MULTIDIMENSIONAL INFORMATION SYSTEMS: HIGHER EDUCATION DIGITAL SERVICES

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Abstract. *Considering the technological scenario that we are inserted, information management moves beyond the influence on reducing product costs and productivity gains in the service sector as it also contributes to the strategic decision making. The present article aims to investigate the multidimensional information flow in information management in an educational institution. Methodologically this article is classified as an exploratory and descriptive study, through qualitative analysis. The result of data mapping points to the indication lack of order in informational flows, generating gap and breakage of the connections SI studied, which in turn comprise the managerial platforms. The results also show that the use of organizing elements of the flows contributes to multidimensional informational mobility.*

Keywords: Information Systems, Strategic Information Management, Information Flow, Information Engineering, Information Technology.

1. Introduction

Manage the flow of information produced in Education Institutions (IES) is one of the challenges faced by their managers, especially those who adopt the modality of distance learning (EAD). Advances in Information and Communication Technology (TICs) contribute to the expansion of education as part of a natural evolution that informational mode. When considering a competitive environment, it is also natural that these organizations generally adopt different strategies to deal with information flows, focusing on maintaining and seeking a differential that aggregates informational flow and competitive advantage. The impact of strategic information management goes beyond its influence in reducing traditional product costs and productivity gains in the service sector. The connection of the information flows in its various sections and subsections of the management platform play an important role. The delimitation of the data in context and quality of information, whose core is in turn huge key component in databases of decision-making, is part of the strategy of triangulation of Information Management, Information Technology and Information Engineering. Davenport (2002) and Schlögl (2005) state that manage a comprehensive approach to information, among other things, is to apply a structured series of tasks, activities or procedures related to the form of procurement, distribution and use of information and knowledge in environment in which they live. Tarapanoff (2006) reports the importance of strategic information management for organizations as one of the most important resources, whose management and utilization are directly related to the desired success. The education institution, in the distance, moves adherent to the context through the use of information as a core component of its business and, as a private business organization seeks fluidity in their information processes. Feliciano, Furlan and Higa (1998), Schlögl (2005),

Demurjian (2008), Teixeira, Freitas and Laurindo (2014) report the existence of articulating connection elements in complex IS, using a set of formal design techniques Information that acts directly on the information flow, promoting his system, which in turn, adds differential in information management platforms, which the authors present as Information Engineering. In this context, the concept of Information Engineering (IE) emerges as "a set of techniques and formal logic, which allows you to plan, analyze, design, build and maintain systems in an integrated and integral way," said Feliciano Neto, Furlan and Higa, (1988, p. 2). Still discussing the concept of IE, Hicks, Culley and Mcmahon (2006) corroborate stating that the IE, the data operating in the information-processing center and that certain data relationships are significant, and as such should be represented in the structure of their systems. Demurjian (2008) deepens the understanding of Information Engineering with the idea of integration applied to business models, from a base of wide-ranging knowledge, to create and maintain information systems with a focus on strategy. In another study Hicks, Culley and Mcmahon (2006) extend the vision focusing on strategy and record that the importance of broad strategic assessment of data that makes up an information system and its interactions with other subsystems involved. To coordinate all the information, EI need to understand the organization of the information flow, and in particular, important phases where information is generated, exchanged and accessed. These processes involve a variety of systems, stakeholders, including customers, suppliers and departments of the organization. "The information flow commanded by the Information Engineering generates speed, economy and especially strategic advantage" Hicks (2006, p 269.). Still the same authors state that the Information Engineering understands the flow of information in its complexity at every stage where information is generated, exchanged and accessed, so you can turn into organizational knowledge and strategically develop the actions of organizations. Given the types of systems integrated in this research IES discusses the importance of strategic evaluation of the information flow generated from the significant and logical relationships of training data that constitute a management platform.

The Distance Education (EAD) is part of an informational evolution that the world is going through together with the complexity of university life, which now require new sets of pedagogical order. In this sense the flow of information is important in all processes and the EAD management should be understood as a set of actions and own requirements for its development involving several actors, specific materials, media and other peculiar features. The fluid traffic information is important in any activity and in higher education management platforms has mister assignment, from which emerges this research. Search It is also, through the manager's view, to investigate the flow of information from its creation, advancing by sections and subsections of different IS that makes up a platform, identifying ordering of elements in the management information platform.

2. Problem Search

Manage information, among other things, it is to apply a structured series of tasks, activities or procedures related to the form of procurement, distribution and use of information and knowledge in the environment where they live, according Schlögl (2005) and Teixeira, Freitas and Laurindo (2014). The EAD management process involves complex actions of interaction involving communication and exchange of

strategic information between participants, Vieira (2006). The strategic use of information, according to Johnson, G.; Scholes, K.; & Whittington (2005), has attracted attention of organizations because the decisions are related to long-term planning, achieving and maintaining competitive responses to changes in the organizational environment, establish increase of necessary resources and skills to achieve the goals. The information, by its very nature, contributes to the organizational strategic development, in that, the manager offers an overview of processes, different informational relationships and departmental contexts. Different concepts and authors relate the importance of management and strategic use of information; however, to ensure the strategic value of information requires a set of management tasks connected under the responsibility of a manager, taking into account the nature of the decision-making process and the stage for decision-making is constantly changing O'Brien (2004). Studies offer relevant in the use of strategic information management in organizations, in this scenario stand out; McGee and Prusak (1995) Davenport (1998), Beuren (2000), Choo (2006). Works such as Curty (2005) and Vieira (2006), specifically address the flux of information as a strategic element in the Information Management. In this context, questioning the research problem arises; what are the facilitating factors of IE contributing to spatial information flow in Education management platforms Distance?

3. Object and objectives of the Research

Object research: systems platforms education institutions management. Research objectives: to investigate the informational flow in education institutions management platforms, and identify the details of the Information Engineering inserted in information flows.

4. Mapping the literature

With the expanded use of information technology, the Information Systems (IS) field was highlighted, demonstrating their strategic value to the decision-making in organizations because information systems have become an integral part of daily business activities. The word system is the most used term, says Pressman (1995). The same author shows the system definition as a set of elements that is arranged to perform certain method, procedure or control to process information. However, the SI in operation require other components to perform their tasks properly. In this context, James A. O'Brien and George M. Marakas (2013, p. 2) claim that the "IS can be any organized combination of people, hardware, software, communication networks, data resources and policies and procedures that store, restore, transform and disseminate information in an organization." Evaluating the different definitions of Information Systems in this work are the Laudon and Laudon adopted definitions (2012) and Stair and Reynolds (2006), which resemble and propose the definition of information system as an interrelated set of components that collect, process and distribute information to support decision making, coordination and control of an organization. The idea described above, that in an organization, information systems must process new forms

of data structure, and enable the reduction of time and space, as the availability of access to products and services from different locations and without limits hours. Dolci and Becker (2007), contribute to the same line of thought of the authors referenced conceptually and accepted in this study. However, to improve decision-making, from the perspective of business intelligence, it suggests the need for a systemic process from the collection and analysis of informational data to distribution. For IES, the information system is an organizational and administrative solution based on information technology to face a challenge posed by the environment (TEIXEIRA, 2015). The "administrator needs to know the wider dimensions of organization, administration and information systems technology and its power to provide solutions to challenges and problems in the business environment" Teixeira, Freitas And Laurindo (2014, p. 6912).

5. Strategic Information Management

Taking the data as a core component, the process of transformation into information through any means, requires human intervention, which makes it questionable as variables; trustworthiness, reliability and validity of these contents (DAVENPORT, 1998). Organizations, in turn, require pre-defined structures for the proper flow of data. Mcgee and Prusak (1994) state that the Information Management is in line with organizational efficiency, increasing the use and application of information resources, linking the systems in which they live. The information in the organizational environment of higher education institutions is present in levels; strategic (decision-making processes and definition of organizational goals), tactical (connection form among the rest levels) or in operational functions. In order to identify the literature on Information Management, based on the information as the main input of an organization, the research Schögl (2005), describes different relationship dimensions of information and its management, linking their respective owners, through a bibliometric research, based Science Citation Index and Social Science Citation Index. Thus, multidimensional scaling different authors and related groups based on conceptual similarity. The proposed Chistian Schögl (2005, p. 5) was adapted and updated in Figure 1.

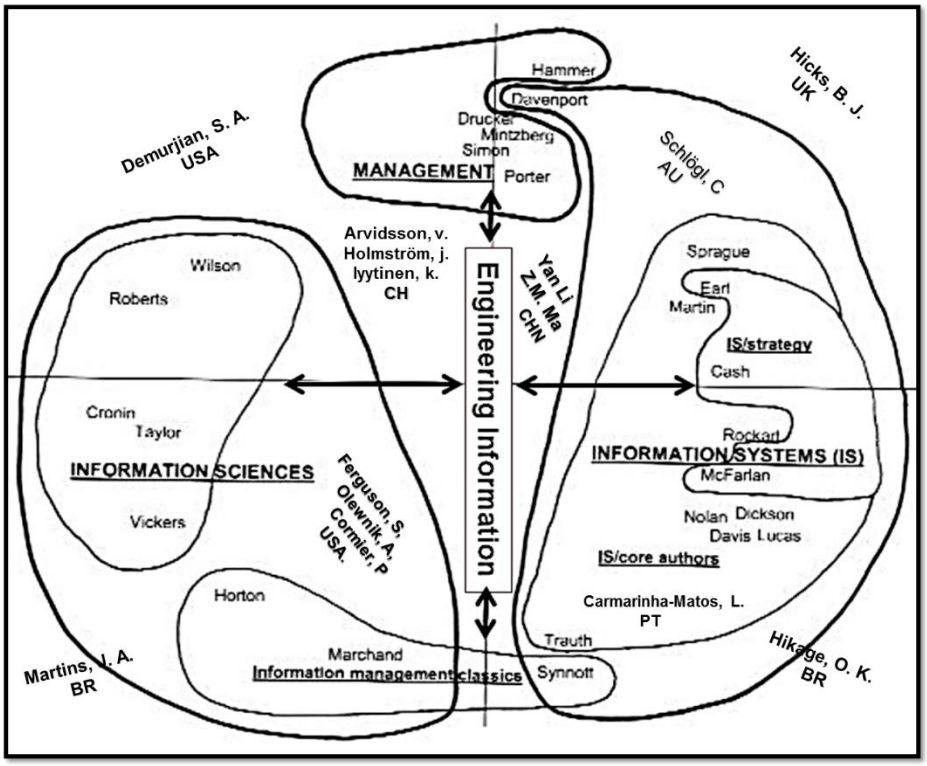

Figure 1. Dimensional relations of Information Management

The study Schögl (2005) brings the discussion of the traffic information in different dimensions and at different levels of management, which consequently articulated systems and technologies, assuming in this way, multidimensional function structuring axis. Information management from this angle stresses the importance of information technology. This is justified by the degree of integration of Information Technology, the complexity of your application and its strong consequences to an organization, Schögl (2005, p.3).

Collaborating with studies on strategy, Porter (1997), states that any organization that competes in an industry, must have a competitive strategy. In his opinion, the creation of a competitive strategy determines how the company will compete, your goals and what policies are needed to perform them. Greenwald and Kahn (2006) define the strategy is something great and different from the tactical choices. Strategic decisions should be based on long-term commitment, and requires large resources allocated. Greenwald and Kahn (2006) go further by saying that strategic decisions are those whose results depend on actions and reactions of others. With the same author, tactical decisions are those that can be taken in isolation and that depend, in large part, by a competent implementation. Understanding this difference is the key to the development of effective strategy. The strategy should be directed to the market, or to better understand the battlefield. Setting this market you can determine the external factors that may affect the organization.

One strategy involves creating unique and differentiated position for the company. Mintzberg et al. (2000 p.13) have schools that address the strategy showing their contributions and limitations. Drucker (1980) saw the strategy as new combinations that

aim to explore new and different opportunities in the future. Senge (2003) seeks to understand the subject more collaboratively seeing the era of knowledge and global economies, and states that the strategy is a learning process, both individual and collective, that is, the strategy can make the organization learn over time.

6. The Management of Data and Information on Education Institutions

Education institutions also inserted in the informational context described, using the Information Management for the management of their informational, internal and / or external content, making them available across platforms. However, the procedure requires attention to the characteristics and peculiarities of their management activities, since the information is under the direct influence of the respective flows as well as distribution and adequacy thereof to the needs of users, say Floriani (2007) and Calazans (2012). The data do not become information until relations between the various facts and their implications for the organization and individuals are discovered, become visible and explicit in the system that manages, (VALENTINE, 2013), also about the same theme, says that active manipulation of information flows, as a strategic resource, must acquire similar importance to other composition factors of Information Systems. The information should be used to avoid errors and optimize the use of resources without waste and articulator form. The generation of value attributed to information is discussed by Taylor (1991, p. 69), which proposes a model that helps to add value to information, back to the informational needs of the user. The same author also states that time is a determining factor in assigning value to the information and that an information system must be agile in their response time. To identify agility generating elements, the observed platform, it was necessary to map the information flow also restricted to the user management environment, identified as internal platform or intranet. The information flows form a chain of steps, the nature of information, its objectification and the movement that shifts form the flow space, "the space of flows is the material organization of social practices of timesharing that work through flows" (Castells, 2005, p. 436).

It is observed that information management is more than a management scheme of information processes, being influenced directly by individuals involved in organizational activities. In the Brazilian scenario, Litto (2009) reported that 60% of private and accredited IES use course management systems and also called for greater customization of the same. Customizations of the EAD management platforms can meet demand alone; however, differ from a macro joint strategy and management of information, which in turn can lead to a mismatch in the informational performance. The Ministry Document of Brazilian Education called "Quality Benchmarks for Distance Education" highlights the importance of the management process for the development of a good EAD system (CENSO, 2013); however, there are still few studies on the subject De Oliveira and Nakayama (2014).

7. The Information Engineering

The definition of Information Engineering (IE), Martin (1991) must be general enough to indicate its usefulness in a variety of fields of application, however, specific enough to transmit a set of concrete concepts that when integrated, they can provide a basis for the comprehensive development project. In this study we adopt the definition of Demurjian (2008) having IE as an integrated set of formal techniques by which business models, data models and process models are constructed from a long-range base knowledge, create and maintain information systems with a focus on strategy, Demurjian (2008, p. 23). A basic premise of IE is that the data is in information processing center and that certain data relationships are significant for a company and should be represented in the structure of their systems. The informational framework and the technology for obtaining information are relevant factors in the strategic process of the company and the lack of coordination between different information systems; generate mismatch, or even the strategic blindness, as indicated in the multidimensional view of alignment strategy depicted in Figure 2, based on Arvidsson, Holmstrom, Lyytinen (2014, p. 58).

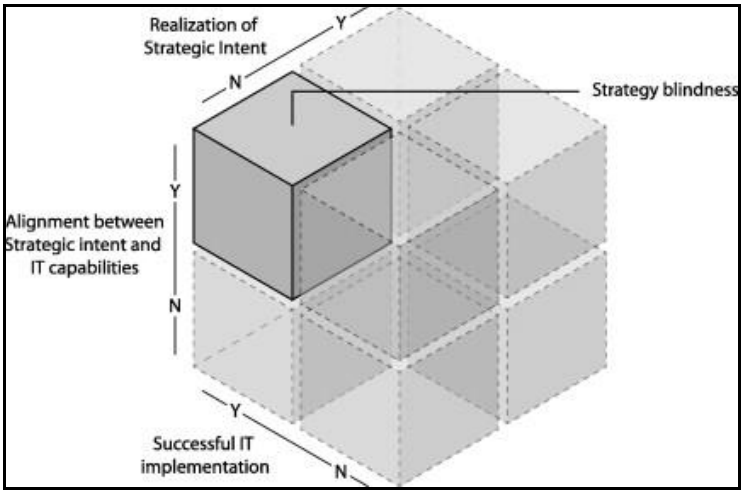

Figure 2. Multidimensional Relation of Information

In a specific context, and by analogy, the strategic blindness can be configured by the lack of coordination and convergence of information systems that make up the firm, the term used for the area of administration and "the articulation of information in different information systems can produce different strategic situation " Arvidsson, Holmstrom, Lyytinen (2014, p.57). In the same study, the authors mentioned above, claim that there are different challenges that must be overcome to implement the strategy of the firm, preventing blindness strategy, still report that; "The strategic implementation of the information system may fail due to improper selection of resources and capabilities" Arvidsson, Holmstrom, Lyytinen (2014 p. 59). Considering a comparative analysis, and assuming the importance of Information Engineering in obtaining the informational flow, can be attributed to IE to connect function information, able to avoid strategic blindness. Studies by Hicks (2006), record the importance of broad strategic assessment of the

data, which make up an information system, and their interactions with other subsystems involved. According Hicks (2006 p. 269), "IE needs to understand the information and organizational flow, in particular, important phases where information is generated, and replaced accessed". In this scenario, information has come to play an important role as a strategy, Apte and Nath (2004). The goal of Information Engineering is to provide the means to respond to changing information needs of an organization, providing the necessary infrastructure to provide rapid results, and allowing the creation of effective processes. The ability of Information Engineering connect the flows of different processes, including sections and subsections of Information Systems, provides strategic value. The information flow commanded by the Information Engineering, generates speed, fluidity and economy as proposed by Hicks (2006) and shown in Figure 3.

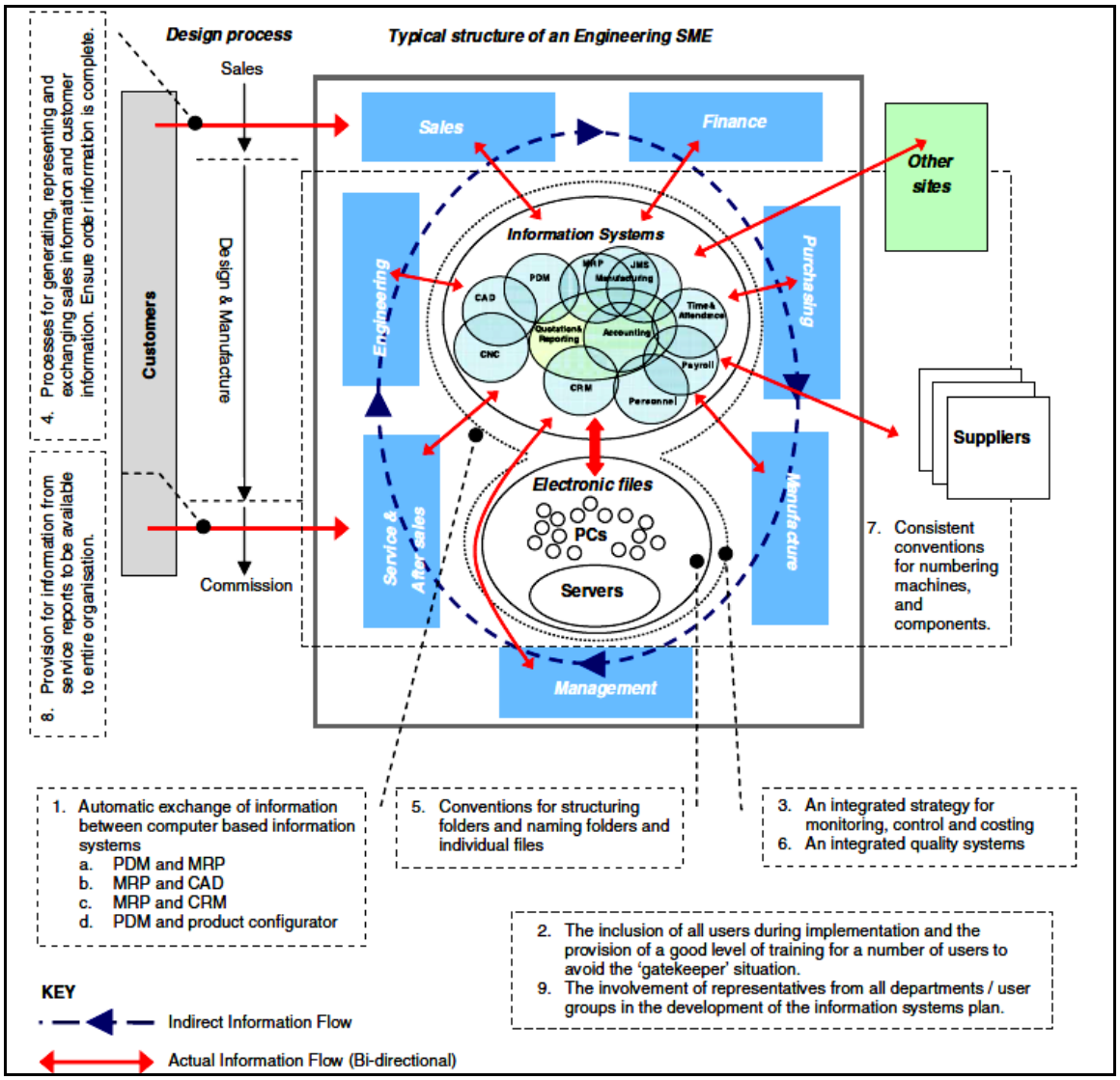

Figure 3. Articulation of the Information Systems, adapted by Hicks (2006)

The information is not limited to simple data collection. So that data is transformed into useful information, they need to be decoded, organized and contextualized according to the needs of decision makers, Beuren (2000, p. 47). In other words, data represents the raw material, which is of utility value in accordance with predetermined purposes, transforming them into information for that specific purpose. Flows are not just an element of social organization: it is the expression of the processes that dominate our economic, political and symbolic. Flows are intentional, repetitive, programmable sequences of exchange and interaction between physically disjointed positions held by social actors in economic structures, political and symbolic of society. Dominant social policies are those that are embedded in dominant social structures. By prevailing social structures, understand procedures of organizations and institutions whose internal logic plays a strategic role in shaping social practices and social conscience for society in general, Castells (2005, p. 501). Considering the ability to connect the different processes by the Information Engineering, the scenery information converges the massive use of Information and Communication Technologies, contributing to the generation of new information sharing mechanisms and contributing to the emergence of disciplines that rely on structuring of knowledge, such as knowledge Engineering, Iske e Boersma (2005). The knowledge engineering methods used to understand the structures of knowledge, allowing the integration of information technology, identifying bottlenecks or opportunities Schreiber et al. (2002).

In information management platforms IES, Information Engineering adds informational value, contributing to spatial information flow and the maintenance of records of knowledge, thereby contributing articulately with the assumptions of this research, that there is little or no coordination of information systems in the IES management platforms.

8. Data Analysis and Results

In order to achieve the objectives proposed by the study, which appears in accordance with the theoretical framework and in accordance with the data collection strategy was applied in an IES; the questionnaire, the interview and observed no participatory way, to their respective information management platforms, which resulted in the mapping of their information flows. The structures of the SI, comprising a platform, were observed and evaluated by following a pre-designed script, serving an intentional sample accepted for this study. The IES identified as intentional sample (A), makes up a scenario with fewer than 2000 active members in the informational platform management, with different variables inserted into sections and subsections of the respective platform. The structured evaluation of information flow through the adapted collection instrument of Vieira (2006) resulted in the identification of variables of information flows, which in turn were divided into intranet and extranet variables. Initially, there was in the open or extranet platform, the presence of research and

observation criteria such as; organizational content variables; design variables, deck layout and access to the platform variables resulting in the external structural elements. The informational link between the access structures, gives agility in information retrieval, and in that sense, the external platform IES classified as (A) showed variations in these informational joints, specifically with the partial presence of a visible architecture of the sections and subsections, in the absence of identification and articulation for minimized navigation. Considering the informational articulation a speed generating element in the recovery of information, platforms are facilitating means of communication and collaboration between teachers, students and researchers who finally allow the sharing of resources of common interest, Teixeira, Freitas e Laurindo (2014). The systematization of the navigation items open platform and their information flows, form an interconnected network of sections and subsections, generating and conducting information. This study does not aim to measure website performance but identify generating elements of planning and flow of information. The articulation of information in different sections is perceived by the developer as an important element and aggregator of value. Information systems, most organizations focus on the collection and dissemination of valid data and do not recognize the information.

The observed Institution (A) is structured through its information systems, and for which their transit flows of demands and decisions, namely; authentication system, academic control system, financial control system, communication system. Through direct access, there are shipping demands that, in turn, requires system decision. The demand is a desire expressed from objectivations, ie at the time which you have a goal, begins the demand process, activates the information flow directed in different sections and subsections, building the informational network Vieira (2006, p.46). Information systems, members of a management platform, are connected and form a network, which gives a new dimension to the management process. The movement of information requires a sequence of steps according to the proposed objective. In an academic informational management platform, said information having an inlet port, processing steps, ie on the informational object, it proceeds to the need for corresponding action desired response. The results of the informational drives, in turn, will feed both the internal and external requirements, involving the sections and subsections of the management platform, the articulated forming informational network. To assess their joint informational, it was necessary to map the flows involved in the system using the Infomapping technique, created by Burk and Horton in 1988. It is a valuable tool for managing information resources. Lets find out exactly what level of ignorance that has on systems with which develops informational jobs, raising the generated information, represented in Figure 4

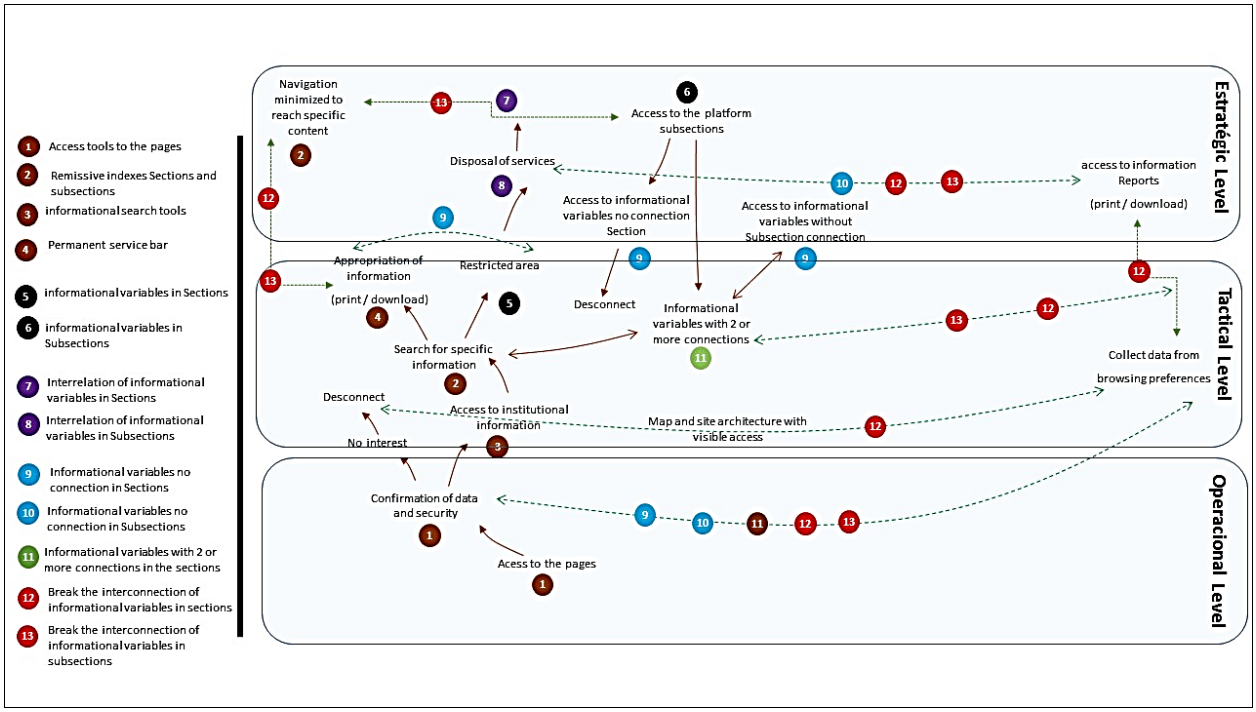

Figure 4. Mapping of information flow

The mapping of streams, represented by Figure 4, relating the variables in their respective sections and subsections, is the SI visibility scope, at different levels. The need for visibility and interconnection is referred to as a requirement for the articulated development of information; Camarinha-Matos and Afsarmanesh (2000). In line with the evolution and informational provision described above, the author Tachizawa (2006) develops understanding about the organizational setting for the management of information in IES, saying that usually prevails a traditional structure, vertical and functional type and therefore, management platforms tend to represent the same functionality. Still on Figure 4, in addition to variables with no provision for connection, the information flow, submitted eleven breaks the informational connection in different sections and subsections, as shown in Figure 5.

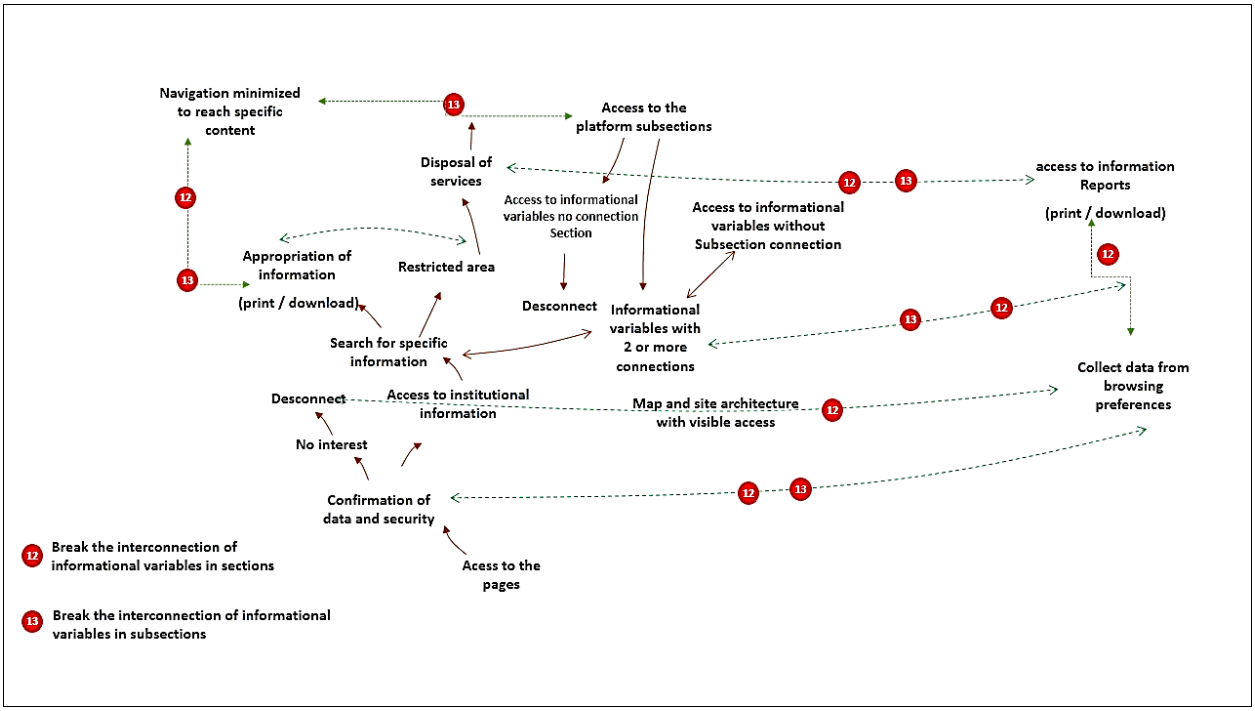

Figure 5. Ruptures the connection of variable information

Disruptions identified in the flow mapping, interrupt handling information, thereby diminishing the connection capacity of its variables, the information retrieval speed, the informational flow and the process lifecycle. The information systems, pivotally arranged in different sections and subsections, the adaptive promote development of informational system through the "engineering or reengineering process as part of the IS cycle, optimizing processes contributing to processing speed by facilitating the purchase information and system memory" Camarinha-Matos and Afsarmanesh (2000, p. 384). Similarly, considering the concept of information engineering as the application of an interconnected set of formal techniques for planning, analysis, design and construction of SI for an organization as a whole, identifying opportunities for gaining competitive advantage, Engineering Information acts as a differential performance. In his work, E-Business and Virtual Enterprises, Camarinha-Matos (2000) describes the process of engineering and reengineering of processes in a dynamic context, supported by the process life cycle, involving systems and information flows at different stages.

Otherwise, re-engineering methodology requires the use of application tools to guide the user, avoiding breakages. Two aspects are considered when developing such tools. The first aspect considers the functionality required to support the development lifecycle, while the second considers how the tools can be complemented by a number of other tools, a change in loop architecture. De Oliveira (2003). As described, the ruptures of processes and information flows, compromises the IS performance of organizations in different areas Le Coadic (2004); Schlögl (2005); Vieira (2006) and Martins (2011).

9. Conclusion

As already presented by Vieira (2006), the information systems in IES, operate by information flows, namely information and knowledge. The flow of information is a sequence of events that moves from a starting point to point of arrival, is a source of emission and another reception. The starting point is the emission source, which energized by an objectification causes a flow in the space-time (traffic), coming to objectification environment where it operates processing by the dialectical interaction between information, intelligence and communication, Vieira (2006, p. 48). In an educational institution, this relationship is well characterized because the processes that make them different from one-platform systems undergo aggregation values, which means the generation of new information and knowledge flows. The flow of information, knowledge generator in the IES, passes the information system for the supply chain adding value, from suppliers to final product available to society. Although how to map the observed information flows, and in a specific context, the structural elements indicated as variable ruptures identify lack of coordination and informational convergence IS, which comprises the platform, these elements, described as determinants for the development of IE and obtaining the informational fluidity.

Preliminary results of this research record that is indicative of problems related to lack of planning in the information flow, as indicated in figure 4, generating gap and break the connections of the variables that make up the sections and subsections of the information systems that integrate EAD platforms. As facilitators the results indicate that the use of the elements of Information Engineering, as the order of the flows involved in a management platform contributes to the mobility of the information flow, proposed by Hicks (2006), facilitating connection contexts different studied variables of generating the increased fluidity information. As future research suggestion, deepening the empirical study of information movement and their interconnections in information systems identifying variables and connection breaks, in order to develop more fluid information systems and interconnected variables.

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