CONNECTING STRATEGY AND EXECUTION IN GLOBAL R&D

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Abstract

The paper investigates the relationship between global product development strategic decisions, which include outsourcing, offshoring practices as well as strategic alliances, and their impact on the day-to-day business in a global and open innovation context. By adopting an exploratory inductive research, founded on core literature in the area and using empirical data from four companies in different industries, the study intends to understand the interconnection between the shift toward a global R&D strategy, and the dependent changes at the operational and managerial level. The series of changes in the innovation network are strictly connected with the company's source of competitive advantage, their internationalisation drivers, the internationalisation practices adopted, and the series of organisational capabilities needed to support the internationalization as well as externalization of innovation sources.

Keywords: Global R&D network, Organisational capabilities, Organisation of product development, Decision making, Case study

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1 INTRODUCTION

Political and economic disruptive changes, combined with technological advances in connectivity and telecommunications, created the rise of new global market opportunities (Friedman, 2006), that led firms toward the disintegration of value chain activities (Kedia and Mukherjee, 2009). In such hypercompetitive business environments (D'aveni, 1998; Teece, 2012), which are dominated by short time to market, changing customer specifications, global competition, and strong demand for local price competitiveness, globalisation of R&D activities may be necessary to stay competitive (Hansen & Ahmed-Kristensen, 2011; Howells, 2008; Santos et al., 2004; Linder et al., 2003; Roberts, 2001). As a result, foreign R&D investment increased steadily over time (Kumar, 2001; Gammeltoft, 2005) and companies relied more and more on the globalization of R&D-related activities by moving tasks to engineering facilities to offshored locations or harnessing global alliances and outsourcing (Søndergaard et al., 2016, Makumbe, 2009). Offshoring is defined as offshoring of product development activities abroad with any ownership structure, while outsourcing refers to offshore outsourcing (Eppinger and Chitkara, 2006). Thus, operations and resources get physically and culturally decoupled over a global network. Global product development (GPD) is thus the globalisation of the product development process (meaning the activities within the process like R&D, product design etc.) from the early concept development stage and detail design through the final testing of prototypes ready for production. Thus, GPD is composed of a set of globally dispersed sub processes built around multiple teams, exploiting collaborative and IT-enabled business processes for maximizing the financial and operational productivity (PTC Whitepaper, 2005; Eppinger and Chitkara, 2006), with the market appeal of the development project that can be either global or local. Previous researches have identified a gap between strategy and execution when turning strategic plans into successful results (Singh, 2014; Leinwand et al., 2015; Clark et al., 2015;). At the firm-level, studies on GPD have focused on the deployment of GPD as a corporate practice (PTC Whitepaper, 2005; Eppinger and Chitkara, 2006, Hansen and Ahmed-Kristensen, 2012), the impact of offshoring and outsourcing on technical operations (Lewin and Peeters, 2006; Hansen and Ahmed-Kristensen, 2010), systematic approaches to managing Global Engineering Networks (Zhang et al., 2007; Zhang and Gregory, 2011; Hansen et al., 2013), and the strategic role of background factors such as, among others, a global culture, corporate commitment and global knowledge integration (de Brentani and Kleinschmidt, 2004; Kleinschmidt et al., 2007; de Brentani et al., 2010; Kleinschmidt et al., 2010). However, to our knowledge, a comprehensive synthesis of the firm-level contribution to successful GPD is still lacking. In fact, studies on GPD tend to be fragmented, don't consider the global dimension of product development, or lack inter-firm (external) relationships. Consequently, the research question we investigate in this paper is: "What are the different approaches to global R&D pursued by multinational companies, and the critical factors that determine successful GPD?". In order to address the research question, the paper clarifies the different roles and drivers of research and development activities within the innovation process, the internationalization practices aimed at sustaining global innovation, and the role of organizational capabilities in bridging the gap between strategy and daily execution. Key components of this paper include the following: firstly, a literature review is outlined. Subsequently, an explanation of the research method adopted throughout the study is summarised, followed by a section presenting the main findings, with a concluding section highlighting implications and further research.

2 LITERATURE REVIEW

R&D is usually considered as a single entity, however the nature of research and development are dissimilar in scope, tasks, and processes. From a corporate perspective, research can be associated with the need for firms to build core technological competences through exploration

(Tsai and Liao, 2014) and it is usually characterized by a longer time horizon and freedom than development tasks (von Zedtwitz and Gassmann, 2002). On the other hand, development refers to the process in which the knowledge created in the research stages is transferred and exploited to develop real products (Tsai and Liao, 2014), and it is usually constrained by time, technical and performance requirements, as well as target market (von Zedtwitz and Gassmann, 2002). Therefore, adopting a global approach requires linking R&D to a company's overall business strategy (Kuemmerle, 1997), which includes the size and locations of R&D facilities, the division of labour between various groups, the choice of technologies used inside the R&D organization, the selection of personnel, the allocation of resources, the design of processes for managing projects, and other factors, to achieve coherence between components and thus superior R&D performance (Pisano, 2012). Scholars have identified many reasons behind R&D internationalization: companies increasingly moved toward GPD to achieve operational, market and financial benefits (Chiesa, 1995; von Zedtwitz and Gassmann, 2002; Khurana, 2006; Eppinger and Chitkara, 2006; Gammeltoft, 2005; Williamson and Yin, 2014; Søndergaard et al., 2016; Hoang and Rothaermel, 2016), which led to a separation of individual R&D units by geography and organization (von Zedtwitz and Gassmann, 2002). Each R&D location is managed consistently with a firm's organizational structure, the actual capabilities at a particular center, the nature of the tasks and investments carried out at the particular R&D location (Kuemmerle, 1997; Gammeltoft, 2005; Khurana, 2006), where the role of subsidiaries can undergo internal evolution along time to encompass more strategic tasks and functions (Gassmann and von Zedwitz, 1999; Khurana, 2006). Mudambi et al. (2015) observed that companies shifting from explorative and exploitative approaches at opportune moments exhibit superior performance. GPD adoption must be approached at the firm-level in order to create the capabilities that would support the business adaptation. Organisational capabilities are gaining much more attention in both academic circles and industry, as they allow a company to operate its day-to-day business and transform technical know-how into results (Smallwood and Ulrich, 2004), to grow, adapt and seek competitive advantage in the marketplace (Clark et al., 2015), as well as to effectively renew the resource-base (Tallman and Fladmoe-Lindquist, 2002; Ambrosini et al., 2009). In this paper, we define GPD capabilities as sorted in two sub-capabilities systems: intra- and inter-firm capabilities. The former aims at integrating globally dispersed processes, people and data, while the latter have the scope of effectively selecting and managing external sources of knowledge. In fact, as part of PD activities, and consequently knowledge, are decomposed, choosing which activities to move outside and maintaining a deep understanding of how product subsystems can fit together is key to architectural knowledge (Zirpoli and Becker, 2011). Sourcing is then evolving into a strategic process for organizing and fine-tuning the value chain, making it more elastic and the organization more flexible, supporting the firm's effort to achieve its long-term objectives (Gottfredson et al., 2005; Rafati and Poels, 2015). Therefore, on the one hand firms need to develop competences to effectively collaborate with people from different organisations that have their own ways of doing things, and it involves cross-cultural collaboration across geographic, industry, and sector boundaries; on the other hand firms must adopt a series of organizational solutions, internal mechanisms, and procedures that are needed to manage and integrate external sources in dynamic and fast-changing markets by developing better management techniques for outsourcing (Quinn, 1999; Linder et al., 2003; Pagano, 2009; Lacity and Willcocks, 2013), and alliances (Dyer et al., 2001; Duysters et al., 2004 Asis Martinez-Jerez, 2014; Hoang and Rothaermel, 2016).

3 RESEARCH METHODOLOGY

Due to the exploratory nature of the research, the study adopts an inductive methodological approach based on case studies for its ability to describe several simultaneous and contextual events in a real life context (Yin, 1994). The primary data source was four case studies, considering the organisation as the basic unit of the analysis. Data was collected through seven

semi-structured interviews to gain an in-depth understanding of the case companies and to create a more open discussion. The semi-structured interviews were based on an interview guide which provided an overall structure. Key themes for the interview development were the international R&D footprint and the drivers that led to offshoring and outsourcing decisions, how the innovation process was influenced, and how the companies internally integrated outsourced and internationalised activities. The semi-structured nature allowed for an iterative interview process with degree of flexibility, enabling the emergence of new, valuable and previously unmet aspects. The output of the coding stage was the identification of several factors, which impact the success and configuration of GPD as a corporate practice. The interviews lasted 30-60 min each, and were audio recorded. The respondents were managers from both strategic and operational level. In this stage, single GPD decisions were identified and contextualized. For each decision the motivation, the background, as well as how the decision affected the innovation process and its management were captured. Secondary sources (such as the company's website, annual reports) were investigated to gain a strong background and to contextualise their current position. The study is grounded in the contingency theory, which states that a firm needs to find the most advantageous course through internal and external factors. This means that the most advantageous course of action for a company is dependent on the situation and the context (Luthans and Stewart, 1977). The case companies were selected based on a series of parameters; they had global research and development activities, and to ensure diversity among the case companies the following aspects were also considered: size (number of employees), industry, motivation for globalising the innovation process, and markets served. All companies have outsourced or offshored product development activities over the last decades. Another aspect considered was to get access to interviewees with an adequate knowledge of the company's internationalization and outsourcing strategy, either as decision makers or actively involved in the process. An overview of the companies and interviewees' roles is shown in Table 1.

Table 1: Companies analyzed in the case studies

Company	No. of interviews	Location	Industry	No. of employees	Interviewees
PharmaCo 1	1	Denmark	Pharmaceutical	5400	Personal Assistant of R&D Executive VP
PharmaCo 2	2	Italy	Pharmaceutical	4500	i) Clinical Outsourcing Manager ii) Head of Legal and Corporate Affairs
EngCo	2	Denmark	Engineering	13000	i) Head of Global R&D ii) Head of Indirect Procurement
ManufCo	2	Denmark	Manufacturing	11900	R&D Site Director

4 CASE COMPANIES AND EMPIRICAL FINDINGS

The analyzed companies showed an evolutionary internationalization of their product development process over the time, as it can be seen in Table 2.

Table 2: Key milestones of case companies' internationalization process

Company	Year	Key milestones
PharmaCo 1	1915	Foundation of PharmaCo 1
	2001	Partnership with Japanese company #1
	2003	Acquisition of US-based research company (center closed in 2015)
	2007	Partnership with Japanese company #2
	2011	Partnership with Japanese company #3 - Research facility in China
	2009-2014	Acquisition of two US companies
PharmaCo 2	1935	Foundation of PharmaCo 2
	1998-1999	Acquisition of two French and UK companies
	2008	Foundation of a biotechnological company in Italy (University spin-off)
	2009	
	2011	Opening of small research center in UK
	2013	Opening of new main research center at the HQ (Italy)
		Acquisition of two Danish and one US companies
EngCo	1882	Foundation of EngCo (1989 - the conglomerate has 125 brands)
	1990	Acquisition of a big US company
	2004	Sale of several companies to focus on strategic activities
	2007	Establishment of Technology center in Chennai, India
	2004-2012	Acquisition of several companies (US, AU, India, Germany, Canada)
	2016	Partnership with big US company
ManufCo	1904	Foundation of ManufCo
	1977	Opening of research center in home country (DK)
	1995-2000	Acquisition of a Swiss and two Danish companies
	2003	Joint venture with a German company
	2005	Opening of main development center (DK) - R&D in Poland
	2008-2010	Acquisition of one UK and two US companies

Even though the case companies present differences in products, financial and organizational characteristics, a common pattern can be drawn from the path pursued when designing a global strategy. The firms in this study focused on the development of specific and integrated knowledge fields to marshal the investments and create synergies among competences, and then to be able to develop products of excellence in a highly challenging global market. PharmaCo 1 and 2, designed their strategy around niche markets, and focused on specific therapeutic areas. EngCo in the past years has moved from a diversified conglomerate to a focused business group organisation. MaufCo's history of international expansion reveals the path pursued by the organisation, now a holding company, to achieve integration among its portfolio of brands operating on shared technologies, mainly through acquisitions of key players. The case companies' international footprint is shown in Table 3.

Table 3: Case companies' international footprint

Int. Footprint	PharmaCo 1	PharmaCo 2	EngCo	ManufCo
Manufacturing	Denmark, China, Italy, France	Italy, France, Brazil	Mainly outsourced	Denmark, Poland, Mexico
Research	Denmark, China	Italy, UK, Denmark/Sweden	Denmark	Denmark
Development	Denmark, USA	Italy, USA, France	Denmark, USA, India	Denmark, Poland, Switzerland
Co-development	Partnerships with Japan-based companies (3)	-	Partnership with US-based company	Joint-Venture with German company

4.1 Drivers for GPD

Knowledge and technology acquisition were the main drivers for the internationalization of R&D activities in research-driven companies (PharmaCo 1 and PharmaCo 2), whose competitive advantage lies in the quality of the long-term, knowledge- and cost-intensive research pursued, and therefore these activities tend to be more globally dispersed to better acquire global resources and knowledge. On the other hand, EngCo and ManufCo, relying strongly on the development phase, have mainly internationalized development activities with the aim of better matching local customer needs and gaining efficiency in terms of cost and time to market. EngCo's foreign technology centers, located in strategic world regions, were the outcomes of a business expansion strategy to strengthen the presence in other markets, or driven by the need to improve efficiency and resource flexibility. The ManufCo's internationalization is led by a large set of drivers: achieving superior cost- and efficiency-related performance, expanding its knowledge and technology portfolio, and penetrating new markets. Thus, in more general terms, offshoring is mainly implemented for long-term strategies and can be related to both market penetration and technology acquisition for high strategic importance components/systems. It is associated with a high degree of control but with a consistent amount of time needed, resources and uncertainty. Alternatively, inorganic expansion (M&As) is associated with the need to sustain and enhance the company's growth through fast technology acquisition and market access. Outsourcing is mainly used for routine, non-strategic tasks and it is related to cost-driven strategies, or the need to access supplementary and specialized knowledge outside the company's core competence. Alliances are used to complement internal R&D with knowledge and technologies that resides in other organizations in addition to mitigating the risks and costs associated with the development phase. Alliances must be intended as a collaborative situation, based on trust and reciprocal exchange of knowledge to create shared value.

4.2 Network type

PharmaCo 1 and PharmaCo 2 manage their R&D network around centers of excellence, due to the quest of technical know-how and expertise for developing core technologies. A substantial degree of freedom, in terms of culture and day-to-day processes is given to foreign centers while creating standardize procedure and maintaining centralised management (i.e. they present a strong centralised R&D center). In the case of EngCo, the tasks performed in each center are diversified on competences, but as circumstances require, the centers might collaborate through global projects, in delivering different stages of the same product development process. The ManufCo's network of centers operates on a project-basis for the whole portfolio of owned brands. The company presents a centralized research center (where competences and technologies converge), and dispersed development centers operating with common goals, standardized and shared processes and culture, characterized by high degree of integration, synergy and mutual support.

4.4 GPD Capabilities

In the path toward GPD, the case companies dealt with the integration and management of both internal and external sources into one single PD process. In this paper, we noted the importance of two dimensions of corporate level organizational capabilities, which co-exist in organization and that follow on the one hand the need for managing external collaborations and on the other hand to integrate owned but globally-dispersed activities. In fact, in an international context it becomes necessary to achieve internal integration of globally and functionally dispersed sources of information about customers, markets, and technical competences for the purpose of developing offerings that respond more effectively to diverse market characteristics worldwide. Thus, knowledge needs to be transferred and integrated across cultures and time zones. On the other hand, it can be seen that the organizations, recognizing the role that external sources are

(and will) play in the global market, are restructuring the company to facilitate the process and enable further organizational development. This can also be seen in the need to maintain architectural knowledge of the whole process by establishing departments or teams that operationally support the execution of outsourced activities. However, even though different contexts created the need for different configurations, the importance on GPD performance of these long-term background factors lies in: (a) enabling knowledge integration and sharing, (b) guaranteeing process integration and alignment, (c) as well as establishing, managing and developing relationships with suppliers; and then create a sustainable field for an effective and efficient organizational development. Key aspects of the analysed factors are shown in Table 4.

Table 4: GPD factors

Factors	PharmaCo 1	PharmaCo 2	EngCo	ManufCo
4.1 GPD Drivers				
Captive Offshoring (Organic)	Access to local science and technology (R)	Access to local science and technology (R)	Cost and resource scalability (D)	Proximity to manufacturing; Reduce cost (D)
Captive Offshoring (M&As)	Business expansion; technology acq. (R and D)	Business expansion; technology acq. (R and D)	Business expansion and customer closeness (D)	Technology acquisition (R and D)
Outsourcing	Clinical trials (testing) to reduce costs and access specialised knowledge (D)	Clinical trials (testing) to reduce costs and access specialised knowledge (D)	Supplementary, non-core knowledge (D)	Validation phase (testing) against international standards and regulations (D)
Alliances	Co-development and commercialisation (D)	-	Integration of technologies (D)	Joint-venture with German company (D)
4.2 Network type	Independent R&D centers with strong centralized R&D center	Independent R&D centers with strong centralized R&D center	Connected and inter-dependent R&D centers	Highly integrated development centers; Centralised research center
4.3 GPD Capabilities	a) Outsourcing team (centralized) to deal with contracts with external suppliers; Clinical R&D department (planning and supporting the clinical studies) c) Cross-cultural mind-set (to maximize relationships with partners) d) Global Project leaders and alliance managers	a) Outsourcing team (centralized) for legal support; involvement of external consultants into the supplier selection phase; team for operational support to clinical trials (France) b) Board member as outsourcing group coordinator c) Virtual meetings; International HR	a) Centralized Procurement: shared among departments; cross-functionally integrated; continuous HR development; involvement of external consultants (if knowledge is lacking) c) Virtual meetings; international HR	a) Suppliers are selected by the Regulatory Department. b) Use of expatriates c) Some design functions closer to manufacturing (knowledge transfer)

5 DISCUSSION

From the findings analysed earlier, it is evident that the shift toward a global strategy creates a series of interdependent changes in an organization's overall structure and processes, strictly connected with their competitive identity, their internationalization drivers, the internationalization practices adopted, and the series of capability needed to maintain smooth and efficient global operations. The analysis shows that the globalization drivers (technology, market and cost) followed both industry-related factors and the degree to which an organisation is research- or development-driven. The continuous adaptation of the company's resource- and knowledge-base happens through the opening or acquisition of new centers abroad, and/or the exploitation of outsourcing and alliances as external sources of knowledge. The internationalization practices adopted show a common pattern in scope. As captive offshoring has been implemented as a main source of a company's specific competitive advantage, research-based companies mostly relied on offshored research centers, while development-driven organizations established development centers abroad. The analysis supports the relationships between business characteristics and its "most suitable" network structure and capabilities. Research-driven companies tend to operate through semi-independent research centers, while development-driven companies show a higher degree of interconnection between globally dislocated development centers. The reason behind this pattern lies in the nature of the two activities, as development requires more coordination, collaboration and control, and on the other hand, research is a freer and more risk-taking process and it can then operate relatively disconnected. Two main capabilities are associated with the efficient and effective management of globally dispersed activities, which are related with the integration of internationalised activities, and, when outsourcing tasks, with the need to maintain system-level knowledge and manage external relationships. Companies tend to support the integration of dispersed intra-organizational activities through a series of company-specific architectural dimensions, intended as the set of governance, organizational structure, (degree of standardized) processes and procedures, culture, human resources management and technology. On the other hand, companies depend more and more on external collaborations and this has been the driver behind the creation of relational capabilities intended as a support function to the whole GPD process.

6 CONCLUSION

This paper investigated the patterns resulting from the globalization of R&D activities across four multinational companies. Answering the research question, the companies expanded their network in quest for specific know-how and technologies, resources flexibility and scalability, knowledge and customer closeness to enter a new market, or to decrease costs. The drivers behind the decision of internationalization followed industry-related factors, as well as a company's individual characteristics and business approach. In fact, even though companies followed their own specific path in regards to strategy design, internationalization practices, network and capabilities development, the organizations showed a common trend in recognizing the importance of the two dimension of capabilities: inter-organisational and intra-organisational capabilities, defined in this research as "GPD capabilities". When functioning in an integrated an harmonized way they create the basis for successfull GPD. However, different organisational structures, governance systems, coordination and communication mechanisms were developed, which are consistent with the company's profile and mission. Further work will include the development of a framework to reduce the gap between strategic and operational planning in GPD (based on the existing literature and refined through empirical studies), which aims at helping practitioners in industry as well as enhance the current literature and theoretical understanding. As the findings are based on an exploratory study, an obvious next step is to increase the number of companies analysed, differentiating them in a broader range of different industries (i.e. FMCG or luxury goods companies), different geographical

locations, as well as different maturity levels, and thus increase the validity and reliability of the findings collected through the whole research study.

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