BUSINESS PROCESSES UNDERPINNING INFORMATION SYSTEMS

A Higher Education Institution's Framework

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Abstract: Organizations have increasingly raised concerns in relation to its processes and the quality of service. There are many methodologies for management processes such as Business Process Management (BPM) and Software Oriented Architecture (SOA). These methodologies alone do not seem to be able to cover all the specific model of Higher Education Institutions (HEI), and it is necessary to integrate Process Management methodologies with Organizational Semiotics to obtain the necessary signals for quality management. With the help of Semiotic Pentagram Framework (SPF), Dynamic Essential Modelling of Organizations (DEMO), Language Action Perspective (LAP) and the Theory of Organized Activity (TOA) we present a framework adapted to the HEI where, after reviewing the options regarding the semiotics, we choose to use the Semiotic Pentagram Framework. The various views of the SPF scheme cover larger part of the HEI activities and needs process. To do that, we will use an approach to Strategic and Business Information Systems. Our objective is to apply the framework at one of IPS schools - Superior School of Health (ESS).

1 INTRODUCTION

Information Systems (IS) development raises many important challenges to organizations and institutions. Nowadays, depending on the type of organization, to some extent business processes are supported by some kind of IS. Emerging organizations want to examine processes across their lines of business to discover which one is the best of breed. Other organizations are looking for the improving their existing processes, or even to automate them. In some countries, government regulations require that business processes be properly documented. These are among the many drivers in the business world today that are making organizations take a closer look at their processes. The first question that arises is that if organizations and institutions have all the same kind of characteristics. In this work we defend that higher education institutions (HEI) nowadays have new specific challenges and characteristics. In the socio-economic Portuguese context Polytechnic Institutes and Universities are centralizing services, decision making processes and IS. It is not unusual to have in this context information and procedures islands lacking a desirable integrated access to information, finding many reasons to capture their business processes in order to obtain top level indicators and competitive advantage in face to other HEI's. In order to understand the HEI business processes we have studied different kinds of approaches to the business processes capture and creation of top-level indicators: the dynamic business processes approaches like Business Process Management (BPM) and Software Oriented Architecture (SOA) and other approaches like Organizational Semiotics, the Semiotic Pentagram Framework - SPF, Dynamic Essential Modelling of Organizations (DEMO), Language Action Perspective (LAP) and the Theory of Organized Activity (TOA). In this paper we present a framework that we have created merging Hoshin Kanri matrix with the alignment between the Strategy and Business Information Systems, BPM, SOA and the SPF Framework and we define methodological aspects in order to validate this framework using one of IPS schools - Superior School of Health (ESS).

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2 MOTIVATION AND CHALLENGES FOR HEI'S

In the last two decades, computer science revolutionized the communication and the access to the information, opening new challenges to the organization of the work and the business processes related to education and learning in HEI. Computer science opens multiples challenges to the "new school", in the field of the management of the new paradigms of functioning and in the support of new forms of education and in way it generates the new paradigms of learning (Macedo P. , 2008).

The paradigms of education are in a process of change in the current school as well as learning. The changes in the society and education in the European community demand that the management of the schools is boarded of another form. A school is an organization form where the process of main business is the training/education of individuals. A school in its essence "sells" the acquisition of abilities and generates knowledge - elements basic resources to manage in the schools. Schools not only need to have one politics of knowledge management, but also to access the applications that allow them to manage the knowledge - its main capital.

School was always an important pillar of the communities. School is an active element of the social and academic community establishing bows of communication and contribution with its partners. The technological structures will have to support and to facilitate the management of the activities and business processes, allowing not only the allotment of resources, but also the coordination of the business processes and activities allowing the creation of top level indicators.

HEI are institutions that take on very specific characteristics deriving from its activities, its size, or even its management framework and autonomy that the law provides. With organizational structures unclear, inflexible, and difficult to define and with very weak lines of authority, decision-making processes have been very tightly hemmed in by different collective bodies mostly independent of each other and often with diametrically opposed views on the objectives of institution.

Additionally, at HEI exists high turnover at the top management positions, causing a general failure to promote a sustained process of continuous improvement. Finally, with regard to the core activities of HEIs, including the activities of teaching and learning, are presented with very transverse processes, with multiple actors with responsibilities for decision making, some of them at the same level but with little coordination, with long cycles of achieving and with little consensus about who are the intended recipients / customers (UNIQUA/IPS, 2009). HEI have been created the need to adopt quality systems and continuous internal improvement, which are associated with effective processes of decision making so that they have a concrete effect on administrative activities, financial, scientific and educational.

The institutions are being evaluated according to the quality of performance, measuring the degree of compliance of its mission, through performance parameters of action and results. According to A3ES (Agency for evaluation and accreditation), the Portuguese institutions are subject to evaluation and accreditation in order to be entered into the European system of quality assurance in higher education. With the "Bologna Process" the institutions may be subject to comparisons and rankings mechanisms, and quality performance, very important factors to get a good position.

The Bologna Process enables to compare with another high school and provides the Global recognition .The Bologna Process aims to create a European Higher Education Area by 2010, in which students can choose from a wide and transparent range of high quality courses and benefit from smooth recognition procedures. The Bologna Declaration of June 1999 has put in motion a series of reforms needed to make European Higher Education more compatible and comparable, more competitive and more attractive for Europeans and for students and scholars from other continents. Reform was needed then and reform is still needed today if Europe is to match the performance of the best performing systems in the world, notably the United States and Asia. IS in HEIs need to be well designed and have to provide key performance indicators (KPI) that will be compared among other institutions. One of that KPI are the Bologna Reports that all the courses in HEI need to have visible to everyone, every year.

In this sense, in order to achieve greater internal quality, UNIQUA/IPS (UNIQUA/IPS, 2009) proposes the implementation of the IPS performance evaluation model based on a process model approach of HEI resources.

3 A HIGHER EDUCATION INSTITUTION IS: IPS INFORMATION SYSTEMS

Information systems exist to support the activities of organizations and institutions, its mission, objectives, strategies and business processes. Therefore, by definition, information systems have to be aligned with the business strategy. But that does not always happen, especially because business is dynamic, and change and information systems rarely have the flexibility to accompany these evolutions (Laudon K. & Laudon J., 2007).

Five years ago, IPS evidenced that it was very difficult to gather integrated information from the students as well as from the teachers. IPS and the schools needed to get management indicators and felt that information was spread on small non integrated information systems. All the stakeholders of the education process needed to have access to their information online and it was not possible to obtain that information without a new integrated system. Besides consisting in a central repository and unique access point, a web portal will allow to access information outside institutions facilities.

It would be a competitive advantage to IPS to give students and professor's access to lectures, as well as, all important academic data. All the systems with this kind of requisites usually take several years to become in production in a stable way. It was created a team that started to analyze all the available academic information systems all over the country. Two years later the team defined finally that there was only a really stable, solid and tested system that meet the identified requirements to be installed in IPS – SIGARRA.

SIGARRA's system architecture is an integrated Web based information system, a student's management applications (GA) and human resources management application (GRH), its main characteristics are: Information integration, Web interface and Modularity and configurability. As IPS has five schools and two more organic units, all of them used different procedures to the organizational processes. The main idea was to standardize the processes in all the schools. The adopted implementation methodology consisted on the migration of the old systems at each school one by one to minimize the impact in services and increase the team expertise. Beside the lack of standardized procedures another challenge was the fact that the legacy systems didn't have enough documentation, so the migration process needed to be validated several times to assure data consistency. While the migration was in progress, the web portal started being installed and customized (Goncalves N. & Sapateiro C, 2008).

SIGARRA - Information System for the Aggregate Management of Resources and Academic registers (Ribeiro, L. & David, G., 2001) which is a stable, robust, widely tested and continuously updated, IS for higher education institutions in use in several Portuguese institutions.

SIGARRA is a really very good IS, but its implementation process and its characteristics determined that the top-level indicators are not easily obtained as well as the business processes are heterogeneous even many of them having the same goals and output information. So, the aggregation of the information in order to help decision making is not as effective as it should, not permitting to make comparisons among schools and services.

Usually top management defines the strategies looking for the results and not to the needs. One way to allow doing this is to review the processes and the stakeholders (e.g. students, professors, collaborators)

SI-IPS implementation adopted, because of political, financial and organizational factors, was the adaptation of each organic unit to the IS, and this brought a problem – the system was adapted to each organic unit instead of potentiating the harmonization of all the existing processes.
This can be a sign that the organic units do not have clean structured procedures. IPS is betting on improving the quality and in the management of business processes. Question: "the management of organizational processes fits on high school?" The need to implement process management comes from standardization of the processes. It is important to harmonize the processes. It is necessary to create valuable indicators, which allow top management to control the processes. They only can control the processes that have defined or someone defined for them. On IPS exists orientation to results, rather than guidance on process and quality.

4 PEOPLE AND PROCESSES

People in organizations are the most important element, for two specific reasons: they are the suppliers and the customers. But alone they cannot produce a quality service. This is because people cannot know whether the processes that lead to the final result are optimized and have the desired quality. This is where the management of processes

appear, one of the most important issues of today's organizations.

Processes, along with people, are of the most difficult to manage in the direction of an organization. And the explanation can be justified in many ways: processes not defined and planned; processes that fail; resources for processing; unclear objectives; lack of process control; motivation of people to implement them; bureaucracy processes.

The functional units of the organizations are beginning to no longer be considered as a discrete set of isolated and well defined borders, and this increases the difficulty of managing the processes. The growing trend to be seen as flexible and interconnected groups of information flows that cross horizontally the units in that group activities, is a reality that is rooted in the movements of reengineering (Hammer, M. & Stanton, S., 1999) and JIT (Just in Time) (Ten Have, S. et al., 2003; Coopers & Lybrand. 1999). Organizations come to be seen as a group of incompletely linked groups and for this reason there is great need to manage processes (UNIQUA/IP, 2009).

Business process drivers can be summarized into three major categories:

- Documentation. Companies need to capture business processes so that others can understand how they work, who is involved, and how activities flow from beginning to end. Typically a business analyst who understands how the processes work models these processes.
- Redesign. Many businesses want to improve their business processes to reduce inefficiencies, drive down costs, and respond faster to customer requests. A process cannot be redesigned before it is understood, so it must first be captured. Redesign can only come after you have properly documented the process. Typically a technical analyst, or perhaps an IT liaison to the business who understands both the business needs, and the I/T systems models these processes.
- Execution. In most cases, the best way to improve the efficiency of a business process is to apply automation to it. If you can reduce or eliminate manual work, the process can be performed faster and at a lower cost. To apply process automation, the business IT staff or a consultant must write code or use a middleware product. It would not be advisable to automate an inefficient process. For this reason, this phase should only occur after you have redesigned the process.

In a organization exists process associated with the mission and the processes on which all activities

Figure 1: Global Processes Model (Pires A., Lourenço R., 2010).

of the institution relates, however exists other processes and not directly connected with the mission of the institution but have a particular importance in the overall management (figure 1) and can be defined (Pires A. & Lourenço R., 2010):

1. Processes that affect all other processes and activities of the institution, including the macro-processes, classified by integrated processes, and take responsibility for organizational convergence, by establishing global forms of action both internally and externally.
2. Processes focused on supporting the internal structures and processes arising from them, classified by support processes, and without them organization hardly reach their goals.

It is important to IPS to restructure and define the procedures to improve quality. At this point is important to talk about two types of management: Quality Management and Process Management (Business Processes and Support Processes).

The processes that we will aboard are the Dynamic Business Processes and several methodologies can be applied in the organization, like BPM (Business Process Management) and SOA (Service-oriented architecture) and with Semiotic approaches is possible to link dependencies of the processes that not suffer any alterations on the organizations, that can be viewed like the skeleton of organization's processes.

Organizational Semiotics can help to see how it behaves throughout the process of information in the organization, helping to validate the flow of information by groups of the organization and deals with organizations such as information systems where information is created, processed, distributed, stored and used. Thus becomes the organization as a system of dependency where the result of a process may depend on another process.

The management processes should be adapted and appropriate to the educational reality, which may have a role in this standard approach as it sees an organization as interconnected and interacting processes by which it achieves the desired objectives. For this is necessary to HEI's clarifying its mission and vision, with emphasis on the ability to provide their recipients / customers products and services recognized by the social, environmental, cultural and economic values (Pires A. & Lourenço R., 2010).

So there is a need for applying something different, because of the specificity of HEI specificities, whereas management methodologies common processes do not fit very well. Interactions are large and actors many with different needs.

A good process management combined with organizational semiotics can improve the quality of how the whole service is provided while improving the definition of all processes and dependencies. So suppliers and customers realize what the procedure is carried out to reach the expected result. These are the processes that make the organization sustainable to offer an educational quality of service allowing continuous monitoring and improvement.

5 DYNAMIC BUSINESS PROCESSES APPROACHES

5.1 Strategic Planning in the context of Enterprise Architecture

Enterprise architecture refers to both the process and the product of the application of systematic methods. As a complex process, enterprise architecture may use a framework of methods and conceptual tools. An early coining of the term "enterprise architecture" to refer to both the process and product was by Steven Spewak (Spewak et al., 1992). This book defined one of the earliest process frameworks for enterprise architecture. One formal definition of the architecture of an enterprise comes from the MIT Center for Information Systems Research: “Enterprise architecture is the organizing logic for business processes and IT infrastructure reflecting the integration and standardization requirements of the firm’s operating model” (Weill, P. MIT, 2007).

This enterprise architecture has mechanisms to ensure alignment between information systems and the strategic objectives of the organization. The enterprise architecture is a method that involves the application of a set principles and models to understand artefacts essential in organization, namely to understand the business, technology and and how is their evolution over time. Its divide by: the organizational, business, information, applications and technology architectures.

In a brief description, these five architectures are defined by:

- The organizational architecture understand the core aspects of the company, as vision, mission, strategic objectives and the structure of the company (like a organization IPS has a strategic plan);
- The business architecture describes all the activities (processes business) developed by the company to achieve its objectives (ex: teaching/learning; I&D; services and consulting);
- The information architecture describing the structure of qualified information that organization needs to develop the business processes (ex: disciplines, programs; school; IPS);;
- The application architecture describes all the necessary applications that support business processes and make use of entities. In this architecture is include de CRUD matrix (Create, Read, Update, Delete) that describes and analyzes the relations between the activities of the processes and manipulated information in the context of business (ex: information system, student’s management applications (GA) and human resources management application (GRH));
- The technological architecture describes the infrastructure of hardware, network and software that supports business needs.

In an approach of the reality, the best way to meet this need is adopting the Hoshin Kanri matrix (Jackson T., 2006) because it allows doing the representation in a single piece of paper the various interrelationships among the critical factors of company strategy. With this method it can achieve a result positive to show that it is possible to ensure the alignment between the business strategy and technology strategy to help improve performance of the organization.

In the figure 2 is an example of a final Hoshin Kanri matrix with the alignment between the Strategy and Business Information Systems. Relation 1 is the alignment between strategic

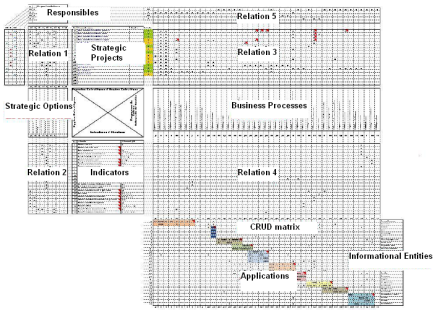

Figure 2: Hoshin Kanri matrix with the alignment between the Strategy and Business Information Systems.

projects of the company with its strategic options, the relation 2 shows which the indicators reflect the choices company's strategic, the relation 3 identify business processes that support each of the strategic projects, the relation 4 identify the business processes that will produce each of the indicators of strategic management (information useful in implementing a system of Balanced Scorecard or "Tableaux de Bord") and finally the relation 5 identify the responsible for business process (High R. et al., 2009).

Management change is a problem with an impact on processes and systems information and with this matrix is possible to have a control change of the alignment between business and information, allowing viewing and understanding the consequences of alignment processes, informational entities and applications. With this the enterprise architecture can help to clarify the role of information systems in business, in a strategic perspective business, especially if it is considered as an alignment tool should be implemented dynamically by the company.

Dynamic business processes and models enable organizations to optimize business performance and rapidly respond to changes in competitive, economic, and market conditions.

By continuously improving key business processes across systems and people with business process management (BPM) and a solid business strategy, businesses can streamline operations, create agile business models, and reduce enterprise costs.

By discovering, documenting, deploying, and optimizing business processes and models, businesses can transform the way they work by:

- Delivering agile business models that rapidly adjust to changing customer expectations and business demands (curriculum design continuously based on market and society needs; using the best pedagogical knowledge; using the best technologies);
- Empowering people to operate in real-time with detailed process visibility, and new insights from sensors and events for smarter decisions and actions (monitoring and becoming available relevant data to the stakeholders, in adequate time, as well as to processes managers/Program managers);
- Flexibly automate and extend business processes to easily find and use the best resources anytime, anywhere (supporting activities and processes in IS).

5.2 BPM

Business Process Management (BPM) aims to provide the alignment of business processes with the strategy, with goals and create a value chain for the organization.

The Management of Business Processes uses the best management practices, such as the mapping of processes, modelling, determining the level of maturity, documentation, communication plan, automating the monitoring, establishment of performance indicators and the cycle of continuous improvement. The aim is the continuous improvement of processes to achieve the expected results.

These practices applied help maximize the results and performance of procedures, and so do organizations have better financial performance, competitive advantages, reduce costs, optimize resources, increase customer satisfaction through products, increased employee satisfaction, which leads to services with a superior level of quality.

5.3 SOA and BPM

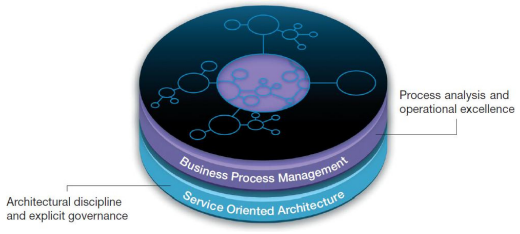

Figure 3: BPM and SOA integration.

The value proposition of Service Oriented Architecture (SOA) is centred on agile and aligned business and IT design and delivery. The ability to architect the alignment between business and IT is a hallmark of SOA, and is the cornerstone for derived

business agility, reduction of cost and risk, as well as improved portfolio management.

The notion of business process optimization has been around much longer than SOA. Yet, around the same time that SOA became a mainstream architectural style, the focus in many process optimization communities shifted subtly to one of Business Process Management (BPM). The key distinction for BPM as a discipline is added focus on flexible and dynamic process design as well as process orchestration and automation through IT enablement. This provides the foundation for agile business optimization and IT responsiveness, a particular aspect of business and IT alignment.

While BPM and SOA each have value on their own, they are naturally synergistic, and best when done together for business and IT agility, optimization and alignment. When done together, BPM provides the business context, understanding and metrics, and SOA provides a governed library of well architected service and information building blocks (figure 3). Both are, in fact, needed in order to dynamically optimize investments, drive operational excellence and manage business risk.

Note that a valuable side effect of doing BPM and SOA together is enhanced collaboration across business and IT boundaries. Communication and collaboration are brought to life through simulations and visual models of process and service orchestrations, as well as through explicit business contracts that govern the horizontal linkage between business units and the realization of end-to-end processes.

SOA can be beneficial to IPS in several ways; the common theme among ctive. And when combined with BPM, SOA can be even more effective (Serra N., et al., 2008).

6 OTHERS APPROACHES

6.1 Organisational Semiotics - OS

Organisational Semiotics (OS) seeks to present new and useful ways to understand human information and communication systems from an organisational perspective. According OrgSem (http://www.orgsem.org), OS is emergent discipline whose purpose is to study the nature, characteristics, functions and effects of information and communication within organisational contexts. The use of semiotics helps by providing many interesting ideas that can be studied, developed and applied in a business and/or organisational context (Gazendam H. & Liu K., 2005).

6.2 Dynamic Essential Modelling of Organizations - DEMO

Dynamic Essential Modelling of Organizations (DEMO) is a cross-disciplinary theory for describing and explaining the action of organisations. An organization is conceived as a (discrete dynamic) system, of which the elements are social individuals or subjects, each of them having the authority to perform particular (objective) actions and a corresponding responsibility to do that in an appropriate and accountable way (Gazendam H. & Liu K., 2005). For the coordination of their actions, the subjects enter into and comply with commitments towards each other. To perform a transaction is needed actions and interaction of the individuals (Barjis J. et al., 2001; Dietz J., 1999).

DEMO fits in a fairly new and promising perspective on business processes and information systems, called the Language/Action Perspective. The pioneer of the L/A Perspective is undoubtedly Fernando Flores. The L/A Perspective assume that communication is a kind of action in that it creates commitments between the communicating parties.

6.3 Language Action Perspective –LAP

The Language/Action Perspective (LAP) introduced in the field of Information Systems by Flores and Ludlow. Organizations have the intrinsic problem of communication between groups is of extreme importance, and according to Fernando Flores communication is exchanging sentences, expressing some proposition with the aim of creating commitment between the parties. This approach, contrasting to traditional views of "data flow", emphasizes how people communicate, what people do while communicating, how language is used to create a common shared reality and how people use communication to coordinate of their activities (http://www.fsc.yorku.ca/york/istheory/wiki).

6.4 Theory of Organized Activity – TOA

Created by Anatol Holt, Theory of Organized Activity (TOA) is based on ‘human’ activities which occur within every organization or business system. Human action or act is the key element for the structuring and planning of all activity processes. Its

dependence is based strictly on the human element, where computers and information technology is just a supporting tool. For the modelling of these dependencies is the language used Diplan (Cordeiro J. & Filipe J., 2004).

6.5 Semiotic Pentagram Framework - SPF

Focusing on the human factor, the Semiotic Pentagram Framework (figure 4) is an alternative sign model with four different views of the sign: Interpretational, Relational, Communicational, Physical and Work (Cordeiro J. & Filipe J., 2004). The Interpretational View is interested in a passive interpretation of signs where the sign already exist and its possible creation is not the emphasis of the analysis, the Physical View emphasis is on a material view of the signs with less attention to any source of meaning from the signs being carried, the Relational View is concerned with all kinds of relations between signs where they distinguish here between formal relations and informal relations, the Communicational View is one of the most important view because the concern here is to communicate, so signs are studied from their use within a communication perspective, and the Work View that is a study on the relation between signs and the common activities or work practices (Cordeiro J. & Filipe J., 2004).

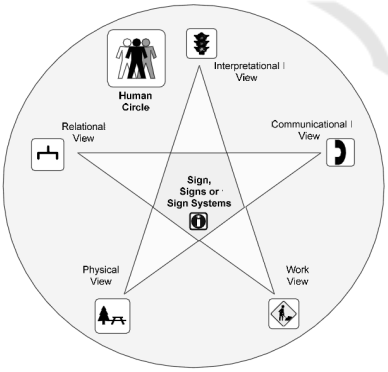

Figure 4: The Semiotic Pentagram Framework.

7 THE BUSINESS PROCESSES FRAMEWORK FOR HEIS (BPFHEIS)

We propose a framework, named Business Processes Framework for HEIs (figure 5), with three objectives: improve quality of processes; build a process portfolio and create procedures documentation. It is very important to view how whole phases work together, in order to create an educational framework that allows a better process management. With process portfolio we want to create a document with all procedures of HEI that can be useful to control and optimize it. BPMS allow us to evaluate and analyze, in a simulated environment, if the services and processes are well defined, removing the cost and complexity of the implementation of the model. Obtaining a simulation of how it works, thus achieving optimal even before approaching the real environment of the organization. This methodology is intended to be more agile and adaptable to HEI, and the requirements delegated. There is a continued focus on optimizing that seeks to increase the quality of all processes in any of three levels: meta-processes, processes or sub-processes. This framework has 3 phases:

Phase 1:

- Define the strategic options and strategic projects
- Identified the top-level indicators that allow monitoring development of strategic goals
- Describe the business processes
- Identification of informational entities
- Identify the applications (with CRUD matrix)
- Create a survey to map the existing processes, with the matrix Hochin Kanri and CRUD Matrix

Phase 2:

- Analyze services supported by SOA (Service Oriented Architecture)
- Re-design the processes with tools like BPMS (Business Process Management Suite)
- Apply Redesigned Processes and services

Phase 3:

- Use Organisational Semiotics - SPF approach to relate human and technology factors
- Analyze the dependencies
- Processes Optimization
- Create a survey that allows evaluating the optimization and increasing quality of processes.

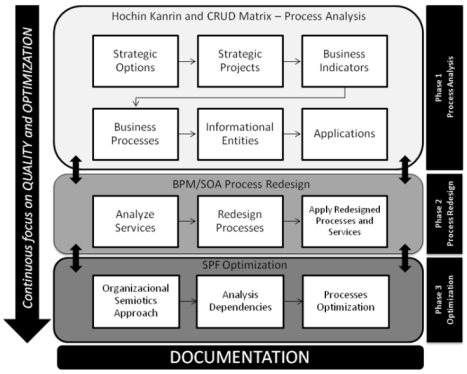

Figure 5: The Business Processes Framework for HEIs.

8 CONCLUSIONS AND FUTURE WORK

In the educational context processes optimization and quality enhancement can lead to changes that our framework intends to become milder with a wider range of areas within the HEI. The approach using enterprise architecture, SOA and BPM manages processes, but only with the help of semiotics, using the SPF, can we really validate how information moves within the organization, and the responses of the various views that can help us in further analysis. We present a framework that enables the optimization of processes and the approach to the institutional strategy, giving a good set of very useful business indicators to help decision making in HEI. The application of the framework may ensure business processes management optimization and quality towards the success of HEI information systems.

Thus, because of the specific nature of the organic unit, it is our objective to apply BPFHEIs at ESS. This choice was due to school size is small, with few procedures and therefore we expect to be a good organization to apply this framework at the beginning, making the ESS a case study, being the next step to apply the framework in other IPS organic units.

A Process Management appropriately adapted and adjusted to reality, has a key role, since this is help to achieve their objectives and this framework is one more added value to the IPS, to implement an internal quality and brings to the institution a competitive advantage in the rigorous educational "market".

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