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Different configurations of flexibility for I/S strategic alignment

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ABSTRACT

An information system (I/S) is generally considered flexible when it can be modified easily to align with changing requirements of the business. Flexibility is crucial to survive in a hypercompetitive environment. Considering a comprehensive conceptual framework of I/S flexibility enablers, a research question was addressed: Are all the enablers in the framework always essential for achieving I/S flexibility? Research results on enterprise flexibility and manufacturing flexibility indicate that different types of flexibility should be considered according to the category of strategic uncertainty to be faced. Based on previous work, four forms of I/S flexibility have been identified: operation, adaptation, extension and transformation. An exploratory analysis was conducted on two case studies of flexible I/S that are closely linked to strategic decisions in a fast-changing environment. The adaptation and extension flexibility forms have emerged as different configurations of necessary enablers.

KEYWORDS

Flexibility, strategic alignment, information system, flexibility enablers, configuration of flexibility.

INTRODUCTION

An information system (I/S) is generally considered flexible when it can be modified easily to adapt to the changing requirements of the business. Flexibility is crucial to survive in a hypercompetitive environment. Previous research has mainly focused on the characteristics of flexible information technology (I/T) without taking into account business. Those two domains are indeed articulated but separated in the Henderson and Venkatraman seminal model of strategic alignment (1999). However, for the last three decades, several authors in the I/S field have studied the interconnection between organization and technology. Mumford pioneered a socio-technical approach in I/S design (2006). Alter has given a vision of an I/S as a work system (2002), including technology, people, information and work practices. Change management theory has long stressed the importance of the organizational and human dimension necessary for achieving I/S success (Kettinger&Grover, 1995). Given the importance of technology and organization interconnection, when dealing with I/S flexibility, one should consider not only the I/T artifact dimension, but also the business, human and organizational dimensions, which can facilitate or hinder the ability to adapt. Consequently, we have proposed a comprehensive framework of I/S properties that act as enablers of flexibility, which takes into account not only technology, but also people, information and processes for both I/T and business point of view.

This study addresses the research question: Are all the enablers of our framework necessary for achieving I/S flexibility? Previous research seemingly assumes that all the flexibility enablers contribute in the same way. However, flexibility has been investigated in other fields — enterprise flexibility, manufacturing flexibility — and some researchers have suggested considering polymorphism, i.e. flexibility can take different forms according to the types of uncertainty which are to be faced. In I/S literature, flexibility has been defined in various terms depending on the author, possibly because their vision of flexibility differs. We thus made the assumption that different types of flexibility should be considered. Using Akrich's work (1987, 1992, 1998) on the evolution of technical objects through usage, we have identified four types of I/S flexibility according to the required change scope, namely: operation, adaptation, extension and transformation. An exploratory analysis was conducted on two case studies of flexible I/S, in order to bring evidence of I/S flexibility polymorphism. For each case, we have determined which factors of our framework can provide adaptation flexibility and extension flexibility. Two different configurations have emerged, which should be taken into account in I/S strategic decisions. Also, our analysis pointed out that I/S flexibility is to be found in two categories of enablers: structural enablers (static characteristics from its design) and human enablers (dynamic adaptation).

In the first section we describe the comprehensive framework of flexibility enablers, built from previous research on I/S and I/T flexibility. In the second section, we develop a typology of I/S flexibility. In the third section, we develop an in-depth study of I/S flexibility that was conducted on two case studies, with a focus on two special types of flexibility, which are particularly important for strategic alignment. Last we describe the enablers' configurations for adaptation and extension flexibility.

I/S FLEXIBILITY ENABLERS

From I/T flexibility to I/S flexibility

From the 1990s, I/S adaptation to strategic movements and to technological innovations became critical for the companies. Most studies on I/S flexibility focused on I/T architecture (Duncan, 1995; Byrd&Turner, 2000). I/T architecture flexibility is generally described along five dimensions: platforms compatibility; network connectivity; applications modularity; data independence and I/T personnel competencies. To extend this resource-based view to I/S flexibility, we have relied on I/S definitions as a socio-technical system (Alter, 1999; Reix, 2000; Reix&Rowe, 2002). I/S may be considered as a system that uses information technology to capture, transmit, store, retrieve, manipulate or display information used in one or more business processes. It includes technology, processes, data, as well as I/T and business people. Concerning technology, we can identify two levels: the first level is related to resources which are shared by several applications (platform, network) and the second level is specific to a particular I/S (application, databases, processes...). This research will focus on the second level, because while using a common architecture, some I/S are more flexible than others.

A framework of I/S flexibility enablers

From our broad view of an I/S, I/S flexibility is to be examined from both the I/T and Business described in Henderson&Venkatraman model (1999), but only in the internal part of the model (Figure 1): Business Infrastructure and Processes, and I/T Infrastructure and Processes.

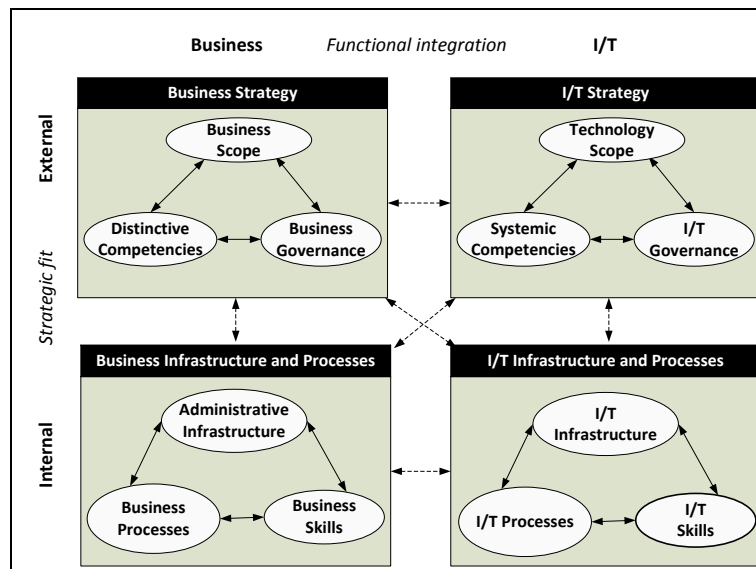


Figure 1: Strategic Alignment Model

Flexibility of each resource is not enough to achieve I/S flexibility. Business and I/T people must be able to take advantage of the flexibility of the resources. At the enterprise level, Sanchez and Heene (1997) call 'coordination flexibility' the managers' ability to modify the use of resources when facing strategic evolutions. This implies "redirecting, reconfiguring, and redeploying the resources available to the organization" (:39).

In the I/S field, as previously defined, business and I/T managers are both involved in the use of resources which are part of an I/S (people, data, processes, application, network...). Thus their ability to cooperate when the I/S has to be modified is of major importance. Indeed, the joint involvement of I/T and business people has long been recognized as a key success factor for both specific applications and ERP projects. This is also the case for further evolution of the I/S. In most cases, business and I/T managers have to collaborate for better efficiency and reactivity, when modifications in the use of resources are

required. At a lower level of granularity (for example, a process), collaboration between different stakeholders plays a positive role in modifying the use of local resources in response to business needs. Thus, we have considered that coordination flexibility at the firm's level corresponds, at the I/S level, to the abilities of key actors to collaborate for adapting the I/S. Collaboration dimension refers to the ability of human resources to work together in order to carry out an evolution in the I/S.

Each of the three dimensions of I/S flexibility — I/T, Business, Collaboration — includes several flexibility enablers. Table 1 lists the characteristics of each enabler that has been recognized as flexibility determinant (Jacome, 2009).

Dimension	Flexibility enablers	Flexibility characteristics
I/T	I/T Processes	Formalization
	I/T people skills	Business knowledge Multiskill
	Databases	Independence from application Location free access Scalability
	Application	Functional modularity Parameterization
	I/T configuration	Technical modularity Interfaces standardization
Business	Business processes	Documentation Standardization Decoupling
	Data	Business standardization
	Business people skills	Multiskill I/T facilitator
Collaboration	Relationships between business and I/T	Good communication
	Adaptive behavior	Ability to make adjustments to the defined processes

Table 1: Framework of I/S flexibility enablers

Since trying to have all flexibility enablers can be expensive, we have addressed the research question: Must all the comprehensive framework's properties of an I/S always be present for achieving I/S flexibility? In order to answer the question, the first step was to explore if there were various types of I/S flexibility (that could use different I/S properties configurations).

A TYPOLOGY OF I/S FLEXIBILITY FOR STRATEGIC ALIGNMENT

Flexibility as a polymorphic concept

In other fields, several authors have considered multiple types of flexibility. According to Evans (1991), enterprise flexibility is a polymorphic concept, i.e. it takes different forms according to the strategic attitude (offensive or defensive) of the firm. Reix (1997) makes a distinction between operational flexibility (short term) and strategic flexibility (long term consequences). Volberda (1997) considers three types of flexibility: operational, structural and strategic. Operational flexibility is based on routines (planned actions) that allow fast answers to foreseeable changes. Structural flexibility is the ability to quickly decide and implement organizational changes, that can be internal (roles, work structure) or external (new partners). Strategic flexibility is the ability to modify the firm activities in response to major breaks in the environment.

In manufacturing management, different types of flexibility fit different categories of uncertainty: market, product, capacity, delivery constraints (Gerwin, 1993). Identifying various types of flexibility makes it possible to introduce relevant improvements at the appropriate level (Slack, 1989; Georgoulas, 2009).

Polymorphism in the I/S flexibility research

A few of the studies conducted at the I/S level have considered different types of flexibility. Concerning I/T architecture, Hanseth et al. (1996) have made a distinction between flexibility *in the pattern of use* (short term) and *flexibility for further changes* (structural changes). Following this distinction, (Gebauer&Schober, 2006) have identified three types of I/S

flexibility: based on a mathematical model, they suggest an optimal cost-efficiency combination of strategies according to the degree of uncertainty and variability of the core business process. *Flexibility-to-use* means providing a large range of requirements in the initial implementation. *Flexibility-to-change* means designing a system that can be easily changed, upgraded, and expanded after its initial implementation. *Manual* flexibility means the possibility of performing part of the process outside the software application scope (manual operations). Although focusing only on a business process, this research underlines that inadequate flexibility can be unnecessarily expensive.

Evolution of technical objects

To establish a typology of I/S flexibility, we have used a theory of evolution of technical objects through usage (Akrich, 1987, and 1992). In this view, users play an innovator role. Four levels of innovation have been identified (Akrich, 1998). *Displacement* means a new usage, without any modification of the product. *Adaptation* means a small modification of the product, without changing its core function. *Extension* means adding new functions. *Diversification* means using the object for a task that is completely different from the intended task.

The reasoning to use Akrich's theory for I/S evolution is as follows: by considering an I/S a socio-technical system (using information technology to capture, transmit, store, retrieve, manipulate or display information used in one or more business processes) an important part is the technical aspect. As a technical object, an I/S is based on an initial design with definite objectives. The system is modified while in use. The change requests come from a business area (users or managers), and not from the I/T unit. Those requests will enlarge, modify or extend the scope of the original I/S.

A typology of I/S flexibility

According to the level of evolution, we identified four types of flexibility.

Operation flexibility is the ability to provide an easy use of all functionalities in a large variety of situations. It does not imply any structural modification to the system.

Adaptation flexibility is the ability to deal with new usage of the system, after slight modifications. Restricted to software, this type of flexibility is generally based on parameterization, which is easy to use without in-depth knowledge of the software.

Extension flexibility is the ability to introduce new functionalities, new types of data, modifications of processes, that were not considered in the initial design. This type of flexibility requires a good knowledge of the system. Modular design is often associated with this type of flexibility. Some types of complex parameterization, which requires in-depth knowledge on the software architecture and design.

Transformation flexibility is the ability to being transposed in different environments. It requires important modifications. The case of the failure of the French railway company (SNCF)'s Socrate system (Eglizeau et al., 1996) was an example of such a transformation from an initial air company system.

Adaptation and extension flexibility are both crucial for strategic alignment, because usually strategic business changes require more than day-to-day variations (as in operation flexibility). Transformation flexibility is a major strategic concern for software package editors, mainly with a focus on the I/T dimension: how to design a software that can adapt to various requirements and contexts. It is also an important issue when an I/S is to be transposed in another setting, as in case of firms merging or acquisition, or when a software is to be implemented in a subsidiary. However, this problem is usually taken into account as a change management issue. Flexibility requirements (operation, adaptation, extension) should be part of the implementation requirements.

Once establishing the need to explore adaptation and extension flexibility, the next step was to determine whether both types of flexibility correspond to a specific configuration of enablers and characteristics, this was done through an empirical study.

Our research approach has been represented on Figure 2. First, we started with a definition of an I/S as a socio-technical system. This means that exploring flexibility will take into account both organization and technology. Then, we asked: How can an I/S stay aligned when business requirements linked to business strategy are changing? The general answer is, by definition, that the I/S should be flexible. So, the question becomes: how to achieve flexibility? Our approach has been to consider two aspects. On the one hand, previous research indicates that some characteristics of an I/S, which can be structured according to dimensions and enablers, can allow flexibility: this has led to a comprehensive framework. On the other hand, we have suggested that flexibility should be approached using polymorphism, i.e. considering different types of

flexibility. We have proposed to distinguish four types. Now, the question is: for each type of flexibility, are all the enablers' characteristics necessary, or is it possible to identify different configurations of flexibility enablers according to the type? To answer this question, it is necessary to conduct an in-depth field study and find out which are the key flexibility enablers for a particular type of flexibility requirement.

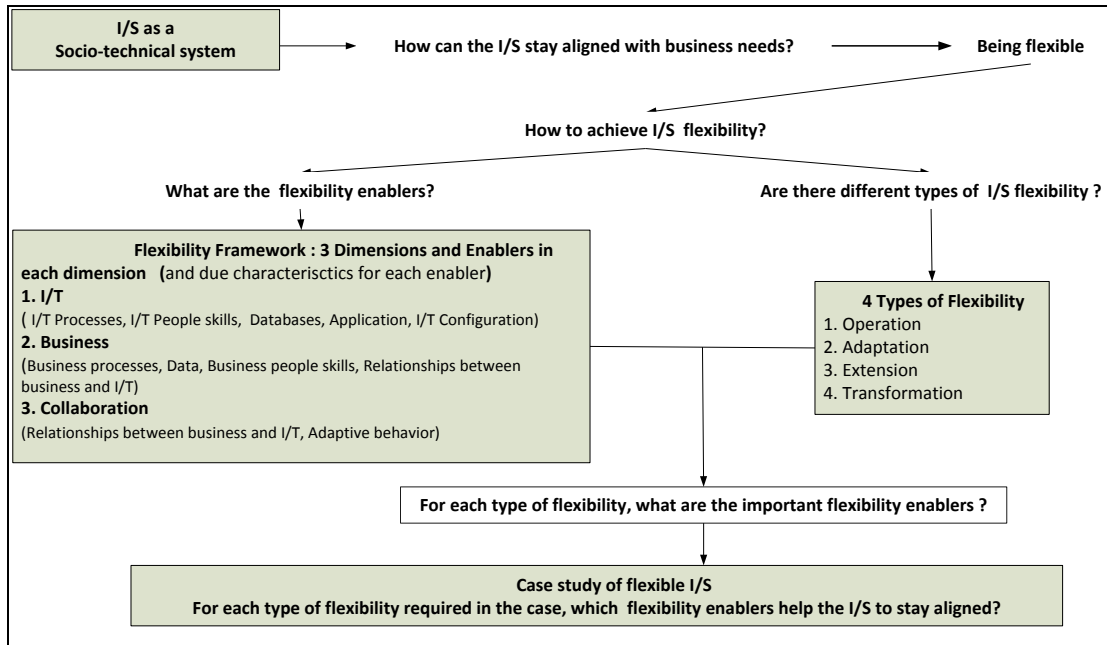


Figure 2: Research approach

EMPIRICAL ANALYSIS OF I/S ADAPTATION FLEXIBILITY AND EXTENSION FLEXIBILITY

Research methodology

The empirical part of our research is conducted through two case studies, of I/S in a telecommunication operator facing strategic decisions on technological convergence. Both I/S cases were considered as flexible by the company, and both were faced with frequent and rapid changes to implement changing strategies. These I/S covered several organizational units. The first case study is a Business Intelligence system supporting marketing decisions. The second one is a Roaming system, i.e. a system allowing customers to use their mobile telephone in all the foreign countries where the company had signed a partnership agreement.

We have gone through these cases with the following questions. Why is there a need for adaptation flexibility or extension flexibility? Which characteristics are providing each type of flexibility? Considering both cases, does each type of flexibility correspond to a distinct configuration of flexibility characteristics?

Business Intelligence I/S Case

The I/S is based on a data warehouse (DWH) which stores information on relevant data throughout the company (customers, contract subscriptions and cancellations, usage, call details, and others). Several business units frequently require various analysis reports to support business decisions and marketing strategies. The interactions between the components of this I/S are represented on Figure 3. In this figure, those components which play a major part in flexibility concern have been grayed. On the I/T dimension, we find the Data Warehouse Application, as well as the interfaces with files from the operating applications used to extract data. And we also have the Data Warehouse team, with people and processes. On the Business dimension, we have the Business Intelligence Unit, with people and processes. Both Data Warehouse team and Business Intelligence Unit play a part on the Collaboration dimension.

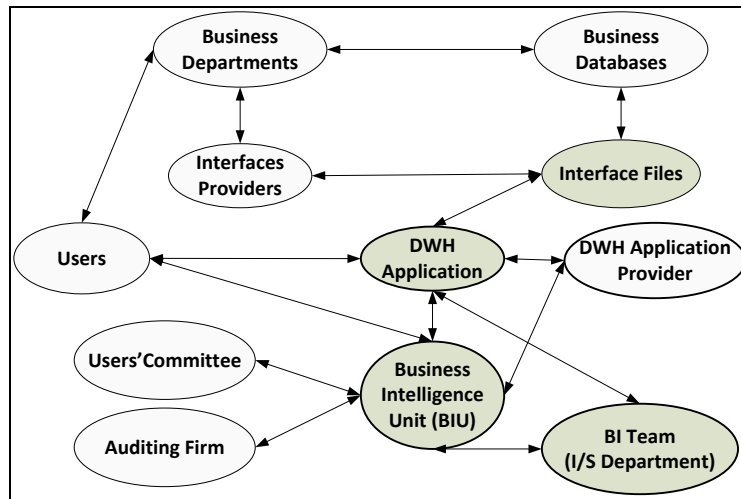


Figure 3: Interactions between the components of the Business Intelligence I/S

Adaptation flexibility for Business Intelligence case

Adaptation flexibility is required to rapidly answer managers' requests for new complex reports, especially those requiring other database access. The following characteristics have been found necessary to achieve this type of flexibility.

I/T team are reactive, because *I/T processes* are well defined but not rigid. Members can introduce a certain degree of *adaptation* to specific requests. They have a good *knowledge* on business data implementation and on extraction rules. Moreover, reports parameters can be easily customized in the *application*. Lastly, *connectivity* between source databases, additional databases and the data warehouse is high. Members of the I/T team can be assigned to other projects, but they make the business intelligence (BI) activity a priority. Thus, on the one hand they develop multi-skills and *adaptability*; on the other hand, they are highly *available* and they promptly react to BIU's demands.

Business processes are well documented, but they are defined only in broad lines. This allows BIU team to adapt to the variety of users' requests. *Data* have been standardized by Business Intelligence Unit (BIU). Each entity and its attributes have been defined, and the extraction rules have been written. This improves BIU reactivity, and members have also a good *knowledge* on entity relationships. BIU members are totally dedicated to users' requests.

Extension flexibility for Business Intelligence case

Extension flexibility is the ability to take into account changes in the business rules or in source databases. This implies modifying extraction interfaces or adding information in the data warehouse. The following characteristics have proved to be helping these tasks.

The initial I/T providers keep control on the DWH application and the interfaces. Due to their *skills* the modifications are carried out rapidly. *Data* characteristics also contribute to extension flexibility. The structure used as an interface to extract information from source databases is standardized. DWH database has been provided with storage overcapacity, so that there is no limitation to the growth of customers' data. The *application* has been designed with technical modularity, so that components can be added or removed easily. Functional modularity allows the application can be easily changed to suit several national contexts, as the BIU covers different Latin-American countries. Particular application parameterization can also be used by I/T provider to carry out certain of such adaptations. For example, when a change occurs in an interface file, extraction rules are to be modified. Lastly, the individual in charge of the BIU has both business and technical expertise. She acts as an *interpreter* between business and I/S Departments to find suitable solutions in case of a complex change request. Communications with the Users' Committee and the auditing firm are also facilitated, due to her I/T skill.

The enablers' characteristics which have a positive effect on both types of flexibility are listed in Table 2.

The BI I/S has been implemented to serve the information needs of the firm. These requirements change quite frequently due to fast-moving environment. If change requests have a limited scope (adaptation flexibility), business and I/T teams play a

major role in achieving rapid outcomes. They share a common set of knowledge; they are willing to cooperate; they are not rigid in performing the processes and adapt quickly to special demands.

If modifications are more significant (extension flexibility), mainly when they affect the data structure, technical design (standardization, modularity) is a key factor. Dual skills (that is I/T and business skills in the same person) also play a critical role in ensuring a good cooperation between I/T and business stakeholders.

According to a previous research, users' knowledge is necessary to benefit from DWH application flexibility (Goetze&Haley, 2007). From our case study, I/T and dual skills are of major importance for achieving I/S flexibility with a broader scope.

Dimension	Flexibility enablers	Adaptation	Extension
I/T	I/T Processes	<i>Well-defined</i>	
	I/T people skills	<i>Good knowledge on business data and rules Adaptability</i>	<i>Good control of the application and the interfaces</i>
	Databases		<i>Interfaces standardization Storage overcapacity</i>
	Application	<i>High degree of reports parameterization</i>	<i>Extraction rules parameterization Technical modularity Functional modularity</i>
	I/T configuration	<i>Connectivity</i>	
Business	Business processes	<i>Well documented</i>	
	Data	<i>Standardization</i>	
	Business people skills	<i>Good knowledge of DWH application</i>	
Collaboration	Relationships between business and I/T	<i>High availability of business people High availability of I/T people</i>	<i>Business – I/T interpreter role</i>
	Adaptive behavior	<i>Adjustments in performing business and I/T processes</i>	

Table 2: Flexibility characteristics for the Business Intelligence I/S

Roaming system I/S case

The Roaming domain is submitted to international standards developed by a mobile operators association (GSMA). The standards address the terms of agreements and the format for electronic exchanges. Roaming I/S scope includes managing partners' agreements and processing the flows of information that are necessary for accounting and invoicing. The interactions between the components of this I/S are represented on Figure 4. Those which play a major part in flexibility achievement have been grayed.

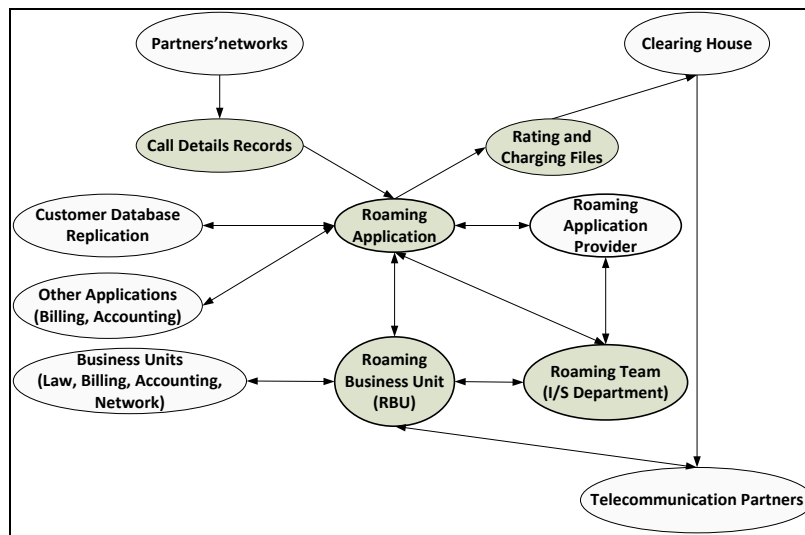


Figure 4: Interactions between the components of the Roaming I/S

The high level of standardization reduces the need for flexibility since all the partners involved are subjected to the same rules. However, change requests are frequent. They can be linked to changes coming from GSMA or to strategic decisions: agreements with new partners, changes in the existing agreements (new roaming services, ratings changes, etc.).

Adaptation flexibility for Roaming case

Adaptation flexibility is required to easily take into account new agreements or contract modifications (rating changes). The following characteristics proved to be helpful in the Roaming I/S case.

The definition of all I/T *processes* (for development and maintenance) are supervised by a Project Management Office. They are well defined, but include many time-consuming control activities. However, the Roaming team could freely skip some activities which proved to be unnecessary in certain cases. So, the roaming I/T processes have been alleviated, but they are well defined and well-documented, which is necessary for a good cooperation with the Roaming Business Unit (RBU). They are strictly followed, to prevent mistakes in setting parameters values. Such an effective rigor is an important enabler for flexibility, because it ensures that any modification in parameterization will be successfully taken into account. Mistakes are a major risk in contract modification, with high business consequences. Besides, I/T modification processes are well-known, and they do not slow down changes.

As I/T team *skills* include good knowledge of the business, they quickly grasp the change requests, and they rapidly identify the best implementation. In addition, the *application* parameterization facilitates the agreements modifications. Lastly, the high degree of *connectivity* between the Roaming application and other systems, internal and external (clearing house) has a positive effect on developers reactivity.

As the operator's roaming activity has been ISO9000 certified, business *processes* have been formally documented. Documentation helps RBU and other departments (accounting and invoicing) to quickly understand the impact of a modification. In addition, due to their broad *knowledge* (legal, technical, financial, commercial) RBU managers can often work independently from other departments on agreements changes. *Data* standardization is a flexibility enabler, for all the input data from other internal applications conform to this format.

Lastly, RBU members have a good knowledge on parameter setting so they can formulate precise requests to the I/T team, which speeds up the process. Roaming I/T team availability, as well as the RBU members, is also very high.

Extension flexibility for Roaming case

Extension flexibility is necessary to rapidly take into account new roaming services. The following characteristics enable the I/S to provide appropriate flexibility.

The I/T Roaming team include developers from the application provider. Thus, software changes can be carried out within a short period of time. In addition, the *application* functional modularity facilitates a fast implementation of additional modules. This is crucial to support strategic extension of roaming services to additional technologies (e.g. CAMEL, GPRS, UMTS or HSDPA). Moreover, due to technical modularity, components can easily be added or removed. This is important either to establish a connection to a new partner's network, or to insert new components in order to provide new services (i.e. Internet access).

Extension flexibility benefits from effective *relations* between business and I/S departments. This is mainly due to the hybrid business and I/T *skills* of the RBU manager. This facilitates the cooperation with the I/T team, especially when the impact of change requests on the application are to be quickly assessed.

The enablers' characteristics which have a positive effect on both types of flexibility are listed in Table 3.

The Roaming I/S is a core strategic system for the firm. Rapid implementation of change requests following strategic movements is crucial. International standardization of roaming systems limits the variations. Standards (rules, data format) are implemented in the software application. However, contractual agreements between partners, changes in standards or new service offerings must be quickly and correctly taken into account. Adaptation flexibility mainly requires cross knowledge in I/T and business teams, as well as high parameterization. Extension flexibility requires modular design and manager's dual skills.

Dimension	Flexibility enablers	Adaptation	Extension
I/T	I/T Processes	<i>Well-defined and well-documented</i>	
	I/T people skills	<i>Business knowledge</i>	<i>Good knowledge on the application</i>
	Databases		
	Application	<i>Parameterization</i>	<i>Technical modularity Functional modularity</i>
	I/T configuration	<i>Connectivity</i>	
Business	Business processes	<i>Formal definition</i>	
	Data	<i>Standardization</i>	
	Business people skills	<i>Broad business knowledge</i>	
Collaboration	Relationships between business and I/T	<i>Business team availability Business team knowledge on parameters setting I/T team availability</i>	<i>Dual business and I/T skills</i>
	Adaptive behavior		

Table 3: Flexibility characteristics for the Roaming I/S

FLEXIBILITY CONFIGURATION ACCORDING TO THE TYPE OF FLEXIBILITY

The previous two cases differ according to the role they play in the firm strategy. The Business Intelligence I/S informs strategic decisions with analysis reports. The Roaming I/S must quickly adapt to strategic positioning on a very competitive and fast-moving market. Despite the differences between the cases, strong similarities in the characteristics providing either adaptation flexibility or extension flexibility are noted.

Adaptation flexibility

Adaptation flexibility is the ability to introduce slight modifications in the I/S, allowing new uses, within a short period of time and without considerable cost. Examples of such modifications are working out a complex report or taking into account the agreement with a new partner.

Table 4 lists enablers’ characteristics contributing to I/S adaption flexibility in both cases.

Dimension	Flexibility enablers	Case 1 : Business Intelligence I/S	Case 2 : Roaming I/S
I/T	I/T Processes	<i>Well-defined</i>	<i>Well-defined and well-documented</i>
	I/T people skills	<i>Good knowledge on business data and rules Adaptability</i>	<i>Business knowledge</i>
	Databases		
	Application	<i>High degree of reports parameterization</i>	<i>Parameterization</i>
	I/T configuration	<i>Connectivity</i>	<i>Connectivity</i>
Business	Business processes	<i>Well documented</i>	<i>Formal definition</i>
	Data	<i>Standardization</i>	<i>Standardization</i>
	Business people skills	<i>Good knowledge of DWH application</i>	<i>Broad business knowledge</i>
Collaboration	Relationships between business and I/T	<i>High availability of business people High availability of I/T people</i>	<i>Business team availability Business team knowledge on parameters setting I/T team availability</i>
	Adaptive behavior	<i>Adjustments in performing business and I/T processes</i>	

Table 4: Adaptation flexibility characteristics

We can first notice the overwhelming role of human enablers. Of course, connectivity (people, servers, databases) is important, and the application should have a high degree of parameterization. However it would be useless if I/T and business teams did not know, each at one’s own level, how to use it best. Moreover, they have to share a common knowledge on business data and rules in order to avoid misunderstandings. As time is a key issue, people should be highly available.

Time overconsumption is avoided because processes are well-defined, and everyone knows how to proceed. If necessary, some small adjustments can be made, as far as no rules are broken. Lastly, business agreements on data standardization clearly facilitate communication and reduce the impact of changes.

Extension flexibility

Extension flexibility is the ability to introduce structural changes in the I/S, without disrupting the system and within a period of time which is aligned to the firm’s strategic plan. Examples of change requests that require extension flexibility are modifying a source database structure, or offering an additional service based on a new technology.

Table 5 shows the factors contributing to I/S extension flexibility in both cases.

Dimension	Flexibility enablers	Case 1 : Business Intelligence I/S	Case 2 : Roaming I/S
I/T	I/T Processes		
	I/T People skills	<i>Good control of the application and the interfaces</i>	<i>Good knowledge of the application</i>
	Databases	<i>Interfaces standardization Storage overcapacity</i>	
	Application	<i>Extraction rules parameterization Technical modularity Functional modularity</i>	<i>Technical modularity Functional modularity</i>
	I/T Configuration		
Business	Business processes		
	Data		
	Business people skills		
Collaboration	Relationships between business and I/T	<i>Business – I/T interpreter role</i>	<i>Dual business and I/T skills</i>
	Adaptive behavior		

Table 5: Extension flexibility characteristics

It is apparent that I/T enablers play a key role in achieving extension flexibility. The application has to be designed for easy evolution, using classical techniques (modularity, parameterization). I/T people must have adequate expertise to introduce structural modification. Databases should be decoupled from applications, using standard interfaces. This prevents impacts due to changes in external systems. Storage capacity is also to be considered if the amount of data is rapidly expanding. The importance of technology in extension flexibility requires an interpreter role. That is a person with high level capability, who is able to understand all the implications of business requirements, and also who has a broad view of technical possibilities and constraints.

CONCLUSION: LIMITS AND CONTRIBUTIONS

This research formulated a comprehensive conceptual framework of enablers of I/S flexibility to then explore two proposed forms of flexibility highly linked to strategic alignment: adaptation and extension flexibility. Adaptation and extension flexibility have emerged with different configurations of necessary enablers from the conceptual framework.

The present research is focused on two case studies of I/S within the same firm in a fast changing industry. Both cases are subject to the need of flexibility; these systems include a software package and external providers’ services. However, they are very different I/S, particularly with regard to strategic alignment. One provides support in strategic decision making; the other participates in strategic decisions implementation. Despite their different strategic role, similarities have emerged when considering two types of flexibility. Adaptation flexibility is mainly based on business enablers, and extension flexibility on I/T structural enablers. For both, human resources play a specific role. To achieve adaptation flexibility, business and I/T team must be able to react quickly, using a good knowledge of the I/S, and also to work in synergy. For extension flexibility, a double skill person, highly positioned, with a good knowledge of the business domain and of the software package, has proved to be of major importance.

This research may be used by researchers as well as practitioners. Our framework of flexibility enablers, as well as our typology of I/S flexibility can serve to conduct additional in-depth empirical studies on I/S flexibility. The types of flexibility could be associated with categories of strategic decisions. Flexibility configurations could be explored in other sectors, where firms are also facing strategic movements, for example supply-chain information systems. In further research, we will extend our exploratory analysis to additional case studies, in different settings. The objective will be to provide further evidence for the benefits of taking into account different forms of flexibility and their associated enablers.

From a managers' point of view, our results may help in formulating flexibility requirements in I/S implementation or evolution. More efficient flexibility with lower cost could thus be achieved when the required form of I/S flexibility is identified, and the associated enablers have the due characteristics.

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