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The impact of electronic commerce on organizational structure: a case study of e-commerce decentralization

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Abstract

This paper focuses on the problem of centralizing vs. decentralizing an organizational structure for e-commerce. First, a conceptual framework is designed based on the literature. Then a case study of the Brazilian subsidiary of a major chemical multinational is explained and analyzed. A decision-making method is applied to (a) identify the alternatives for organizational structures and evaluation criteria, and (b) determine which criteria enable one to identify an alternative as better than the others. In the context of the case, a centralized e-commerce structure was recommended. This paper makes two main contributions to theory. First, it shows the usefulness of the literature on R&D and innovation management as theoretical support for studies in other fields, in this case e-commerce organization. Second, it provides a methodology, which can be adapted for use by companies facing the same decision problem. Thoughts on possible future studies close the article.

Keywords: **e-commerce, e-business, organizational structure, internet, decentralization, centralization**

INTRODUCTION

The Internet and specifically e-commerce are powerful tools that can enrich the strategy of firms in their quest for competitive advantage (Porter, 2001; Kalakota and Robinson, 2001; Weill and Vitale, 2001; Turban et al., 2008; Jun and Kang, 2009; Amit and Zott, 2001; Tapscott, 2001).

Many studies highlight that one of the key aspects of doing business over the web is the organizational structure that firms put in place for this (Gulatti and Garino, 2000; Moore, 2000; Rindova and Kotha 2001; Zilber and Vasconcellos, 2004; Chu and Stevenson, 2007). The information era and e-commerce in particular dictate new organizational strategies, structures and processes (Venkatraman and Henderson, 1998; Weill and Vitale, 2001; Kao and Decou, 2003). Studies suggest that adopting e-commerce and its evolution make it necessary for firms to adjust their organizational structure (Kickul and Gundry, 2001; Strebinger and Treiblmaier, 2006; Jackson and Harris, 2003). However, none of these studies presents methodologies that help firms to decide between centralizing and decentralizing their e-commerce operation. A corporation with several business units can set up a single e-commerce department for all its operations or create a separate e-commerce department for each business unit (BU).

This article results from research designed to answer the following question: how should a firm decide among different centralization or decentralization possibilities regarding its organizational e-commerce structure? Based on the SMART method (Edwards and Barron, 1977), a methodology was developed with two main objectives: (a) to identify different organizational structure alternatives and decision criteria; and (b) to identify the criteria that contribute the most to each one of the alternatives. This methodology was applied in a case study of the Brazilian subsidiary of a major chemical multinational.

This study contributes to both academia and management practice. From a theoretical point of view, the main contributions are twofold. As discussed above, though many articles mention the importance of organizational structure for e-commerce, there are no studies discussing methodologies that might help firms decide among the different degrees of decentralization. The second contribution is that there appears to be no discussion of factors that further e-commerce structure centralization or decentralization in the literature. Therefore, for theoretical support, we resorted to the literature on the centripetal forces (favoring centralization) and centrifugal forces (favoring decentralization) of R&D (Chiesa, 1996; Gassman and Zedtwitz, 1998; Pearce, 1999; Blanc and Sierra, 1999), to identify criteria that might be used in this study.

Many companies are structuring their initiatives with no theoretical support, based on intuition and trial and error (Rindova and Kotha, 2001). Some companies open an entirely new enterprise to handle sales via the web, and have to integrate this with the organizational structure of the original firm the year after, due to the many problems that arise (Thomas et al., 2005). Thus, any methodology that might help management make a decision on organizational structure with greater awareness of the consequences might further the success of e-commerce as a competitive weapon.

THEORETICAL FRAMEWORK

Several researchers have agreed that "real" and "virtual" companies are no longer separate entities. These two universes are tending to merge, forcing "traditional

companies," i.e., those that existed before the Internet came into use, to incorporate e-commerce into their corporate strategies and processes (Gulati and Garino, 2000; Porter, 2001; Kalakota and Robinson, 2001; Willcocks and Plant, 2001). However, the current strategy and structure models are not particularly suitable for dealing with today's information era challenges (Venkatraman and Henderson, 1998). For traditional firms, whose nature is far more social than technical, implanting e-commerce is a major challenge (Chu and Stevenson, 2007).

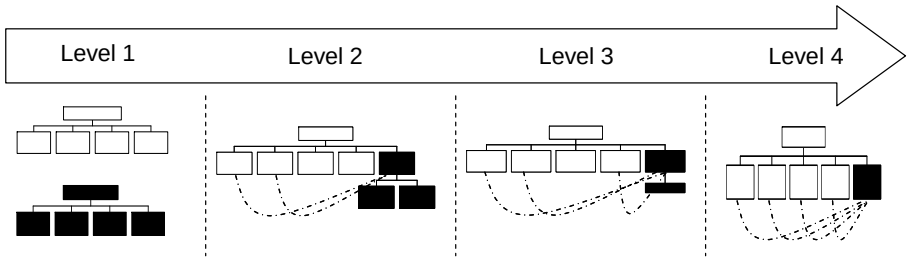
In a study of over 100 large companies in North America, Europe, Australia and Asia, Moore (2000) identified five e-commerce models for large enterprises:

- Greenfield: companies put their e-commerce operations in separate firms.
- Semi-autonomous in parent firm: e-commerce structure has closer ties with the overall structure of the group/corporation.
- Integrated into parent-firm functions: e-commerce division reports to the top executives and to those in the BU.
- Integrated into parent-firm IT: the corporation's IT department handles e-commerce.
- Parallel organization: e-commerce is an entirely independent operation.

A firm's e-commerce units may share support resources (HR, finances, accounting, data processing, etc.) to different degrees. A specific e-commerce area that is fully separate from a company's current structure implies greater speed and more specialization in handling e-commerce operations, but it also entails duplication of resources, which may drive up costs and isolate the e-commerce structure from the rest of the firm. On the other hand, an e-commerce structure with operations shared by other company areas may lead to insufficient specialization, which in turn might indicate rejection of this new area of operations and lower efficiency of the services rendered to the company. Zilber and Vasconcellos (2004) developed a model that allows one to visualize these several degrees of sharing of support resources among different areas of the traditional company and the e-commerce unit (Figure 1):

- Level 1 - The virtual and traditional business structures are entirely separate. The black sections of the organization charts represent the e-commerce unit. As resources are not shared with the support areas, there is duplication. This level was considered an extreme situation and assumes that the electronic venture has no connection whatsoever with the firm that is creating it. This tends to occurs when a traditional enterprise sets up another firm or strategic unit, separate from and unrelated to its overall structure. In other words, it does not share resources: the entire structure is duplicated.
- Level 2 - e-commerce is established as a separate unit, with some resources, such as buying and delivery being shared and others being duplicated. The dotted line connecting the e-commerce unit with two white units indicates resource sharing.
- Level 3 - e-commerce is established as a separate unit but many support areas are shared. A division in upper management is established for e-commerce, but resource sharing is high. Virtually no support area is duplicated.
- Level 4 - e-commerce is set up as a separate unit in charge of coordination, but all support areas are shared with the traditional business. There is no duplication. The proposed model is shown in Figure 1.

Figure 1: Levels of Sharing of Support Resources among Structures in a Traditional and in an E-business Venture



Source: Zilber and Vasconcellos (2004)

We found no discussion in the literature of the factors that spur e-commerce centralization or decentralization. However, there are many studies on centripetal forces (that encourage centralization) and centrifugal forces (that encourage decentralization) of R&D structures (Chiesa, 1996; Gassmann and Zedtwitz, 1998; Pearce, 1999; Blanc and Sierra; 1999; Hakanson and Nobel, 1993). With the necessary adaptations, many of these factors are applicable to the centralization or decentralization of e-commerce structures. Table 1 shows the factors that appear to be the most appropriate for the study at hand.

Table 1: Centripetal and Centrifugal Forces

Centripetal (or Centralization) Forces
• Economies of scale (Gassmann and Zedtwitz, 1998; Pearce, 1999; Pearce, 1999; Blanc and Sierra, 1999)
• Avoidance of duplicated development (Gassmann and Zedtwitz, 1998)
• Avoidance of coordination problems (Chiesa, 1996; Pearce, 1999, Blanc and Sierra, 1999; Hakanson and Nobel, 1993)
• Coherence (Blanc and Sierra, 1999)
• Central and easier control (Chiesa, 1996; Gassmann and Zedtwitz, 1998; Hakanson and Nobel, 1993)
• Communication (Chiesa, 1996; Gassman and Zedtwitz, 1998; Pearce, 1999; Blanc and Sierra, 1999)
• Acceleration of the firm's learning process (Chiesa, 1996); making the earning process easier (Gassman and Zedtwitz, 1998);
Centrifugal (or Decentralization) Forces
• Improve local responsiveness (Chiesa, 1996) and flexibility (Gassmann and Zedtwitz, 1998)
• Closeness to lead users (Gassmann and Zedtwitz, 1998)
• Closeness to production, market and distribution (Gassmann and Zedtwitz, 1998)
• Adaptation to local production process (Gassmann and Zedtwitz, 1998)
• Technical service to support other company functions (Chiesa, 1996; Hakanson and Nobel, 1993)
• Promote global learning (Gassman and Zedtwitz, 1998); access to global knowledge (Chiesa, 1996; Blanc and Sierra, 1999)
• Customer-specific development (Gassmann and Zedtwitz, 1998)

The studies published on this topic of organizational structures for e-commerce

acknowledge the importance of a well-designed structure. Authors generally agree that a firm can choose from a broad range of possibilities (Gulati and Garino, 2000; Moore, 2000; Strebinger and Treblmaier, 2006; Chu and Smithson, 2007; Jun and Kang, 2009). However, no study was found that might help companies make these decisions. This was the main reason why this study was conducted and is being presented in this article.

METHODOLOGY

For this research study, we used the case study method, which is suitable to investigate contemporary phenomena in their real-life contexts and where the boundaries between the phenomena and the context are not clear or obvious (Yin, 1989; Eisenhardt, 1989).

The sampling criterion was theoretical (Eisenhardt, 1989), since it involved identifying a company that engages in e-commerce and has a large number of business units. We were thus able to focus on the problem of centralizing or decentralizing the e-commerce area.

For this purpose, the Brazilian subsidiary of a chemical multinational was chosen. For reasons of confidentiality, it will be referred to here merely as CHEMCOMPANY. When fieldwork began, the company had nine Business Units (BUs) and a centralized e-commerce department. The e-commerce area did not work alone. There was a person in charge of each BU's e-commerce, called a 'focal point', besides other people who were involved in disseminating the tools among clients. In the IT area, a web technologies department was established and put in charge of the IT infrastructure and of the requisite e-commerce applications. The duties of each area will be discussed in more detail when the case study is presented.

For this study, we adapted the methodology known as SMART - Simple Multiattribute Rating Technique, proposed by Edwards and Barron (1977). This method is based on identifying decision alternatives (called entities) and evaluation criteria (called dimensions). To determine he weights of the criteria, Edwards and Barron (1977) recommend rank ordering them in rising order of importance, with the least important criterion being assigned a weight of 10. Concerning the second least important criteria, one should ask oneself to what extent it is more important than the first. A grade of 20 means that it is considered twice as important as the first. One must then iterate these procedures for all the criteria. Then the weight of each criterion is divided by the sum of the weights, to be expressed in percentage terms. For each criterion, the decision-maker is required to ascribe a grade for each decision alternative. Finally, for each decision alternative, one must calculate the sum of the multiplication of the grade by the weight of the criterion. The alternative with the highest grade is theoretically the best one, as it maximizes benefits in accordance with the analyzed criteria. The advantage of this method is that it is simple to apply and easy for managers to understand. Additionally, its application is speedier.

As there are other decision-making methods, it is fitting to discuss the reasons for the choice. Studies comparing methods argue that the so-called outranking methods have better characteristics from the theoretical point of view (Olson, 2001; Salminen, Hokkanen, Lahdelma, 1996). Their underlying principle is that the decision-maker should conduct the relative comparison of preference among the alternatives for each one of the criteria. For example, if there are three decision alternatives (A1, A2 and A3) for each one of the j decision criteria, the decision-maker needs to voice his or her preference for A1 relative to A2, for A2 relative to A3 and, finally, for A1 relative to A3.

However, these methods also have disadvantages. Participants tend to find it harder to understand them and to apply them; they take up more time and presuppose that the decision-maker is able to voice correctly his or her relative preference among the alternatives, which often not the case. As the difference between the results that the methods yield is not major (Salminen, Hokkanen, Lahdelma, 1996) and as the interviewees' availability to take part in the research was limited, we chose to use SMART as the basis, though adapting it to this case.

The methodology used in this study comprised four stages:

Stage I: Collecting General Information.

In this phase, the theoretical basis of the study was presented to the e-commerce and web technologies managers, showing the main organizational structure models for doing business over the web. A pre-tested and semi-structured questionnaire was used to gather data on the firm and on its e-commerce structure. The methodology was presented and the participants with a suitable profile to take part in each of the subsequent stages of the study were identified. The firm's web site was also consulted in order to complement or cross general information.

Stage II: Identifying the Degrees of Decentralization and the Evaluation Criteria

The manager and a senior web technologies analyst as well as a senior analyst from the e-commerce department took part in this stage.

First, the possible structure alternatives with different degrees of decentralization were identified. This resulted in a list of i possible structure alternatives [SA1, SA2, ..., SAi]. Then, the interviewees were presented with a list of possible analysis criteria based on a review of the literature (table 1). They were then asked to analyze the relevance of each criterion, and to maintain, suppress, or modify these criteria, or add new important criteria for decision making at CHEMCOMPANY. One should stress that this stage is required, as each firm has a specific decision context, so that indiscriminate use of a pre-defined list of criteria is unsuitable. The result is a list of j analysis criteria [C1, C2, ..., Cj]. At the end of this stage, a data collection tool was created, akin to table 2, in which, for each analysis criterion, there is a field in which to fill in the weight and the evaluation of each one of the structure alternatives.

Table 2: Tool for the Evaluation of Structure Alternatives

Criteria	Criterion weight	SA_1	SA_2	...	SA_i
C_1					
C_2					
...					
C_j					

Stage III: Evaluation of Structure Alternatives

For each analysis criterion, the respondents were asked to ascribe a grade on a 0 to 5 scale (whole digits) for each organizational structure alternative; 0, the lowest grade, means the structure is totally inadequate in

relation to the analysis criterion, whereas 5 is the top grade, meaning that the structure is totally suitable in relation to the criteria. The respondents were also asked to ascribe a weight to each of the criteria according to its importance, on a 1 to 10 scale.

Eight people took part in this stage: the manager and three business analysts from the e-commerce department, the manager and the customer service supervisor from the web technologies department, two focal points from the BUs, one from the performance chemistry unit and another one from the plastics unit.

Interviewing people with different profiles had the aim of avoiding the bias that one might get if all participants had come from a single area. The first person to be interviewed was the e-commerce manager, as he was the person who tested the data collection tool. Besides filling out the questionnaire, he reviewed each criterion. Once we had obtained his approval, we applied the questionnaire to the other participants, one by one. Each interview took from one and a half to two hours.

Stage IV: Consolidation and analysis

Consolidating the questionnaires involved:

a) Calculating the mean of the weights: for each criterion, the mean of the weights given by the interviewees was calculated. The weights were adjusted so that their sum would add up to 20, in order for the top possible grade of a given structure alternative to be 100. The aim of this adjustment is to facilitate analysis, making the grade a percentage of the top possible number of points.
b) Calculating the mean of the grades ascribed by the interviewees for each structure alternative, according to each criterion.
c) Calculating the weighted grade (WG) for each criterion, consisting of the weighted mean, obtained by multiplying the mean of the grades obtained in step (b) by the mean of the weights obtained in step (a).
d) Calculating the total grade of a given structure alternative, which corresponds to the sum of the weighted grades (WG). This being the case, for any given structure alternative (SA), considering the weighted grades obtained for the j criteria (C) that range from 1 to k, the total grade is given by the following formula:

$$\text{Total Grade}_{SA} = \sum_{j=1}^{k} WG_{Cj,SA}$$

The adopted method has certain limitations connected with assumptions that, if they are not met, might imprint biases on the evaluation process. The first assumption is the independence of values. This means that the preference for alternative SA1 in relation to alternative SA2, for dimension C1, is not affected by the position of the evaluated entity in the dimensions C2, C3, ... (Edwards and Barron, 1977). However, according to Edwards and Barron (1977), even if there are small deviations for each of the dimensions, they will not make much difference for the end result. The second assumption is environmental independence, i.e., dimensions C1 and C2 must be independent from each other, because if there is a perfect overlap of what is being measured by the dimensions, only one of them should be evaluated. Alternatively, the

weight of both the variables should be adjusted for the sum to correspond to the right importance of the two dimensions, to avoid giving to much weight to criteria that correspond to a single dimension (Edwards and Barron, 1977). We tried to reduce this risk by presenting to the interviewees the normalized result of the weights, so that they might review them and change the weights ascribed should they consider that certain weights had been given too high or too low a value in relation to what they felt would have been the right weight. The chief advantage of the adopted method is that it is simple to use and the methodology is easy for people who are not decision theory experts to understand (Edwards and Barron, 1977; Salminen, Hokkanen, Lahdelma, 1996).

PRESENTATION AND ANALYSIS OF THE CASE STUDY

Presentation of the Company and its Organizational Structure for e-commerce

The studied company is one of the largest in the world in the chemical industry. It produces items in various categories, such as chemical products, plastics and fibers, performance products, products for agriculture and nutrition, as well as oil and gas. The structure of the Brazilian subsidiary, which is in fact responsible for all of South America, comprises nine BUs. The company has a matrix structure, with each BU or department reporting to its regional superior as well as to the person in charge of the area at the head office.

The company also has a services division, which includes various support services for the business areas. The e-commerce department is under the responsibility of this division, together with the areas of IT, finances, purchasing, logistics, auditing, and quality. Although this division is known as e-commerce, its operations are fairly broad and include all e-commerce solutions.

The e-commerce department was set up in to accelerate and spread e-commerce technologies throughout the company. The respondents noted that at first there was a serious cultural barrier against adopting e-commerce, but that this problem was gradually overcome as the benefits of the new technology became apparent.

The main attributions of the e-commerce department were:

- Strategic alignment: verifying the strategies of each BU and determining how e-commerce might contribute to them.
- Setting goals and follow-up: the area sets the goals for the electronic transactions of each BU and follows up on these goals.
- Planning e-commerce tools to service clients and areas, with follow up of their development by the IT area.
- Training and support: involving the training of both clients and members of the BU during the implantation stage.
- Ongoing: managing orders and the role of business leader, to instruct people in the company’s units to use e-commerce.

Besides the manager, the e-commerce Department had four e-commerce consultants and one trainee. Each consultant was responsible for dealing with one or more business units and for particular solutions.

The e-commerce Department did not operate alone. The company's business areas had focal points, which were actually persons from the BU itself charged with being the unit's contact persons ("interlocutors") for implementing e-commerce. The attributions of the focal points were:

- To define the e-commerce strategy: to set the goals and action strategies

together with the e-commerce Department.

- To define which BU clients should be approached in order to persuade them to use the new tools. This analysis considers not only the volume of purchases, but also the likelihood of the client actually using the tool.
- To implement solutions in conjunction with BU clients, train them and follow up on their use of the tool.

The e-commerce department also works in close contact with web and client services technology, one of the departments of the IT area. Any new tools or functions detected by the e-commerce Department are implemented later by the web technologies area. In addition, changes in versions of IT tools or in the ERP employed can generate changes in e-commerce-related processes. Before any such changes are implanted, the e-commerce Department should be advised, to analyze the impact of these changes on e-commerce processes. The duties of the web technologies area concerning e-commerce are:

- Management and execution of projects for implementing e-commerce solutions. In some cases, the area adopts global solutions for CHEMCOMPANY, as was the case of the extranet tool. Changes in this tool are carried out centrally, under orders from headquarters, and costs are transferred to the subsidiaries that requested the changes. Costs are then borne by the BUs. All negotiations and management of development are handled by the IT area.
- Approval of solution providers: for certain solutions, the Brazilian unit, which is responsible for operations in South America, has autonomy to hire domestic providers. Selection is made by the e-commerce department, but the web technologies area must approve the choice of providers. When necessary, the area is also responsible for developing new tools and hiring programmers.
- Technical maintenance of solutions: continuity of solutions is also the responsibility of the IT area.

The web technologies department has six account coordinators, each of whom services certain specific BUs.

The respondents mentioned that this entire structure played a very important role at the beginning of e-commerce because both internal BU resistance and external client resistance had to be overcome, by proving the advantages that e-commerce technology would add to the existing processes. In five years, the firm managed to get e-commerce to account for roughly 50% of its invoicing. Despite this achievement, senior management and e-commerce managers felt that many of the business areas had already incorporated e-commerce into their procedures and that a centralized department was no longer necessary.

To help the company make a decision in this regard with a stronger degree of awareness, we applied a technique for evaluating the organizational structure, presented in the methodology section. The next stage of this process consisted of identifying the possible degrees of decentralization for e-commerce that might be implemented in the company.

Identification of Degrees of Decentralization for e-commerce and Criteria for Analysis

In the Stage 3 of the methodology, we held an interview to identify the possible degrees of decentralization of e-commerce and the significant criteria for deciding on the most suitable structure. Three alternatives for an e-commerce structure were identified, namely:

- Centralized e-commerce Department: this alternative corresponds to the current structure, with a centralized e-commerce Department serving the various business units. Figure 2 illustrates this structure. The respective duties are shown below each department, as described above.
- e-commerce incorporated into IT: a structure where most e-commerce operations are absorbed by the web technologies area, which is part of the information technology division (figure 3).
- Decentralized e-commerce: where the duties of the present e-commerce department are decentralized to the BUs (figure 4).

Figure 2: Centralized e-commerce Department (A1)

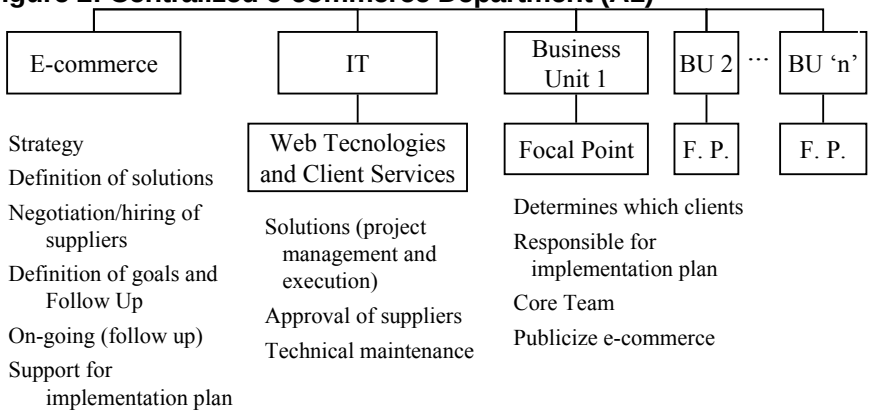


Figure 3: e-commerce incorporated into IT (A2)

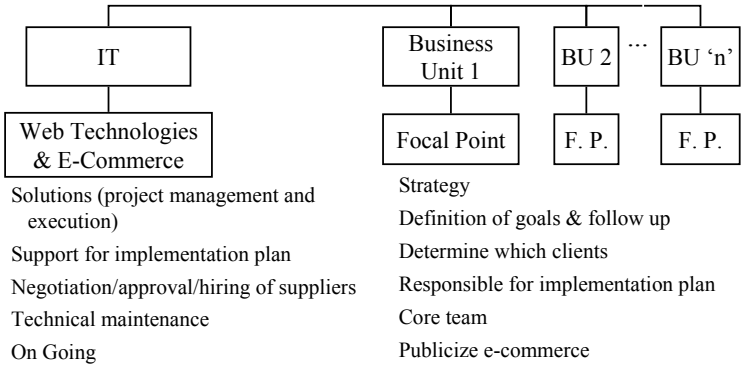
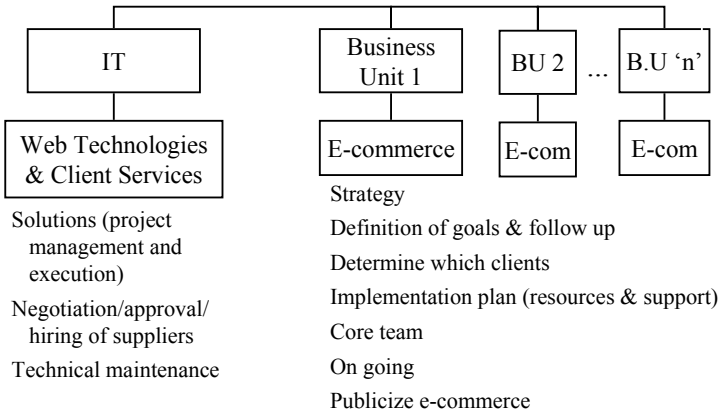


Figure 4: Decentralized e-commerce (A3)



Later, the criteria that should be considered in an analysis of the most suitable degree of decentralization of e-commerce were drawn up.

As explained in the methodology section, an initial list of criteria drawn from the bibliographic review was presented. An intense discussion ensued among the participants, not only to select the criteria, but also to arrive at the most precise explanation, to facilitate understanding by future respondents. This was also necessary to ensure the reliability of the research results.

Table 3 presents the criteria defined by the interviewees. Besides the factors backed by the literature, the interviewees made three new suggestions.

Table 3: Criteria for Analyzing Degrees of Decentralization

Criteria for Analysis	Corresponding (C) – Centralization Force or (D) – Decentralization Force according to the literature
Cost of the Structure	(C) Economies of scale (Gassmann and Zedtwitz, 1998; Pearce, 1999; Pearce, 1999; Blanc and Sierra, 1999)
Speed of Service	(D) Improvement of local responsiveness (Chiesa, 1996) and flexibility (Gassmann and Zedtwitz, 1998)
Feasibility of implementation	-
Clarity of responsibilities and objectives	(C) Avoidance of duplicated development (Gassmann and Zedtwitz, 1998)
Relationships with clients	(D) Closeness to lead users (Gassmann and Zedtwitz, 1998)
Relationships with outside organizations	(D) Closeness to production, market and distribution (Gassmann and Zedtwitz, 1998)
Ease of coordination	(C) Avoidance of coordination problems (Chiesa, 1996; Pearce, 1999, Blanc and Sierra, 1999; Hakanson and Nobel, 1993)
Development of executives	-
Alignment with corporate strategies and/ or policies (head office)	(C) Coherence (Blanc and Sierra, 1999)
Alignment with regional corporate strategies and/or policies	(D) Adaptation to local production process (Gassmann and Zedtwitz, 1998)
Ease of measuring results/ benefits	(C) }Central and easier control (Chiesa, 1996; Gassmann and Zedtwitz, 1998; Hakanson and Nobel, 1993)
Degree of diversification of e-commerce solutions and technologies (portfolio)	-
Fluctuation in the demand for e-commerce area	(D) Technical service to support other company functions (Chiesa, 1996; Hakanson and Nobel, 1993)

Criteria for Analysis	Corresponding (C) – Centralization Force or (D) – Decentralization Force according to the literature
services	
Geographical dispersion; access and communication difficulties	(C) Communication (Chiesa, 1996; Gassman and Zedtwitz, 1998; Pearce, 1999; Blanc and Sierra, 1999)
Technical and administrative training	(C) Speeding up of company's learning process (Chiesa, 1996), easier learning process (Gassman and Zedtwitz, 1998); (D) Promotion of global learning (Gassman and Zedtwitz, 1998); access to global knowledge (Chiesa, 1996; Blanc and Sierra, 1999)
Easy identification BU needs	(D) Customer-specific development (Gassmann and Zedtwitz, 1998)

The literature on R&D centralization vs. decentralization backed almost all the criteria that CHEMCOMPANY devised, except for three. The first is "feasibility of implementation." According to the researched firm, this is an important decision criterion. However, in the case of R&D decentralization, the viability depends heavily on the firm's expansion strategy. For example, if a firm expands by setting up commercial offices or as a result of accidental opportunities (Chiesa, 1996), the tendency, at first, is to keep R&D centralized. However, if the strategy is to acquire an operation abroad, the firm has to incorporate the acquired enterprise's R&D (Hakanson and Nobel, 1993) and this gives it a decentralized structure. The second criterion is "degree of diversification of e-commerce solutions and technologies (portfolio)," a specific e-commerce complexity not applicable to R&D. Finally, the criterion "development of executives" is one of the firm's concerns: developing leaderships that are aligned with e-commerce technologies. It is interesting that this factor does not arise in R&D decentralization literature. A possible explanation for this is that it is a very technical activity, meaning that it is impossible for business people, with no technical training, to take on R&D positions.

Support material was prepared containing explanations about the alternative structures, including graphic representations and a description of each analysis criterion. This support material was presented and explained to the respondents before they filled out the questionnaire.

In the Stage 3, we held interviews in order to analyze the alternatives for e-commerce-related organizational structures (Figures 2, 3 and 4) according to the different criteria (Table 2). As explained in the methodology, eight persons were interviewed.

Below we present our analyses of the collected data.

Results

Based on the tabulation method explained in stage IV of the methodology, we get to table 4. The results show that the alternative SA1 (Centralized E-Commerce Department) achieved the best evaluation (81.48). We have highlighted in bold the number of points of the alternative with the highest grade in each criterion.

Table 4: Grades for the Different Degrees of Centralization

	Weighted Grades		
Criteria for analyzing Centralization vs. Decentralization	**SA_1**	**SA_2**	**SA_3**
Cost of the structure	4.04	5.20	**5.58**

Speed of service	**6.09**	5.20	4.30
Feasibility of implementation	**5.69**	4.90	3.16
Clarity of responsibilities and objectives	**6.46**	5.16	5.16
Relationships with clients	5.13	4.42	**6.00**
Relationships with outside organizations	**4.53**	3.83	2.90
Ease of coordination	**6.58**	5.06	3.71
Development of executives	3.04	2.91	**3.28**
Alignment with corporate strategies and policies (head office)	**5.95**	5.47	3.86
Alignment with regional corporate strategies and/or policies	**5.72**	5.39	4.24
Ease of measuring results/ benefits	**5.48**	4.45	5.14
Degree of diversification of e-commerce solutions and technology	**5.22**	5.06	3.96
Fluctuation in the demand for e-commerce area services	4.93	**5.08**	4.06
Geographical dispersion	**2.08**	2.00	2.07
Technical and administrative training	**5.57**	5.11	4.21
Easy identification BU needs	4.98	4.61	**6.82**
Total Grade	81.49	73.85	68.45

The results largely corroborate the theoretical references on R&D centripetal and centrifugal forces. One should keep in mind that 2 of the 11 criteria that favor centralization (SA1) were not mentioned in the literature. They were “feasibility of implementation” and “degree of diversification of e-commerce solutions and technology (portfolio)”; 7 of the remaining 9 correspond to centripetal forces addressed in the literature. Only 2 are seen as centrifugal forces, diverging, therefore, from the research results. The first is “speed of service” (Chiesa, 1996; Gassmann and Zedtwitz, 1998). The interviewees believe that the existence of a centralized area makes rendering e-commerce services speedier, because this alternative takes into account full-time e-commerce employees. In the decentralized alternative, people are not, presumably, dedicated full-time to e-commerce and must reconcile this with other requirements of the area, a situation that does not normally arise in R&D. The other criterion is “relationships with outside organizations” (Gassmann and Zedtwitz, 1998), to which the explanation above also applies, besides the perception that the e-commerce area has been highly efficient in formulating agreements and managing the relations with partners and suppliers. The BUs are very satisfied with the outside suppliers selected.

The criterion “Fluctuation of the demand for services in the e-commerce area,” which the literature considers a centrifugal force (Chiesa, 1996; Hakanson and Nobel, 1993), favors the intermediary decentralization alternative, which is the incorporation of e-commerce into IT. This strikes us as coherent because bringing together part of the e-commerce team with the existing IT team presumably allows a larger number of people to handle the area’s peaks of demand, as well as the reallocation to other activities (in this case connected with IT) should the volume of work fall.

No literature references were found for one of the four criteria that favor the

decentralized structure alternative ("development of executive"). As for the three remaining criteria, two corresponded to centrifugal forces. Only one of the criteria corresponded to a centripetal force, namely, "cost reduction." The literature argues that R&D centralization enables economies of scale and that many firm prefer, first, to occupy fully the headquarters' structure to only then set up structures at other units (Gassmann and Zedtwitz, 1998; Pearce, 1999; Blanc and Sierra, 1999). However, in the e-commerce case, decentralization does not means establishing the entire structure of laboratories required in the case of R&D. Employees tend to feel that the currently available tools are well suited to their needs, which reduces the importance of a department solely dedicated to this purpose. Thus, in the decentralized alternative, it seems that the people involved with e-commerce would perform such activities on a part-time basis, being also engaged in carrying out other activities in the BUs.
Our final thoughts on the subject follow.

FINAL CONSIDERATIONS

In this study, we have tried to bring together two different lines of academic research: e-commerce organization, and centripetal and centrifugal forces in R&D structuring. The empirical study showed that there is strong correspondence between the centripetal forces and the criteria that favor the centralization of e-commerce at the multinational that was studied, as well as between the centrifugal forces and the criteria that foster decentralization. However, the other analysis criteria in this research study may be used to analyze the centralization or decentralization of organizational functions other than R&D, creating new research opportunities. With the appropriate adaptations, the methodology can be used in other real situations to help managers determine the degree of decentralization that should be applied in e-commerce, a complex decision. Academics interested in replicating the study or in adding further contributions may also find our research valuable.

This study suggests important themes for further exploration through research. A more in-depth study could be conducted using both the methodology of this study and another method to check for results consistency. This would allow the researchers to investigate the source of eventual divergences, making it possible to improve the method. Unfortunately, it was impossible to apply several methodologies in this study because of the limited availability of the interviewees. Another possibility is a quantitative study covering several firms, to analyze how the size and nature of the business affect the criteria of choice and the respective weights.

The main limitation of this study is that it cannot be generalized statistically, because the case study was used with a theoretical sample and small number of interviews.

Because of timeframe limitations and the availability of our respondents, we were unable to interview all the focal points in the business areas, a factor that may have led to a results bias due to the respondents' perceptions of the advantages and disadvantages of each structure alternative. Interviews with people from other areas in the organization might have provided different contributions, allowing a broader analysis.

Another potential bias of this study is that the respondents evaluated a structure that was already in place and of which they had a substantial understanding, in terms of advantages and disadvantages, rather than alternative structures that do not exist at present. The respondents were required to imagine what the future situation in each case might be and then attribute a grade to each analysis criterion according to their

perception of what advantages and disadvantages might be involved. Furthermore, there is no indication that all participants are good decision makers or even that their perceptions correspond in any way to what would actually occur if any one of the alternative structures were implemented.

Despite such restrictions, the analysis was extremely important for the company studied. The results of the study were presented to the e-commerce and web technologies managers. Although they were both initially in favor of a change toward decentralization, they decided to reconsider and re-analyze this change based on the results of the study. Both agreed that the decision to establish the most suitable degree of decentralization called for greater objectivity.

The alternative that achieved the highest number of points should not be adopted indiscriminately by the company surveyed. In other words, the proposed analysis is not meant to replace any decision-making agent. Those responsible for such a decision must consider the results presented here, together with their own personal judgment, and include countless other variables (experience, intuition and even personal objectives).

One should also emphasize that implementation of any alternative structure less favorably appraised in the analysis is not necessarily doomed to failure. Based on the analyses presented here, before implementing one of the less favorably appraised structures, the company should take measures to minimize the conflicts and problems detected in the analyses carried out.

REFERENCES

Amit, R. and Zott, C. (2001). Value Creation in E-Business. *Strategic Management Journal*, 22 (6-7), p. 493-520.

Amor, D. (1999). The E-Business (R)evolution. *Prentice Hall*, New York.

Blanc, H. and Sierra, C. (1999). The internationalisation of R&D by multinationals: a trade-off between external and internal proximity. *Cambridge Journal of Economics*, 23 (2), pp. 187-206.

Chu, C. and Smithson, S. (2007). E-Business and Organizational Change: A Structurational Approach. *Information Systems Journal*, 17 (4), pp. 369-389.

Chiesa, V. (1996). Strategies for Global R&D. *Research Technology Management*, 39 (5), pp. 19-25.

Edwards, W. and Barron, F. (1977). How to use multiattribute utility measurement for social decision-making. *IEEE Transactions on Systems, Man, and Cybernetics*, 7 (5), pp. 326-340.

Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review*, 14 (4), 532–550.

Gassmann, O. and Zedtwitz, M (1998). Organization of Industrial R&D on a Global Scale. *R&D Management*, 28 (3), pp. 147-161.

Gulati, R. and Garino, J. (2000). Get The Right Mix Of Bricks and Clicks. *Harvard Business Review*, 78 (3), pp. 107-114.

Hakanson, L. and Nobel, R. (1993). Determinants of foreign R&D in Swedish multinationals. *Research Policy*, 22 (5-6), pp. 397-411.

Jackson, P. and Harris, L. (2003). E-business and organizational change. *Journal of Organizational Change Management*, 15 (5), pp. 497-511.

Jun, B. and Kang, B. (2009). Organizational Characteristics and Electronic Commerce Utilization in Korea. *Journal of Global Business and Technology*, 5 (1), pp. 1-19.

Kalakota, R. and Robinson, M. (2001). e-Business 2.0 – Roadmap for Success, Addison-Wesley, Boston.

Kao, D. and Decou, J. (2003). A strategy-based model for e-commerce planning. *Industrial Management & Data Systems*, 103 (4), pp. 238-252.

Kickul, J. and Gundry, L. (2001). Breaking through boundaries for organizational innovation: new managerial roles and practices in e-commerce firms. *Journal of Management*, 27 (3), pp. 347-361.

Moore, K. (2000). The E-volving Organization. *Ivey Business Journal*, 65 (2), pp. 25-28.

Olson, D. (2001). Comparison of three multicriteria methods to predict known outcomes. *European Journal of operational Research*, 130 (3), pp. 576-587.

Pearce, R. (1999). Decentralised R&D and strategic competitiveness: globalised approaches to generation and use of technology in multinational enterprises (MNEs). *Research Policy*, 28 (2-3), pp. 157-178.

Porter, M. E. (2001). Strategy and the Internet. *Harvard Business Review*, 79 (3), pp. 63-78.

Rindova, V. and Kotha, S. (2001). Continuous morphing: Competing through dynamic capabilities, form and function. *Academy of Management Journal*, 44 (6), pp. 1263-1280.

Salminen, P., Hokkanen, J. and Lahdelma, R. (1998). Comparing multicriteria methods in the context of environmental problems. *European Journal of Operational Research*, 104 (3), pp. 485-496.

Straub, D. and Klein R. (2001). E-Competitive Transformations – how companies can

use e-commerce to recast themselves strategically. *Business Horizons*, 44 (3), 3-12.

Strebinger, A. and Treblmaier, H. (2006). The Impact of Business to Consumer E-Commerce on Organizational Structure, Brand Architecture, IT Structure, and Their Interrelations. *Schmalenbach Business Review*, 58, January, pp. 81-113.

Tapscott, D. (2001). Rethinking Strategy in a Networked World (or Why Michael Porter is Wrong about the Internet). *Strategy+Business*, 24, pp. 1-8.

Thomas, D., Ranganathan, C. and Desouza, K. (2005). Race to Dot.Com and Back: Lessons on E-Business Spin-Offs and Reintegration. *Information Systems Management*, 22 (3), pp. 23-30.

Turban, E. et al. (2008). Electronic Commerce - A Managerial Perspective, Prentice Hall, New York.

Venkatraman, N. and Henderson, J. C. (1998). Real Strategies for Virtual Organizing. *Sloan Management Review*, 40 (1), pp. 33-48.

Weill, P. and Vitale, M. R. (2001). Place to Space, Harvard Business School Press, Boston.

Willcocks, L. P. and Plant, R. (2001). Pathways to E-Business Leadership: Getting from Bricks to Clicks. *Sloan Management Review*, 42 (3), pp. 50-59.

Yin, R. K. (1989). Case Study Research: Design and Methods, Sage Publications, California.

Zilber, S. N. and Vasconcellos, E. (2004). The adoption of e-business by automotive companies and the impacts on their organization structures: three cases in Brazil. Proceedings of the International Conference on Technology Management (IAMOT 2004), Washington, pp.1-16.