

Impact of enterprise resource planning systems On Scientific Research System in Public University

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Abstract—scientific researches represent a very important axis for the university, because it ensures its innovation and its productivity and develop the competencies of these researcher and research laboratory. But the management and automation of this sector represents a great challenge for universities either for managers, directors, or the researchers from which comes the need of find relevant and effective solution. To manage this sector, we have to study several computer solutions which ensure good management of the information system but trying to use open source and scalable solutions to ensure adaptation to the new change that can be brought to the system.

Keywords— *Enterprise Resource Planning; ERP systems; ERP implementation; Scientific Research; Public University; case study approach; Odoo.*

I. INTRODUCTION

Lately the world has entered into an era that is called the societies and knowledge in which science, knowledge innovation its source of wealth. In this vision the university represents a pillar of development of each country.

In the last decade, the use of information communication technologies became important in all sectors, this technological revolution enhance establishment to integrate the ICT in their information system in order to implement governance [1] and democratization of having information.

In this case, the Moroccan governments through the E-Governance strategy [2] move forward in the field of information technology and encourage all establishments to adopt new tools for developing their information system.

This new strategy encourages public university to adopt open source tools like Enterprise Resource Planning [3] to facilitate communicating information around the functional processes in the public university and to improve their performance. This Information system is useful to support strategy, operations, management analysis, and decision-making functions in an organization.

In this work, we contribute to the implementation of management information decision support system in a public university especially in Scientific Research.

The paper has five parts. First section we propose a short recall of the scientific research in public university. Second section shows the relevant literature review of ERP. In the third section introduces the context of study and describes our system developed by the enterprise resource planning system. The fourth section shows benefits of an ERP. The last section shows the result find in the case study of public university.

II. SCIENTIFIC RESEARCH IN PUBLIC UNIVERSITY

The rapid evolution of the highly competitive world of higher education today imposes constraints that require the establishment of a minimum management framework.

For the university nowadays to take risks is an essential aspect of the dynamism of the institution is not tolerable, the risk must be understood and managed.

Some experts have identified five ways in which management integrates a culture in the university [4]:

- Strengthen the central steering structure.
- Develop peripheral activities.
- Diversify sources of funding.
- Mobilize academic skills.
- Integrate a corporate culture.

The departments are the stones on which universities build their success, and the structures that link these departments directly to the center of the university, without intermediaries, shorten lines of communication and accelerate decision-making.

Good governance [5] contributes to the success of the institution when the external elements involved, the administrative staff and the scientific community work closely together. On the other hand, progress will be hampered if one of these elements takes over.

By studying research management [6] twelve characteristics of a productive research environment are identified:

- Clear objectives that have a coordinating function.
- Emphasis on research.
- A culture of specific research.

- A positive group climate.
- Strong participatory governance.
- A decentralized organization.
- Frequent communication.
- Accessible resources (especially human resources).
- The size, age and diversity of the research group must be sufficient.
- Appropriate rewards.
- High emphasis on recruitment and selection.
- Management with the necessary experience and expertise in the field of research to put in place the appropriate organizational structures and apply participatory management methods.

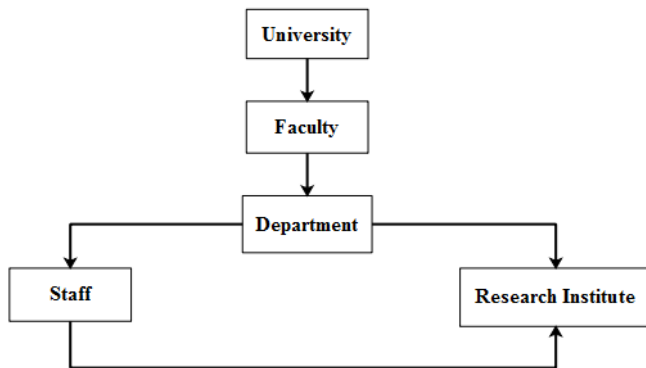


Fig. 1. Scientific Research Architecture.

Among the main outcome indicators used in research universities were the following:

- Measures of resources: financial resources.
- Number of researchers.
- Number and percentage of current researchers.
- Applications for research funding.
- Product measurements.
- Number of publications.
- Directed theses.
- Research applications.
- Academic awards.

Scientific research competence today is important for many professions and activities: it is necessary not only to creatively apply the obtained knowledge but also to create new knowledge, to carry out the applied researches. Also, scientific research activity is the basic component of developing science education.

The purpose of the research is to describe the current situation of organization and realization of scientific research

activity, to define essential factors promoting and hindering students' interest in scientific research activity, to determine lecturers competence peculiarities in the sphere of organization and realization of scientific research.

In the first study years, the students should create reports, present works, raise problems and propose various problem solution variants; the most important criterion was the competence of experts and current research activities (scientific publications, participation in the national and international projects, etc).

The PhD students have possibilities to participate in seminars, projects, conferences, that lecturers willingly help the students to choose the research subject that interests them.

The participation in conference is great. In other hand, it is obvious, that the main subject in scientific research activity is the student and sufficient lecturers contribution promoting this activity; scientific research activity requires consistency, diligence, creativity.

Despite the financial difficulties, the institutions must find the possibilities and form conditions for professional improvement.

Between the most important recommendations in scientific research:

- Apply modern study methods, promoting critical thinking and new subject search.
- Students should be more involved in the performance of the lecturers research works, as assistants, putting data in order.
- Develop lecturers and students team work.
- Include in study programmes more subjects for education of research competences.
- Prepare more complex science projects, in which students could participate.

III. THE CONTEXT OF STUDY

In this context, even Moroccan public universities are becoming more dependent on using ERP tools for developing, communicating information around the functional processes, especially in the scientific research section; the aim of our research study is to develop a model related to ERP system.

Universities use ERP technologies for academic purposes that differ from other organizations because they have different environments and circumstances. The ultimate goal for our system is to facilitate the interaction between the administrative staff and the researchers through ERP.

Although, universities are planning to renew their information systems in the future, this necessitates the call for more research efforts in this area. Because, the study concluded that ERP potentially improves services offered to researchers, faculties and staff.

Change management [9] is a primary concern of many universities in terms of adopting an ERP system, as activities,

processes, and methodologies that support researchers and staff.

The aim is to develop a pertinent information system is to support researchers and their scientific activities in the Moroccan university.

A. Justification for the choice of open ERP Odoo

Enterprise resource planning system [3] is a new management technology that integrates core corporate activities and diverse functions of the establishment by incorporating best practices in order to facilitate rapid decision-making, cost reduction, and greater managerial. The basic concept of an Enterprise Resource Planning evolved over the past 40 years.

- 1960s: Systems just for inventory management and control.
- 1970s: Material Requirement Planning (MRP) [7]: Computer science was used to automate procedures, each service had its own Information System and applications were developed independently of each other. That will ultimately prove some problematic for companies.
- 1980s: The new software systems named Manufacturing Resources Planning (MRP II) [8] that will support efforts to optimize manufacturing processes by synchronizing the materials with productions requirements.
- 1990s: ERP becomes a standard in companies. It adopts a standardized solution for all services and centralizes data in a single database.
- 2000s: Extended ERP comes to market to customer relationship management and offers extended services like e-commerce, warehousing, logistics, scheduling and capacity planning.
- ERP II: Simplified keeping data in synchronization and reduced the number of software required within larger companies.

Odoo [10] is a suite of open source business apps that cover all needs. Its unique value proposition is to be at the same time very easy to use and fully integrated.

The implementation of an automatic system for managing scientific research is based on an open technology such as Odoo. The reasons for this choice are:

- Open Source.
- Ease of use.
- Flexible.
- Easily interoperable.
- Multiple languages.

The system is developed by Odoo ERP based on MVC architecture, Python language and Xml. Concerning database,

Odoo interacts with PostgreSQL, otherwise, Odoo security has two aspects:

- Authentication: is the act of confirming the truth of a user via LDAP or through two Factor Authentications.
- Authorization: is the process of giving someone permission to do or have something in Odoo. These roles are given by administrator.
- Model-view-controller (MVC) is a software architectural pattern for implementing user interfaces on computers. It divides a given software application into three interconnected parts so as to separate internal representations of information from the ways that information is presented to or received from the user.
- Python is a widely used high-level, general- purpose; interpreted, dynamic programming language.
- Extensible Markup Language (XML) is a markup language that defines a set of rules for encoding documents in a format that is both human- readable and machine-readable.
- PostgreSQL is an object-relational database management system (ORDBMS) with an emphasis on extensibility and standards-compliance.

B. Architecture of the system

Thanks to the fast development of the new information and communication technologies, the university has firmly decided to facilitate the access and treatment for all process, especially in scientific research in order to help administrative staff, PhD students and professors to provide with digital services that they need.

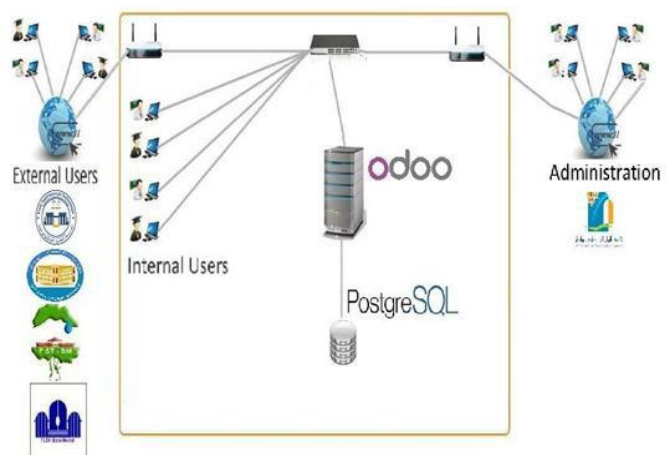


Fig. 2. Architecture, technology and tools used in the system.

Our system deal with different aspect related to the scientific research:

- First axis:

HUMAN RESOURCE MANAGEMENT

This section must provide us general information about all the researchers, Research units, equipment, partnership and scientific cooperation.

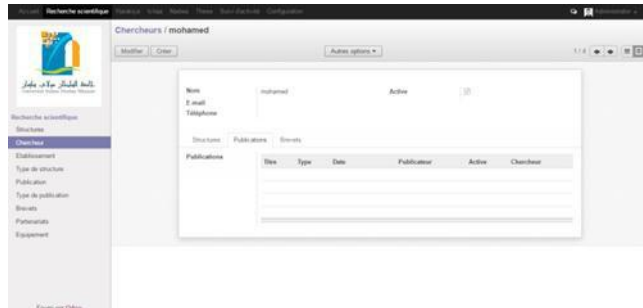


Fig. 3. Platform managing the human resources.

MANAGEMENT OF RESEARCH STRUCTURES

This section must provide us general information about all the Research units, the member of each unit, the equipment allowed to unit etc.

MANAGEMENT OF PARTNERSHIP AGREEMENTS

This section must provide us general information about all the partnership agreements, the goals and benefits behind this agreement, the members involved, the period of availability of the agreement etc.

MANAGEMENT OF THESIS PUBLICATIONS

This section must provide us general information about the entire thesis published in the university by each researcher, also the publication and all information related such as the journal date of publication and the co-authors related to this papers etc.

Second axis:

Firstly, we define the terminology used by the Scientific Research Committee at Sultan Moulay University:

MANAGEMENT OF ICH'AAE

This procedure is dedicated to the publication and dissemination of research works, support nature, information on the project leader, project description, etc.

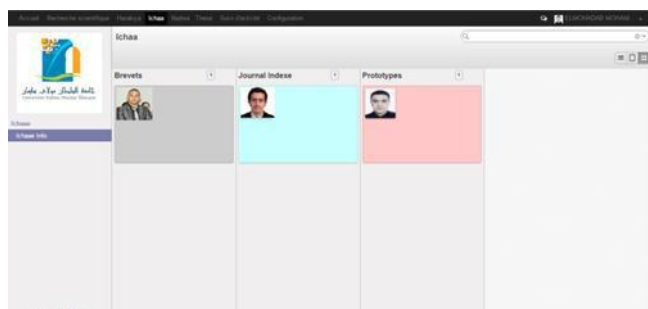


Fig. 4. Platform managing the ICH'AAE procedure.

MANAGEMENT OF NADWA

This procedure is dedicated to the organization of scientific events, budgets, organizing committee, coordinator of the event, research entity organizing the event, etc.

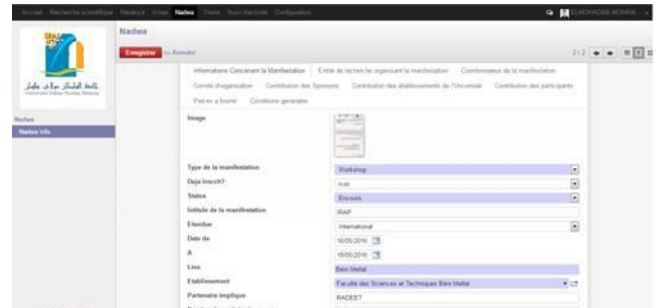


Fig. 5. Platform managing the NADWA procedure.

MANAGEMENT OF HARAKIYA

This procedure is designed to manage the mobility of researchers and everything concerning their participation in scientific events and research internship.

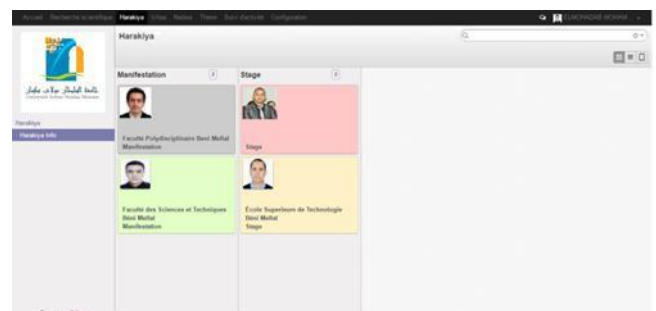


Fig. 6. Platform managing the HARAKIYA procedure.

The implementation of an ERP is a complicated process because it requires good management and governance from the different departments, Research entities, and researchers involved.

Between the main problems areas identified with the implementation of an ERP system we find:

- Resistance to change: The implementation of an ERP represents an enormous change for both administrative staff and users; this component can represent a big problem especially for users if the not take any software training
- The choice of ERP: The selection phase of the ERP is a critical step that requires taking in consideration the needs proposed such us proprietary or free ERP; developing another bricks in the future, upgrade the ERP, etc.
- Technical problems: Simple users can deal with all the technical issue that can face, so the IT service must deal with different problems.
- Critical factors: Including top management support should create a clear vision on how the company

should operate in order to satisfy users, and adapt the system to the information system needs.

IV. BENEFITS OF AN ERP

Between the major benefits that can provide ERP for the university we find:

- Integrity and data security: The use of rules in such system can give more to data security and can ensure the data integrity between the various departments, also provide to the manager the ability to impose rules in user's access in the system.
- Internal communication: For universities, the use of ERP system facilitates internal communication between the various departments of the university and also between the administrative staff and researchers.
- Improvement: Continuous improvement and integration of changes in real-time;
- Reporting: Reporting is an important tool to generate reports and to deal with all data by the system.
- Efficiency: The use of ERP automate all process and eliminate some of the manual processes such us (fill manual form, change courier service, etc..). Besides, the ERP centralized the database between all other applications such us (human resource, Local management, etc..)
- Satisfaction: One of the key successes of the system is the satisfaction of users because it provides a range service to the researcher into the university and reduces the manual interaction with the administrative staff. In addition, the ERP facilitate the work of the administrative staff by speeding up the File processing, and reduce the risk of loss of forms, etc...
- Facilitating control: Facilitating both the control and the audit by providing traceability of the various transactions.
- Reduce costs: Reducing rework, and better decision making.

V. CASE STUDY OF PUBLIC UNIVERSITY

Sultan Moulay Slimane University is a young public university that try to adopt the latest technologies in order to renew all their information system. Now, after the adoption of our new system developed by Odoo we try to know some practical information about the reactions and acceptance of the management system implemented.

A. Research Methodology

The analyze that has been released to discover the utility of the new system adopted, are initiated through the relevant interviews and distribution of questionnaires. The purpose of interview is investigate the strategies, tools, and methods has been used when implement ERP system and what are the main difficulties faced by the administrative staff and searcher and

also our main target of this study is to discover the effectiveness and the reaction of the user for the ERP system.

In order to derive and measure the effective and success of new management system of scientific research system by measuring the acceptance of employee's reactions for ERP, the data collected from the distributed questionnaires answers to most of the queries. Therefore, the questionnaires were distributed among some of Sultan Moulay Slimane University mail for both scientific research staff and researchers. The results derived from the questionnaires were discussed below.

B. Interview results

The interview was conducted with the support of the scientific researcher department of SMS University. The data collected from the interview shows that the implementation of ERP system adds more well managed structure in the application of developmental strategies of the university. The data collected from our interview are presented below:

Before the implementation of ERP system, the IT department officers make pre implementation step and make orientation session for the scientific research department to study and determine the employee computer skill and experience especially in web application. In order to study and determine who are accepting the new system and who are resisting and how much they show their resistance.

Also, before implementation they make very impressive awareness about the advantage of ERP among all researchers in university by sending email. Moreover, the users voted to select best name for new system and they select SRSMSU as name of new system.

Based on the pre-implementation step, there are many resistance employees and the old employees are more resistance than young employees. However, the old style people, technology enemy, are more resistance than other. The reasons of resistance may be political issues, special benefit for resisting a new system, afraid from risk and make mistake, or depend on the person type (some of people does not like the change).

During implementation, IT officers select the more enthusiastic employee in scientific research department to become SRSMSU representative and give him more training. Moreover, they make training session for all intervenient. In other hand, IT officers involve the resistance employees in decision making and give them opportunity to attend the training to solve the resistance employee's problem and transfer them from resistance to change. Moreover, there are very impressive communication between end user and IT technical support by phone, email.

After implementation, the IT officer evaluates the development of SRSMSU job performance for each week employees. The evaluation done by, weekly meeting to discuss the statuses of employees, and generate report to determine the point of weakness to solve it.

C. Questionnaire result

A first questionnaire, comprising 18 questions, was designed to measure the impact of the implementation of ERP system. This questionnaire was distributed among all employees of scientific research department.

These selected people were of different age groups and were with different job experiences. The feedbacks received from these people were based on their personal interpretations and the amount of experiences that they have collected till date in this department.

For the first questionnaire we received only 5 questioners: 3 from female employees, and 2 from male employees. However, 2 of these employees (male/female) did not use ERP system. The questioner results as follow:

- At the beginning of ERP implementation, 75% face difficulties when they using ERP.
- Also 92% observed that the job performance is clearly advanced from beginning of ERP implementation until now.
- 83 % did not face any difficulties now and they found help and assessment from IT technical support.
- 100 % were benefited from ERP training.
- 75 % agreed that there is awareness about ERP feature and benefit before Implementation.
- 64% agreed that the number of training is adequate and suitable for employees.
- 100% agreed that the interaction and communication between IT technical support and employees is impressive.
- 100% not prefer the traditional system before implement ERP to do the job.
- 100%, believed that ERP system help them to do the job in easy and effective way.
- 87% agreed that the ERP technical support solve all employees problem.
- 60% of unused ERPP did not have computerskill and experience that is make obstacle to useERP.
- 0% thinks that the new technologies are no effective in management fields.
- 60% believed that they spent many years doing an excellent job without help from ERP system.
- 80% agreed that are no need for ERP because they know how they do the jobs efficiently.

A second questionnaire, comprising 18 questions, was designed to measure the impact of the implementation of ERP system. This questionnaire was distributed among all researcher of the university in order to know their observation and suggestion to improve the system. The feedbacks received from these people were based on their personal interpretations.

For the second questionnaire we received 249 questioners: 196 from female researchers, and 53 from male researchers. However, 75% of these researchers (male/female) did not use ERP system. The questioner results as follow:

- At the beginning of ERP implementation, 75% face difficulties when they using ERP.
- 80% researchers have the possibilities to take part in conferences, projects, seminars.
- 90 % did not face any difficulties to fill form in ERP system.
- 75 % were participated and benefited from ERP training by the IT department .
- 50 % Students' scientific research activity is more —paperl than real.
- 70% Conditions for scientific research activity are not favorable.
- 60% researchers benefit of Harakiya program through the new system.
- 35% of professor of the university benefit of Nadwa program through the new system.
- 65% researchers benefit of Ichaae program through the new system.
- 63% Students are involved in research projects.
- 60% ERP system motivate the students to participate in scientific research activity.
- 90% researchers Note that the time of respond after the use of ERP system is reduced.

D. Case study and contribution

Based on data collected from the two questioners and interview, we summarized that ERP system implemented among three phases:

- Pre-implementation phase: we look at the existing method and tools and we look for the better solution to solve it.
- Implementation phase: we prepare a training session for administrative staff and also for the researcher's evaluation.

As conclusion, the result find true the questioner and the interview, show us that the implementation of the ERP system management in scientific research was the right choice because the statistics show us that the administrative staff and the researchers don't face major obstacle with the system, also the time of treatment and respond of the request for the three program (Harakiya,Ichaae,Nadwa) compared with the traditional system.

VI. CONCLUSION

The new orientation by the government by adopting the governance in all aspects of institutional Moroccan life leads to the change of the way of employing IS in this sector because the affect administrative staffs, the quality of services, and the time of respond, etc.

Scientific research represents one of the axes that need modernization and automatization by adopting and implementing ERP system. In this direction, this paper has examined the needs presented by researchers and the administrative staff and present as solution the implementation of an ERP system.

As response, we present some problems areas identified with the implementation of our ERP system, and the benefits of the implementation for all users, as a perspective, it is important that future research examines some of the negative aspects associated with the implementation in order to promote the use of ERP in other departments.

VII. FUTURE WORK

This work was a real opportunity to present our vision for promoting scientific research in public university to give more importance to new the implementation of the tools of decision-aid in public university.

In the near future, we will propose a new project which will propose the centralization of the work of other departments in order to have a global information system with centralized in on database all related data.

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