

Monteiro Chacon, Márcia Josienne; Carrasco Diaz, Daniel; Sanchez Toledano, Daniel David

**Article**

## Integrated systems in a Brazilian university: Cooperative information as strategic resource

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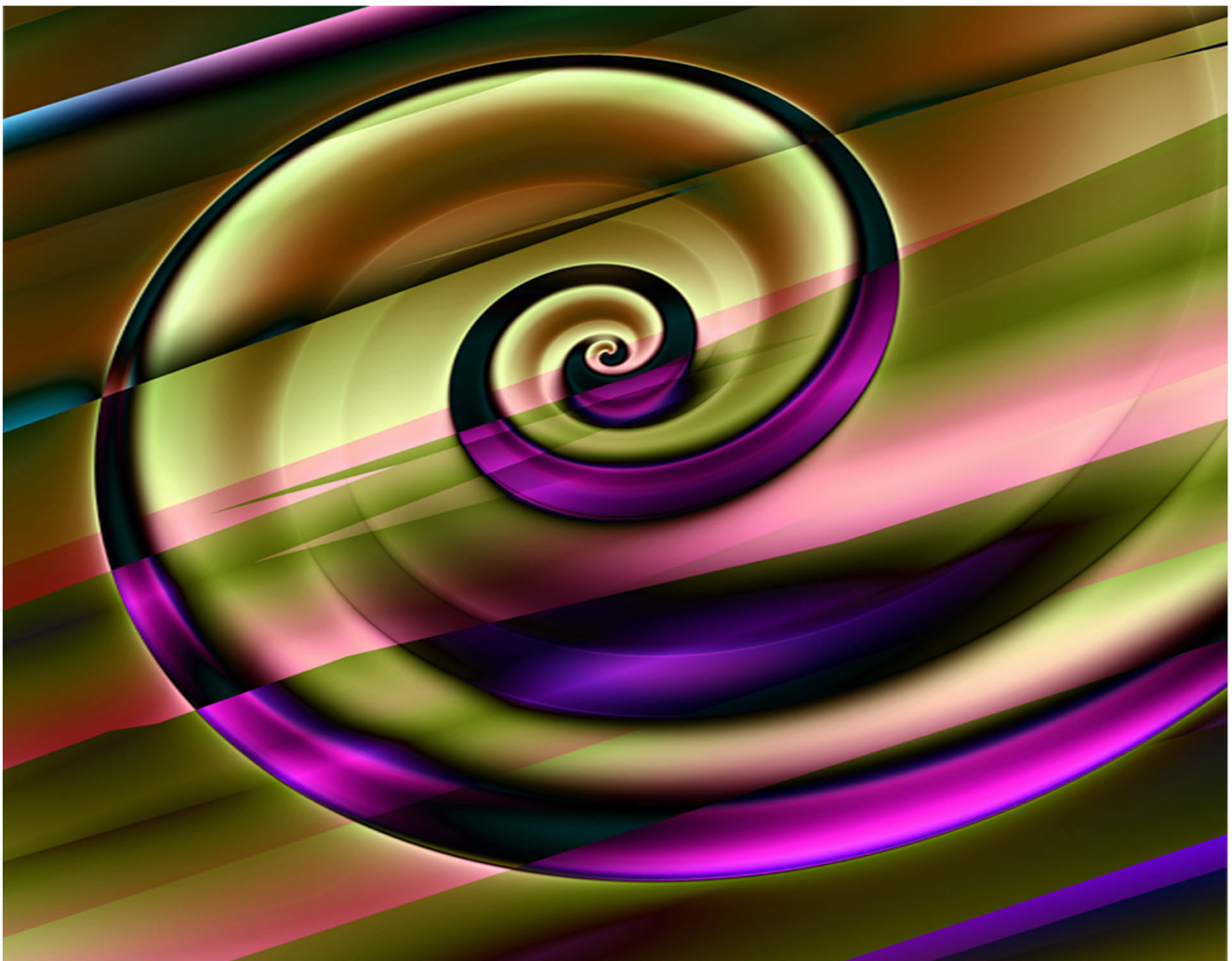
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## **Integrated systems in a brazilian university: cooperative information as strategic resource**

Márcia Josienne Monteiro Chacon<sup>1</sup>

Daniel Carrasco Diaz<sup>2</sup>

Daniel David Sanchez Toledano<sup>3</sup>

### **Abstract**

The proposal discusses the obstacles arising from interconnected information systems that support the management in Brazilian federal public universities. Question the nature of information and sources that are used in the decision-making process by managers. It aims to analyze the information generated from the Management Information Systems in UFRN - Federal University of Rio Grande do Norte for decision making. This is a Case Study, which reflects the problems of the various institutions of higher education. Presented the system used in UFRN and its modules. It was concluded that the use of management systems are useful for Universities. It is observed that there are limitations that seek to overcome, such as asset control, module integration and system cost, with the possibility of implementing a Controller.

### **Keywords**

*Information Systems, Business Intelligence, Universities Management.*

### **1. INTRODUCTION**

The federal public universities seek to overcome obstacles arising from existing models of management, considering the peculiar complex structure. To do so, are required interconnected information systems that process data and give support to management. These are called Business Intelligence - BI, and refer to the collection, organization, analysis, sharing and monitoring of information that support business process management.

The concept originated in the 80s, describes the ability of corporations to access data, and exploits information contained in Data Warehouse, analyzing and developing understanding, enabling them to enhance and transform into information for decision-making. BI collectors get the primary sources of

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information within the institutions. The sources help who has to decide and how you can do optimally. Secondary sources include user needs, economic, technological aspects and cultural trends.

If you know that in whatever time, managers need to take decision. For this, an information system can be defined as an automated process, in other words, manual, cover people, machines, and/or organized to collect, process, transmit and disseminate data that represent user information for methods is necessary/or customer. All data generating system that converts information generally may be considered as an information system. An organizational information system can be conceptualized as the organization and its various internal subsystems, still contemplating the external environment. In universities is no different, managers, specifically authorizing the expenditure, need an information system to aid management.

Thus, information systems are those that focus on communication processes. Human information processing systems, electronic systems for data processing and information retrieval systems are examples of mechanisms specifically designed to facilitate information retrieval. Thus, information retrieval systems are types of communication systems, which, among other functions, they will provide access to information, recorded therein. Such information constitutes recorded human memory (Belkin, 1976).

In this context, the question is: *what is the nature of the information and sources of information that are used in decision making by managers of public universities process?*

This concern is based on volume of documents produced and received by the institution deemed too big and they do not realize there is a document management thereof. This fact may contribute and interfere with the decision-making process. The guiding objective of this work is to analyze the information generated from the Management Information System – SIG in Federal University of Rio Grande do Norte - UFRN for decision-making. Specifically, describe the information used by managers; punctuate the existing SIG in UFRN and their limitations, and to present the existing network between universities using the same system.

The methodology used for the work of inductive method, exploratory approach. We used a survey to collect data and classify it as a case study. This work is justified by the need to manage in a timely manner. Management systems evolve from the managerial needs, so now of decision, the manager needs to have at hand the information that will make the correct decision arrives, thus considering the system efficiency and management effectiveness.

## 2. THEORETICAL FRAMEWORKS

Globalization and the evolution of IT changed the way businesses and people relate. Consumers have several options of products and services that years ago was not possible. The same applies to governmental organizations.

In post-industrial countries, most sectors of the economy are devoted to information. Your search, creation, manufacturing, warehousing, sorting, selecting, editing, summarizing, interpreting, accumulation, acquisition, sale and distribution. This is the foundation on which the economies of these countries will be called "information economies" (Melody, 1986).

The Constitution of the Federative Republic of Brazil (2004, p 8), article fifth (5th), XXXIII, determines that:

Everyone is entitled to receive from government agencies information of particular interest, or of collective or general interest, to be provided within the law, subject to liability, except for those whose secrecy is essential to the security of society and the State.

The management of information systems must support strategic planning to present guidelines that are not only concerned with the legal aspects, but with management practices that enable decision of

directors and officers of expenditure. When it is committed to the quality of information, these shall be considered as an effective tool for strategic, tactical and operational plans, feeding the management information system and promoting preventive and corrective actions where necessary.

## 2.1 Organization and Decision Making in the Federal Universities

Although there have been significant changes in the Universities, Chauí (1999) reports that, over time, universities were settling, restricting the fulfillment of bureaucratic rules, losing its autonomy as a social institution and somehow seeking a possible strategy.

Analyzing schools known strategy proposed by Mintzberg (1998), it is understood that the School of Learning is best suited to integrate business and Information Technology-IT; it contemplates in his studies the process of storage, processing and use of information for strategic decision making. This school seeks to understand how the actions of strategists have been adopted over time and how these actions contribute to continue learning within institutions. The idea focuses on the formulation of standards behaviors (success or failure) of experiences, and as such, legacy contributes to the formulation of strategy.

In Brazil, higher education was established based on a template isolated and professional nature, which would explain many reflections and distortions observed today (Souza, 1997).

The growth of higher education in the country was, in fact, in the 70s, and understanding of Cunha (1997), only with education reform, undertaken in 1968; it was possible to create, effectively, Universities in Brazil.

The role of universities may be so appointed, according Kunsch (1992, p. 23)

For their own purposes, plays a fundamental role in the construction of modern society. It has an appointment with the past, preserving the memory, to the present, generating new knowledge and forming new professionals, and to the future, and working as a vanguard university cannot isolate itself from the world we live in today. Must be present and act so that it is teaching, its research and extension services meet the requirements of modern times, from the perspective of a face the problems of the current socio-economic structure.

To understand the complexity of university organization is necessary to define organization to Etzioni (1989, p. 3) are "intentionally constructed and reconstructed social units (or human groupings) in order to achieve specific goals".

Universities, despite its statutes, regulations, and specialist staff, develop a different logic from other organizations because their primary attention is focused on training and dissemination of knowledge through educational practices, making different contributions to society. It is in this context that presents inactivity in decision-making, where participants tend to remain distant from the process, judging this activity as unrewarding.

Universities have many organization models. However, to Baldrige *et al.* (1982), there are a number of aspects common to all of them, and how the systems hierarchy, division of labor, decision-making processes that establish the institution's policies, accounting and financial management, and human resource selection based on technical competence and the degree of professionalization, and essentially academic data with information for teachers and students .

Given the autonomy, hierarchy and assistance to many users, observed that universities need to keep Intelligent Systems, interconnected so that their academic and administrative needs are met in real time.

## 2.2 Management Information Systems

With the turn of the century, technological revolution brings the need to rethink new teaching method and adapt it to the new reality. These adaptations occur through the computer that enables a methodological breakthrough opening paths for all areas of knowledge.

This information explosion, which, incidentally, should have better designation (explosion of documents / messages), is only one aspect involved in information systems. The computer is also handling other aspects such as storage, processing and transmission. According to Tennant and Heilmair (1991), in the 70's the first commandment of a programmer was "not waste machine time!". The cost of such time was frighteningly high: If paid-for fraction of a second. In the 80s, began an era of "computational plenty". Today, the imperative is to find more uses for the computer company, already taking place enormous reductions in the cost of the duties performed by him. Within this context, the technologies of Information Systems have benefits allowing systems to process a greater volume of information with diverse nature and competitive advantages.

Since the early 1980s, the Information Technology (IT) has become a powerful tool for competitive advantage. Piccoli (2005) states: "Since the early 1980s, Considerable research attention has focused on the strategic role of information technologies and their potential for creating competitive advantage".

As Stair (1998), system is a set of elements or components that interact to achieve goals. Information Systems are series of interrelated components that collect (input), manipulate and store (process), disseminate (output) data and information and provide a feedback mechanism, which is an output used to make adjustments or changes in input or processing activities. In addition, to Breton (1989) the information comes from the word *informare* Latin: shape, put into shape or appearance, create, but also represent, display, create, idea, or notion that something is put in order, in order. The etymology of the word information, Greco-Latin origin, refers to a universe of meaning much broader.

In fact, the search for a general theory of systems continues. As rightly noted Mattessich (1982), the great success of the systemic approach can be attributed to the growing dissatisfaction of the scientific community with the mechanistic view as universal model, and the need to counteract this same community fragmentation of science specialties in almost isolated from each other.

Regarding the need for information to Oliveira (2008, p. 73) "... Business efficiency is being seriously undermined by systems that simply produce huge amounts of data and information that are not worked and used". These tools allow managers to obtain dynamic and practical information necessary to support either the decisions that guide the company, in internal administrative issues, sales strategies or other areas that require a more accurate indicator management.

## 2.3 Characterization of Business Intelligence - BI

The term business intelligence is a general concept, now a category associated with the owners of open cases of business and specific technologies. Its main goals are generally for it, collect data, information and transforming sequentially it useful for taking decisions and Timely knowledge information.

The intelligence is immediately referred to the notion of privileged information to join competitive advantage on one Opponent determined and any successful strategy. The demand and technological complexity are these changing needs and trends.

The information produced and the databases of the activities are a growing the exponential pace. For you both, them transform data into knowledge is necessary. All these contingencies require much attention to them to provide systems of internal control performance management information and support for the process of taking decisions.

The BI environment is within this context and is substantiated by Helm Filho (2004) as "all issues related to decision making, data storage, publication of information (on the Internet or another friendly environment for users), to production of multi-dimensional 'cubes' data", for the author, these are a set of services, applications and technologies, combined to add value, manage, and analyze information.

The business intelligence systems are catalysts of change that allows it to work in these new practice approaches for good management. One way for the effective diagnosis, and analyzes the accessibility of the data, it is possible that is governing government them realize what that is essential and to turn them into useful information amount, huge knowledge timely and reliable. And of course, this turned into knowledge results for the companies that you can pass the operational efficiency business efficiency. Sezões, Oliveira and Baptista (2006) definen *Business Intelligence* - BI as a set of a support of applications that allow decisions faster database access shared information and interactive information and the manipulation and analysis as, through different these tools, users can find trends and relationships and render large amounts of information into useful knowledge.

In addition, since the BI, by nature, is an application that seeks to meet since middle management, with its extensive analytical capability to the senior management of companies, with the generation of quantitative performance indicators, it is essential to link it to the formulation process strategy. According Mintzberg (2005)

(...) When there was a major strategic redirection, this rarely stemmed from a formal planning effort, and indeed often even the rooms of senior management. Instead, strategies were due to a small variety of actions taken by all kinds of different people (...) In other words, reported in people anywhere in the organization can contribute to the process strategy.

As understood from what has been said here, that the existence of BI systems is justified by its suitability several institutional realities of his life. There is now a set of critical activities and organization cases opened each model, where obtaining of essential knowledge that is needed is for the specific decisions. In the first synthesis, these business intelligence systems have common fundamental series important goals: access to reliable data, increases the transparency and understanding of the business and support decisions.

The main element is the BI Data Warehouse (DW). A large database where information about company transactions, where you can perform analytical queries are stored. After the implementation of a DW and fostering the construction of a BI environment, the feedback of the information with the result of actions taken system from the analytical data set available is of vital importance to the creation of knowledge that second Wakefield (2005)

Knowledge generation, storage, and diffusion are facilitated by IT, by using such mechanisms as groupware, on-line databases, intranets, data warehouses, and software agents. When knowledge assets are leveraged using IT, organizations experience increased performance, greater business value and enhanced dynamic capabilities.

Recognizing the ideas importance that the analytical use of the data is has something gave place, their business intelligence. However, the potential value of its analytical use of the data is the unique heritage of private enterprise, the common bell any organization.

Picazo and Paula (2013, p. 26) choose the term "institutional intelligence" when referring to the application of business intelligence technologies of business intelligence, serving the higher education institutions. Justify that existing several reasons to use separate y un specific ending, instead of following en el original finish using BI refer to when referring to the application of business intelligence Business Intelligence them to Universities. How following them:

»Commercial purpose of the IE is generally well received when I apply a particularly public university context. It can have negative connotations, as something that other areas do perceive own sectors and dismissed from the University.

"The Varian analysis objects to move much from the companies the scope to Scope of Higher Education ... need specific analysis models define ...

"While the tools and techniques for operating the analytical exploration of data are common, the reality is the very distinctive university business. The strong decentralization and autonomy of teachers and administrative units compose ... make ... that context is much more complex, and have a straight face and various specific situations commonly found in businesses.

An intelligence system, seen from the perspective of its technological aspect, should be included in the information systems infrastructure of the university, considering that a BI system cannot exist by itself, is linked to data sources either the transactional systems or multimedia files.

On the other hand, it is necessary to understand the interaction between information produced and their end users, which, through various interfaces and visualization tools, take advantage of what was produced, filtered and synthesized.

Several customizable Business Intelligence tools in higher education, called BPM or *Business Performance Management* and *Business Performance Measurement*. The *Business Performance Management* is a way to actively guide decisions about the direction you want, quickly and accurately, rather than passively criticize the results after they have already produced the facts. This term refers to a method for the global analysis of decision making in the institutions, with the aim of improving the understanding of the actions and manage performance at all levels within an integrated management environment. As a complement, *Business Performance Measurement*, which are the measures in the key performance indicators and performance measure or supporting information used in the analysis phase of the economic cycle used.

BPM management is supporting modeling and exploration of scenarios and takes the user one-step further, allowing the examination of the consequences of alternative courses. It can support predictive modeling and enable performance management of universities. For business intelligence and apply there are several definitions of BI tools in higher education institutions is a valid point, because these effects to be applied according to tax this sector in recent years. However, the term refers to various interpretations aimed at aspects of the business that do not coincide with the beliefs and values of the university environment for their distinctive characteristics.

Consequently, in order to find a definition that best represents the computer systems of universities, intelligence agree with psychology as the ability to reason, plan, solve problems, comprehend ideas and language and learning is accepted.

### 3. STUDY CASE: THE FEDERAL UNIVERSITY OF RIO GRANDE DO NORTE – UFRN

Like other institutions UFRN with purpose to expand information to students and develop real-time activities of teachers, record searches, document extension projects and essentially take administrative



and financial decisions, maintains an integrated system with the purpose of optimizing the information system, streamlining decision-making.

Reports directly to the Dean, the Office of Information Technology is the body responsible for coordinating the administration, design and development of computer systems and the nature of corporate infrastructure management UFRN network activities (Figure 1).

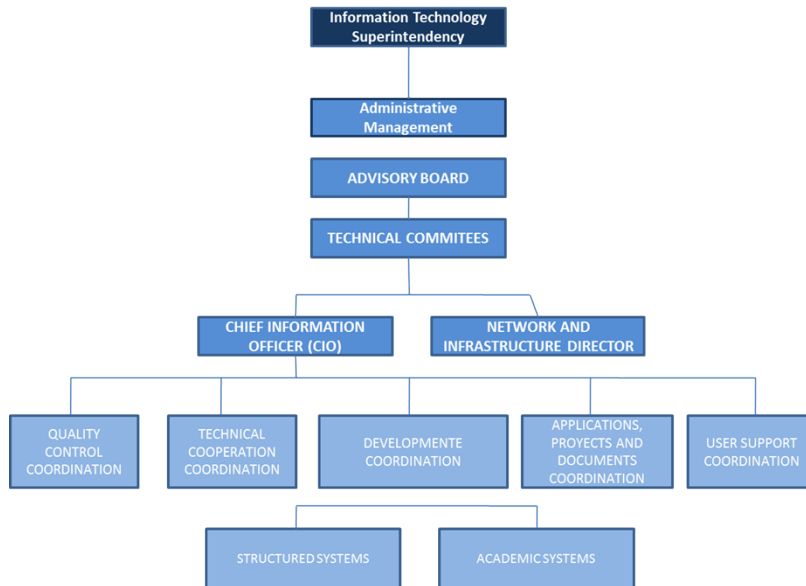


FIGURE 1: Organization chart of the department of informatics  
SOURCE: <http://www.info.ufrn.br/html/conteudo/organograma/>

As the agency responsible for coordinating the administration, design and development of computer systems and nature of corporate infrastructure management UFRN network activities, the Office of Information Technology has the following skills:

- I. coordinate the planning, implementation and evaluation of activities and submit the management plan, their annual action plans and budget proposals, as well as annual reports, financial statements for the year and reporting to the Advisory Board;
- II. coordinate periodic survey of the needs of computer users in UFRN, aiming to improve the activities and services;
- III. set standards for the use of computer services, and authorize expenditures and contracts, safeguarding existing provisions in UFRN;
- IV. sign, together with the Office of Administration, credit transactions, purchase and sale of assets;
- V. move, together with the management of the funds of the Superintendence Administration;
- VI. work in administrative modernization, upgrade technology and human resources;
- VII. fix the internal personnel policy, finance, materials, equipment, assets, facilities, except for the provisions governing the UFRN;
- VIII. Provide logistical support for the operation of the Advisory Council and Commissions.

Given the existing competence, each area develops their skills according to the needs of the system, grading them:

- a) **Administrative Management:** Is the executive area that provides operational support to the Superintendent in relation to infrastructure management and staff development, materials management, inventory, finance and services.
- b) **Advisory Board:** Is the higher advisory body on policy, administrative, budgetary, and financial and property matters.
- c) **Technical Committees:** interim authorities are working, constituted in accordance with identified needs or at the recommendation of the Advisory Council to perform specific activities.
- d) **Directors:** The Directors are areas of specific technical activities with executive functions performed by coordinators, appointed by the Superintendent of Informatics.

The Board Systems is responsible for development and maintenance of systems UFRN. In addition to the Director, the Board consists of four teams: Team requirements, user support team, development team and testing team and quality control. **Systems Business Intelligence UFRN**

The systems can be classified according to their method of use and the type of feedback given to the decision-making process may be operational or managerial context, in other words, Operations Support and System Management Support Systems.

When speaking to provide information for decision-making throughout the organization must be involved in this process. The complex relationship between the various managers of an organization should be facilitated by managerial support systems.

O'Brien (2002, p.29) states, "when information systems focus on providing information and support for effective decision made by managers, they are called management support systems".

The decision-support systems - SSD are fitted with large amount of data and modeling tools, provide flexibility, adaptability and rapid response capability to managerial level of the institution. In this context, Batista (2004, p. 25), considers how SSD "... systems that have interactivity with the user's actions, providing data and models to solve semi-structured problems and focusing on decision-making". The decision support systems provide critical resources that enable the decision support for managerial level. Have management information system supports the functions of planning, control and organization of a particular institution, providing timely and reliable information for decision-making time.

Oliveira (2002, p. 59), states that, "The management information system is represented by a set of subsystems, integrated and visualized able to generate information needed for decision making way".

Garcia and Garcia (2003, p. 29) cited Polloni, which define management information system "is any system that provides updated positions, resulting from the integration of multiple groups of information systems that use resources consolidation and interconnection of entities within an organization".

The management information systems are constantly changing, which goes against the need for any organization to survive in the market. To Batista (2004, p. 22)

management information system: It is the set of technologies that provide the necessary means to available data operation. It is a system oriented to collection, storage, retrieval and processing of information used or desired by one or more managers in performing their activities system. It is the process of transforming data into information that is used in decision-making structure and provide administrative support to optimize the expected results.

The decision-making structure in the context of managerial processes, rank systems according to organizational problem solving that helps. Thus, we present Table 1 with Integrated Information Systems in UFRN:

TABLE 1: INTEGRATED SYSTEMS IN UFRN



ACRONYM	NAME	OPERATIONALIZATION
<b>SIPAC</b>	Integrated Heritage Management and Contracts	Provides basic operations for managing the units responsible for finance, property and contracts being active in activities. Integrates the administrative area from up control of budget distributed internally. Each unit has its administrative budget and authorization of any expenditure per unit, must occur in this system. Manage controls: shopping, bidding, police services, settlement expenses, maintenance of minutes of record prices, assets, contracts, agreements, deeds, maintenance of campus, invoices, payment of scholarships and grants, supplies and vehicle expenses, memos Sourcing, processing of cases among other features.
<b>SIGAA</b>	Integrated System of Academic Activities	Computerized procedures in academia through the modules: undergraduate, graduate, technical school, high school and kindergarten, submission and control projects and research fellows, submission and control extension actions, submission and project control education (monitoring and innovations), recording and reporting academic production of teachers, distance learning activities and a virtual learning environment called virtual Class.
<b>SIGRH</b>	Integrated Management Planning and Human Resources	Computerized procedures for human resources, such as marking / modification vacation, retirement calculations, functional assessment, sizing workforce, Frequency Control, competitions, trainings, online consultations, applications services and functional records, reports RH, among others.
<b>SIGAdmin</b>	Administration System of Systems (Technical and Management)	It is the area of management of integrated systems 3. Manage common entities between computer systems, such as users, permissions, units, messaging, news, management of websites and portals, among other features. Only managers and administrators have access to SIGAdmin.
<b>SIGED</b>	Integrated Electronic Document Management	A technology aims to provide a means to easily create, manage, store, share and retrieve information in existing documents. The GED allows you to preserve this heritage and organize documents electronically, ensuring accurate information at the right time, for the right person.
<b>Project</b>	Integrated Project Management	It is a management tool for software development process that allows integrating the flow development through its various teams (development, testing, validation, support, integration) in a single tool.

SOURCE: [www.ufrn.br](http://www.ufrn.br), accessed at 13/03/2013

### 3.1 Limitations of the System

In every type of system used, we realize that with the evolution constraints are emerging gradually. In UFRN, this is not different. Many are the needs for adaptation and improvement. The aim of this work was not classify existing problems, but to demonstrate a network of Brazilian universities that use the same system that is evolving and being perfected.

So even with the difficulties to demonstrate the best that can be seen for comparison and improvement, we observe the following limitations:

- a) **Integration of the modules in a limited way**, such as the request for daily travel, initially used the SIGRH to request the withdrawal and that system that serves to inform the remoteness, goals and dates; daily are generated by another person which operationalizes another system SIPAC;
- b) **Delay in the low values of budget**: still considering the daily trips to the example. The process starts in SIPAC by a person authorized, executed, finished, terminated, each procedure by different people, generating rework. Thus, after payment, such amounts should be downloaded immediately from the budget balance. However, another person operationalize and this limits the efficiency;
- c) **With the limited integration between systems**, often authorizing spending to check the balance of the drive to free up some spending, sees a value, however, the delay of low balance requests shown is much smaller than the real;
- d) **A system of fees treated with a managerial focus**, as an aid to decision making, generating reports of special nature, and formatted differently for each study or analysis requested way, considering that not only units and centers of the University as well as schools and hospitals that are part of the campus.

The limitations arise from the operation of the system. This does not mean that the systems used do not meet the management. Still prevails a culture where innovations affects and sometimes have resistance to change.

Intelligent Systems takes its name because of the speed of your existing fitness changes in each organization, facilitating decision making and effective management.

### **3.2 Technical Cooperation**

Technical cooperation is regulated by Presidential Decree No. 6.619/2008 which conceptualizes that cooperation is an instrument by which the transfer is adjusted credit agency of the federal government directly, municipality, public foundation, or federal entity same nature. The network of institutional technical cooperation promotes a network of collaboration between institutions and greater interoperability with government systems. The cooperation project is to deploy the systems at the Federal University of Rio Grande do Norte (UFRN) in other institutions. The systems in question are Administrative Systems (SIPAC), Human Resources (SIGPRH) and Academic (SIGAA) areas.

In 2009, UFRN signed terms of technical cooperation in the IT field with seven federal institutions of higher education (IFES) and three other government institutions, forming the G11. Such terms allow technology transfer UFRN for cooperative institutions and in return received investments in the technology park (HP blade servers, video conferencing equipment), infrastructure (acquisition of property, availability of resources mobility, mobility equipment (cell phones and laptops) and human resources, this has increased to 100% in a year to meet the demands. During 2010, six new institutions joined the project cooperation, increasing IFES Network and Cycle Network, forming the G17, as can be seen in the figure 3:

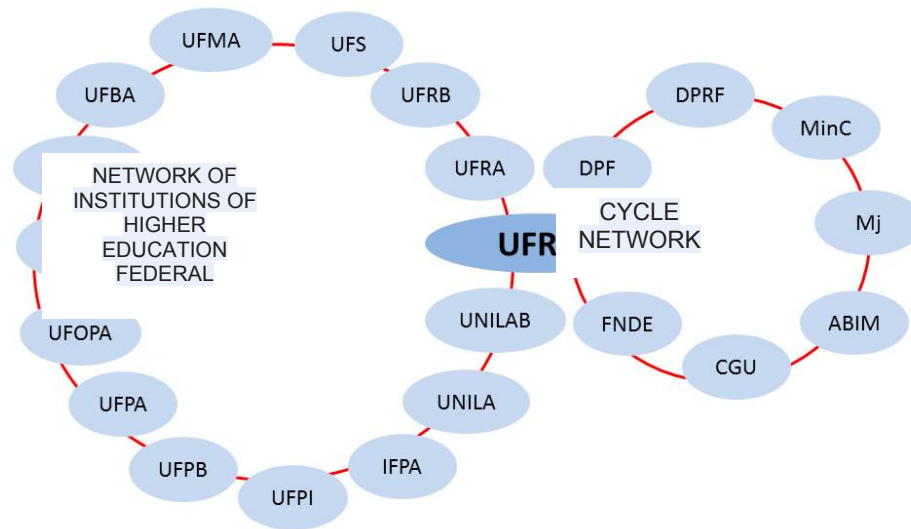


FIGURE 3: Cooperative network of Federal University of Rio Grande do Norte - UFRN.  
SOURCE: <http://www.info.ufrn.br/html/conteudo/organograma/>

After the implementation of management information system, the company began to experience an increased speed in all cases, because the reports that were previously assembled to assess each situation are now available in automated form in SIG.

In addition to easy access to essential information, there was also an increase in the reliability of the information, since the implementation of the management information system step, all sources of data and therefore all data are validated, ensuring their reliability in order to generate cooperative networks.

Of how systems and characterizations networks are being used, it is observed that there is the possibility of implementing a Controller in UFRN, which is nothing more than the current evolutionary state of the science book, stating Catelli (1999) institutions could use rational methods, being in constant evolution, have predictive power, present character of certainty in asserting their utterances. Consists of an amalgamation of information systems with their own accounting and system costs.

#### 4. CONCLUSIONS AND FUTURE WORK

To overcome the bureaucratic obstacles federal public universities seek management models. For this, needs interconnected information systems. Refers to the collection, organization, analysis, sharing and monitoring of information that support business process management.

It is known that at any date, managers need to take decision. In universities is no different, managers, officers expense, require an information system to aid management. This work concerned with the nature of the information and sources that are used in decision making by managers of federal universities process, aiming to describe the information generated from the Management Information System - SIG in federate University of Rio Grande do Norte - UFRN for decision-making. Specifically, scoring SIG in UFRN and their limitations to present the existing network between universities using the same system.

We used the inductive method, surveys and exploratory approach to data for the case study. The main justification for this research is the need to deal in a timely manner, because we know that management systems evolve from the managerial needs.

It was presented the Management Information System UFRN, in Brazil, and a description of each of its modules. Through these results, we can evaluate how positive the use of a tool of management information systems in UFRN, for all the goals that were envisioned with its use have been achieved, and at times even exceeded, generating financial returns required for viability deployment and maintenance of this system.

We conclude that the use of management information systems can be useful for universities and within expectations and that, the program was developed, meets the needs of the institution, so that other universities sought their systems and are developing optimally to date. We observe, therefore, that there are some limitations that seek to overcome, such as asset control, full systems integration without rework and deployment of a system costs, there is also the possibility of implementing a Controller.

This study was not intended to exhaust the subject, only describe a situation that may serve to further investigations of other researchers, specifically the implementation of a controller and system costs.

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