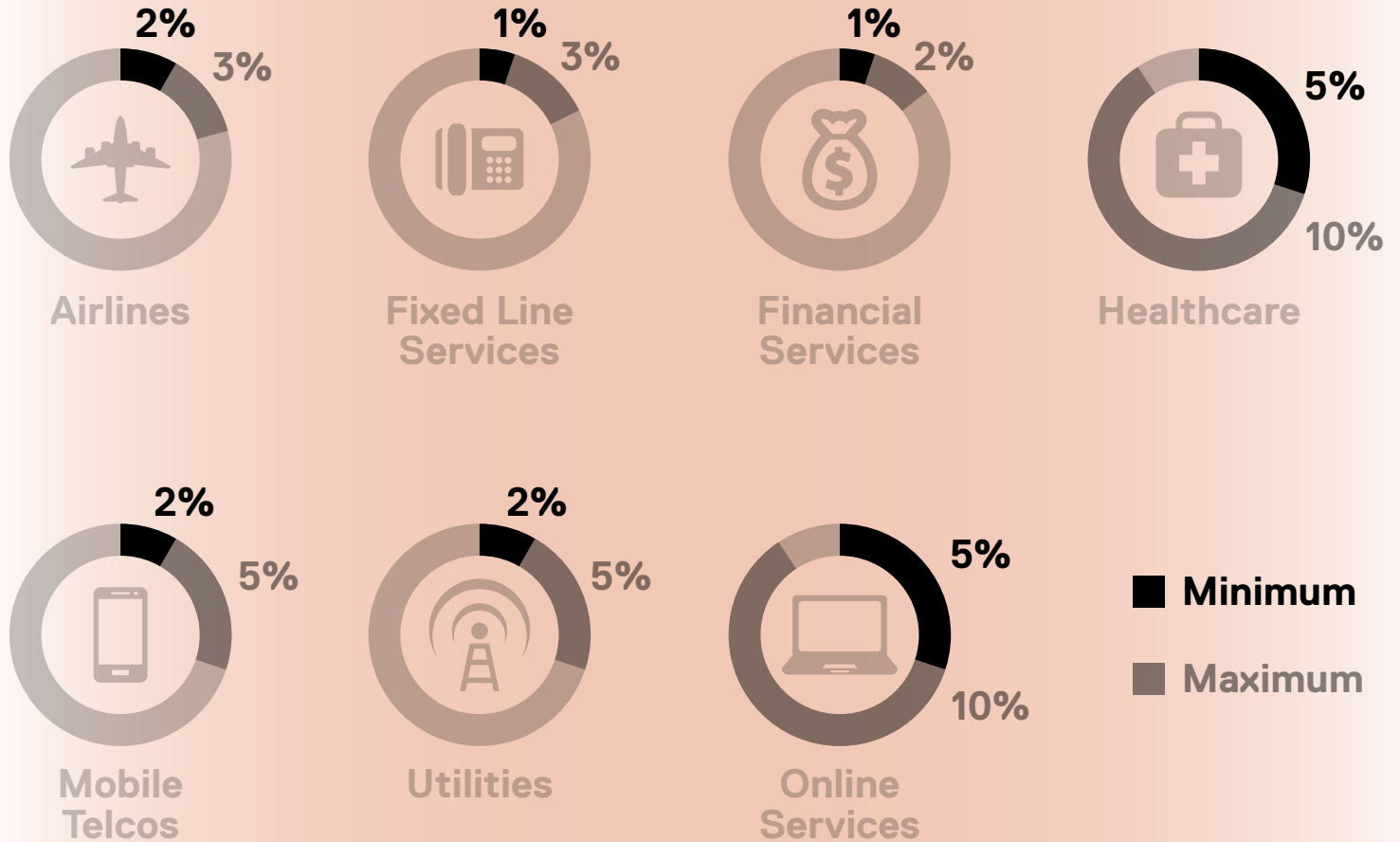


### Other Industries



EXHIBIT 5

**Estimated revenue losses by sector**



■ Minimum  
■ Maximum

## WeDo's internal process mapping structure



# MAPPING OF PROCESSES

## 4 levels of documentation

### 4 The Quality Handbook and the White Book

Quality & Innovation Manual  
and  
Information Security Management Manual

White Book

### 3 Procedures

Procedures

### 2 Instructions

Instructions

### 1 Templates/Quality records, Presentation and Color Books

Templates, Checklists, Slides, Manuals, Quality Records, Blue Book, Pink Book, Green Book, Orange Book, Yellow Book and Purple Book

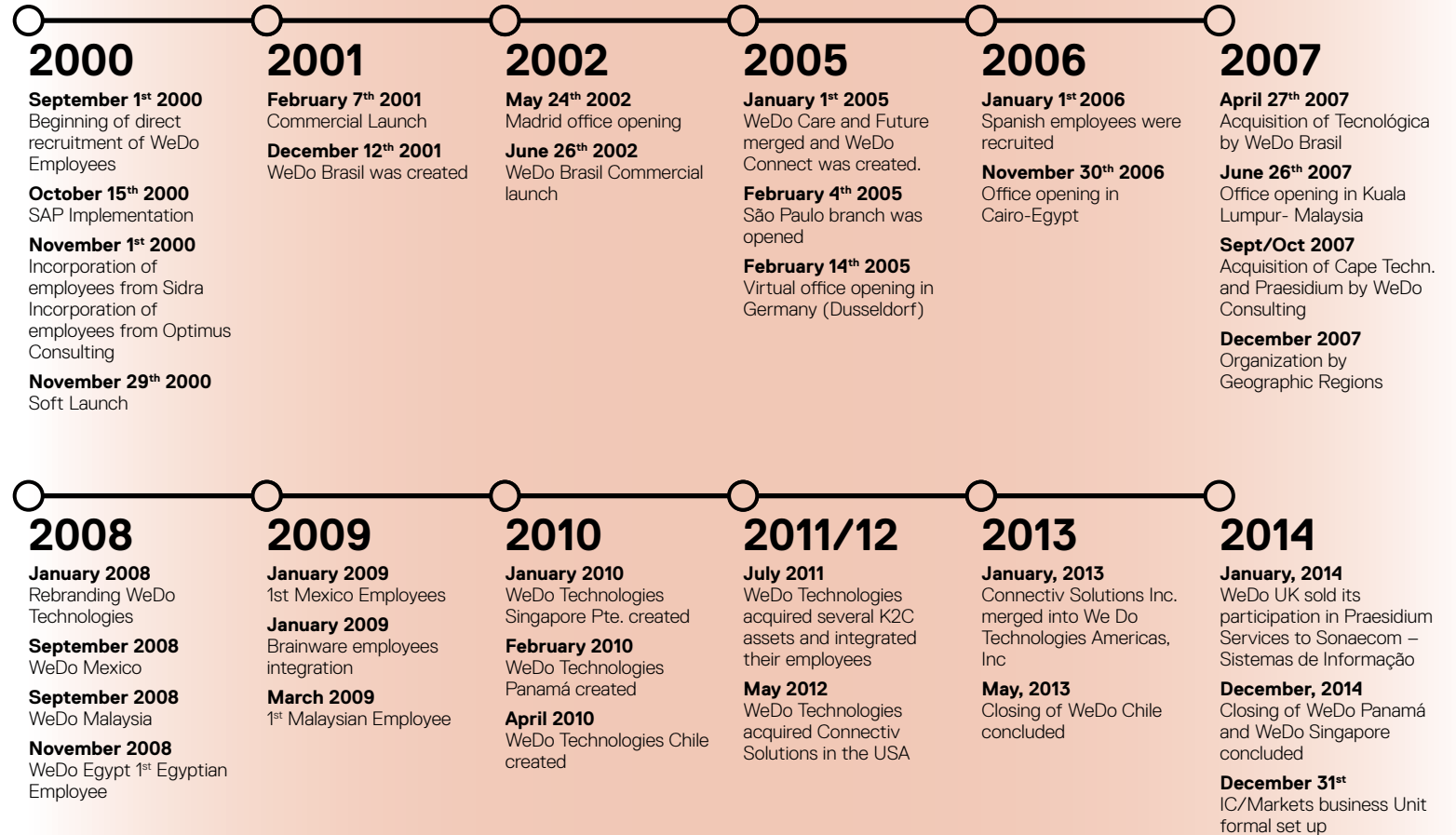
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EXHIBIT 7

## Timeline – WeDo's key milestones and acquisitions

### 15 YEARS BUILDING A GLOBAL ORGANIZATION

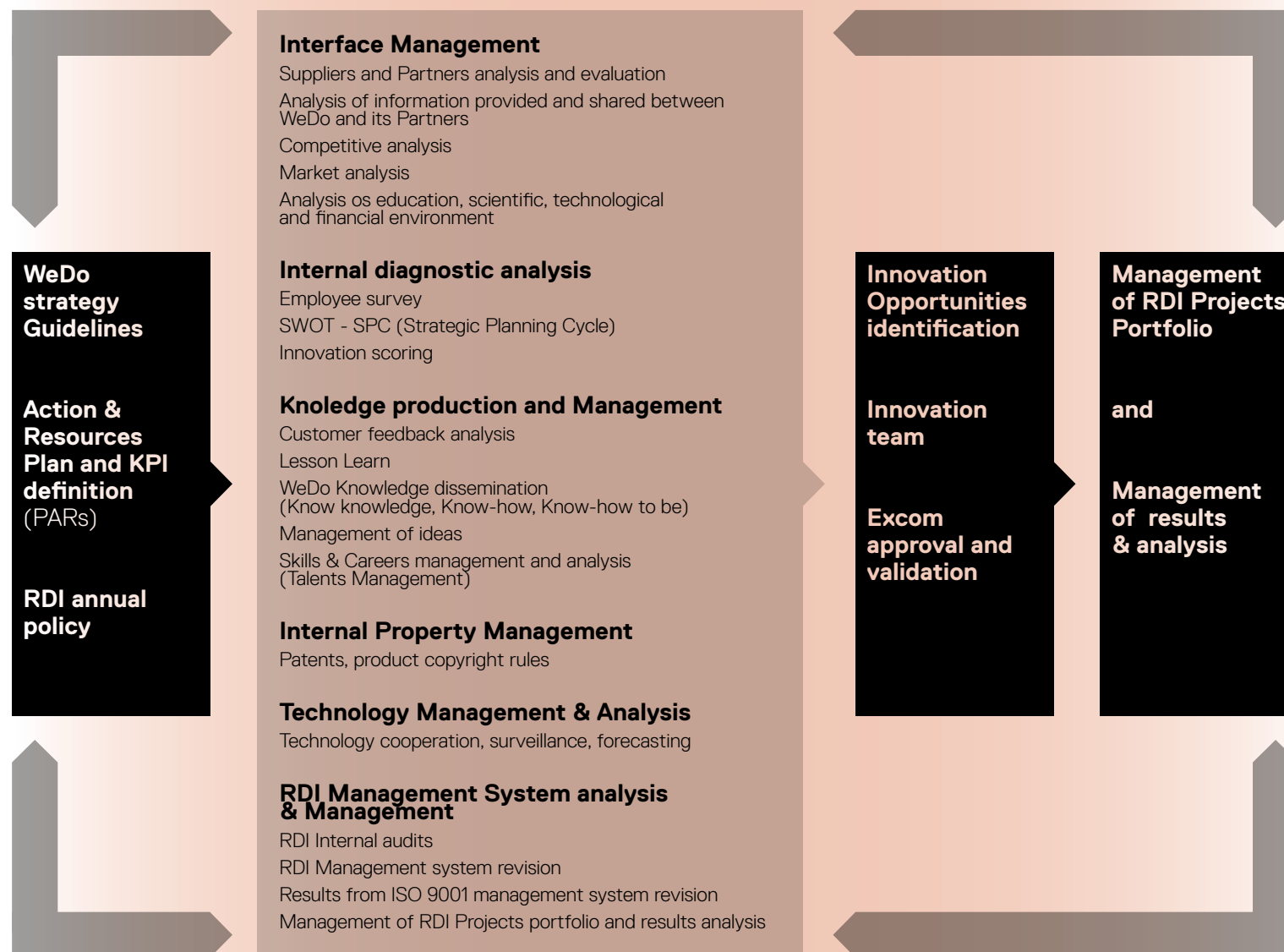


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EXHIBIT 8

## Research, development and innovation (RDI) management system





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## WeDo Technologies:

A new step in the  
affirmation of a  
born-global company

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