

A Software System in Support of Quality of Degree Programmes

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Abstract: We present a software system aimed at providing support to the management of processes for the self-evaluation of the quality of degree programmes. The system was developed for quality management at the University of Salerno, Italy. Its main functionalities include: monitoring of the process status, scheduling of meetings, document management, support for working groups. With the help of some screenshots, the main features will be described in the context of scenarios that commonly arise in the management of processes of self-assessment of quality.

1 INTRODUCTION

In recent years, the evaluation of the quality of the services of Italian universities has gained an increasingly important role, also in determining the amount of fundings to assign to each institution. Currently, quality management only relies on the work of internal organizational structures, established for this purpose. Such structures adopt a specific system for quality management, used for the evaluation of the different services, such as administrative procedures, education, services to students and employees, economic management and so on. The most careful quality managers also took this opportunity to define quality management systems to be certified according to a standard (ISO, IEC, etc.).

Quality has been investigated in many aspects of e-learning (Ehlers et al., 2004; Costagliola et al., 2008; Costagliola et al., 2010). To achieve the desired result more efficiently, the organization's approach to quality should be based on processes (Proto et al., 2010). The adoption of a carefully defined and constantly improved Quality Management Systems (QMSs) brings undeniable benefits both within the institution and in external relations. Although these systems can be inspired to similar ones used in other government institutions, universities provide a particular service that not all governmental structures include among the services offered to citizens: teaching. The social role played by teaching is among the most important elements contributing to the education of future generations.

Recently, university education has been repeatedly reformed by Italian governments. Among these

reforms we must mention that of 1999¹, which introduced autonomy (economic and decisional) of individual institutions, set the duration of the degree programmes (3 + 2 years), and established provisions for the adaptation of Italian Universities to the European level, which started with the "Bologna Process". Subsequent amendments were made in 2004² and a new reform came into force in 2010³. Each of these legislative measures, changed the structure of curricula. Teaching was massively involved, especially in the aspect of quality. Students had to change their curricula several times, having to juggle among different degree and examination titles.

The integrated AVA (Self Assessment, Periodic Evaluation, Accreditation) system was introduced by ANVUR⁴ (National Rating Agency for the Evaluation of University System and Research) to ensure the quality of the courses in Italian universities. More information on this system will be given in next section.

In this context the need arose for referring to a national unified system for the quality management of degree programmes. Periodically evaluating a degree programme is crucial to prevent the occurrence of abnormal situations, which may compromise educational and related activities. To avoid the occurrence of such situations, we propose a software system aimed at providing support to the management

¹http://www.miur.it/0006Menu_C/0012Docume/0098Normat/2088Regola.htm

²http://www.miur.it/0006Menu_C/0012Docume/0098Normat/4640Modifi_cf2.htm

³<http://www.camera.it/parlam/leggi/102401.htm>

⁴<http://www.anvur.org/>

of processes for the self-evaluation of the quality of degree programmes. This software is targeted to the personnel involved in the quality system, i.e. the heads of organizational structures within the degree programmes, which are assigned the tasks defined for the processes. Among the requirements of the system we have identified the following:

- Constant monitoring of processes by the concerned people;
- Scheduling of meetings and communication to the concerned people;
- Delivery (e.g., by e-mail) of any type of document related to the processes and management of notifications of document events;
- Appointment of working groups in a simple and intuitive way;
- Access from any terminal equipped with a Web browser, without any additional software or plugin.

The use of the proposed system, would provide several advantages in the quality management process for the degree programme. Firstly, the manual management of processes will no longer be necessary, saving time and resources and avoiding the occurrence of human errors. The documents would be kept in the system, cataloged according to established rules and protected from unauthorized access and modification. Document search would be facilitated, ensuring a faster and more accurate access to information. Lastly, in case of inspection, it would still be advantageous to have a software system providing a summary of the status of all the activities.

The rest of this paper is organized as follows: the next section contains some background information, especially regarding the legislation in force and the internal organization of the University of Salerno; Section 3 describes the software system; its implementation is described in Section 4, together with some examples of uses; lastly, some final remarks and a brief discussion on future work conclude the paper.

2 BACKGROUND

This section describes how the University of Salerno has implemented the provisions of the Regulations issued by the national agency for the evaluation of the quality of educational programs.

2.1 The AVA System

The integrated AVA system, that Italian universities are adopting since 2013, is the means through which

ANVUR implemented the provisions of Law no. 240 of 2010 and the Legislative Decree n. 19 of 2012.

Through the AVA system, ANVUR pursues the objective of progressively addressing universities towards autonomy of accountability and evaluation. In particular, the Agency, after fixing criteria, parameters and indicators, verifies their presence for initial and recurrent accreditation, as well as for the purpose of annually allocating funds and resources to universities.

The structure and characteristics of the AVA system are primarily derived by both national laws and guidelines issued and approved by European ministers at the Bergen conference in 2005⁵, and reported in European Standard guidelines (ESG-ENQA). These guidelines were adopted in the Recommendation of the European Parliament and Council (2006/143/CE). In particular, the structure of the AVA system is described in detail in a document issued by the executive board of ANVUR in July 2012⁶.

2.2 The Annual Evaluation Form

The rules of AVA system were implemented by the University of Salerno through the establishment of the Center for Quality (CQA), which adopted a system of quality management based on processes. Each process is aimed at managing a particular aspect of a degree programme.

The CQA supervised (this task is now up to another structure, called PQA, with similar responsibilities) the production of the *Annual Evaluation Form* (AEF). The AEF must be completed for each individual Degree Programme (DP) and submitted to the Ministry of Education every year by June 30, and constitutes a functional tool for the design, construction, self-evaluation and possible re-design of a DP. The adoption of the AEF is a requirement to ensure the quality of education.

The AEF is composed of two sections: the former section, "Administration", includes information about the educational offer and the organization of the DP, while the second section, "Quality", describes the objectives, implementation mechanisms, results, and information on the adopted organization and quality management.

The compilation of the AEF is carried out under the responsibility of the chair of the Teaching Council (TC), in accordance with the procedures defined by internal rules of the university and the statements

⁵<http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:064:0060:0062:IT:PDF>

⁶http://www.anvur.org/attachments/article/26/ava_documentofinale_0.pdf

of ANVUR. In particular, these rules specify a precise sequence of steps and deadlines to be observed for the processing of documents and records. To ensure compliance with these constraints, the TC appoints an internal organizational structure for quality assurance, the Quality Assurance Self-assessment Group (QA Group) and possibly, further commissions or delegates. This structure is responsible for the effective fulfillment of the activities on the bases of criteria such as: promptness in gathering the information; effectiveness and efficiency in processing solutions, in the use of resources and in the implementation of activities.

Together with the AEF, ANVUR requires the completion of an Annual Review Report (ARR) which contributes to the definition of the AEF, for the "Quality" section. The ARR is the product of an audit conducted annually with the aim of identifying specific conditions which negatively affect the validity of a DP, including the proposal of appropriate solutions to solve them.

According to the directives of ANVUR, AEF and ARR constitute appropriate self-assessment documents for a DP. In particular, the AEF allows to verify the persistence of the necessary conditions for a university to continue to offer a particular DP, while the ARR is a useful tool in order to identify and solve any critical situations for the DP, the effect of which will then be assessed. The activities to be carried out in the early stages of the preparation of ARR and, consequently, the AEF, can be freely implemented by universities. The preparation of the AEF and the ARR sets up an instance of the so-called Deming Cycle or *PDCA Cycle* (Johnson, 2002), which is a simple and effective tool for quality. This cycle is composed of four steps performed in a sequence:

1. planning what to do and how to do it;
2. realization of what was planned;
3. verification of the results;
4. implementation of the necessary corrective actions.

Finally, the cycle is restarted.

The actions taken as a result of the evaluations and recommendations made in the ARR of the previous years need to be assessed. This evaluation is a duty of the working groups. Each Working Group (WG) has the task of assessing the efficiency and effectiveness of a process, putting into practice what is described in its definition. WGs produce, at the end of the evaluation, the review report for the process, also concerning the activities and the achievements. The TC appoints a WG for each process. The composition of a WG varies: it may coincide with the chair of

the TC or may include individual teachers, committees (possibly integrated with students), administrative staff, non-academic experts and representatives, and so on. A WG may stay in charge for a fixed period of time, usually for the development of a specific activity.

2.3 Processes for Quality Assurance Self-assessment

The self-assessment of quality for the DP has been entrusted to a system for quality management based on processes. These processes were specifically defined by CQA and include a range of activities that its WG has to perform, and then assess its results and summarize them in a review report. The following list shows the breakdown of processes in four macro-processes. In parentheses we report the identifier of each element.

- Didactic planning (MP1)
 - Definition of educational objectives and learning outcomes (DP Orientation) (MP1-P1)
 - Educational design (academic regulations) (MP1-P2)
 - Consultation with stakeholders (MP1-P3)
- Orientation (incoming, ongoing) (MP2)
 - Incoming orientation, (MP2-P1)
 - Ongoing orientation, (MP2-P2)
- Monitoring and analysis (MP3)
 - Annual Review (MP3-P1)
 - Student progress monitoring (MP3-P2)
 - Analysis of the satisfaction with the educational service (MP3-P3)
- Job placement (MP4)
 - Job placement (MP4-P1)

Each process involves the TC that, in addition to appointing the WG should, in most cases, plan corrective actions for the DP on the basis of the outcome of the work of the WG. The Chair of the TC, instead, performs tasks related to the publication of the works outside of the organizational structure.

Figure 1 shows the form used to define a process. Being a document for internal use, some parts can not be reproduced and are omitted. The form is composed of four parts. The first part specifies the name of the process and the macro-process. The second part lists all the documents related to the process divided into:

- Input documents;
- Partial and final output documents;

MACROPROCESSO	MPI - PROGRAMMAZIONE DIDATTICA
Processo	P3 - Consultazioni con le Parti Interessate
Elementi in Ingresso	<ul style="list-style-type: none"> [...] Rapporto Annuale di Riesame [...] [...] [...] [...] [...]
Elementi in uscita parziali e finali	<ul style="list-style-type: none"> [...] Rapporto di Riesame del processo/attività Verbali delle riunioni
Doc. Registrazione	
Fase Impegni/Responsabile	
Planificazione	[...]
Gestione e verifica	[...]
Comunicazione esiti e Riesame	[...]
Fase Anno accademico	
	Ott Nov Dic Gen Feb Mar Apr Mag Giu Lug Ago Set
Planificazione	
Gestione e verifica	
Comunicazione esiti e Riesame	

Figure 1: Definition of the "Consultation with stakeholders (MP1-P3)" process.

- Documents for registration.

The registration documents include all meeting minutes produced during the process. The third part contains the textual description of the commitments for the process. For each of them, a manager is appointed. The most common commitment is any meeting of the WG or the TC, which should concern the aspects described in the process definition. The commitments for any process are always divided into three phases:

- Planning;
- Management and assessment;
- Reviewing of outcomes and communication.

The last section of the definition contains instead a Gantt chart, showing the time and duration of the process steps during the academic year.

In general, the processes are presented as instances of a generic schema, which defines their structure and components (Figure 2). We can note from the schema that phases are composed of separate commitments (green), representing units of work to do for the prosecution of the process.

3 THE SOFTWARE SYSTEM

In this section we describe the software system that automates the processes described in the previous section. The cited laws and regulations require that every involved organizational entity should accomplish its commitments, complying with the schedule and terms

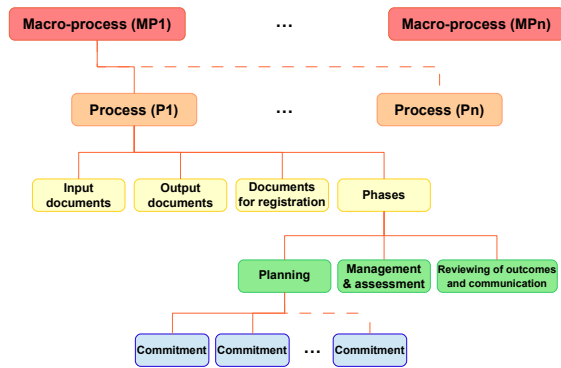


Figure 2: Generic schema of process definition.

imposed by the quality programming documentation. Nevertheless, they do not describe "how" to perform the planned tasks.

Without conditions or suggestions, every organizational structure would organize autonomously: aspects like communication, development, registration and storage of documents, information sharing, etc., would be left to the wisdom of the structure supervisor. Nevertheless, every single subject, e.g. a WG member or a quality manager, is a smaller part of one single organization: the quality management system. The achievement of the best level in internal efficiency of groups would not make sense when, at the very end, it is impossible to put everything together in a system that, for its nature, must be unique and homogeneous. Using a metaphor, it would be like if cells belonging to the same tissue, would produce without any problem the same substance, but with a different molecular structure.

Thus it is necessary to set a number of requirements for "quality in quality management". Maintaining a consistent structure to manage every electronic document, for example, could be a possible solution to the problems related to registration, sharing and storage of the documentation to develop or to use whilst processes advance. Indexing of documents in a single system would also allow users to search this archive, rapidly accessing to any needed information.

If every user is registered to the system, he or she could be directly and automatically informed anytime about a meeting or appointed for a task. This will at least partially solve the problems related to communication amongst quality management systems' actors.

Since quality self-assessment processes are essentially a set of commitments managed by the Chair of the TC or by a WG supervisor, their status should be known at any time either to the already cited subjects as well to the AQ group Supervisor, who is responsible for the operation of the WGs.

The above requirements set the demand for a sys-

tem that could be helpful in the management of quality self-assessment processes, that defines common procedures and ensures traceability for the performed operations.

3.1 Main Functionalities

In the following sections, we describe the functionalities and the main characteristics of the system.

3.1.1 System Access

Any user has access to the system not only from his/her own PC, but also from any computer running a non-obsolete Web browser without any plugin or external software installed.

3.1.2 Process Management

The system allows the Chair of the TC to immediately know the status of all processes, to check if some of them requires a TC meeting. This functionality automates a very burdensome task: without the system, the chair should manually check the process definitions, identify the active ones and later identify those waiting for a TC meeting.

Furthermore, the system allows to start new processes and tracking their status, provides all users with the needed information (e.g., process status and task list) for task completion, either at system access or through email messages, as depicted in Figure 3.

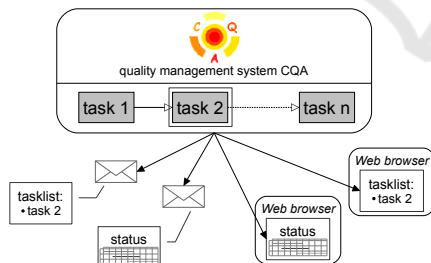


Figure 3: Schema of requesting process status and tasklist.

3.1.3 Meeting Planning

Each process requires the organization of meetings. The supervisor of the WG should care about its planning. He or she has to choose a date, an hour, a place, define the agenda and finally wrap all this information in an email message, that has to be sent to all WG members, for whom he or she had previously found all email addresses. The system automates all of the above duties, as schematized in Figure 4.

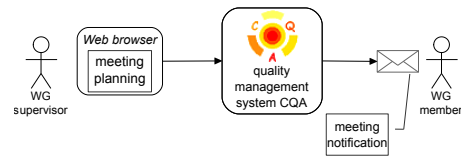


Figure 4: Schematics of a meeting planning with the system.

3.1.4 Document Management

For each meeting held, the involved group draws a meeting minute, containing important information for the process. Frequently, the minutes are in a digital format and the group supervisor saves them on his own PC. In this case, there could be the risk of accidental deletions, machine faults and difficult retrieval due to a non meaningful filename. Sharing the meeting minutes is another topic to concern about. They could be stored in an hosting service or sent by email to all participants; in both cases, one would lose track of the possessors of the copies as well as the sharing link.

The system stores the documents related to a process in dedicated spaces, with user-specific access rights. Documents can be submitted through the Web interface or as e-mail attachments. If stated in the process definition, the Chair of the TC or the AQ group Supervisor is informed of a document submission. Lastly, since the self-assessment processes are scheduled yearly, the documents are classified by the academic year they belong to. All the documents stored in the system are indexed to enhance keyword search. The schema in Figure 5 shows the above described functionality.

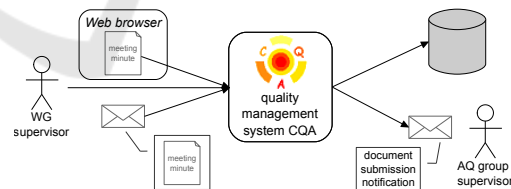


Figure 5: Schema for the submission of a document.

3.1.5 Appointing Workgroups

Every process requires the TC to appoint WGs. The system provides an on-line form to easily add users to the process' WG: notification are automatically sent to group members and supervisor, as depicted in Figure 6.

3.2 System Characterization

As evident from the functionalities described in the previous subsection, the system is focused on pro-

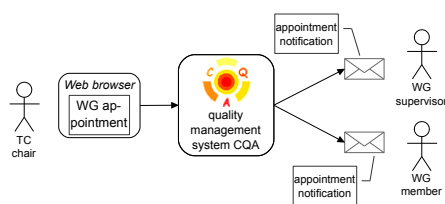


Figure 6: Schematic of workgroup nomination with the use of the system.

cess and document management. The continuous improvement of processes and optimal use of resources requires a circular model, where the process status is constantly monitored and assessed through reports that the organizational structures should draw.

This kind of system could be hence considered as a *Content Management System*⁷ (CMS), which can manage big amounts of documents. For this particular domain, the system so far described could be further categorized as a CMS with *Business Process Management*⁸ (BPM) functionalities.

4 IMPLEMENTATION

This chapter presents the implementation of the system. Here we describe the operations carried out for the realization of the functionalities previously introduced.

4.1 Criteria for the Development of the System

The development of a system like the proposed one may be complex and the product will be extremely specialized on quality management of DPs. Nevertheless, there are software products for *Enterprise Content Management* (ECM) whose efficacy and reliability is proved. The choice of an ECM system should focus on the ease with which the product fits the features of a quality management system.

Many *Content Management* software products are proprietary and released under a commercial license. Among these we can mention: *ECM Documentum*⁹, the ECM suites from IBM¹⁰, and *OpenText*¹¹. These

⁷<http://www.comentum.com/what-is-cms-content-management-system.html>

⁸http://en.wikipedia.org/wiki/Business_process_management

⁹<http://www.emc.com/enterprise-content-management/documentum-platform.htm>

¹⁰<http://www-03.ibm.com/software/products/en/category/enterprise-content-management>

¹¹<http://www.opentext.com>

products are indeed very complex and costly, suitable for large industrial companies and often supplied in *ad-hoc* solutions, offered with the integrated support of the software house.

Considering the identified features, from an analysis of existing products, we narrowed our choice on two of them: *Microsoft SharePoint* and *Alfresco*¹². The former is an Enterprise CMS, widely adopted in the business domain; it provides many functionalities, including: creation of websites for document sharing, visualization of Web delivered contents, indexing, search and creation of intranet pages. The latter has similar features and is widely spreading (Shariff, 2007), attracting the attention of many big organizations, some noteworthy like KLM, NASA, Michelin, the New York Philharmonic and the Fox Broadcasting Company¹³. Recently it has been placed in the “visionary” section of the *Magic Quadrant* realized from the consulting firm Gartner¹⁴ and amongst the *Strong Performers* in the last Forrester Research report about ECM¹⁵.

We balanced the considerations on features with the cost of the products. SharePoint 2013 Server has both a paid and a freeware license. Unfortunately, the latter is limited to basic services and is focused only on *Web Content Management*. However, its main drawback is its closed nature: almost all components of SharePoint use proprietary standards that would require a steep learning curve or the acquisition of programmers already skilled in .NET technologies. Alfresco has an Open Source license and is based on non-proprietary standards. For the above reasons, we chose Alfresco for our system development.

4.2 System Development

The whole system is based on Alfresco; every developed module was added to it as an *add-on* or custom configuration of its features. Alfresco allows developers to act on its internal mechanisms at different levels. In our implementation it is predominant the lowest level (coding) approach, but some features were developed using the user interface or the Administration console.

The process management provided by Alfresco is essentially based on XML files that define processes according to the *BPMN* notation (White, 2004). This notation is then integrated with elements belonging

¹²<http://www.alfresco.com>

¹³<http://www.alfresco.com/customers>

¹⁴<http://www.gartner.com/technology/reprints.do?id=1-1KQF4YJ&ct=130924&st=sg>

¹⁵available previous registration at the page <http://www.alfresco.com/forrester>

to XML namespace introduced by *Activiti*, the workflow engine. These tools allow to create very complex workflows. Each workflow is composed of a list of concatenated elements, similarly to flowcharts. An element can be for example a *task* or a *gateway*; the latter has the same function of a logic port. Figure 7 shows a BPMN representation of a process.

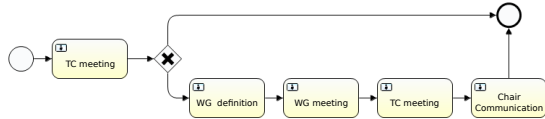


Figure 7: BPMN representation of the process *Definition of learning objectives and learning outcomes* (MP1-P1).

Activiti introduces the possibility to run specific code in several points of the definition of the BPMN workflow, e.g. at the creation or the completion of the task. This code can be written in Java or JavaScript. We chose the former, to exploit the advantages of using a compiled programming language: i.e. the use of an IDE, the possibility of testing code through *JUnit*, the access to the whole API instead of the subset available from JavaScript, the availability of a larger number of free libraries.

The interface of Web Alfresco Share is fully implemented through the *Spring Surf* framework. To add a page to a site or to customize its appearance, it is just needed to create or edit XML files. In our system we specifically created a template for the sites for process management. This model includes several pages: the archive of documents, an internal wiki, a calendar, a collection of useful URLs and page for displaying the Gantt chart.

To receive and send e-mail messages, Alfresco must have access to a mail server. We appropriately set its configuration to handle this function. We also implemented a module to manage messages and sending attachments and specifically designed templates for e-mail messages.

4.3 Examples of Use

This subsection presents examples of system use. With the help of some screenshots (in Italian), the main features will be described in the context of scenarios that commonly arise in the management of processes of self-assessment of quality.

Let us imagine a simple scenario where the only active process is *Consultation with stakeholders* (MP1-P3). The process has a dedicated home page. As shown in Figure 8, it contains a customizable control panel composed of *dashlets*. Common dashlets include a calendar, a wiki and other useful

tools. Other web pages are reachable through the main menu bar. These include the archive of documents, the Gantt diagram, etc.



Figure 8: Screenshot of a process home page.

By simply sending an e-mail to the system, the Chair of the TC can know which process requires a meeting of the TC, and possibly organize it. The system replies with the mail shown in Figure 9 which includes, besides the requested information on processes' state, a link to the meeting organization form page. There (see Figure 10) it is possible to choose date, hour, location and agenda of the meeting. Upon form submission, the system sends an e-mail notification to all participants. An e-mail with a summary of data is also sent to the Chair. Besides these information, the e-mail contains instructions on how to archive the minutes of the meeting (see Figure 11). This can be done by submitting it through a Web form or by attaching it to an e-mail.

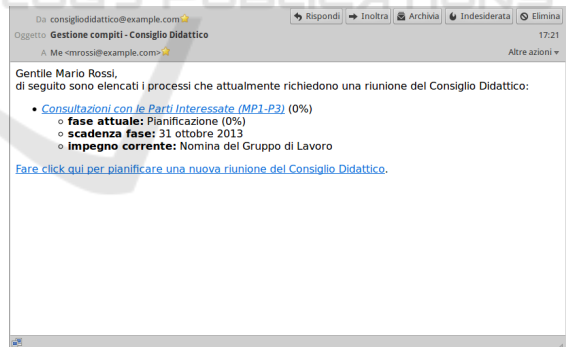


Figure 9: System e-mail sent to the Chair of the TC with information about process states. It also includes a link to the meeting organization form page.

5 DISCUSSION AND CONCLUSIONS

We presented the design and implementation of a system for the management of quality of educational programs in university. The system provides people involved in the processes with an effective tool for the

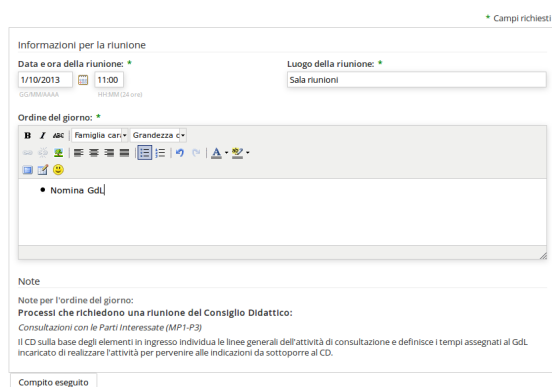


Figure 10: Screenshot of the meeting organization form page.

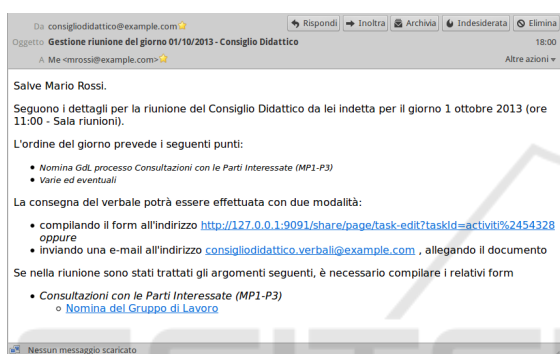


Figure 11: System e-mail sent to the Chair of the TC with information about an organized meeting. It also includes a details on how to archive the minutes of the meeting.

management of commitments assigned as well as for keeping track of the process status in the management of the quality of the degree programmes.

Since the identification of requirements, the system was characterized as a software for document management. The choice of using Alfresco as a starting point proved adequate, despite some difficulties in the development. The identified functionalities were obtained by extending and customizing the basic functions of Alfresco, taking advantage of the opportunity to access source code. Moreover, the presence of the Activiti engine for the execution of workflow, made our system suitable to model the management of quality.

At system login, the user is presented with a customizable summary screen, which in most cases displays a list of tasks to be performed. Furthermore, all meeting information (date, time, place and agenda), are automatically sent to the involved users by e-mail, according to a pre-formatted template. The users immediately have a clear picture of the actions to be taken for the processes they are involved in.

The definitions of the processes have been represented through XML code and manually added to

the system. The level of abstraction reached in process management through the system allows to modify from outside the existing definitions or to add new ones, without facing particular difficulties. The system was built to meet the needs for quality of Degree Programmes at the University of Salerno. Nevertheless, it can be used with a few or no changes in other educational institutions with similar objectives.

In conclusion, the system is indeed a useful tool in the management of quality of the courses. It allows simplified care and facilitates the work of users involved in the processes of self-assessment, providing a great support to perform the required tasks and activities.

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