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Managing Complex Projects in Multinational Enterprises

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ABSTRACT: The management of complex projects has received the attention of several scholars. It is considered a process that contributes to the future success of organizations and their businesses. Within this context, Multinational Enterprises (MNEs) have specific characteristics where the correct use of the concepts of managing complex projects is a critical factor. This study was developed to analyze how capital goods manufacturing MNEs manage complex projects in the segment of Complex Products and Systems (CoPS). Based on multiple case studies, the main techniques used by MNEs representative of this market segment have been assessed. They do have some organizational practices aligned with the concept of project complexity but there is a distance between the academia and the industry.

Keywords: *Project Management; Complex Projects; Multinational Enterprises*

1. INTRODUCTION

Despite a long debate whether project management is a practice or an academic discipline, there is a convergence amongst authors regarding the increasing importance of project management (PM) within organizations. According to Kwak and Anbari (2009), based on a study of 18 top management and business journals (including *Journal of Operations Management and Academy of Management Perspectives*), project management shows connections with eight disciplines. Ranked from the most to the least appeared subjects, they are: (1) Strategy/Portfolio Management, (2) Operations Research / Decision Sciences / Operation Management / Supply Chain Management, (3) Organizational Behavior / Human Resources Management, (4) Information Technology/Information Systems; (5) Technology Applications / Innovation / New Product Development / Research and Development; (6) Performance Management/Earned Value Management; (7) Engineering and Construction; and (8) Quality Management/Six Sigma.

Project management is perceived as a strong contributor to business become more competitive. It is also recognized as a process to enable organizations for future business success (Whitty & Maylor, 2009). Continuous demand for sustainable growth and innovation, including fast changes to technology, require companies to invest in new infrastructure intensifying the use of PM (Shenhar & Dvir, 2007). Furthermore, projects have been used as a form of work organization, comprising the need to innovate (Newell, Goussevskaia, Swan, Bresnen, & Obembe, 2008). According to Söderlund (2002), there is a *projectization* which has led to changes in the way firms organize product and process development. Finally, the use of PM system is spread along the majority of construction, product development and engineering efforts (Shenhar, 2001). Despite of this convergence regarding the use of PM as an important tool for organizations to cope with the continuous state of change, the extant PM theory is recent and needs further development. As projects become more complex, the need for more comprehensive literature and practical test of the existing theory is required. The objective is to understand the practical implications on how to effectively use the concepts of PM (Shenhar, 2001).

Approaches like the Diamond concept and the need for more qualified project managers through certification schemes like the Project Management

Institute – PMI are responses to current demands. The term complex itself has been subject to intense discussion. It may be confused with complicated (Whitty & Maylor, 2009) or perceived as a result of combined factors as per the diamond approach of Shenhar and Dvir (2007). The managerial complexity can arise from dimensions like mission, organization, delivery, stakeholders and team (MODEST dimension). Each of them with dynamic and structural complexity elements as defined by Maylor, Vidgen, and Carver (2008).

Multinational Enterprises (MNEs) are defined as organizations that own and control activities in two or more different countries. Data on MNEs show that they are responsible for about 80% of global trade (estimated at USD 19 trillion) and Foreign Direct Investments are estimated to reach USD 1.8 trillion in 2015. According to data from the Brazil Central Bank (Banco Central do Brasil, 2014) the Foreign Direct Investments (FDIs) in Brazil have reached USD 33.7 billion in 2007 with an increase of 30% in 2008 (USD 43.9 billion) and USD 30.4 in 2009. The capital goods market segment accounted for 36%, on average, for the growth over this period.

According to Dunning and Lundan (2008), MNEs engage in FDIs in order to increase the value of their assets as perceived by owners. In addition, Kalasin, Dussauge, and Rivera-Santos (2014) state that organizations expand to international markets in order to leverage their advantages in new environments. The internalization of an organization is determined according to a paradigm named as OLI (ownership, location, and internalization). This concept offers a general explanation of the extent and pattern of MNEs foreign value added activities of an organization (Dunning, 2001). Projects increase organizational innovation, facilitate the implementation of changes, and implement strategies to increase competitive advantage (Shenhar & Dvir, 2007). Therefore, in order to increase the value of their assets, companies engage in some kind of project management.

The capital goods manufacturing segment has important characteristics not only in terms of importance to MNEs but also in terms of project complexity. Based on an evaluation of Mergers and Acquisitions retrieved from data published in the UNCTAD reports from 2010 to 2013, we identified that the capital goods segment accounted for USD 530 billion in acquisition value (approximately 39% of the total amount of acquisition value – USD 1.360

billion) (UNCTAD, 2010, 2011, 2012, 2013). Regarding to complexity, manufacturing capital goods industry includes a special type of products, best known as Complex Products and Systems – CoPS. The term is used to categorize high technology and high-value capital goods (Davies & Hobday, 2005).

The main objective of this study is to explore how capital goods manufacturing MNEs manage complex projects within the CoPS market segment. More specifically, we aim at investigating three main aspects: (i) what dimensions of project complexity organizations consider, (ii) how complex projects characteristics affect organizations' project management practices, and (iii) how organization strategies are aligned with project execution.

The relevance of the theme can be highlighted by the importance of this market segment to FDI investments, mergers and acquisitions and the unique characteristics

of project complexity related to the CoPS market segment. In order to respond these questions, we initially performed a theory review covering project complexity, MNEs, capital goods (CoPS) and the management of complex projects in MNEs. Following the theoretical review, we presented the methodological procedures employed. We, then, demonstrated the results and discussed them. Finally, we made some conclusions and recommendations for further research.

2. THEORY REVIEW

Theory review was performed to cover four main topics: (i) project complexity, (ii) multinational enterprises, (iii) capital goods, CoPS, and (iv) managing complex projects in MNEs. Table 1 summarizes these topics by mentioning some relevant works related to each of them.

Table 1

Theory Review	
Project Complexity	Maylor et al. (2008), Whitty and Maylor (2009), Browning (2014), Baccarini (1996), College of Complex Project Managers (2006), Shenhar and Dvir (2007), Sauser, Reilly, and Shenhar (2009)
Multinational Enterprises	Dunning and Lundan (2008), Harris, Kim, and Schwedel (2011), D'Aveni and Gunther (1994), D'Aveni, Dagnino, and Smith (2010), Dunning (2001), Hitt, Ireland, and Hoskisson (2011), Scholes, Johnson, and Whittington (2008)
Capital Goods – Complex Products and Systems	Davies and Hobday (2005), UNCTAD (2010), UNCTAD (2011), UNCTAD (2012), UNCTAD (2013), Banco Central do Brasil (2014)
Managing Complex Projects in Multinational Enterprises	Sauser et al. (2009), Wikström, Artto, Kujala, and Söderlund (2010), Pinto and Slevin (1988), Raz, Shenhar, and Dvir (2002), Shenhar (2001), Milosevic and Srivannaboon (2006), Shenhar (2004), Hass (2009)

Source: Summary prepared by the authors

2.1 Project Complexity

The first important aspect regarding a complex project is the definition of the word *complex* and its distinction from *complicated*. Understanding the difference is an important baseline for managing this kind of undertaking. According to the Webster Dictionary, *complex* is defined as “composed of two or more parts; involving many parts” – *complicated* is something “difficult to analyze or understand”. The difference relates to the interconnection between

parts. In complex parts, there is interdependency between them. In complex systems there are interactions amongst parts of the system producing neither linear nor predictable outcomes (Maylor et al., 2008). Further expanding this concept, Whitty and Maylor (2009, p. 305), states that “a complex system is a system formed out of many components whose behavior is emergent”. The outcome of the complex system cannot be inferred from the behavior of its components.

Complexity is an attribute that does not depend on the observer in opposition to complicatedness. According to Browning (2014), complexity is an objective characteristic of the system and complicatedness is a subjective one. Complicated may be related to the number of stakeholders involved. In complicated projects, complication can be managed with expertise, a better understanding of the parts that constitute the system. Project complexity has been studied by a number of authors and there is a general understanding that the application of the same approach for different projects (one size fits all) is not effective (Baccarini, 1996; College of Complex Project Managers, 2006; Shenhar & Dvir, 2007). Project complexity is defined as a measure of project scope which reflects characteristics like the number and interdependency between tasks as per Shenhar and Dvir (2007).

Project complexity affects the way projects should be managed. Baccarini (1996, p. 202) defines project complexity as “consisting of many varied interrelated parts and operationalized in terms of *differentiation* and *interdependency*”. Complex projects require a greater managerial effort during its execution. Therefore, project complexity can be applied to different dimensions of the project management process, like organization, technology, decision-making, and environment. In such a way, when defining project complexity, one needs to state for which dimension the concept is being used (Baccarini, 1996). Complexity is a measure of the difficult to achieve the desired understanding of a complex system. Although high levels of uncertainty are a fundamental aspect of complex projects, this is not an exclusive characteristic of complexity. In this sense, complexity is a variable and not a qualitative concept (Whitty & Maylor, 2009).

Another approach for the management of complex projects is the adaptive model, the Diamond concept. The underlying concept in this model is that different projects should be managed in different ways. This approach contrasts to more prescriptive ones adopted by the body of knowledge framework since it requires a system to identify the basic differences between projects. These differences are related to four dimensions, NTCP: novelty, technology, complexity and pace (Shenhar & Dvir, 2007). In the contingency theory, the idea is to fit project characteristics to project management approach instead of identifying critical success factors (Sausser *et al.*, 2009).

The ‘novelty’ dimension is related to how new the product is and it is composed of three sub dimensions: derivative, platform and breakthrough. The ‘technology’ refers to how much new technology is used encompassing sub dimensions as low-tech, medium-tech, high-tech and super high-tech. ‘Complexity’ is related to the extent of the complexity of systems and subsystems used and is classified into sub dimensions like assembly, system and array. Last, ‘pace’ gives an idea of how critical the period is, involving the sub dimensions regular, fast/competitive, time-critical and blitz. These four dimensions of the adaptive model for project management form the diamond model that sustains that the greater the diamond, the greater the potential benefits of the projects and the associated risks. The combination of these characteristics provides a comprehensive set of management practices what is expected to support the organization achieving project success and business results.

2.2 Multinational Enterprises

An MNE is defined by Dunning and Lundan (2008, p. 8) as an “enterprise that engages in FDI and owns or, in some way, controls value-added activities in more than one country”. In the overcoming decades, MNEs shall face macroeconomics shocks that will establish the way MNE adapt and grow in the next decades. The world Gross Domestic Product (GDP) is estimated to reach USD 90 trillion by 2020, an increase of 40 percent when compared to that of 2011 (Harris *et al.*, 2011). The sources of the economic growth will tend to come from developing and emerging economies, considering that two thirds of the growth will be generated by advanced economies (Harris *et al.*, 2011).

According to the “World Investment Report 2013” (UNCTAD, 2013), MNEs are expected to account for 80% of global trade through their networks of affiliates, partners and suppliers. Specifically in developing countries, the trade value added generated by MNEs contributes to 30% of GDP. However, participating in this global value chain involves risks for these countries since there may be a potential for them to capture only a small portion of this value added chain, remaining locked to low added value activities. Nevertheless, according to UNCTAD estimates, foreign direct investments may reach USD 1.45 trillion in 2013 and USD 1.8 trillion in 2015. Table 2 indicates the FDI in Brazil from 2005 to 2009, according to the Central Bank of Brazil.

Table 2

FDI in Brazil – Evolution (USD billion)					
Year	2005	2006	2007	2008	2009
Capital Goods	6.4	8.7	12.2	14.0	11.9
Total	21.5	22.2	33.7	43.9	30.4
% of Capital Goods	29,8%	39,3%	36,1%	31,9%	39,2%

Source: Prepared by the authors based on Brazil Central Bank (2014)

As said by Dunning and Lundan (2008), MNEs engage in FDIs and production in order to increase the value of their assets as perceived by owners. MNEs activities are defined according to an approach called eclectic paradigm or OLI-Model. In line with this paradigm, internalization of an organization is determined by the transaction cost theory: in such cases, transactions are made within the organization when the transactions costs of the market are higher than the internal ones. This paradigm offers a general explanation of the extent and pattern of MNEs foreign value added activities of firms.

According to this paradigm, three forces determine the FDI undertaken by a firm. First, *Ownership advantages*, i.e., the competitive advantages that an organization of one nationality possesses when compared to organizations of another nationality in supplying a product or service to a particular set of market – for example, economies of scale, production processes, and property rights. Second, *Location advantages*: in this case, the organization chooses to add value to its operation/processes by locating its operation in other countries (for example, the existence of raw materials, low wages, and incentives). Third, *Internalization advantages* is re-

lated to the perceived advantage of producing rather than licensing to an external company or developing a partnership for production purpose (Dunning, 2001). Complementary to this concept, internalization advantages are expected to exploit market failures, like avoiding moral hazards, and compensation for the absence of future markets (Dunning & Lundan, 2008).

In order to earn above average returns, organizations define and implement strategies at business and corporate levels. At the business level, the concern is to gain a competitive advantage using organization's core competencies in a specific market. Corporate level strategies are focused on generating competitive advantage by selecting in what markets to compete (product and businesses) and how corporate functions should manage those firms (Hitt *et al.*, 2011). Regardless of strategy level, both have the ultimate objective of adding value to the company. Although there are some questions regarding the extent to which corporate level strategies add more value when compared to the isolated value created by business units, the fact is that companies use corporate level strategies for different reasons as indicated in Table 3.

Table 3

Corporate Strategies	
Strategy	Reasons Underpinning the Strategy
Market penetration – consolidation* <i>*Defense actions to protect its assets</i>	Retaliation from competitors; Legal constraints; Defending market share; Downsizing or divestment.
Product development	Develop new or modified products to existing markets.

Corporate Strategies	
Strategy	Reasons Underpinning the Strategy
Market development	Offering new existing products to new markets.
Diversification	Efficiency gains – economies of scope; Deployment of corporate capabilities into new markets; Increase of market power; Response to market decline; Spreading of the risks; Fulfillment of power stakeholder’s expectations.

Source: Adapted by the authors from Scholes *et al.* (2008).

2.3 Capital Goods – CoPS: Complex Products and Systems

As discussed, the capital goods segment plays a fundamental role in the Mergers and Acquisitions (M&A) scenario as well as in the FDI. In 2012, the global economic crises in the Eurozone and the reduction of growing in the emergent economies produced an impact not only on greenfield FDI as well as on M&A projects (UNCTAD, 2013). The capital

expenditure on greenfield projects fell by 33% comparing to that of 2011 reaching USD 612 billion in 2012, and the cross-border M&A declined significant 45% in the same period (total of USD 308 billion in 2012). Even considering the global economic crises, FDI greenfield projects within the capital good segment (manufacturing) reached USD 264 billion in 2012 (43% of total cross-border FDIs). M&A reached USD 308 billion in 2012 as indicated in Table 4.

Table 4

FDI Greenfield and M&A Cross-border investments (USD billions)					
	FDI Greenfield			Cross border M&A	
Year	2012	2011		2012	2011
Services	323	385		124	214
Manufacturing	264	453		137	205
Primary	25	76		47	137
Total	612	914		308	556

Source: Adapted by the authors based on UNCTAD (2013)

A subgroup of this market segment is the Complex Products and Systems (CoPS), defined as high technology and high value capital goods. According to Davies and Hobday (2005), this definition encompasses high cost products like electricity network control systems, infrastructure and engineering constructions. In general, MNEs provide these services and products through business projects. These com-

panies use project management concepts to handle the delivery of major capital undertakings. The typical hierarchical and management structure does not match the needs to bring the required knowledge to face the environmental dynamics of this market. A project-oriented organization is more adaptive to these needs and to comply with that of customers in a fast changing condition (Davies & Hobday, 2005).

In terms of projects, the provision of CoPS depends fundamentally on project capabilities. According to Davies and Hobday (2005), every CoPS is a new project, requiring organizations in this area to develop abilities to win bids, learn from previous projects and manage in an efficient and effective way their projects, rather than focusing on cost, scope or economies of scales advantages.

2.4 Managing Complex Projects in Multinational Enterprises

The management of projects is becoming a central concern in most organizations. Its framework and concepts are used to leverage internal resources into process improvements, product development and/or new services (Sausser *et al.*, 2009). Organizations also engage in projects to improve their own innovative capacity, serving as a strategic process to develop new capabilities (Wikström *et al.*, 2010). Not only project-based organizations use projects to manage complex business transactions but also those in the construction business, technology-based and service providing firms. These organizations structure their operational activities in different projects. Similarly, large events like Olympic Games organize their business into multiparty projects. The management of these complex projects produces new requirements for proper control by means of portfolio and program management (Wikström *et al.*, 2010).

The need for aligning strategy with project management has received the attention of various scholars (Pinto & Slevin, 1988; Raz *et al.*, 2002; Shenhar, 2001; Shenhar & Dvir, 2007). According to Milosevic and Srivannaboon (2006), aligning projects with organizational strategies is an important aspect to avoid costs of project termination that do not contribute to organization's goals or the resource allocation to ongoing projects not aligned with these goals. Project management may be defined as a specialized form of management used as a mechanism or process to achieve business goals, tasks in a defined time/cost basis. Its fundamental objective is to support the execution of a specific strategy. As organizations formulate their strategies to achieve their goals, it can be concluded that projects are a mechanism or tool for achieving them (Milosevic & Srivannaboon, 2006).

Following Shenhar (2004), the traditional approach to project management focused on 'getting the job done' through the control of costs/schedule/scope is not enough to cope with the current business

needs. As defined by its conceptual approach, Strategic Project Leadership®, projects are strategic organizational processes developed by organizations to achieve business strategies and goals. Customer needs, strategy, and success dimensions should be the focus of these projects. A project strategy is required as a form of alignment between business strategy and project management. In this sense, project strategy is defined as guidelines and definitions on how to achieve competitive advantage from project outcomes. The project success depends on factors like efficiency, impact on customer, impact on team, business and direct success and preparation for future (Shenhar & Dvir, 2007). However, in order to be successful, the management has to consider five factors: strategy, spirit, processes, organization and tools.

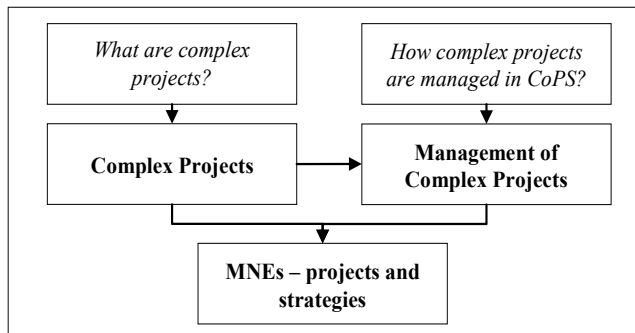
Contemporary projects performed by different organizations are focused on the process of adding value through implementing breakthroughs ideas, improving process performance, and creating competitive advantage (Hass, 2009). In order to achieve these benefits, MNEs engage in some forms of projects and have to develop project capabilities (Davies & Hobday, 2005). Furthermore, complexity is associated with four dimensions: size, variety, difficulty and change. In terms of size, projects with many components tend to be more complex (Frame, 2002). Variety is associated with the excessive options (and decisions) that project managers have to face (different contractors, employees, solutions, dates, etc.). Difficulty is related to something that is hard to do. The rapidity of change is the last facet of complexity. It contributes to the complexity "...by creating moving targets" (Frame, 2002, p. 30). Even as one assumes to have understood the customer requirements, they change. Sources for this facet of complexity can come from technology change, level of competition changes, and economic forces, for instance.

These factors tend to be present when MNEs implement their strategies as they involve different countries (size of the project), variety/decisions (local or international suppliers), difficulty in managing communications, and pace of change of local conditions (market innovation, change in regulatory markets).

The question on how capital goods manufacturing MNEs manage complex projects, particularly in the CoPS, is an important aspect of project management. The manner companies handle the complexities related to the business and project management needs to be understood and explored in a deeper

way. Moreover, other important market segments can use lessons learned from these organizations. Figure 1 summarizes the proposed model.

Figure 1: Schematic of the conceptual model



Source: Prepared by authors

3. METHODOLOGY

In order to answer the question stated in the beginning of this study – how capital goods manufacturing MNEs manage complex projects – a qualitative approach through a descriptive multiple case study was used (two MNEs). As an exploratory work, it aimed at developing and clarifying ideas and concepts for further studies or the development of hypotheses to be used by other researchers (Gil, 2008; Yin, 2010).

According to Yin (2003), a case study should be used when the main objective of the study is to answer “how” and/or “why” questions and the behavior of the participants cannot be controlled. Furthermore, the case study is indicated when it is necessary to evaluate contextual situations that are relevant to the phenomena under investigation. The nature of this study is descriptive as it is recommend when the objective is to analyze a phenomenon within its context and an emphasis is placed on the processes involved. A multiple case is justified when the researcher is interested in collecting data from different sources to draw conclusions based on empiric observations (Yin, 2003).

The unit of analysis is the organization. To select the investigated organizations we have used the following criteria. First, the organization should be a MNE. For the purpose of this study, “MNE, multinational or transnational enterprise, is an enterprise that engages in FDI and owns or, in some way, controls value-added activities in more than one coun-

try” as per Dunning and Lundan’s (2008, p. 8) definition. Second, the organization (and its business unit) should be part of the capital goods segment, engaged in the manufacturing of CoPS – Complex Products and Systems (high technology and high-value capital goods (Davies & Hobday, 2005). Third, the organization would have to be project-oriented for the provision of its products and services to their customers. Last, it should be an important unit to the MNE in terms of the Brazilian operation, considering its strategic function within the group.

In order to proper evaluate the responses we defined some characteristics of the persons to be interviewed. He or she should have a deep knowledge of project management, act in a managerial position and have more than 10 years as an employee of the organization. The small number of interviewed persons (one from each organization) is justified by the focus of this study and by the representativeness of the selected persons.

The first selected organization is an European-based MNE named hereafter as Alpha. With global revenues greater than USD 40 billion in 2013 and more than 100.000 employees in the world, its business is comprised of different business units, all of them in the electrical equipment industry. Its portfolio of products includes assembly of electronics, software and system integration, and tailored suited to the customer requirements. All business units are project-oriented and most of their facilities hold ISO certifications like ISO 9001 (Quality), ISO 14001 (Environmental) and ISO 18001 (Occupational Health and Safety). This MNE operates in Brazil for more than 50 years and according to its annual report, revenues from Americas increased at a double-digit rate when comparing 2013 to 2012.

The second MNE (Beta) is an European-based corporation who is involved in the manufacturing of electric and electronic CoPS for different market segments, like civil construction and aerospace industries. These pieces of equipment are highly connected to specific software applications. The revenues of the group as a whole are greater than USD 40 billion with investments in research & development of around 20% of revenues. It operates in more than 50 countries with 60.000 employees and innovation is a driving force for both global and local operations. The Brazilian operation, although not large, plays an important role within the group, being a center of excellence of the entire group in its area of expertise. In Brazil, the business unit is part of the corporate

organization for less than 10 years and holds ISO 9001 Quality Management System certification.

We used primary and secondary sources of information for data collection. As primary source, we opted for semi-structured interviews that were conducted in August 2014 and based on a script prepared considering the Shenhar and Dvir (2007)'s research and complemented with other theoretical insights. As secondary source of information we basically used the annual reports of both organizations in order to confirm the compliance to our selection criteria of MNEs. Some specific procedures on how to manage projects and regarding the process for internal qualification/certification of project managers specifically for organization Alpha (a total of 2 procedures and more than 10 specific training programs) were evaluated. For organization Beta, secondary sources of information were based only on annual reports written by the headquarters. It has to be noted that organization Beta operates in a more sensitive market in terms of confidentiality. For organization Alpha a sample record of the project managers qualification was also checked during the interview process.

As a result, the questions of the script involved the following topics: (i) characteristics of complex projects, (ii) management of complex projects in CoPS, and (iii) MNEs and their complex projects. Due to the research focus, one interview was performed with the manager responsible for the operational excellence of the processes within the business unity (Alpha). His professional experience included more than 20 years in the company, having supported the establishment of the process of project management, occupying the position of Project Manager for more than five years. In organization Beta, the interviewed was a mathematician, with a specialization in computer network and project management. The interviewed, at the time of interview, had more than 20 years in the engineering field, being 11 years in project management.

As secondary source of information, analyses were performed both in documents (procedures, records and other general documents) made available during the interview and in documents obtained in their websites, like Alpha and Beta annual reports. The content of the interviews was analyzed through the concepts of content analysis. According to Krippendorff (2012, p. 18), content analysis is "a research technique for making replicable and valid inferences from texts (or other meaningful matter) to the contexts of their use". The basic steps of this process

were based on Moraes (1999): (1) preparation of information, (2) unitization of information, (3) categorization or classification of the unities in categories, (4) description and (5) interpretation.

4. DATA ANALYSIS AND DISCUSSION

The data analysis was performed into three different aspects: (i) what dimensions of project complexity are considered by organizations, (ii) how complex projects characteristics affect organizations' project management practices, and (iii) how organization strategies are aligned with project execution.

Prior to the interview categories of analysis were defined and used as the basis for formulating the semi-structured interview script. The categories included were: (i) MNEs and the alignment between projects and strategies, (ii) project complexity and its differentiation to complicatedness, and (iii) management of complex projects in MNEs.

4.1 Complex Projects Characteristics

Organizations Alpha and Beta are project-oriented businesses what confirms the theory of organization structure of this market segment (Davies & Hobday, 2005). Alpha's projects are not the same in terms of complexity, although a general classification can be done using the Diamond approach. With regard to *Novelty*, Alpha's projects usually fit on platform (new generation in an existing product line) but a disruptive product may be developed locally or at the corporate level. In relation to *Technology*, it is medium to high technology. It has to be addressed that technology seems not to be a concern for organization Alpha. As addressed by the interviewed Alpha's executive, "We are a company of engineers; we always have someone in the group with a proper solution for an existing problem, always".

Regarding the *Complexity* dimension, Alpha's projects are a system or a matrix, a collection of scattered systems with a common mission. In respect to *Pace*, time is usually critical since Alpha's products are generally huge investments in capital goods made by their clients to increase manufacturing capacity. To Alpha, pace is one of the key aspects of their business. First, because pace is a common client complaint revealed by their customer satisfaction survey. Second, some of the delays are out of Alpha control since, to some extent, delays are caused by the client itself. As informed by the Alpha's execu-

tive interviewed, “sometimes delays or anticipations are requested by the client due to the price of the commodity, for example, energy and/or gasoline”. Other external factor is the myriad of customer specific manufacturing standards for the product; what may be accepted in Europe as best practice, Brazilian customer demands a more stringent technical solution even to a higher cost. According to Alpha’s executive, the third reason for delays is: “Brazilians are too optimistic ... our planning is not real ... we easily forget what happened in the past”. Regarding complexity, Alpha does not identify or establish a difference between complex and complicated projects, although both factors are addressed by Alpha through different ways of managing complex projects as previously discussed in item 4.2.

Differently from Alpha’s set of projects, Beta performs projects with a very similar level of complexity. Using the Diamond model, these projects can be classified as follows: (1) platform (novelty dimension), (2) high technology (technology dimension), (3) system (complexity dimension), and (4) regular (pace). In terms of project control, a different series of meetings is locally held in a monthly basis, and every four months at the corporate level.

Beta makes distinction between complex and complicatedness. All Beta projects are complicated since purchasing has more interfaces in terms of legal aspects than a normal business operation due to product reasons. The complexity comes from the process within the engineering function. For Beta, the specific characteristics of their engineering fit into the general definition of complexity made by scholars (Baccarini, 1996; Whitty & Maylor, 2009).

4.2 Management of Complex Projects

Alpha MNE follows corporate guidelines to manage projects although they may be flexible to match local procedures and needs. For instance, controlling cost is mandatory but how to do that may vary across countries. As informed by the interviewed, “It is basically an Alpha PMBoK, but including stronger considerations to safety and environmental aspects”.

Alpha has a system to classify projects according to their complexity and complicatedness altogether (project complexity factor). Some of the factors involved in this classification are country of the client, involvement of state-owned companies, value of the project, existence of a joint venture between Alpha units in different countries, level of product innova-

tion and others. This set of aspects is rated in a numerical scale and depending on the number, a more skilled project manager is designated for a specific project. Alpha has a formal program to certify their project managers according to a 4-level scale and evaluate their performance through a career planning process.

Other aspect of project complexity considered by Alpha is the project review process. As the complexity factor mentioned above is higher, a different group of people makes the project review. According to the Alpha’s executive interviewed, “the idea is simple: the more complex the project is, a higher level of functions is required to perform the project review”.

On the execution side of projects in Alpha, there is an operations manager. Once a sale is closed, the operations manager assigns a project manager responsible for the project development. Their responsibility is to make sure the project is delivered according not only to the classic iron triangle (cost, scope, time) but also to the interface with clients in order to keep their needs under control. The project manager also participates in the commissioning of the equipment in order to understand problems that may emerge due to project management.

The project management process used by Alpha to conduct their projects does not follow the Diamond model in its full extent. However, it employs some aspects regarding the four dimensions of Shenhar and Dvir (2007) approach. Factors of *Novelty*, *Technology*, *Complexity* and *Pace* can be seen in their system for project complexity evaluation. On the other hand, despite the fact that technology is an important factor for complexity in the Diamond approach, it is not a concern for the organization Alpha. The reason for that, according to the interviewed, is one of their competitive advantages: the engineering knowledge and expertise of the Alpha team around the world.

Documentary sources of information from organization Alpha validated the qualification/certification process as well as that one used to manage projects. These documents are clear in terms of scope, detailing the steps required for managing projects like project review, interfaces with clients and control of all aspects of project execution – cost, scope and time. The documented qualification/certification process confirmed the data retrieved from the interview.

In Beta, the complicatedness of a project is managed through the basic concepts of PMBoK. Once a proposal is accepted, a project manager is designated and a project team is built. Team members are more functional rather than someone specifically designated to the project. For instance, there is no specific member responsible for the procurement process. In project review meetings, someone from purchasing participates to inform about the status of the processes. As said by the Beta's executive interviewed, "resources do not belong to project manager". In opposition to Alpha, there is no a general project manager.

In Engineering, Beta uses some specific tools for addressing the complexities of this set of activities. For instance, statistical and more probabilistic tools are used like the Graphic Evaluation and Review Technique (GERT), Monte Carlo Simulation, etc. As per the opinion expressed by the interviewed, "the current project managers do not have knowledge regarding PERT and other tools to analyze the complexities involved in projects and the interdependence of activities".

Based on the observation made, some conclusions may be drawn. Despite the fact that both organizations deal with complexity to some extent, they have the same basic level to address it as per the Diamond approach. The way both organizations deal with complexity is different and it is relevant to pointing out that, although both Alpha and Beta do not fully follow the diamond approach in terms of managing complex projects, both agree with the underlying concept of "one size does not fit all" (Shenhar & Dvir, 2007).

Organization Alpha used to have a system to financially reward the best projects. If the profit margin of the project was higher than planned part of the additional margin was distributed between team members and the project manager. There were three main reasons for Alpha to cease this financial reward. First, in some projects, an increase in the profit margin was an easy task and in most times this was not directly related to the internal capabilities of project team members. Second, the increase of margin was associated with external factors. As stated by the interviewed, "The better margin achieved was related with client mistakes rather than a good management of the project". Third, when projects were sold with known low margins, there was a tendency of the project manager to refuse to manage this project but Alpha has implemented a system to promote the best projects. Every year, all countries may indicate one successful project for each business unit to

be evaluated by the corporate committee. Based on aspects like cost, scope, time, etc., one project is selected and awarded. According to the interviewed, "It is a reward, a statue; it is an Alpha Oscar". It has to be highlighted that client perception plays a fundamental role in this process.

There is no financial award, but the project manager goes to the European headquarters and can take his wife with him and enjoys other interesting features like a formal ceremony, etc. The indication itself grants a status of an excellent project manager and can leverage their career. Finally, Alpha locally uses a small holographic statue with the project name in order to promote the project and reinforce its importance to the group. This way of promoting values aims to enhance the project meaning to the organization and it is in line with the concept of strategic project leadership by Shenhar (2004).

In Beta, the company was founded and initiated by engineers carrying out projects. In this sense, the interviewed has a perception that the employees have a great sense of self-motivation. The way the company performs businesses drives team members to an adequate level of motivation. As per the interviewed, "Project Management is our DNA".

4.3 Multinational Enterprises and Their Complex Projects

Both organizations, Alpha and Beta, have corporate offices in Europe. The FDI investments of these companies, according to their annual reports, follow the concept of the OLI paradigm (Dunning & Lundan, 2008). The strongest forces seem to be the internalization and location advantages. It is clear from their annual reports that investments in local operations explore these advantages. It also has to be addressed that for organization Beta, due to its line of products, the internalization is apparently the only option.

Organization Alpha is focused on technology innovation and business integration in order to capitalize the synergies between new companies and existing business unities. This strategy intends to increase Alpha's penetration in a market segment and develop new markets through acquisitions of other companies and product development (product innovation and improvement). This general corporate strategy does follow the concepts of the OLI paradigm of Dunning (2001), Dunning and Lundan (2008) and the Ansoff Matrix (Scholes *et al.*, 2008).

In Alpha, the alignment goes beyond projects and corporate strategy to encompass quality, health, safety and environmental policies. The execution of the strategy is performed through a matrix organizational model. In this case, there is a manager responsible for strategy implementation who evaluates market trends. As informed by the interviewed "the business unit manager is responsible to get the businesses".

It has to be highlighted that Alpha's organizational structure has changed over the years from matrix to functional and vice-versa. According to the interviewed the matrix works better when there is a good personnel synergy between the operations manager and the business unit manager. The alignment between projects and corporate strategies is also pursued when there is a need to develop equipment and solutions to local clients. In this case, when a decision is made to enter a new market or to offer the same product to an existing market, Alpha sends their personnel to a center of excellence, for instance, in China, in order to acquire the competencies required for the business. This market strategy is in line with Ansoff's matrix as market penetration and also product development (Scholes *et al.*, 2008).

In Beta, a weaker organizational function matrix is in place. The Key Account Manager (KAM) is responsible for executing corporate strategies in terms of market penetration and product development. However, to some extent, the KAM has more autonomy to identify local opportunities and to locally work on them, what is different from Alpha's procedures. In any case, this new business or line of business has to be within the corporation portfolio of products and services and to consider potential risks for the business. Another aspect related to the alignment between projects and strategies is the corporate company request to establish a bidding process area.

The bidding process area is responsible to make sure that not only all aspects of the bidding process

have been fully considerate (profit margin, costs, cash flow, time, procurement, etc.), but also there is a proper alignment between sales proposal and corporate strategies. The initial analysis includes risk evaluation (e.g. country sensitivity), financial analysis (e.g. change fluctuation), accounting (taxes) and last, the required expertise for developing the solution to the client. This process happens before a commitment for selling is made.

Organization Alpha seems to be more mature in terms of organizational structure since it has experiencing lessons learned for longer time than Beta, who is still in the process of changing some local practices. For instance, Beta is a fully project-oriented organization and according to the interviewed person, "At corporate level, PM has complete authority".

Both Alpha and Beta manage their complex projects in a similar way. The idea of "one size does not fit all" is an underlying concept used by them to deal with the complexities of their projects and products. For Alpha, the management of complex projects is based on a corporate guideline and in this sense, complex and complicatedness are considered in the "project complexity factor". Alpha also has a strong organizational matrix structure what seems to be a consequence of a longer time under the corporate "umbrella". In Beta, the complexity and complicatedness of their projects are managed separately allowing the differentiation of both concepts and the implications of this differentiation. Beta deals with complexity in its engineering functional area and complicatedness is managed through the traditional concepts of project management like work breakdown structure.

The comparison between the two investigated companies was done in order to identify similarities and fundamental differences. Table 5 summarizes the main aspects identified.

Table 5

Alpha and Beta Comparison		
	Similarities	Differences
Complex Projects	Both Alpha and Beta are project-oriented organizations and conduct complex projects.	Alpha deals with complex and complicatedness altogether.
The management of complex projects	Both Alpha and Beta control projects with reviews made at different levels.	In BETA, complexity is within the Engineering function and complicatedness relates to the project as a whole. Alpha has a more restrictive approach do project management through guidelines from Corporate Headquarters. It uses a system for project classification. Beta does not follow specific guidelines for project management. Engineering project activities are considered complex and some probabilistic tools are used for project control and analysis.
Multinational Enterprises	Both Alpha and Beta conduct FDI investments based on internationalization strategies and location advantages. The execution of corporate strategies is done by a specific function.	Alpha has a strong matrix organizational structure. The BU manager is responsible for aligning strategies and projects. In Beta, alignment between strategies and projects rests with KAM and the bidding process.

5. FINAL REMARKS

The main objective of this empiric study was to answer the question on how capital goods manufacturing MNEs manage complex projects, specifically within the Complex Products and Systems (CoPS) market segment. In order to properly answer this question, a descriptive case study was conducted in two capital goods MNEs, being both considered representative of the phenomenon under investigation.

Alpha and Beta MNEs consider complexity in their projects in different ways under the Diamond approach. In such a way, both MNEs have adaptive systems to manage their projects (Shenhar & Dvir, 2007). Alpha uses a complex factor calculator as the basis for managing their projects. Due to the similarities of their projects in terms of complexity,

Beta uses different probabilistic tools for controlling them in the engineering department. Therefore, both MNEs consider that “one size does not fit all”.

With respect to project management, the way Alpha and Beta consider complexities in projects reveals some interesting aspects. First, the concepts of complexity and complicatedness seem not to have a clear consequence in the way Alpha manage their projects. As projects have different levels of complexity (as revealed by their complexity factors), complexity and complicatedness of the projects are taken altogether. In Beta, all projects have the same level of complexity. Alpha approach is more adaptive while Beta has a more informal way of executing their projects.

In terms of a system to pursue success within project management, Alpha seems to be more proactive.

Our analysis reveals that this mature view is possibly due to its longer project experience in Brazil. Alpha operates in Brazil for more than 50 years and have lessons learned on project motivation. Beta, however, has less than 10 years as part of the corporation and, therefore, the European culture of project management has not yet been fully absorbed by the local company. It is interesting to see that there is a real concern regarding the success of projects in both organizations although they address this aspect in different ways.

We also found that both organizations, at the corporate level, develop FDI mainly based on the internalization force (the OLI paradigm), confirming the theory proposed by Dunning and Lundan (2008). For Beta, the strongest force is clearly the internalization due to the specific characteristics of their products and client demands.

Considering how Alpha and Beta manage their complex projects, we concluded that they employ similar approaches since both are project-oriented organizations. While Alpha uses a strong organizational matrix to pursue the goals of each functional area involved Beta has the Key Account Manager (KAM) and a bidding system to assure that all proposals are aligned with corporate strategies. Therefore, Alpha and Beta follow much more 'common sense' practices rather than a specific theory of project management.

The empiric observation shows that the alignment between corporate strategies and projects, for both companies, seems to be a natural consequence of how these companies perform their business. As both companies operate in the CoPS business, investments made in research, at the corporate level, are deployed at local market depending on local conditions.

Further areas of research could be identified as a result of this study. First, an evaluation of the existing gaps between practitioners and recommendations from scholars on how to manage complex projects. This evaluation could focus on practical differences between complex and complicated projects. Second, explore how organizations can leverage the management of project complexity based on compensation (through financial and/or recognition award). Third, study how multinational project-based organizations manage complex product undertakings in the CoPS market segment and how they align them with business strategies.

Although limited in the number of MNEs studied and persons interviewed, this paper contributes in practical and academic senses. It encourages organizations involved in the CoPS business as well as in other market segment to apply the concepts largely used in managing complex projects in order to avoid the typical 'one size fits all' pitfalls. This paper has clear limitations. First, the number of the MNEs involved in the study has to be considered when extending the conclusions and recommendations. Second, the number of interviewed persons is also limited. These factors, rather than being seen in a restrictive perspective, should be an incentive for other scholars to expand its concept in order to support theory development regarding project complexity in MNEs.

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