Journal of Teaching and Education,
CD-ROM. ISSN: 2165-6266 :: 03(02):175–183 (2014)

Journal of Teaching and Education

BPM FOR QUALITY ASSURANCE SYSTEMS IN HIGHER EDUCATION

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The University of Valencia, in accordance with Spanish and European regulations, has implemented an Internal Quality Assurance System that establishes procedures and evidences that allow one to conduct and document the analysis, evaluation and continuous improvement in Higher Education processes.The correct monitoring of the processes and the proper storage of documentary evidences must be secured, and the most efficient way for that purpose is a computer platform using Business Process Management (BPM) tools. This work presents the design of such a Quality Assurance System,the technological details of the computer platform underneath and the experience collected during several years of usage.

Keywords: Quality in higher education, Business process management, Open source.

Introduction

The European Higher Education Area (EHEA) framework and European and Spanish national regulations establish that institutions should ensure the fulfilment of specified quality goalsrelated to their different degree programmes, in a context of continuous improvement (EHEA, 2014).

For that purpose, Spanish Universities have implemented Internal Quality Assurance Systems (SGIC by its local acronym) that should be formally established and publicly available. The University of Valencia was one of the first universities to develop such a system, as it was recognized by the Spanish Agency ANECA (*Agencia Nacional de Evaluación de la Calidad y Acreditación*, i.e. National Agency for Quality Assessment and Accreditation of Spain) as part of the AUDIT programme (ANECA, 2014).

An Internal Quality Assurance System establishes processes and evidences to conduct and document the analysis, evaluation and continuous improvement of the different aspects and dimensions of the teaching and learning activities. Then the key issues to be tackled are the correct monitoring of the procedures and the proper storage of documentary evidences, and both must be properly secured. The most efficient way for that purpose is a computer system using Business Process Management (BPM) tools.

The design of the Internal Quality Assurance System, the technological details of the computer system implemented and the experience of using all together during several years will be the contents of this paper.

Internal Quality Assurance System (SGIC)

A system to ensure the quality should facilitate the review, control and improvement of the teaching processes by the University and by the different actors involved. The University of Valencia has designed

an Internal Quality Assurance System (SGIC by its Spanish acronym) that describes the processes to be followed, the responsible of each action and the documentary evidences that should be generated and stored (SGIC, 2014).

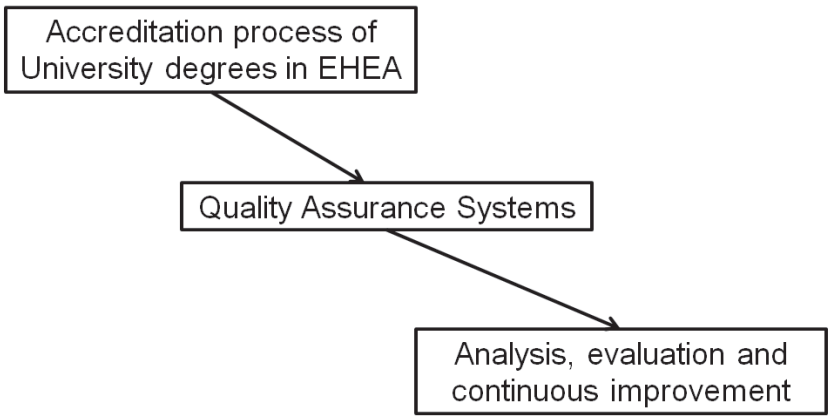

Figure 1. Quality Assurance for Continuous Improvent

Through this system, the University:

a) collects and analyses periodically all relevant information,
b) promotes improvement actions, and
c) preparesitself for external evaluations, which supervise the implementation and its quality.

The University should define a set of processes, determining the tasks to be done, the responsible of each task and the required documents. This set of processes covers the most relevant aspects of the teaching and learning activities, clustered in seven dimensions, as shown in figure 2, namely:

- Programme
- Organization of teaching
- Human resources
- Material and financial resources
- Teaching
- Results
- Quality assurance

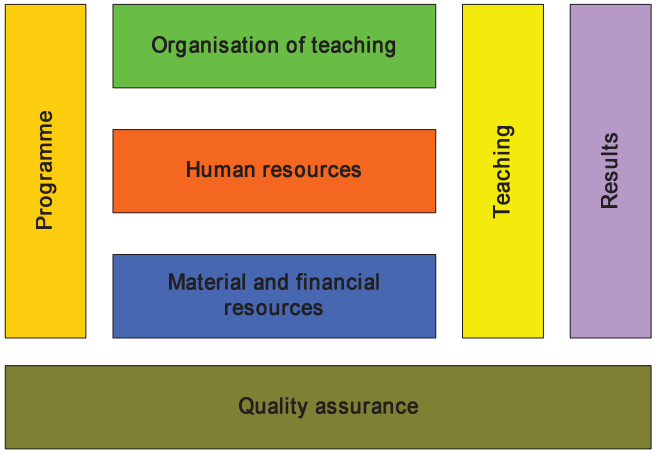

Figure 2. SGIC: aspects to be analyzed.

Business Process Management (BPM)

According to one of the best established definitions, Business Process Management (BPM) is a discipline involving any combination of modeling, automation, execution, control, measurement and optimization of business activity flows, in support of enterprise goals, spanning systems, employees, customers and partners within and beyond the enterprise boundaries. BPM is done by people primarily concerned with the improvement of the processes (Dumas et al, 2013).

The design of each process implies the definition of the tasks, the sequence and the workflow, the responsible actors, the due time (deadline) and the evidences that document the completion of each of them. Figure 3 shows a sample process with the taskssequence (with possible loops and alternatives), responsibles, inputs and outputs.

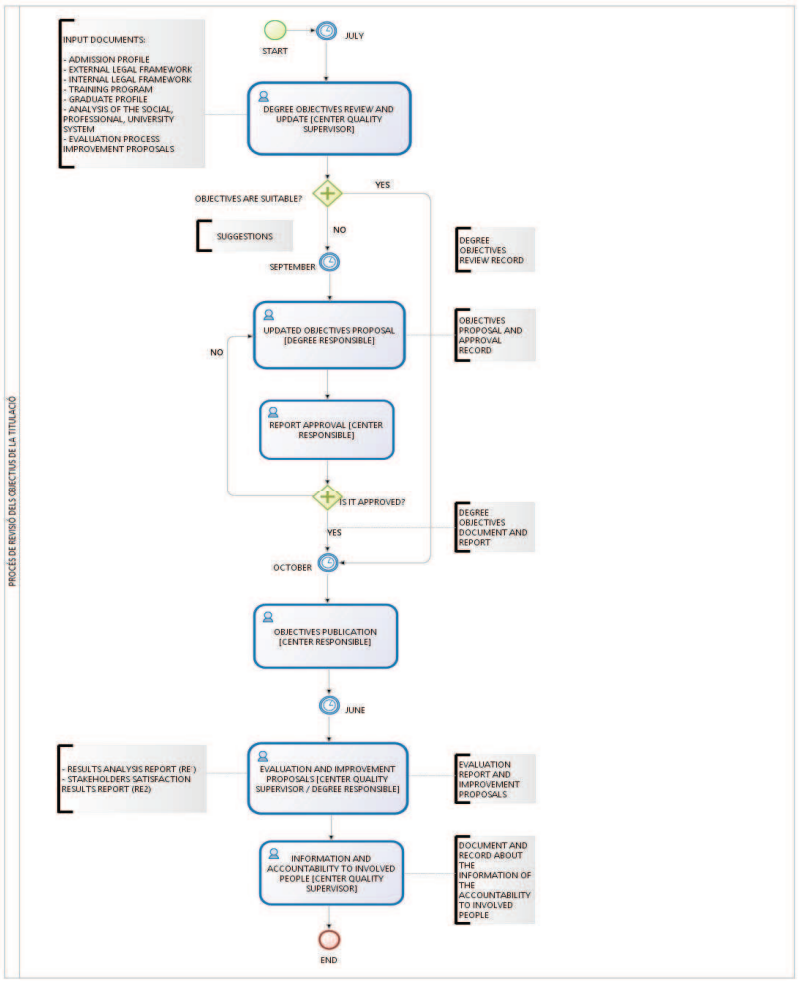

Figure 3. Sample Process for Degree Objectives.

SiGIC: Computer System supporting SGIC

In order to implement and support the Quality Assurance System, we have designed SiGICas an open source tool that integrates proven quality components in a modular and flexible approach.SiGIC(*Sistema Informático de GarantíaInterna de Calidad*, i.e. Computer System for InternalQuality Assurance) integrates Business Process Management with document repository technologies for tracking the set of quality processes and storing the resulting documents.

The computer system was developed to cover the following functions:

- Control of the workflow so that the tasks are accomplished on time by the right actors also following the established sequence.
- Store in a structured way, for further analysis or consultation, the information generated or used in each task.
- Allow users to check whether they have to perform any task, and providing them with the needed information to carry them out.
- Proactively notify users when they have a task to perform and when the deadline expires.
- Inform the user in charge of each center (School/Faculty) and also the university quality management team about:
    - the status of each process,
    - the users responsible for the active tasks and
    - the deadlines to complete each task.
- Allow the responsible users to view all the information stored so far.

SiGIC architecture

SiGICis structured asa three-layer architecture, in which presentation, application processing, and data management functions are separated.Currentclient technologies are used such as HTML5 and JavaScript at the presentation layer.

The business logic layer, also named application tier, resides on an application server and runs the SGIC application (with its different modules) and the Bonita BPM Engine (the selected workflow engine) (BonitaSoft, 2014), and also interacts with the UV LDAP server and the UV Mail server.

Third, the data layer includes the data persistence mechanisms and the data access layer that encapsulates the persistence mechanisms and exposes the data. In our case, the data tier comprises a PostgreSQL database storing the application data and all the data required for the workflow engine, and also contains the Document Repository server.

A graphical representation of the SiGIC three layer arquitecture and its components is shown in figure 4.

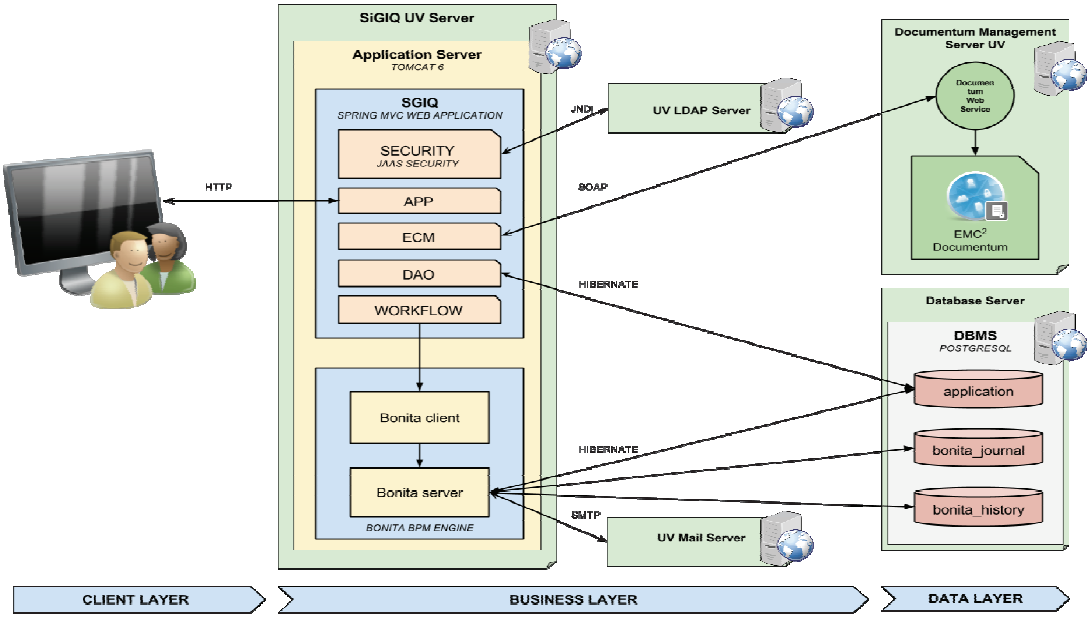

Figure 4. SiGIC architecture.

SiGIC Technological Details

The SiGIC web application follows the standards for Java Enterprise Edition (Johnson, 2002) and uses the Spring Framework that allows using light application servers like the selected Apache Tomcat 6.

The SGIC is a Spring MVC web application composed of several packages: SECURITY to manage authentication and security issues, APP that drives the logic of the application, WORKFLOW to interact with the Bonita BPM Engine, DAO that handles the Data Access Objects, and the ECM package to interact with the Document server.

In our system based on Business Process Management, Bonita BPM is used at the core of the SiGIC. Bonita BPM Engine implements and instantiates the processes (here quality processes), and controls the workflow and the different aspects involved such as roles and deadlines (Bath, 2013).

The definition of the processes is done off-line with the graphical environment Bonita BPM Studio, which facilitates the description of processesthat are internally formattedusing XPDL (eXtended Process Definition Language) (OMG-BPMN, 2014). This description is then loaded into the system,so processes can be instantiated and managed by the BPM Engine.

Finally,SiGIC interacts with the Corporate Content Repository through a web service using SOAP (Simple Object Access Protocol). This configuration allows interaction between independent systems, such as Alfresco (Alfresco, 2014) or Documentum (EMC, 2014), so enabling adaptation and integration with the institution information systems.

SiGIC user Interface

As a three layer web application, SiGIC uses a Web based client at the presentation layer, so end users need only a simple browser. The presentation layer has been developed with the common standards allowing the users to use almost any browser on any Operating System.

An end userenters the system authenticated via LDAP and gets, according to his/her role:

- A list of tasks to be done, with overall information of processes, including process name and schematic diagram, state (current task) and details, and the deadlines for each of them. A sample of such a list is shown in figure 5.
- An interface, as shown in figure 6, to perform a specific task, providing description, data and access to all relevant information to complete it, and the method to upload a file when documentary evidence is needed.
- An interface to supervise the whole set of processes and instances, their history (tasks initiated and completed, actors that performed each task, when they did it) and the documentary evidences stored during the processes (see figure 7).

Experience and Results

The Internal Quality Assurance System has been gradually introduced in the University of Valencia. A first pilot test was conducted in 2009 at 3 diverse schools: School of Engineering, School of Pharmacy and the School of Law, finally producing the SGIC system that was recognized by the ANECA (National Agency for Quality Assessment and Accreditation of Spain).

Since then, the system has been already applied to all Schools, and to all Bachelor and Masters Degrees of the University of Valencia, to the extent reflected in figure 8.

The SGIC is being used in all 20 schools of the University of Valencia, with an increasing number of users ranging from the initial 24 users of the 2009 pilot test to the 307 currently active users. For the Quality Assurance, 18 processes have been described by now and they have been instatiated for 161 degrees of the University.

Figure 5. List of tasks

Figure 6. Interface to complete a task.

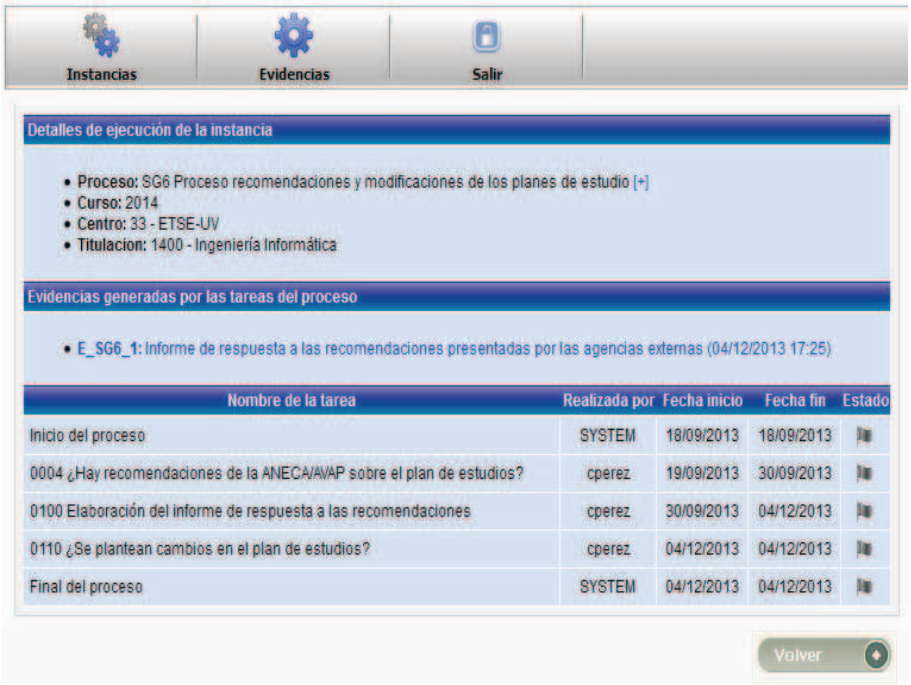

Figure 7. Supervision of a process.

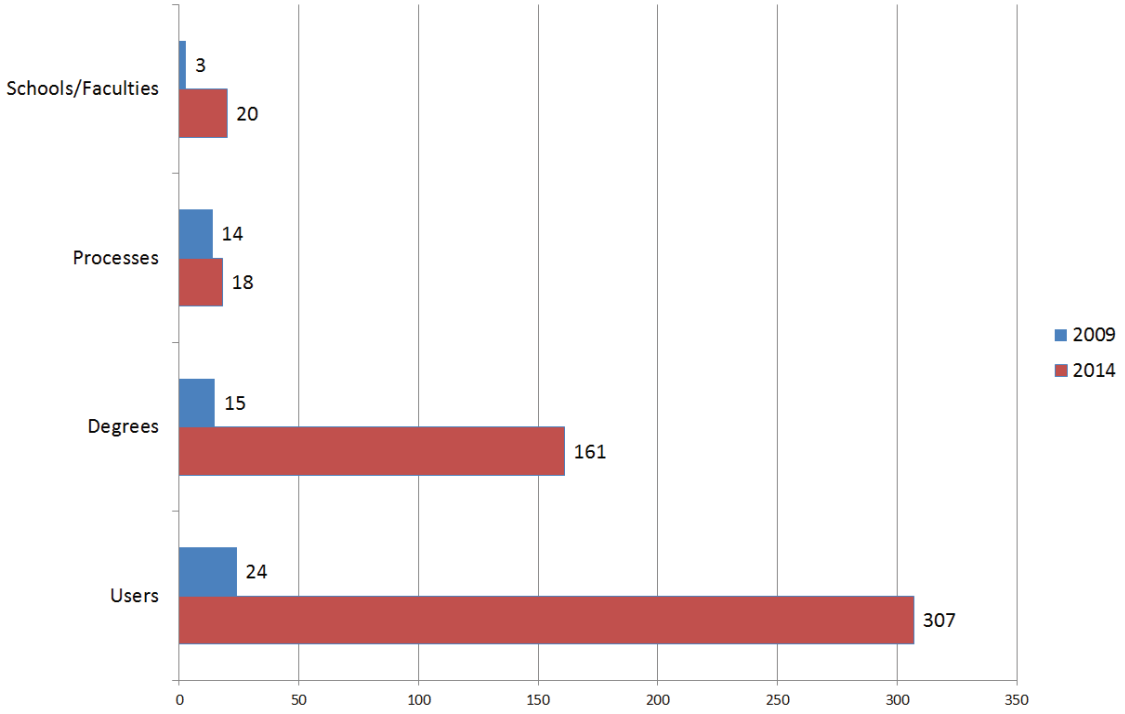

Figure 8. SGIC basic numbers.

As shown in figure 9, these basic numbers have resulted in 978 process instances until 2014 (they were only 124 in 2009), for which 3576 tasks have been initiated and the number of documentary evidences stored so far is 732 (some tasks are not completed yet, and others simply consist in answering yes or no without requiring any evidence).

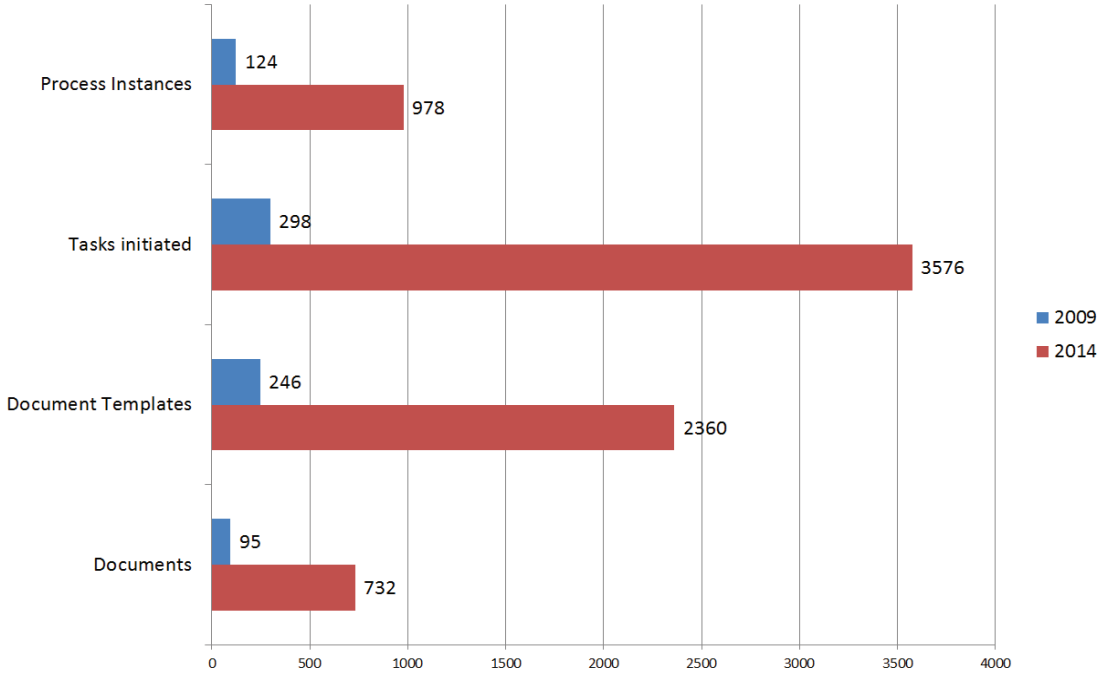

Figure 9. Main SiGIC detailed numbers.

With respect to the users' experience, the users agree that having such a system helps and facilitates the quality objectives and the compliance of processes, that should have to be done in any case.

Conclusions

As stated in the introduction of this paper, Universities must ensure and facilitate the compliance of actions for quality assurance and continuous improvement.

Our work has proven that Quality Assurance Systems, and the overall functioning of organizations, may be supported by Business Process Management (BPM) software systems, in which:

- a workflow engine should be used;
- process development should be documented with evidences that should be stored and organized in a structured content repository.

In order to adopt the quality culture in an organization, Quality Assurance Systems should not be seen as an additional source of workload. Instead, the University heads should transmit that a good Quality Assurance System helps and supports all the work related to the analysis, planning and evaluation that higher education institutions perform in any case.In the case we described here, the users' experiences prove that a computer supported quality system based on BPM facilitates the compliance of quality processes.

Last, the computerized implementation will also allow further improvement of the whole quality system and its processes, an overall concern of BPM.

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