

Mapping R&D within Multinational Networks: Evidence from the Electronics Industry

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Abstract. Based on the final results of the R&D.COM - Local R&D COMpetencies within Global Value Chains project, this paper aims at mapping the trajectories of delocalised R&D units within a multinational's global strategy and designing the knowledge flows within the global value chain. This analysis was performed using typologies proposed in the theoretical framework, which help us to have an overview of the network. The methodology is grounded on one extended case study that involves a local R&D unit (Portugal), a foreign R&D unit (Netherlands) and the headquarters (Norway) - developed on a multinational from the electronics industry. This case is an example of a multinational company where R&D is developed mainly in the headquarters but it is also delocalised to some subsidiaries with a certain level of autonomy.

Keywords: multinational networks, I&D, Innovation, subsidiaries, knowledge transfer and autonomy.

1 Introduction

It seems undeniable that we face a different social and economic structure from the one which predominated in previous societies and that this new context is profoundly influenced by a dynamic of creation and dissemination of knowledge. In the emergent economy and society, the accumulation of knowledge becomes the main growth and development motivational strength.

The economies based on knowledge are, essentially, economies where the knowledge managing activity, in relation to the innovating process, has become decisive in the competition among economical actors (Murteira, 2004).

In this way, Castells (2005) tell us about an economy that is, simultaneously, informational, global and networked. According to the author, global economy designates an economy with the capacity to work as a unit in real time, in a planetary scale.

Actually, one of the central actors of this globalization process refers to the multinational companies (MNCs) that elaborate their strategy and organize their activity in a planetary scale. Thus, with the internationalization of companies – it can even be stated, today, the transnationalization – part of the functions considered strategic, as, for example, the R&D, have been targets for delocalisation (Sölvell et al, 2002).

Following this theoretical research line, this paper aims at mapping the trajectories of delocalised R&D units within a multinational's global strategy and designing the knowledge flows within the global value chain.

2. R&D in multinational networks: a new approach in a new context

2.1. From hierarchical to heterarchical organizational forms: the trend to R&D delocalization

In the last decades, the activity of multinationals enterprises (MNCs) has grown, not only in extension, but also on variety and intensity. These developments are commonly associated with the economy globalization process, more specifically with the increase of the interdependences outside borders between different markets.

In a growing way, companies tend to invest abroad, in order to explore resources and activities already in place, but more and more trying to create new activities and competencies (Cantwell et al., 2001).

If before, the multinationals were seen mainly in terms of their capacity to explore the advantages generated in the headquarters of the multinational, recently, this point of view has changed, emerging, increasingly, the potential to create knowledge by companies fitted in chains of global value.

This new perspective has been driven by structural changes in global economy, as well as by the tendency to the internationalization of R&D functions in multinational companies that we have been testifying. As a matter of fact, the internationalization of companies has contributed to the delocalization of an important part of strategic functions, as, for example, R&D.

According to this alternative perspective, an important source of competitive advantage to multinationals is the capacity of subsidiaries to generate innovations based in resources of the local environments where they are positioned (Frost, 2000: 21).

As wrote Cantwell and Mudambi (2005), from an historical point of view, multinationals use to locate R&D in subsidiaries in other countries especially with purpose of adapting the products to the countries where they were developed. In this way, the subsidiaries depended on the competencies of other companies and their role was mainly the exploration of those competencies (competence-exploiting). Recently, some subsidiaries acquired a more creative role, generating new technologies, innovation and new competencies. This transformation lead to an increase of the R&D destined to these subsidiaries creators of competencies (competence-creating).

As a matter of fact, the level and type of R&D developed in the subsidiaries, which determine subsidiaries to be creators of competences or, simply, explorers of competences are influenced by several factors (Cantwell and Mudambi, 2005): a) the place where the subsidiary is located and the relations that are established between the subsidiary and the local environment; b) the strategy of subsidiary acquisition by the MNC; c) the autonomy and strategic independence of the subsidiary.

This scenario, where subsidiaries can play an active role as developers of innovative processes is not compatible with the traditional view of MNCs as a clear hierarchical structure but with an horizontal and heterarchical form. In this sense, multinationals appear as flexible horizontal networks, characterized by processes of lateral decisions, where the headquarters are no longer the company brain, but instead, the whole company is faced as a brain (Schmidt et al., 2002: 45). It seems that hierarchy as the dominant organizing principle in MNCs is being supplanted by the emerging principle labelled heterarchy, which is associated with laterally/horizontally oriented MNCs¹.

In new the organizational form, first, the importance of autonomy in the organization as a stimulant to the creation, adoption and diffusion of knowledge and innovations contrasted with the traditional emphasis on efficiency and tight controls; and, second, the structure was radically transformed from hierarchy in which knowledge, resources and expertise are centralized into a network where they might be located anywhere but are able, by various communications systems, to be disseminated to any other subsidiary (Johnston, 2005: 38)².

2.2. Subsidiaries and organizational contexts: the diversified role and autonomy

This new horizontal understanding of multinationals and of the subsidiaries' behaviour gives a great relevance to the subsidiaries' autonomy issue, which should be seen not only in the unidirectional and hierarchical relations context between headquarters and subsidiaries, but also in the subsidiaries development point of view (Cantwell and Mudambi, 2005 and Cantwell and Iammarino, 2003). Subsidiaries are not only instruments doing tasks imposed by headquarters, but also play an active part in the multinational network (Simões et al., 2002).

In this line of thought, Simões, Biscaya e Nevado (2002) carried out a study where they tried to identify the factors that determine the autonomy of subsidiaries. For the authors, they are, as in the study of Cantwell e Mudambi (2005) at three levels: at level of the subsidiary, at the level of the multinational network and at the level of the local economy.

In this perspective, the literature faces the subsidiaries as organizations with three faces. On one side, they are members of the multinational group, that supply them with resources (financial, knowledge and reputation) and with whom they develop connections and synergies. It is, therefore, a face turned to the group. On other side, the subsidiaries, more than belonging to multinational groups, are located in certain countries and develop relations with the local economy and with the economical agents established there, accessing the knowledge of other companies, recruiting local qualified personnel and cooperating with other local research centers. Thus, it is a

¹ Heterarchy is a new trend in multinational organizations, which it doesn't mean, however, that vertical and hierarchical organizations don't play an important role in economies anymore. What we are emphasizing is that the transformations in global economies are creating new strategic and organizational imperatives for companies worldwide, which lead to new organizational forms.

² The organizational knowledge management in MNCs and the network as a new pattern of organization are important issues in the new organizational context. The process of effectively creating, disseminating and leveraging a company's knowledge resources is vital to MNCs' competitiveness. At the same time, networks constitute what organizations must become if they want to be competitive in today's business environment (Johnston, 2005; Nohria, 1992).

second face, turned to the local economy. Finally, the subsidiaries have their own history and develop their own competences (Simões et al., 2002). This is therefore, a third face, turned to the subsidiary itself.

Considering that subsidiaries are multidimensional organizations, which characteristics are a result of the combination between several factors, it is possible to identify types of subsidiaries. Simões (1992) propose a typology of subsidiaries, through which is possible to establish a relation between MNCs' strategies and subsidiaries' characteristics³. By its turn, Johnston (2005) adopts an integrated model of the headquarters-subsidiary relationship, where he develops a typology of subsidiaries tasks. These proposals, despite being very different in terms of theoretical bases, methodologies and goals, have some similarities. They contemplate from subsidiaries typically related with hierarchical organizational forms, which are high centrally controlled and low autonomy subsidiaries ("marketing satellite" or "distributors") to subsidiaries in line with the perspective of MNCs as heterarchical organizations, which enjoy independence and contribute to the development of knowledge and innovative processes and products ("strategic major" or "innovators").

In point of fact, there has been an increased emphasis on innovation and the creation of new products and services in MNCs. New product and innovation strategies have always been important to the MNC but the process of their generation was usually centralized in the headquarters. The new emerging strategy extends the MNC's innovative and entrepreneurial skills via the development of a multidimensional, distributed, integrated, flexible, interdependent, learning organization that generates locally leveraged and globally linked innovations (Bartlett and Ghoshal, 2002).

2.3. The creation and diffusion of innovation and knowledge: the rise of a network-based perspective

The development of knowledge and innovation in MNCs and, mainly, the way they are diffused, is central to corporate success.

Therefore, a crucial challenge for multinationals is to avoid that subsidiaries become isolated from other parts of the multinational and assure that competencies from the different units of the multinational are diffused throughout the group (Andersson et al, 2002: 116).

At the same time, the knowledge transfer process is related with the type of organizational form of the MNC and, consequently, with the "status" of the subsidiaries (as competencies explorers or creators). The knowledge flows and the "dynamic" of the transference itself, on an integrated and interdependent MNC are different from the ones developed in a vertical and centralised organization. According to this, Mudambi (2002) develops a knowledge flows perspective, in which he identifies the flows between a source and a target, which occurs along a

³ The author alerts to the fact that this typology must be used with care, especially when applied to the links between corporate strategies and subsidiaries characteristics. There is not a one-to-one correspondence: a given strategy may lead to the setting-up of different types of subsidiaries, and a single firm may follow different strategies (Simões, 1992: 262).

channel in a MNC. The author identifies four flows: from the subsidiary to parent, from location to subsidiary, from subsidiary to location and from parent to subsidiary.

In the same way as Mudambi's perspective (2002), the taxonomy of innovation processes proposed by Bartlett and Ghoshal (in Simões, 2008), provides an important instrument to assess the organizational context where the subsidiary develops its activities.

In this manner, the knowledge management issue is closely related with innovation and, mainly, with the innovative capacity of the MNC, which can be centralized in the headquarters (considering a hierarchical perspective) or can be localized in the subsidiaries (considering a horizontal view), and consequently related with the capacity of diffusing innovations in the network.

They considered four basic types: central, local-for-local, locally leveraged and globally-linked. The first corresponds to the traditional perspective that new opportunities are identified in the MNC home country and lead to centrally developed innovations, which are then exploited internationally. This perspective, based on a hierarchical view, the innovative capacity is centralized. The second type is characterised by the development of innovations by subsidiaries just for local use, not being diffused in the multinational context. The last two types follow a network view. Locally leverage innovation processes enable the dissemination of the innovations developed by the subsidiaries in the multinational network. Finally, globally-linked processes are characterised by putting together the resources and capabilities of diverse worldwide units in the company, at both headquarters and subsidiary level, to create and implement innovations on a joint basis (Bartlett and Ghoshal in Simões, 2008: 10).

Taking into account the new concept of MNC, that we have been pointing out, its straightforward to understand that the two first types of innovation processes described, characterized by a vertical and hierarchical view of MNC and by an inefficient communication and transfer, in this specific case, of ideas and innovations, between the different units of the multinational and between them and the headquarters, doesn't allow that the company takes advantage of its units.

In this way, the hierarchical approach is gradually giving rise to a more network-based perspective of the MNC. This is not to say that hierarchical control no longer exists, it means that control mechanisms are changing and that more open control mechanisms, putting less emphasis on centralisation and promoting subsidiary involvement, are gaining room (Simões, 2008: 10).

3. The case of a multinational from the electronics industry

3.1 Methodological Steps

Concerning the methodological aspects, we used the case study method. The results presented are based on one extended case (that involves a local R&D unit (Portugal), a foreign R&D unit (Netherlands) and also the headquarters of the global chain (Norway) developed on a multinational from the electronics industry.

In the case studies two techniques were combined to carry out the empirical research: *in-loca* observation of the work processes and semi-directive interviews addressed to actors belonging to different departments and hierarchical levels.

In the extended case study three R&D units have been studied. In the first unit, the headquarters in Trontheim, 11 interviews have been conducted: a) From Top Management: CEO; vice president business development & compliance; vice-president R&D; Human Relations Manager. b) From Operation: System Development Manager, Head of Project Management, Service and Maintenance Manager and Project Engineering Manager. c) From R&D: two group managers. d) From Sales: Sales Regional Director. The second R&D unit, located in Beilen (Netherlands) has been recently acquired by KNetwork. In this company we conducted 6 interviews addressed to the General Manager, the Responsible for the R&D and the Automation and Computation Tooling. We interviewed the Responsible for the Data Entry, the Financial Manager and the Office Manager as well. In Portugal 5 interviews were conducted: General Manager, two Projects Development, the Office Manager and the Responsible for the Maintenance.

3.2 Mapping R&D in the Network: understanding trajectories, patterns and specificities

KNetwork is a MNC from the electronics industry. It is a global supplier of solutions and products for the Road User Charging and Traffic Surveillance offering solutions and products such as DSRC (tag) and OCR (image processing), with deliveries in Europe, Asia-Pacific, Middle East and North and South America. The company has 270 employees in 12 locations and representatives in 6 other countries.

Despite being present worldwide, it is a small MNC, which, on the one hand, has offices with a considerable number of people, a good degree of maturity and experience and, consequently, a high level of autonomy; but on the other hand, has in the majority of the countries, small offices, mainly dedicated to sales and maintenance.

The core R&D is centralized in the headquarters, and some subsidiaries develop local specifications to the products. However, the level of development done by the subsidiaries is different, so it is their autonomy and independence, which varies with factors like: the longevity and maturity of the subsidiary, the weight of the local market, the importance of local costumers or local relations, the local products and business, the local activities (from development to sales), the distance to the headquarters.

KNorway defines clear centralized management strategies, and doesn't want to lose control of its subsidiaries. In the words of the CEO: "I want that subsidiaries can have some autonomy and can decide for themselves but everyone has to follow the same strategy, and of course I never want to lose control."

There is also a strategy of new companies' acquisition with new competencies needed by KNorway. The strategy of KNorway is to be leader in its business area, and in order to achieve that, it had to acquire competencies and tools, which they didn't have, like the case of the video system, in which "KNetherlands was simply the best company." In this sense, KNetherlands became a completely different subsidiary,

acting like an extension of the headquarters, and being the most important R&D unit after KNorway. According to the CEO of KNetherlands the great achievement for his company was "to take advantage from the big sales experience and also from the financial maturity from a very mature company." As a matter of fact, KNetherlands continues his R&D activity independently and have a very autonomous management, although both companies are following a path where practices are being standardized, and where KNetherlands is slowly becoming a special company with his individuality but part of a multinational network.

Therefore, KNetherlands is what we can call, according to Cantwell et al (2005), the competence creating subsidiary with the higher level of innovation creation. Other subsidiaries, like Australia, Portugal, Brazil and Malaysia are also competence-creating subsidiaries, mainly developing some local specifications, but in a lower level than Netherlands. The other subsidiaries don't have competence creating expertise because they are mainly sales officers, being classified as competence explorers.

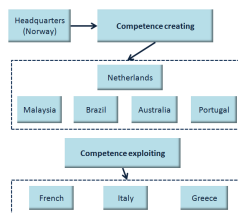


Figure 1 - Cantwell et al (2005) orientation of subsidiaries

As a matter of fact, the subsidiaries of the network have different tasks, levels of maturity, degrees of autonomy, capacities of innovation, and all these differences allow us to integrate them into typologies, which help us to have an overview of the network. We will consider the Simões (1992) subsidiaries typology and Johnston (2007) integrated model of headquarters-subsidiaries relationship.

KNetherlands is a type of subsidiary that enjoys a strategic independence, contributes with innovative processes and products and plays an important role within the network as well. That's why we can call it a strategic major and innovator subsidiary.

KPortugal, KAustralia, KBrasil and KMalaysia have been classified as product specialists, in the way that, despite not developing the entire product, they introduce specifications and particular configurations in it, originating some kind of product specialization. Nevertheless, if the first two subsidiaries can be called "contributors", the last ones will be designated as "adapters".

Portugal had since the beginning of its foundation a strategic importance for the company, due to the strong and special local costumer, to which Portugal developed specifications and develop the maintenance of the systems. But later this costumer "wanted to control of the systems, just buying components and integrate them in the systems". Even after the decreasing of this activity, Portugal continues to perform developments for this costumer, whereas they establish relations with other local costumers and started to collaborate in projects with KNorway. "Portuguese people are now participating in projects in Norway that having nothing to do with Portugal"

(CEO). In this way, KPortugal always was, in different ways and stages, mainly on the first stage, a product specialist based on the local relations and, especially on the second stage, a contributor to the value chain, due to the projects developed with the headquarters and other subsidiaries. Remind us the manager of Kportugal that Portugal is not only a contributor to the network, but it is also "one of the subsidiaries that can influence the most the strategic decisions of the headquarters due to the important projects that are being developed there."

KAustralia was a very autonomous and strategic independent organization, very focused on the local market and on the relations with local costumers, being responsible for the development of local specifications. However, nowadays efforts have been made in order to integrate Australia in the multinational network, to establish a bi-directional relation between the headquarters and Australia, and to make Australia contribute to the headquarters and the other subsidiaries, being for this reason also a contributor to the network.

Brazil and Malaysia are what Johnston (2007) called "adapters", in the sense that they are subsidiaries that generated products adapted to the unique demands of the local market. Actually, Brazil is fundamentally a sales office with some development skills, making some local specifications, but this specifications don't have special contributes to other places of the network, maybe just in a small portion to some other South American countries.

In Malaysia the development that is made is locally based, because it is a special product just for Asian countries. "In Malaysia we have a center of excellence where we develop a manual toll system that only work in Asia" (vice president business development and compliance). Therefore, this local product is adapted to a local market, which can involve other local countries like Bangkok and Taiwan.

The other subsidiaries, like French, Italy and Greece, are classified as "marketing satellite", which the main objective is to sell products developed centrally, and consequently they act like sales and distribution units ("distributors").



Figure 2 - Simões (1992) subsidiaries typology and Johnston (2007) integrated model of headquarters-subsidiaries relationship

In summary, the main R&D is centralized in the headquarters and then diffused to the subsidiaries. In this sense, the major knowledge flow come from Norway and goes to the other subsidiaries. Despite this knowledge pattern being the predominant, we also observe that some subsidiaries, mainly KNetherlands, have a strong position in terms of creating and diffusing knowledge for the headquarters and for the other

subsidiaries, being an example of a locally leveraged innovation process. There is a second particular case of a subsidiary (Portugal) that initially developed innovations based on local relations with a strong local customer, and nowadays the creation and diffusion of innovation is done in a more global scale, resulting from the decrease of the local relations. However, the MNC seems to be developing a strategy where globally linked innovation processes are putting together the resources and capabilities of diverse worldwide units in the company, at both headquarters and subsidiary level, to create and implement innovations on a joint basis strategy.

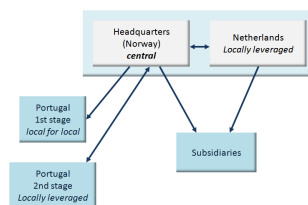


Figure 3 - Mudambi (2002) knowledge flows perspective and Bartlett and Ghoshal (2008) processes of innovation typology

The knowledge transfer is made, whenever is possible, through the presence of researchers or other workers in the place where the knowledge is and can be learnt. Usually, workers from other subsidiaries go to KNorway to learn some competencies, although workers from the headquarters could also go to other countries to teach locally, even though they can also learn some local knowledge. "What we usually do is to bring people here to work with us and to learn and then they come back with the knowledge, but it is important for us they come here because they have important local knowledge" (vice-president R&D).

In terms of organizational mechanisms, there is an intranet, an internal network with internal information of the MNC accessible to all the subsidiaries; a competencies system, useful to find out people from the group with certain competencies, which are needed for a specific project or work, which could lead to a cross use of resources. Nevertheless, the most common way to share and diffuse knowledge is the informal way. Notwithstanding, it is something that is being improved: "that is something we are working on (...) we want to have more interaction and communication with people all over the world" (vice-president R&D).

4. Conclusion

Summing-up, the study points to a multinational with a new vision on the business and on the network as well, justified by a recent new CEO. This new vision is based on the assumption that the network needs to be stronger; it means to reinforce the relationship among the subsidiaries but also with the headquarters. Another important point is related to the fact that the multinational wants to incorporate new competencies into the network, buying companies with specific knowledge. In fact, they used to subcontract these competencies but now their preference is not to be

dependent, broadening what they could offer to the market. As far as R&D strategy is concerned, one can say that it is essentially centralised into the headquarters and now, also into one of the companies that has been recently acquired. In fact, they work as an extension of Norway, thus they have specific competencies central to the business strategy followed by the new President (CEO). The network is present in many countries but with different positions according to the level of the business and the costumers specificities. As analysed, they are trying to enter into new markets some of them considered quite difficult because of their specificities, such as EUA, or South African. One can say that some of the old markets are not so strong as they were in the past; on the other hand, they are trying to extend the variety of products in order to enter into the new markets with wider possibilities to the costumers. Finally, the headquarters' strategy is based on building a broader network of business relationships with stronger subsidiaries, thus it will be easier for them to assert their own identity.

Finally, it would be interesting to extend the number of case studies so that we can have a comparative perspective in terms of subsidiaries with similar characteristics, but situated in different latitudes around the world.

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References

1. Andersson, Ulf, et al., "Subsidiary Absorptive Capacity, MNC Headquarters' Control Strategies and Transfer of Subsidiaries Competencies", em Sarianna Lundan (ed.), *Network Knowledge International Business*, Cheltenham, Edward Elgar Publishing, 2002.
2. Cantwell, John and Narula, Rajneesh, "The Eclectic Paradigm in the Global Economy", *International Journal of the Economic Business*, vol.8, n° 2, 2001.
3. Cantwell, John and Iammarino, Simona, *Multinational Corporations and European Regional Systems of Innovation*, London, Routledge, 2003.
4. Cantwell, John and Mudambi, Ram, "MNE Competence-Creating Subsidiary Mandates", *Strategic Management Journal*, 26, 2005.
5. Castells, Manuel, *A era da informação: economia, sociedade e cultura*, Vol I. *A sociedade em rede*, Lisboa, Fundação Calouste Gulbenkian, 2005.
6. Frost, Tony, "The Geographic Sources of Foreign Subsidiaries' Innovation", *Strategic Management Journal*, 22, 2000.
7. Johnston, Stewart, *Headquarters and Subsidiaries in Multinational Corporations: strategies, tasks and coordination*, New York, Palgrave MacMillan, 2005.
8. Murteira, Mário, *Economia do conhecimento*, Lisboa, Quimera Editores, 2004.
9. Schmidt, Stefan, et al, The MNC as a Network: a closer look at intra-organizational flows, in Sarianna Lundan (ed.), *Network Knowledge International Business*, Cheltenham, Edward Elgar Publishing, 2002.
10. Simões, Vitor Corado, European Integration and the Pattern of FDI Inflow in Portugal in John Cantwell, *Multinational Investment in Modern Europe – Strategic Interaction in the Integrated Community*, Great Britain, Edward Elgar, 1992.
11. Simões, Vitor Corado, et al, Subsidiary Decision-Making Autonomy: Competences, Integration and Local Responsiveness, in Sarianna Lundan (ed.), *Network Knowledge International Business*, Cheltenham, Edward Elgar Publishing, 2002.
12. Simões, Vitor Corado, Innovation initiatives by MNE subsidiaries: an integrated research framework, Paper presented in IV International Iberian Conference of Management – Burgos, 2008.
13. Urze, Paula and Manatos, Maria João, *Local R&D Competencies in Global Networks*, Paper presented in I Fórum de Sociologia ISA, Barcelona, 2008.