Abstract

This paper investigates IS flexibility as a way to meet competitive challenges in hypercompetitive industries by enabling firms to implement strategies by adapting their operations processes quickly to fast-paced changes. It presents a framework for IS flexibility as a multidimensional construct. Through a literature review and initial case study analysis, factors to assess flexibility in each dimension are constructed. Findings of an exploratory study conducted to test the framework are reported. Based on the above it is argued that the concept of IS flexibility in hypercompetitive industries IS flexibility must be pursued from a holistic perspective to understand how it may be exploited to achieve a competitive advantage.

1.0 Introduction

More and more of today’s organizations find themselves in dynamic, even hypercompetitive environments. Traditional business processes featuring repetitive transactions and routine activities will no longer suffice in such environments. Increasingly, organizations must move away from old rigid organizational structures and management processes to more flexible organizational designs and management practices to adapt to escalating global competition, the rapid rate of technological change, and more exacting customization demands from customers. New, more flexible organizational designs, management practices, and business processes of some firms allow them to compete aggressively and even to gain competitive advantage in their industries [11].

Reportedly, one of the major contributors to organization productivity and performance has been information systems (IS) [4]. However, there is some questions about information systems providing the necessary capabilities to enable flexible organizational designs and business processes that organizations need in hypercompetitive environments produced, in many cases according to research, inflexible organizational designs instead of flexible ones [14]. Researchers have recognized this dilemma and called for the development of more flexible IS to support the need for more flexible, agile organizations [5]. Although there have been attempts to measure and gauge the impact of IS flexibility in organizations [5], there are still many gaps in our understanding of the relationship between IS and the new, more flexible organizational forms needed for hypercompetitive environments[14]. This paper presents an exploratory study in an examination of IS design for firms in hypercompetitive industries. An initial framework of IS flexibility that is purported to provide a fit for firms in hypercompetitive is created from a review of the literature. This initial framework is tested using data collected through interviews of managers in a company in the hypercompetitive industry of telecommunications.

2.0 The Telecommunications Industry

The telecommunications industry has witnessed many changes since the opening of its markets. Recently, technological convergence has transformed the industry into a very fast-changing environment because of the so-called triple play of services (consisting of the provision of voice, data and media services on a unique network) can now be delivered. Alliances, mergers, and acquisitions have re-shaped the industry. Frantic searches for new sources of revenues have added to the uncertainty and turbulence in the telecommunications industry. For example, several wireless telecommunications operators around the globe are spending billions on a technology for rapidly transmitting large amounts of information via radio signals called WIMAX and will spend more over the next few years [9]; several leaders in the telecommunications sector are partnering to provide service to growing markets such as those in South America [3]; and markets,
such as the European telecom industry, are expected in 2008 to place a greater emphasis on migrating customers to 3G services and on developing content to stimulate higher average revenue per user among consumers.

This all means that companies in the telecommunications industry are undergoing constant transformations in terms of implementing new strategies and technologies in response to the ever-changing challenges and demands of this industry [11]. Unfortunately, unless they have altered their more formal business operations and processes, many telecommunications firms may find it difficult to react to an environment that is uncertain, fast moving, and with many potential threats and opportunities. This difficulty is amplified because of the technology intensive nature inherent in these operations and processes. Therefore, IS are a substantial determinant in the overall flexibility of the business operations and processes of telecommunications companies. This flexibility is key to successful and rapid strategic responses in a hypercompetitive industry. Unless the business operations and processes – and by necessity the IS – can be changed quickly, there will be a disconnect between the desire to meet the competitive challenges in this industry and the capability to fulfill that desire. Consequently, it seems likely organizations that are in hypercompetitive industries and that are information technology (IT) intensive should examine ways to develop and implement more flexible IS.

3.0 Flexibility

The concept of flexibility itself is often viewed as a vague term and with many different connotations [10]. It can be used as an inherent property of an entity such as an information system, functional area, or organization. It can also be viewed as a response capability to foreseen or unforeseen changes in the organization or environment [10]. There is also a temporal aspect to this view of flexibility. One might ask how quickly should the response be for an entity to be labeled as “flexible.” Other views are also found in the literature [10]. Therefore, it is imperative in any study to clearly define what is meant by flexibility. The next section will examine flexibility and articulate its denotation for this study.

Flexibility has long been a topic of research in many business disciplines including economics [13], organization studies [1], decision theory [16], manufacturing [10], and information technology [5]. The problem with all of this attention in these various disciplines is that the concept of flexibility has been defined in many different ways. It is not clear in many studies just what is meant by the term flexibility. Flexibility is very closely related to such terms as adaptability, agility, robustness, versatility, elasticity, malleability, and resilience. Some researchers have made attempts to formally and unambiguously define flexibility and thus bring a distinction between flexibility and these related terms [10]. These attempts have not met with much success because of the polymorphous nature of the term. The meaning of flexibility is many times colored by the nature of the problem or setting being examined [10]. Probably the most successful strategy that has been attempted in past studies has been to split the concept of flexibility into component parts that can be operationalized and, therefore, measured, prioritized, and improved. This is the perspective taken in this study.

Golden and Powell [10] identify four dominant metrics of flexibility from the research literature. The four metrics are (1) efficiency, (2) responsiveness, (3) versatility, and (4) robustness. Efficiency can be defined as the capability to minimize degradation in performance of a system within some defined range [10]. Responsiveness is related to the temporal dimension. Responsiveness is defined as the speed of a response to change stimuli. Das and Elango [6] describe responsiveness as the nimbleness and swiftness of actions of being proactive in exploring opportunities while guarding against threats. Other researchers have also given similar characterizations for this metric of flexibility [7]. The next metric is versatility which measures “the extent to which the organization has planned for, and can respond to environmental change” (p. 379). Robustness, on the other hand, measures the capacity of a system to be responsive to unforeseeable environmental changes [10]. The changes in the unforeseeable environment are total surprises and cannot be realistically planned for.

In hypercompetitive industries, one might expect that the concept of flexibility to be more related to responsiveness and robustness. Both of these can be used to examine flexibility where change is omnipresent and uncertainty about the competitive landscape is exceedingly high. In such environments, the time to respond to outside stimuli and the capacity that is available in that response are critically important. However, as is shown in this study, the concepts of efficiency and versatility are also represented. Despite the high uncertainty in the telecommunications industry, some planning for expected changes is still part of a valid strategy.
according to the managers in the telecommunications company used in this study.

4.0 Information Systems Flexibility

In this study, we will examine IS flexibility. Studies show that to optimize capabilities such as responsiveness and robustness, all levels of an organization must be involved [17]. For IS, several related components must be present and considered. In this study, these are people, processes, IT, and data [15]. Based on these studies, IS are the “arrangements of people, data, processes, and IT and their interactions needed to complete organizational tasks” [12]. In this study, the people of IS are the managers and team members involved with the design, development, and implementation of the IS. Process represents a set of activities to perform a business task. IT includes the IT infrastructure, business applications, and communications networks in a firm. Data elements contain the information that is processed, used and manipulated by the processing components.

To examine IS flexibility, it is necessary to first identify the characteristics for assessing the flexibility of each dimension of IS – people, process, IT, and data. This is in line with the notion that to understand flexibility in any area it is necessary to operationalize its characteristics in that domain and be able to measure and improve upon these characteristics. Jacome [12] developed a framework featuring the characteristics of each of these components of the IS that are involved with determining its flexibility. These are shown in Figure 1.

Figure 1: Preliminary IS Flexibility Framework

The characteristics of the IS Flexibility Framework attempt to capture a holistic organizational view. Resource-based theory suggests that it is important to consider complex sets of organizational resources in understanding how flexibility may result in competitive advantage. For example, the strategic
value of a characteristic (e.g., modularity) may be linked to the presence of other organizational resources such as flexible structures and cultures. The same principle may be applied to the holistic view of IS flexibility. The value of being flexible in one dimension may be not only due to that particular dimension but to other organizational resources such as the effect of flexibility in the remaining dimensions.

5.0 Case Study

To evaluate this initial framework of IS flexibility, the views of managers in a telecommunications company were sought and analyzed. The company is one of the largest telecommunications companies in this country. This phase of the study was designed and conducted to investigate if the issues suggested by the literature and featured in the IS flexibility framework were actually perceived and utilized by practitioners as flexibility issues. The main objective was to answer questions such as: What do managers perceive as critical for IS flexibility? What factors actually helps? Are there other potential indicators of IS flexibility that have not been considered.

High level executives from the telecommunications company participated to explore potential indicators of IS flexibility within this industry. The managers that were interviewed were three vice-presidents one level below the chief executive officer (CEO), seven executives two levels below the CEO, and six managers three levels below the CEO, for a total of sixteen.

The conditions surrounding the telecommunications industry within the country that this study took place are certainly indicative of a hypercompetitive industry. The industry has recently experienced deregulation that caused the transition from being a fairly stable market to a very dynamic and competitive market in just a few years. As mentioned, technology convergence is redefining the market and the services offered adding to the uncertainty in the marketplace. These factors impose the need for more flexible IS.

6.0 Questionnaire

The study consisted of semi-structured interviews. The interviews were conducted to follow indicators of IS flexibility. For this objective, an interview instrument was prepared to obtain the executives’ view on those indicators. The instrument contained a list of open questions related to flexibility factors in each dimension. The factors used to develop the instrument are shown in the Table 1.

<table>
<thead>
<tr>
<th>Table 1. Factors Used to Develop a Semi-Structured Interview Instrument</th>
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<tr>
<td>Initial factors to assess the characteristics of process flexibility</td>
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<td>Process decoupling</td>
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<td>Monolithic process</td>
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<td>Understanding business process</td>
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<td>Initial factors to assess the characteristics of data flexibility</td>
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<td>Having rules or standards</td>
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<td>Having independent data</td>
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<td>Sharing of data across applications</td>
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<td>Implementing mechanisms that find and access data</td>
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<td>Initial factors to assess the characteristics of people flexibility</td>
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<td>Creating multifunctional teams</td>
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<td>Managers commitment</td>
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<td>Managers abilities</td>
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<td>Policies to encourage peoples’ multiple capabilities</td>
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<td>Informing of business plans</td>
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<td>People with multiple capabilities</td>
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<td>People arranged in few hierarchical levels</td>
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<td>Initial factors to assess the characteristics of IT flexibility</td>
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<tr>
<td>Efficient maintenance</td>
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<td>Simple systems as opposed to big silos</td>
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<td>Possibility to update a systems (program) incrementally</td>
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<tr>
<td>Having rules or standards</td>
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<td>Correct integration of systems</td>
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7.0 Analyzing results

From the interviews the main factors deemed as important for managers related to their professional experience were extracted and arranged in the 4 dimensions proposed. Following is their description and possible interpretation of what managers believe helps them deal with change related problems.
7.1 People Dimension

According to interviews conducted, the factors needed to define an operational construct for IS flexibility in the people dimension are more oriented towards managing the complexity at an organizational level. This complexity has been defined as the complexity of organizational environments surrounding projects. A detailed analysis of what managers believed helped for IS flexibility shows that at the peoples’ level they are trying to deal with a complex environment through managers with several skills, small-independent teams assigned to a single BU and good communication.

The answers in this dimension are heavily skewed toward the need to have a high degree of group interaction and collaboration among the stakeholders in the telecommunications company because of its fast-moving environment. Group interaction and collaboration is a complex process. According to Michelis et al. [15], during collaboration, people coordinate their activities, deal with contingencies, and change their practices through discussion and learning. The problem these activities face is that interaction and collaboration, by their very nature, require a high degree of flexibility and malleability in the systems of human work.

Communication. Managers’ responses revealed a strong link between having excellent communication networks and IS flexibility. According to these managers, excellent communications among stakeholders associated with an IS project is a critical enabler of a high level of collaboration and part of an antidote for the uncertainties of a hypercompetitive industry. The role of excellent communication was stressed over and over again by the managers that were interviewed. Communication was mentioned at different levels and to serve different purposes. Even the IT managers whose role is more oriented towards “implementation” tasks (to provide the IT platforms and software to make commercial ideas or new services viable), found this communication critical for achieving IS flexibility. Communication is also important because as Weill and Ross [18] have noted, enterprises use it as a mechanism to implement governance arrangements.

To timely and accurately provide the IS infrastructure and business solutions for changing strategies and commercial ideas, IS personnel must clearly understand the requirements so they can make implementation decisions. This is accomplished by several means (i.e. a written specification of requirements, meetings and business plans) which usually involve collaboration and communication according to the managers. It must also be considered that the business context of an IS Project frequently changes during the development process in hypercompetitive environments. These business changes result in redefinition of user requirements of the system under development and thus more communication is needed [19].

Skills. Skills and capabilities were also mentioned in interviews as means to accomplish IS flexibility. This is consistent with previous findings that relate flexibility to dynamic capabilities and skills. Dynamic capabilities are defined as a firm’s abilities to integrate, build, and reconfigure internal and external resources, competences and capabilities to address rapidly changing environments [19]. Organizational flexibility is enhanced by these capabilities [17].

Adaptability and understanding, along with communication, are the capabilities mentioned more frequently. This can be understood because such skills enable the control of the organization in a rapidly changing environment. A firm uses these skills so that for each competitive change there is a corresponding managerial capability and firm response.

As a managerial task, flexibility involves the creation or promotion of capabilities for situations of unexpected disturbance. A skill that serves this purpose that was mentioned very often by the managers is the capability to understand. This capability was mentioned as it related to understanding business dynamics, processes, requirements, specifications, and technology. For example, although marketing managers are involved with definition of strategies and new products, skills mentioned are not mainly related to marketing skills, but to the capacity to understand the ever changing business dynamics of their market and thus the ability to define ad-hoc strategies. These are related to so-called dynamic capabilities where the ability to quickly create new capabilities is the real key to sustained competitive advantage in hypercompetitive industries.

Xia and Lee [19] defined the flexibility of a development project team as the ability to effectively and efficiently respond to business and technology changes. One could think that the skills needed for those teams to respond efficiently would be technical. Surprisingly the IS skills mentioned are not related to technical abilities (such as programming skills). They are more related to the management side of IS. This managerial skills orientation can be explained because IS development in hypercompetitive
industries is inherently complex as it must deal with not only technological issues but also to organizational factors that are outside of the direct control of the project team [19].

An example of this is seen in the development of a requirement definition document. It must be defined carefully, completely, and with much detail. Frequently several units are involved in the process. The requirements are also constantly fluctuating because of uncertainties in the environment. Therefore the skills to quickly understand, define, and implement these requirements are critical.

Other skills important for IT managers are those related to understanding the business processes and strategies. Managers’ opinions in interviews also reflect the need to promote the creation of capabilities at different levels, not only on the manager side. This reflects the organizational culture which is recognized to play a role in flexibility. More democratic and more participative forms of decision making in organizations (vs. authoritarian managers) tend not to restrict capability development to a limited number of people.

Manager’s Capabilities. In the interviews managers believed that promoting change, communicating its benefits, motivating and creating a culture oriented to adapt to change are capabilities that promote IS flexibility. Managers’ capabilities and skills are particularly important because IS flexibility is a duality of two separate tasks: a managerial task and an organizational design task. It is related to the degree to which an organization has a variety of managerial capabilities and speed at which they can be activated. Management has to initiate changes that often involve the entire organization.

Teams. At the team’s level, managers mentioned the characteristics of independence and multifunctionality. For IT managers, small independent teams were among the mechanisms mentioned to deal with the problem of rapid changes implementation. The assignment of IT teams to a unique business unit was also deemed as important. This helps the teams to communicate better with the business side of the firm and to intensify the understanding of the business unit’s organizational dynamics. This knowledge of the unit’s dynamics and needs enables them to deal with the implementation complexity and better able to cope with changes within their hypercompetitive industry. Xia and Lee [19] mention managing IS development complexity as critical to IS success. As IS teams are assigned to a single unit, integration of the different projects is easier. The downside of this team arrangement is the integration of projects where several business units are involved.

7.2 Process dimension

Architectural flexibility of processes used to develop and distribute products or services is likely to be more prominent in the 21st century. Also the architecture of these processes is a potential source of increased strategic flexibility for firms facing dynamic market environment. In general, literature around process flexibility has been biased towards its implementation details (tightly integrated, not decomposed and monolithic) and not in the steps prior to implementation (such as complete and correct process definition or defined to be easily implemented). It is precisely at this definition level that interviewed IT managers believe are centered the issues of process flexibility. This raises the question if a more managerial view of process flexibility is suitable.

In the original framework there were no factors related either to process definition or about their specifications for implementation purposes. Nevertheless, these two factors were mentioned as critical for responding to changes on time. Correct definition of the process’ specifications was identified as critical and also a source of flexibility. The development of these specifications is a complex problem (several people involved, they are not always completely or clearly defined by commercial units, not always understood well, etc.). Managers stated that this definition should be clear, easy to implement and well documented. A constant in these interviews is the importance to understand processes and to communicate them. A clear process can be communicated and understood easier. Managers mentioned that too many tasks associated with a simple activity as a constraint to agility.

According to their experience, the processes that are strongly link to the operations or those that involve several business units should be especially flexible. The argument behind this reasoning is that the changes in those processes have more impact on the organization. Other important issues according to the managers that promoted IS flexibility in the process dimension were enforced alignment of processes with enterprise policies, policies to clearly defined shared processes, and the existence of a governance structure. These factors are all closely linked with structural aspects of the enterprise.
7.3 Information Technology Dimension

IT flexibility is part of the organizational core competences that are needed for organizations to survive and prosper in rapidly-changing, competitive, business environments. The issues suggested by the responses indicate that problems surrounding IT flexibility are more related to how technology is managed and not so much around technical or architectural details.

The original IS flexibility framework did not acknowledge that IT flexibility was also concerned with managerial aspects. An example pertains to the decision that IT management must do concerning the IT acquisition versus the IT development choice. In general, commercial software versus in-house development is preferred for flexibility purposes, according to the managers. The reason explained is that commercial software was built to be easily customizable and thus very flexible since conception. The software developed specifically for the industry is the result of the union of expertise in the field as well as in software development. Azani and Khorramshahgol [2] refer to this subject by noting that in-house development increasingly becomes more expensive and less interoperable.

Still, IT managers feel that IS flexibility is reduced if they are constrained by global enterprise IT strategy in purchasing software of their choice or pursuing a particular software solution. This is a management issue that relates to independence. However, research has shown in the long run that such policy could increase flexibility when an entire organization is considered.

Another managerial issue mentioned by the managers relates to IT planning; it must be done by involving all the right people and completed on time. This planning can sometimes be anticipated, for example, when legislation changes are likely to occur. Having the right people allows for different points of view to be heard and taken into consideration when the IT planning, and subsequently, the IS applications are implemented. Scanning the organization and the environment for knowledge about future developments also enhances IS flexibility since different options can be embedded into the software.

The topic of interface management was also discussed by the managers. Such issues as the design and definition of correct interfaces and problems surrounding systems badly integrated where a small change means recompiling many functions were given as examples. The awareness for the need of interface management has become more evident as systems become larger and more complex and as family of systems, inter-organizational systems and intra-organizational systems become the rule rather than the exception.

7.4 Data Dimension

For Duncan [8], key data and core data-processing applications are part of the IT foundation to enable present and future business applications. She relates infrastructure flexibility to the degree its resources are sharable and reusable. Information gathered from interviews show that for managers, the main data issues for IS flexibility are data integration, data definition and data availability. In the interviews, these factors are indirectly related to the sharable property. For example, conjoined definition of data (in the sense of data needed and its format) and establishing naming conventions enable managers to act swiftly as they share a common vocabulary and have the data all business units need. Also, they view as important being able to access data in a timely manner to take fast decisions. The managers consider standards with external entities (such as other operators) very important due to the fact of the high level of interaction the industry requires (e.g., to be able to share data from networks of different providers in order to calculate costs and other metrics). On the other hand, they do not consider as important to have to enforce standards at the development level in their own IS unit. This can partly be explained by the team arrangement they have (independent teams in charge of a single business unit) and by the high use of external providers to implement applications.

8.0 Conclusion

IS flexibility enables organizations to maintain control and respond to constant changes in hypercompetitive, fast-changing environments. However, a precise definition of IS flexibility has been somewhat elusive. This paper is a beginning at looking more clearly at IS flexibility and its possible dimensions. In this paper IS flexibility is proposed in four dimensions to reflect a holistic organizational perspective: People, Process, IT and Data. The People dimension relates to the capacities and human-factors that enable the flexibility of the adoption and implementation of IS in an organization. The Process dimension includes the characteristics and architecture of processes enabled by IS in an organization. The IT dimension comprises technology components, standards, and management practices that directly determines the composition of IS in an organization. Finally, Data dimension is the capacity to manage and distribute
data throughout the organization in response to fast-paced changes.

An initial framework was purposed. IS managers in a telecommunications company that compete in a hypercompetitive industry were interviewed to confirm or refute the characteristics of the dimensions purposed in this initial framework using semi-structured questions. The results from the interviews added additional characteristics to the ones already identified in the initial framework. These additional characteristics are given in Figure 2. From interview analysis and the previous literature findings, it becomes clear that a 1) complex set of characteristics is needed to measure flexibility at each dimension; 2) the flexibility of a dimension has an effect on the flexibility in the remaining dimensions. This means that the problem is not only concerned with defining the adequate items for the flexibility construct of each dimension (people, IT, process and data), one must also consider the dynamics among them and how they influence one another. The attribute or property of being flexible does not depend only on the flexibility of a single dimension (people, process, IT and data) but to a flexibility mix of all dimensions. This ad-hoc combination should likely take into consideration several factors such as the type of organization and the industry environment. Flexibility decisions (as well as assessments or evaluations) should most likely be done considering the specific market-type and organization context. It also becomes evident that understanding how organizational resources should be arranged for flexibility purposes and what their contribution is to flexibility is a complex process. Although this work constitutes an advance in defining an IS flexibility construct, there is still a need to accurately refine it and thus formulate more accurate IS flexibility propositions.
References


