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STRATEGIC BUSINESS AND IT ALIGNMENT: REPRESENTATION AND EVALUATION

KARIM DOUMI, SALAH BAÏNA AND KARIM BAÏNA

Al-Qualsadi Research & Development Team, National Higher School for Computer Science and System analysis (ENSIAS), Mohammed Vth University-Souissi
Rabat, Mohammed Ben Abdallah Regragui avenue, Madinat Al Irfane, BP 713, Agdal,Morocco

E-mail : kdoumi@fsjesr.ac.ma, sbaina@ensias.ma, baina@ensias.ma

ABSTRACT

Nowadays, business IT alignment has become a priority in most large organization. It is a question of aligning the information system on the business strategies of the organization. This step is aimed at increasing the practical value of the information system and makes it a strategic asset for the organization. Many works showed the importance of documentation, the analysis and the evaluation of business IT alignment, but few proposed solutions applicable to the strategic and functional level. This paper aims has to fill this gap by proposing a simple approach for modeling and evaluate enterprise strategy in the context of strategic alignment. This approach is illustrated by case study of a real project in a Moroccan public administration.

Keywords: *Business IT Alignment, Goals Modeling, Enterprise Architecture, Information System, Evaluation, Metric.*

1. INTRODUCTION

Applications of ANN to power systems are a growing area of interest. Considerable efforts have been placed on the applications of ANNs to power systems. Several interesting applications of ANNs to power system problems [1]-[5], indicate that ANNs have great potential in power system on-line and off-line applications. The feature of an ANN is its capability to solve a complicated problem very efficiently because the knowledge about the problem is distributed in the neurons and the connection weights of links between neurons, and information are processed in parallel.

Today, it is not enough to build powerful information systems, In order for the enterprise to be performing and be able to compete and evolve, its information systems and business processes must be permanently aligned and in perfect coherence with its strategy.

Many authors have shown the importance of alignment in the evolution of the enterprise [1-3] and according to [4-7], this alignment has a great influence on the performance of the organization and any rupture in the process of alignment causes a fall of the organization's performance.

If the interest of alignment is greatly recognized, its implementation remains very limited. According to [1-7], few leaders consider that the strategy and the information systems are aligned. Thus, this implies that actors of the organization are not able to distinguish between alignment and misalignment. Also, the absence of methods of evaluation of alignment makes the task extremely difficult at the decisional level.

According to [8], a step of engineering is necessary to analyze the strategic alignment of the information system. This vision is also supported by the approaches of enterprise architecture [9] as well as the leaders of information system [10].

In the literature, several approaches are concerned in the issue of strategic alignment of information system such as [11-12], [14-16]. Several possible reasons for this interest:

- Interruption of alignment leads to lower performance of the organization [17].

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-The current state of research on alignment does not determine, at a given time, whether the objectives of the strategy and information system are aligned.

-Many projects encounter difficulties at the implementation, because the system does not meet the expectation of the strategic level [18].

- Over 90% of information system direction believes that "realign the information system is a major challenge" [19].
- There is a fairly large difference between strategy and the IS, several researchers have also confirmed that research in the field alignment is insufficient [20]. At the industry, it is seldom that we find leaders who see the strategy and information systems are aligned to their business, confirmed by reports of IBM and CIGREF 2004.

This paper aims have to fill these gaps by proposing an approach for modeling and evaluate enterprise strategy in the context of strategic alignment. An approach to (1) represent and (2) evaluate the business IT alignment.

The paper is organized as follows: Section 2 presents a state of the art works on our issue: modeling and evaluation of business IT alignment. Sections 3 and 4 present our approach. Sections 5 and 6 present the application of our approach by case study of a real project in a Moroccan public administration. Finally, Section 7 presents primary conclusions of the work presented in this paper and gives short term perspectives for ongoing research work.

2. RELATED WORKS

In section 2.1 we present the studies on modeling and representation of business IT alignment. Similarly in section 2.2 we present studies on the evaluation of business II alignment.

2.1 Modeling Of Business IT Alignment

One of the most recurrent problems lately is the lack of strategy in strategic alignment [20], and even when it is taken into account, it remains ambiguous and very difficult to adapt. Indeed in the industry can find a set of techniques dedicated to the strategy. Each has its own concepts, methods and tools (eg, BCG matrix, the method MACTOR, SWOT analysis, the McKinsey 7S, internal value chains ... etc). These techniques are often used to plan and coordinate the business decision process with the Business Strategy. They are often used by business leaders and strategy consulting firms. They are thus based on measurements and performance values, but these approaches are rarely used in a process of alignment with the operational level.

At most research approaches alignment does not always specify explicitly which elements of the business that are involved in strategic alignment. For example, Bleistein [11] in trying the method of using B-SCP requirements engineering for linking high-level requirements (strategic) with those of lower level, and focusing on the alignment of strategy business and information system components. Yu & al. [21] look at the reasons and contexts (including strategic goals) that lead to system requirements.
The approach e3 values interest in values exchange between the network actors. The approach e3-alignment [29] focuses on the alignment within and between organizations with respect to: (1) business strategy, (2) values, (3) business processes, and (4) Information System.

In all these approaches, there is little explicit links with the elements of the enterprise to align (strategic and functional level). These models use either intermediate or dependencies between the elements, or the decomposition of high level goals into low-level goals.

Approaches ACEM (Alignment and Evolution Correction Method) [13] and INSTALL (Intentional Strategic Alignment) [14], fit into the type methods that use an intermediate model to represent alignment. Note however that the first (ACEM) addresses the alignment of IT and business process but do not take into account the strategy.

Approaches of the dependence that propose to define dependencies between high-level goals (strategic) and operational goals. Approaches based on i* models [11],[21] and the approach of urbanization Longépé [10] fall into this category.

Decomposition approaches propose to decompose high level goals into lower level goal (operational level). Among these approaches, we find KAOS or approaches of enterprise architecture (Eg Zachman).

Indeed when strategy of enterprise is taken into account in the process of alignment, we find that most of these approaches use the intentional paradigm, such as the use of I* in the approach of [11] or formalism of maps in [28]. But none proposes an explicit modeling of strategic alignment, with more specific concepts at the operational level. Indeed these approaches are

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useful at the strategic level but seem not very flexible at the operational level view that does not cover elements such as object, function, modules, application...etc.

2.2 Evaluation Of Business IT Alignment

Several approaches have been developed to evaluate the alignment; some approach proposes evaluation through interpretation, judgment. Other proposes measures between the elements that contribute to the construction of the alignment. These are evaluations that allow to conclude that the alignment or misalignment.

For example [2] propose a framework for measuring the alignment between business strategies and information technology (IT) strategies. It is a framework that is based on the foundations of the CMM model (Capability Maturity Model). This method allows an evaluation according to five levels (1=misalignment to 5 = strong alignment).

Other approaches propose measures for evaluation the alignment. This is for example to list the number of activities supported by the system [22]. For this the authors identified a set of parameters with thresholds. Il is thus possible to measure the alignment and to detect a malfunction if the result obtained is less than the threshold value. [13] Proposes measures for generic alignment between business Process and information system. [14] Proposes measures between elements of strategy and elements of operational level.

In conclusion, the evaluations methods can be of different types: interpretation, judgment, metrics …etc. However these methods propose measures that do not cover clearly the information system. This may seem insufficient and suggest the usefulness of approach for evaluate business IT alignment.

3. META MODEL FOR STRATEGIC BUSINESS IT ALIGNMENT

In this paper we proposes a meta model, in context of business IT alignment (figure 1), for describing, linking and tracing organizational concepts at multiple levels, allowing a common language to be used not only in strategy, but in operational level. These levels are subdivided into strategy and goals, business processes and information systems. By using UML, it is used a common representation language in both business and IT domain.

Although a business process does not have a universal accepted definition [23], it can be described as a set of activities that, in conjunction, transform the inputs, creating outputs which have value to a customer. Also, a business process has goals and is triggered by one or more events either internal or external to the organization, so is by using goals that one can assess, quantitatively or qualitatively a business process. Since it is by analyzing and modeling, goals and processes, that an organization can trace its strategy down to the business processes, they reveal themselves to be of great importance, to which is not always given the proper attention. In order to represent the goal model, we use the formalism of I* [21] for its flexibility and the possibility to be used in different contexts. The I* technique focuses on modeling strategic dependencies among business agents, goals, tasks and resources.

As the alignment is our concern, the business processes are represented as a hierarchic decomposition of the different activities that compose them, and provide added value in the achieving of a hard goal. Using this decomposition, a separation is made between the core and the supporting processes, as well as between goals and processes, allowing strategy and processes to be correlated. As the same approach is applied to the information system level, the system components that support the processes can also be represented.

At the functional level, information system, we have been inspired by the approach of urbanization (enterprise architecture) [10] for several reasons: In the context of urbanization, the functional view is generally deducted from the business view. This functional view is designed to meet the needs of the strategy. The link between the two views is realized by evaluating their alignment. This architecture at the functional level use the metaphors to found the concept structures, in particular the metaphor of the city is used like base of information system [10].indeed Any functional architecture comprises several Business areas. A business area is broken up into several neighborhoods (district in notation city). Each neighborhood is composed of several blocks. This last belongs has only one and only one neighborhood. A block should never be duplicated and 2 blocks should never have a direct exchange.

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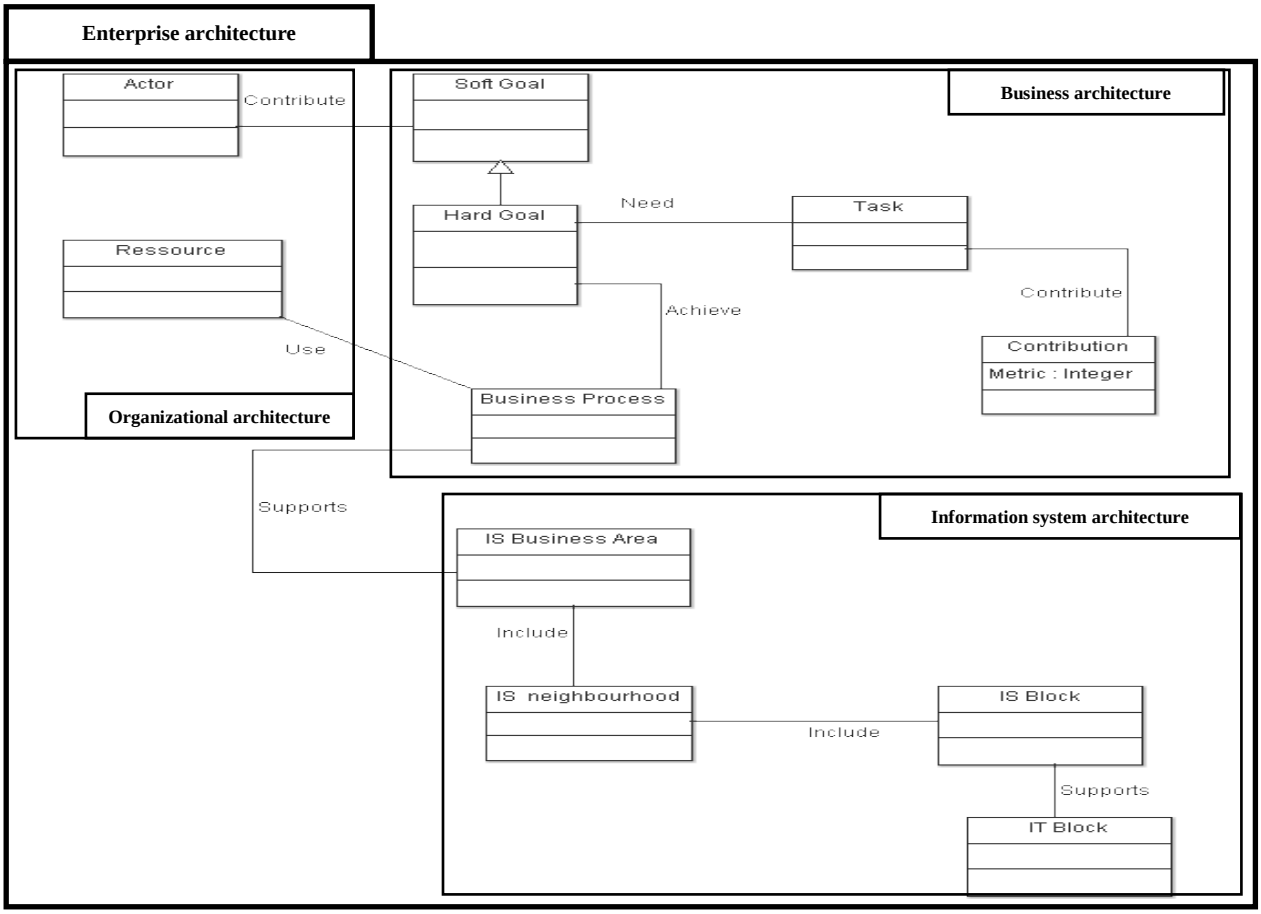

Fig1: Meta Model For Business IT Alignment

In the high level, the objective is to describe the business strategy through the soft goals set, which are declined in more detail in hard goals, and must be achieved through one or more business processes. The second level describes the business processes and its existence is relevant in order to satisfy one or more goals. Also, business processes interact with resources, in order to realize work, and may or may not be supported by information systems, more precisely with a business Area. Finally, the information systems layer (through business area, neighborhoods, blocks and blocks IT that support them) aims at modeling the system components supporting the business. Although there is a separation among layers and the concerns are distinct, the dependencies and relations between them are also considered.

Noted that, our Meta model includes the concept of enterprise architecture, in a sub level we identified the business architecture, organizational architecture represented through the actors and resources and finally the information system architecture represented through information system and IT blocks that support them.

4. METRICS FOR EVALUATION STRATEGIC BUSINESS IT ALIGNMENT

4.1 Measurement Framework Alignment

We focus on the measures proposed by McCall and Cavano [24] that were developed by [13] as a framework for measuring software quality. The authors define a framework that is based on 3 concepts: factors, criteria and metrics.

Factor is Management oriented view of product quality, Criteria is Software oriented attributes which provide quality and Metrics are quantitative measures of those attributes, used to measure a criteria.

According to the IEEE Standard Glossary of Software Engineering terminology, the quality metric can be defined as "a function that takes as argument the software and data that returns a

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single numerical value. This value is used to measure the extent to which software possesses a given quality attribute.

The framework of Cavano & McCall [24] has eleven factors and thirty criteria. This is a reference in the field of quality measurement. It has inspired many hierarchical model such as Boehem model [25], Dromey model [26] and the standard ISO/ IEC 9126. The framework of McCall is also used by manufacturers such as, in major military projects of USA [27].

Etien in [13] developed this framework to propose a measurement framework consisting of 4 factors to measure the degree of alignment between the business process model and information system model: (1) intentional alignment (2) informational alignment (3) functional alignment and (4) dynamic alignment.

Similarly, our measurement framework alignment consists of factor, criteria and metrics. We have identified 2 factors on which the relationship of strategic alignment can be measured: intentional factor and functional factor. Each factor is associated to criteria. Each criteria is associated to metrics that measure the degree of alignment.

The intentional factor measures the gap between the strategic and process level, while the functional factor used to measure the gap between the process and information system level.

As shown in table 1, 5 criteria and 5 metrics were identified.

Table 1. Measurement Framework Alignment

Factor	Criteria	Metric
Intentional factor	Rate supporting goals by business process	Percentage of goals supported by Business processes.
	Presence rate of resource	Percentage of resources used by business processes related to goals.
	Presence rate of actors.	Percentage of actors that contribute to achieving a goal.
Functional factor	Rate supporting business process by information system.	Percentage of business process by Information system.
	Degree of cooperation between direction of Information System and managers	No measurable criteria.

Intentional Factor and its criteria assess the degree to which strategic goals are supported by business processes (support rate). It also measures the degree of presence of actors and resources.

Functional factor assesses the degree to which business processes are supported by information system through business areas and also the degree of collaboration between the direction of information system and managers. Such assessments are made using two criteria, the rate of support for business processes by the Information System and degree of collaboration.

The metric of the intentional factor used to study the gap between elements of the strategy and business processes while the metric of the functional factor used to study the gap between business processes and information systems.

4.2 Evaluation metrics

In this section we define five metrics that we identified in the measurement. Three metrics are related to the intentional factor and two metrics for functional factor.

The following template (table 2) is used to describe the metrics proposed.

Table 2. Evaluation Metric Template

Acronym	Metric acronym
Name	Metric name
Formal definition	Description on the metric formula
Description	Description of the goal of this metric

Rates Support Of Goals :

Acronym	AGBP
Name	Average number of "hard goal" supported by "business process"
Formal definition	Average number of "hard goal" supported by "business process" is computed counting the number of "hard goal" supported by "business process " divided by the number of "business process" AGBP= $\sum_{i=1}^{\#business\ process} \frac{\#(hard\ goal)\mathbf{sby}"\text{busines process}"i}{\#(business\ process)}$ #(hard goal): the number of "hard goal" #(business process): the number of business process #(hard goal)sby"business process"i: the number of hard goal supported by business process index i
Description	The goal of this metric is to evaluate the degree of alignment between the goal of the strategic level and business processes that support them.

Rate Presence Of Resources :

Acronym	ARBP
Name	Average number of "resource" used by "business process" supporting a "hard goal"
Formal definition	Average number of "resource" used by "business process" is computed counting the number of "resource" used by "business process"supporting a "hard goal" divided by the number of "resource". **ARBP=** $\sum_{i=1}^{\#business\ process/HG} \frac{\#(resource)\mathbf{uby}"\text{busines process/HG}"i}{\#(resource)}$ #(resource): the number of "resource" #(business process/HG): the number of business process supporting a "hard goal" #(resource)uby"business process/HG"i: the number of resource used by business supporting hard goal.
Description	The goal of this metric is to evaluate the degree of presence resources in alignment between the goals and business processes that support them. Resource, which represents a physical or an informational entity.

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Rate Presence Of Actors :

Acronym	AAG
Name	Average number of "actor" who contributed to make decision and achieve a "hard goal" in strategic level.
Formal definition	Average number of "actor" who contributed to make decision and achieve a "hard goal" is computed counting the number of "actor" contributed to achieve "hard goal" divided by the number of "actor" in the system. AAG= $\sum_{i=1}^{\#hard\ goal} \frac{\#(actor)ach"\text{hard goal}"i}{\#(actor)}$ #(hard goal): the number of "hard goal" #(actor): the number of "actor" #(actor)ach"hard goal"i: the number of actor contributed to achieve hard goal.
Description	The goal of this metric is to evaluate the degree of presence of actors in construction of alignment between the goals and business processes that support them. Actors depend on each other for goals to be achieved, tasks to be performed and resources to be furnished. By depending on others, an actor may be able to achieve goals that are difficult or impossible to achieve. Actors are strategic in the sense that they are concerned about opportunities and vulnerabilities, and seek rearrangement of their environments that would better serve their interests by restructuring intentional relationships

Rate support of business process by Information System:

Acronym	ABPIS
Name	Average number of "business process" supported by "IS business area"
Formal definition	Average number of "business process" supported by "IS business area" is computed counting the number of "business process" supported by "IS business area " divided by the number of "business process" ABPIS= $\sum_{i=1}^{\#business\ area} \frac{\#(Business\ P)sby"IS\ busines\ area"i}{\#(IS\ bsiness\ area)}$ #(IS business area): the number of "IS business area" #(business P): the number of business process #(business P)sby"IS business area"i: the number of business process supported by business area index i
Description	The goal of this metric is to evaluate the degree of alignment between the business processes and information system through business area. Blocks dedicated to support a business process and each area corresponds to a single business process

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5. CASE STUDIES: PROJECT OF THE MINISTRY OF HIGHER EDUCATION (MOROCCO)

The project we have chosen is very important for the Moroccan government, which is part of a national program to improve the situation in higher education. The study of the alignment of this project will help actors to decide if information system is aligned with this project. The case study is inspired from a real project at Rabat University, Morocco.

Description and representation of the Case

Public administration can be viewed as the development, implementation, and study of branches of government policy, aiming at the pursuit of public good by enhancing the civil society and ensuring a fair and effective public service. In a more concise definition, public administration is the typical activity of organisms and individuals which, under supervision of the political power, realize in name of a collectivity, the task of satisfying regularly and continuously the collective needs for security, culture, and economical and social well-being, in the terms of the applicable legislation and under the control of the appropriate courts.

As part of public administration and in the context of the reform of higher education in Morocco, a reorganization of the university cycles based on LMD System (License - Master - Doctorate) took place. Also, important efforts were made to develop the technical and professional options in each University.

The objectives of studied project are:

- To improve the internal output of higher education and the employability of the award-winnings who arrive on the job market.

- To offer to the students good conditions of training and lodging.

Some of the awaited results are:

-Creation of almost 124,000 places at the University.

- Multiplication by 2 of the capacity of reception of university.

- Registration of the 2/3 of all students of higher education in technical, scientific and professional options.

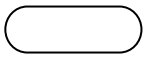
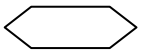
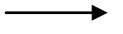
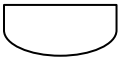
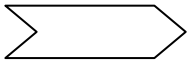
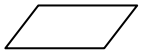
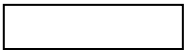
- Creation of almost 10,000 places in the halls of residence.

In order to apply our approach for strategic alignment to the university Mohamed 5, the first step consists in the translation of all objectives of the project into goal model formalism. After we linked the goal (hard goal) with business processes related to our project and in the last step we have linked all business process with information system through business area.

Note that in the modeling of this project we have ignored the representation of some elements of information system (neighborhood and block of each business area) in order to make the figure over loaded and therefore unreadable.

For the representation of the project (Figure 2) we used the notation of I * and business process and business area:

Table 3. *Elements Of Modeling*

Symbol	Name
	Soft Goal
	Hard goal
	Task
 +	Contribute to
	Means End Link
	target
	process
	Actor
	resource
	Business Area

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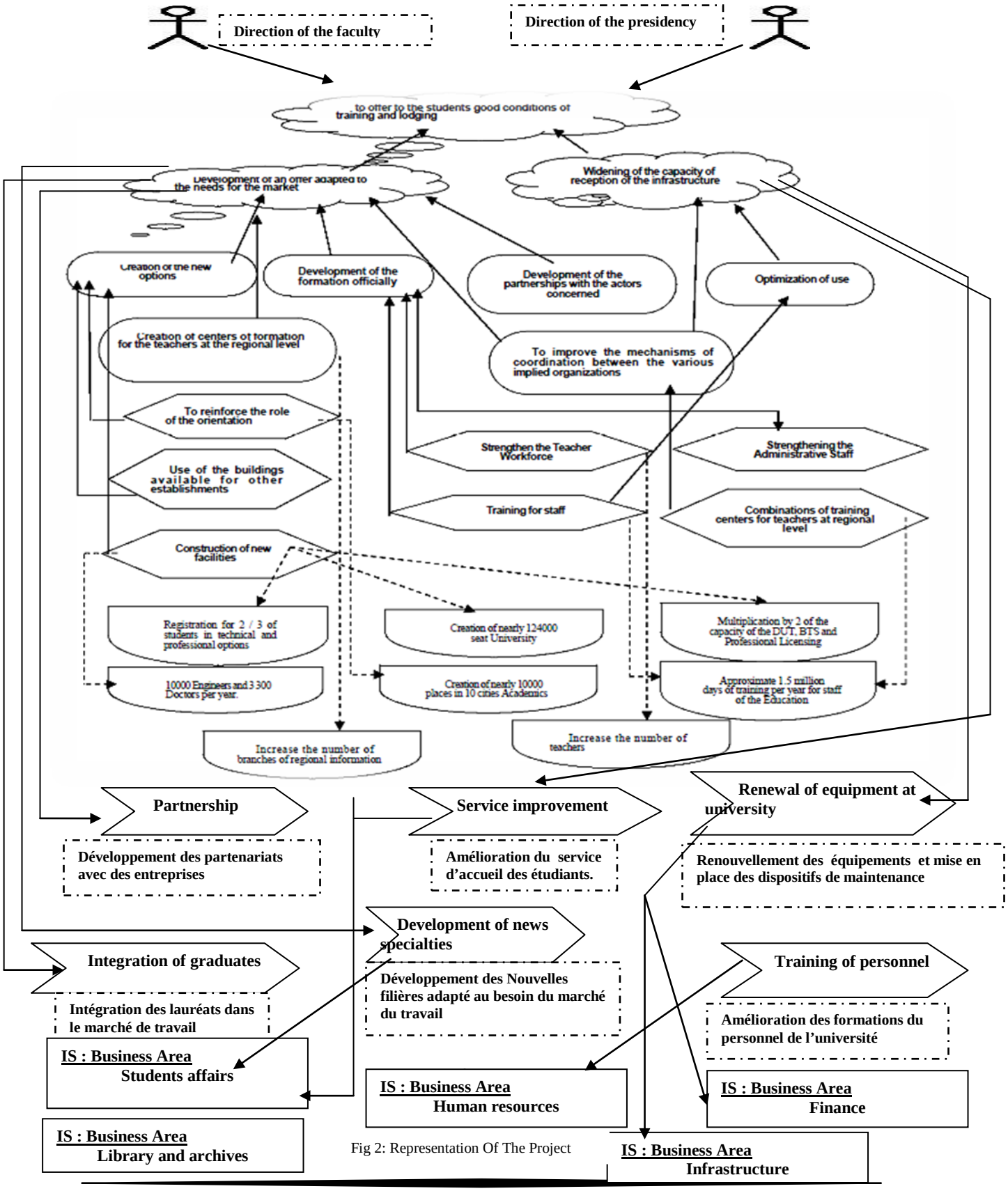

Fig 2: Representation Of The Project

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6. EVALUATION OF THE ALIGNMENT OF THE PROJECT:

Our measurement framework alignment consists of factor, criteria and metrics. We have identified 2 factors on which the relationship of strategic alignment can be measured, intentional factor and functional factor. Each factor is associated to criteria. Each criteria is associated to metrics that measure the degree of alignment.

The intentional factor measures the gap between the strategic and process level, while the functional factor used to measure the gap between the process and information system level.

6.1 Intentional Factor

Intentional factor and its criteria assess the degree to which strategic goals are supported by business processes (support rate). It also measures the degree of presence of actors and resources.

For this factor we have identified two metrics:

Metric AGBP: Average number of "hard goal" supported by "business process" is computed counting the number of "hard goal" supported by "business process "divided by the number of "hard goal"

$$\sum_{i=1}^{\#business\ process} \frac{\#(hard\ goal)\ \boldsymbol{sby}\text{"busines process"}i}{\#(Business\ process)}$$

For our project:

Each business process (related to our project) is related on an objective (hard goal), But 2 business processes are isolated and already launched independently of the project.

The measure of the metric is:

AGBP= $\frac{1+1+1+1}{6}$ =0, 66

For this metric we see clearly that only 66% of business processes that are linked to strategic goals of our project and 44% of the business process have a problem of alignment, which exists but is not related to a goals of strategic level.

Metric ARBP: Average number of "resource" used by "business process" is computed counting the number of "resource" used by "business process"supporting a "hard goal" divided by the number of "resource".

$$\sum_{i=1}^{\#business\ process/HG} \frac{\#(resource)\ \boldsymbol{uby}\text{"busines process/HG"}i}{\#(resource)}$$

The identification of resources in our project was an extremely difficult task. The goal is to identified any resources that can be physical or informational and participating to achieve a goal or business processes.

Indeed, to achieve a goal or the execution of a business process, we note that almost all resources were used. So for the rate of this metric is 100% (ARBP =1).

Metric AGAA: Average number of "actor" who contributed to make decision and achieve a "hard goal" is computed counting the number of "actor" contributed to achieve "hard goal" divided by the number of "actor" in the system.

$$\sum_{i=1}^{\#hard\ goal} \frac{\#(actor)\ \boldsymbol{ach}\text{"hard goal"}i}{\#(actor)}$$

We identified two actors that contribute to achieving the strategic level. An actor who represents the university and another that represents the faculty. Since the project is done at the faculty, we note that there is a lack of participation of the university for this:

AGAA= $\frac{1}{2}$ =0, 5

We can say that only 50% of actors are involved in achieving the goals of the project.

6.2 Functional Factor

Functional factor assesses the degree to which business processes are supported by information system through business areas and also the degree of collaboration between the direction of information system and managers. Such assessments are made using two criteria, the rate of support for business processes by the Information System and degree of collaboration.

This factor used to study the gap between business processes and information systems.

Metric ABPIS: Average number of "business process" supported by "IS business area".

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Average number of "business process" supported by "IS business area" is computed counting the number of "business process" supported by "IS business area "divided by the number of "business process"

$$\sum_{i=1}^{\#business\ area} \frac{\#(Business\ P)sby"IS\ busines\ area"i}{\#(IS\ bsiness\ area)}$$

The goal of this metric is to evaluate the degree of alignment between the business processes and information system through business area.

Normally business area is a Block dedicated to support a business process and each area corresponds to a single business process. But several dysfunctions have been detected. For example the business area" Library and archives" is isolated and independent of processes.

The measure of the metric is: ABPIS= $\frac{1+1+1+1}{5}$ =0,8

So 20% of business areas do not cover the business process, and therefore represents a problem of alignment between business processes and information system

7. CONCLUSION

In this paper the authors proposed a set of strategic alignment evaluation metrics, namely: Average number of "hard goal" supported by "business process", Average number of "resource" used by "business process", Average number of "actor" who contributed to make decision and achieve a "hard goal" and Average number of "business process" supported by "IS business area".

With these metrics, as described in the case study in this paper, the manager has a set of indicators for evaluate the degree of alignment between the goals in strategic level and information system.

However the authors recognized that much more testing on the metrics should be developed in order to assess its merit and significance.

The implementation of a tool for automatically evaluate strategic alignment of Information System is also a planned future work.

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