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Workflow Management: Integration Technology Tools for Fees Exemption System

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ABSTRACT

Workflow management systems have received much attention in the last few years as tools for improving the business process efficiency within organizations. They aim to structure and decompose business processes and assist in the management of coordinating, scheduling, executing and monitoring of organization activities. This study describes the design and implementation processes of a workflow system for the University of Bahrain to deal with students' exemption fees process handling mechanisms. The system is built on top of an object-oriented database system and incorporates a number of modeling functionalities supporting adaptive features such as object orientation, roles, rules and other active capabilities.

Key words: Object-orientation, workflow management, workflow integration, exemption handling mechanisms

INTRODUCTION

Many organizations have realized the importance of Information Technology (IT) as a tool to improve their working efficiency. However, the business processes, within an organization (Bentellis and Boufaida, 2009), as well as the interaction among processes have not been clearly described and streamlined. In addition to this, the fact is that the techniques and methods which are used to follow-up and control business processes are limited and inadequate. All this leads to the misunderstanding of responsibilities, blocks in coordination and to slow reactions to the changing business rules and required services.

Workflow management technology (Shahzad and Rashid, 2005) is being developed to overcome the above shortcomings. It promises to provide an efficient way to model and control complex business processes within and between different departments of any organization. Although workflow management technology has been known for years, it is only in the last few years that it has become very popular in the educational, service and commercial organizations as well as the in the literature. The benefits of workflow management technology include explicit process definition, a quick reaction to changing environments and an easy track of operations.

While workflow management focuses on managing the process logic, it needs to integrate other technologies so to fully control a business process, such as activity assignment and resource allocation. Comparing to the formal workflow management methodology, software agent integration technology provides flexible, distributed and intelligent solutions for business process management (Georgakopoulos *et al.*, 1995; Chin *et al.*, 1998). The combination of these two technologies will definitely provide solutions to problems not to be solved by any individual technology.

Integration of workflow and agent technology has recently attracted a lot of attention of researchers in the related areas. The paper provides an overview of this exciting research area and explains in details our experience in applying workflow technologies to Bahrain University service applications. It addresses the workflow aspects of students' exemption system and the perspectives for using workflow management technology for more efficient services.

One widely accepted definition of workflow comes from the Workflow Management Coalition "Workflow is the computerized facilitation or automation of a business process, in whole or part" and the Workflow Management System (WFMS), is defined as a system that defines, creates and manages the execution of workflows through the use of software, running on one or more workflow engines which is able to interpret the process definition, interact with workflow participants and, where required, invoke applications or components.

A workflow management system (Li and Du, 2009; Sun and Du, 2008) is a system that defines, manages and executes workflow processes through the execution of software whose order of execution is driven by a computer representation of the workflow process logic. Workflow technology incorporates the benefits of co-operative information systems, computer-supported co-operative work, Groupware systems and active databases. Workflow management technology addresses the following requirements (Owaied *et al.*, 2011):

- Improved efficiency, leading to lower costs or higher workload capacity
- Improved control, resulting from standardization of processes
- Improved ability to manage processes; identification and analysis of problems
- Reduced Costs (e.g., labor)
- Increased quality or capacity while controlling costs
- Construction of unique customized business processes to deal with specialized management work practices
- Improved information distribution and elimination of the delays caused by the need to move hard copy information around the organization

Thus workflow management can be considered a very attractive technology for integration and interrelation of real world application management components. There are differences among the architectures which are used by workflow systems, however most of the workflow systems fall into one of two broad categories:

- Forms and messages based workflow systems which performs electronic routing of forms to users' e-mail in-boxes
- Engine based workflow systems which communicate with humans or components via specialized middleware. It is the workflow engine based approach which this paper will focus upon to achieve management component integration

Wendler and Loef (2001) discussed the importance of process automation in the healthcare sector. They defined workflow as the automation of business process, in whole or part, during which documents, information or work items are passed from one participant to another for action, according to asset of procedural rules. They show in their article that workflow appears attractive for automation of the majority of structured, routine process in radiology and can be beneficially applied in healthcare to improve efficiency, cost-effectiveness and quality of services.

We expect the workflow systems to be adopted widely by commercial products (Yan *et al.*, 2001) to help automate the management of business process to a much greater degree than has been possible before (Shen *et al.*, 2000). Georgakopoulos *et al.* (1995) defined workflow as the principle supporting technology for the automation of business process. It focuses on the description of the aspects of a business process that are relevant to the control and coordination of the execution of its constituent tasks and the provision of technologies for the implantation of the process.

Kaya (2001) presented concepts and approaches for interoperability of workflow management systems. He emphasizes on the interoperability approach specified by the workflow management coalition. He concluded that interoperability was still not nature.

Workflow management system technology is considered by Chin *et al.* (1999) as one of the main types of the next generation information systems. It is perceived that workflow technology not only requires the support for complex data model functionality but also flexibility for dynamically modifying the workflow specifications in cases of exception handling.

A PROCESS INTEGRATION AND WORKFLOW MANAGEMENT

Changes in dealing with the processes within the students' exemption system forced the administration personnel in UOB to look for new methods for the organization of work and for methods to record and monitor many related activities. Furthermore, new socioeconomic boundary conditions are forcing the UOB administrative people to completely ask for the redesign exemption processes to meet essential educational and social targets.

Business Process Re-engineering (BPR) and process automation (Workflow Management) are increasingly seen as key factors for the successful operation of many organizations and services (Georgakopoulos *et al.*, 1996; Chen and Feng, 2006). This is in line with observations from other business sectors (e.g., banking and insurance) which are similar to students' exemption system in the sense that professionalism and success are based on a strict approach to customer orientation and cost effectiveness. In these sectors, process awareness and the use of tools to manage processes and organizations are much more common than in other non-service organization.

The application systems currently in use in students' exemption system are rarely designed to explicitly and dynamically support changing processes and flexible organizations. Many of the reports on the improvements in efficiency and reduction in costs after installation of IT claim moderate success but do not sound overenthusiastic. Usually, the workflow aspects of installed systems are dealt with in time consuming and expensive projects, rather than in product features that would support this important aspect of system integration.

There is a lack of effective concepts to deal with business processes on the exemption system level as well as on the University systems level. Due to the separation into isolated application systems, it is common for workflow aspects in Students' exemption system are changing rapidly. In the registration system-and in students' exemption system as an integral part of it-we are facing a challenging situation of shrinking budgets, increasing cost pressure and growing demands to increase both the efficiency and the quality of services. Reacting to these challenges, student services enterprises increasingly rely on Information Technology (IT) solutions. Workflow deals with processes including (Fig. 1):

- Process models: Modeling the sequence of activities regarding fees exemption
- Organizational models: Modeling all aspects of human resources
- Management of operational units (tools)
- Management of software components

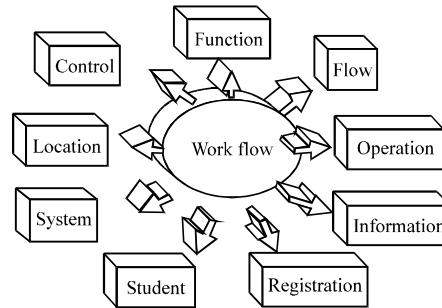


Fig. 1: Workflow architecture

- Modeling and tracking of student flow
- Adherence to all kind of business rules that define budget, political, economic, legal or time constraints

The following attributes have been considered during the analysis, design and implementation of the exemption system.

Modeling: Business processes need to be well described. We need modeling methods (Mustafa and Shah, 2007) especially for the processes across organization boundaries. We also need verification methods, based on mathematic analysis. The exemption system has many processes. Some of the processes are within the boundary of the organization (UOB) and other processes are outside the university boundary which need to be interrogated and the necessary items of information are extracted. A primary key “CPR”, the national number in Bahrain which is unified across all the Kingdom Ministry offices, controls all processes.

Communication: Efficient communication languages for exchanging service definitions. Required rules of communications are devised and recorded in a relational database.

Negotiation: Negotiation methods and protocols compliant to the features of the workflow management process.

Personal working environment: Good user interfaces by using interface agents and personal assistant techniques. The exemption system is written in SQL/PL under Oracle Database system. The system has very good report generator facilities.

Integrated with other technologies: Integration with other technologies such as project management, intelligent scheduling and optimization, etc. The student exemption system is integrated with many other systems and tools such as authorized personnel tool, accounts receivable, registration office, student records and deserve factor solver.

Learning: Creation of new business process logic during run time through learning.

THE WORKFLOW MODEL FOR THE FEES EXEMPTION SYSTEM

The fees exemption system automates many activities involved in the decision of eligibility of students to be exempted from paying fees. The system receives information from the administration

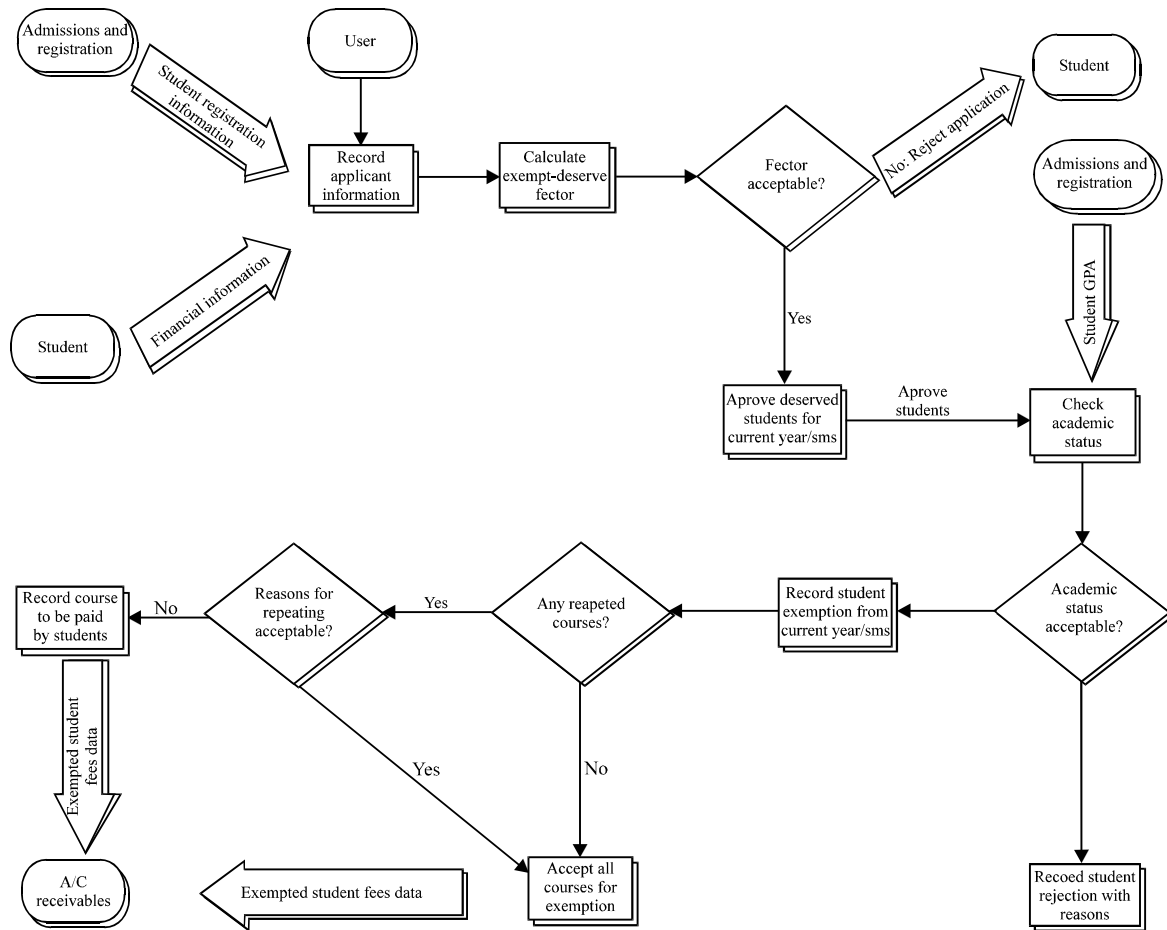


Fig. 2: System’s workflow model

and registration office, students and users. The input items of data are passed to a module responsible of calculating exemption-deserve factor. Figure 2 illustrates the system workflow model.

The system workflow model is essential to show the interaction among components of the system. It also shows how information is moving from one part of the system to other parts. It also shows the inputs to each component and the expected outputs from each component.

As mentioned earlier the exemption system is an integrated workflow management system that incorporate many tools from student records to admission and registration system to financial system especially the receivable account system.

Entity relationship design: The integrated system is made up of a number of entities or relationship tables. New applicants are inserted into a table called APPLICANTS table. Information regarding students’ families is inserted into the STUD_FAMILIES table.

Other items of information regarding students' current financial status, such as their living conditions, number of the member of the family, spouse current job, income, etc. are recorded in the GARDIAN_INFO, GARDIAN_FREE_WORK (part time work undertaken by any family members), GARDIAN_LIVING tables.

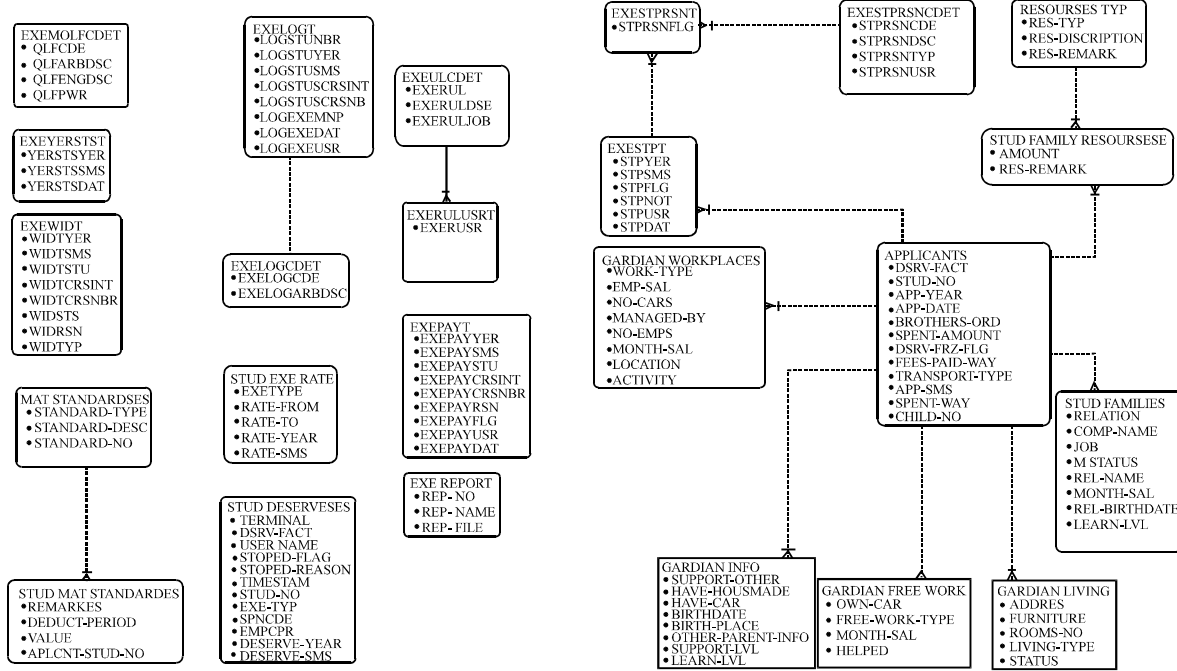


Fig. 3: Details of operations

The table GARDIAN_WORKPLACES records the information about the work places of the applicant's guardians. Note that "Guardians" include anyone living with the student as seen in Fig. 3. STUD_MAT_STANDARDDES records income to the entire family and the financial outcome after all necessary expenses have been deducted.

The relation STUD_FAMILY_RESOURCES record finance support resources given to the family, by donations, charities, etc. STUD_DESERVESES table records all students who according to UOB criteria, deserve to have fees exemption, recording the 'deserve factor' for each student as calculated by the system, exemption type and other related information.

The table EXESTPT records the students that are suspended from exemption for a specific semester in a specific year as a result of their academic status (low GPA, for example). EXESTPRSNT record reasons of suspension from or applied for exemption. This facility helps decision maker to query the system in order to get full details of all activities and reasons behind the suspension process.

EXEWIDT contains information regarding withdraw courses for students and whether or not those courses are accepted for exemption.

EXEMQLFCDET is a lookup table for levels of educational qualifications, used in the details of the student's family. STUD_EXE_RATE is a lookup table that defines the exemption rates for each year and semester, for different types of exemptions as shown in Fig. 3.

EXE_REPORT contains a list of all the reports generated by the system. EXERULCDET contains the rules that define the levels of authorization given to various users of the system. EXELOGT contains a detailed log of all the operations performed on the system as it is illustrated in Fig. 3.

The exemption system is an interactive system as shown in Fig. 4 in which the system receives items of information automatically from different sources including the registration

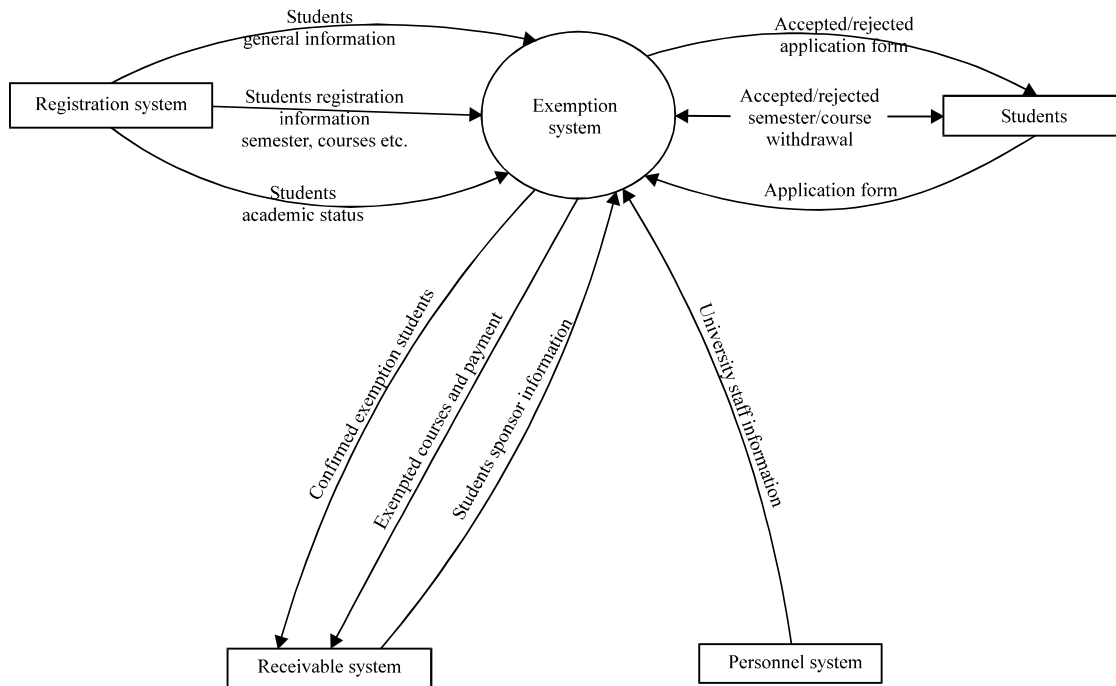


Fig. 4: Context diagram

system available in UOB. The information can be grouped into general ones, course and semesters and student academic status.

The system is designed with four main processes in mind. These processes include:

- Entering applicants' information
- Calculate applicant deserve factor
- Confirm applicants deserve factor
- Exempted staffs' children
- Confirmation of exempted students

Each process accepts a number of input items either entered directly by clerks or extracted automatically from other tools. This approach enables many systems and tools to cooperate and interchange information. The details are outlined in Fig. 5.

OBSERVATIONS ON THE PERFORMANCE OF THE EXEMPTION SYSTEM

The student population of UOB is approximately 22 thousand full time students. 30% of the students are expected to apply for fees exemption each semester. The university personnel cannot handle this large number of applicants manually without tools being integrated and managed.

The system provides higher workload capacity by integrating many tools on one platform. Many items of information are collected and summarized to enable decision makers to base their decision. Some mathematical equations are used to compute the deserve factor for each student. Students whom their deserve factor is low will be removed from further consideration with a detailed report is generated for each rejected application with justifiable reasons. The deserve factor depends on

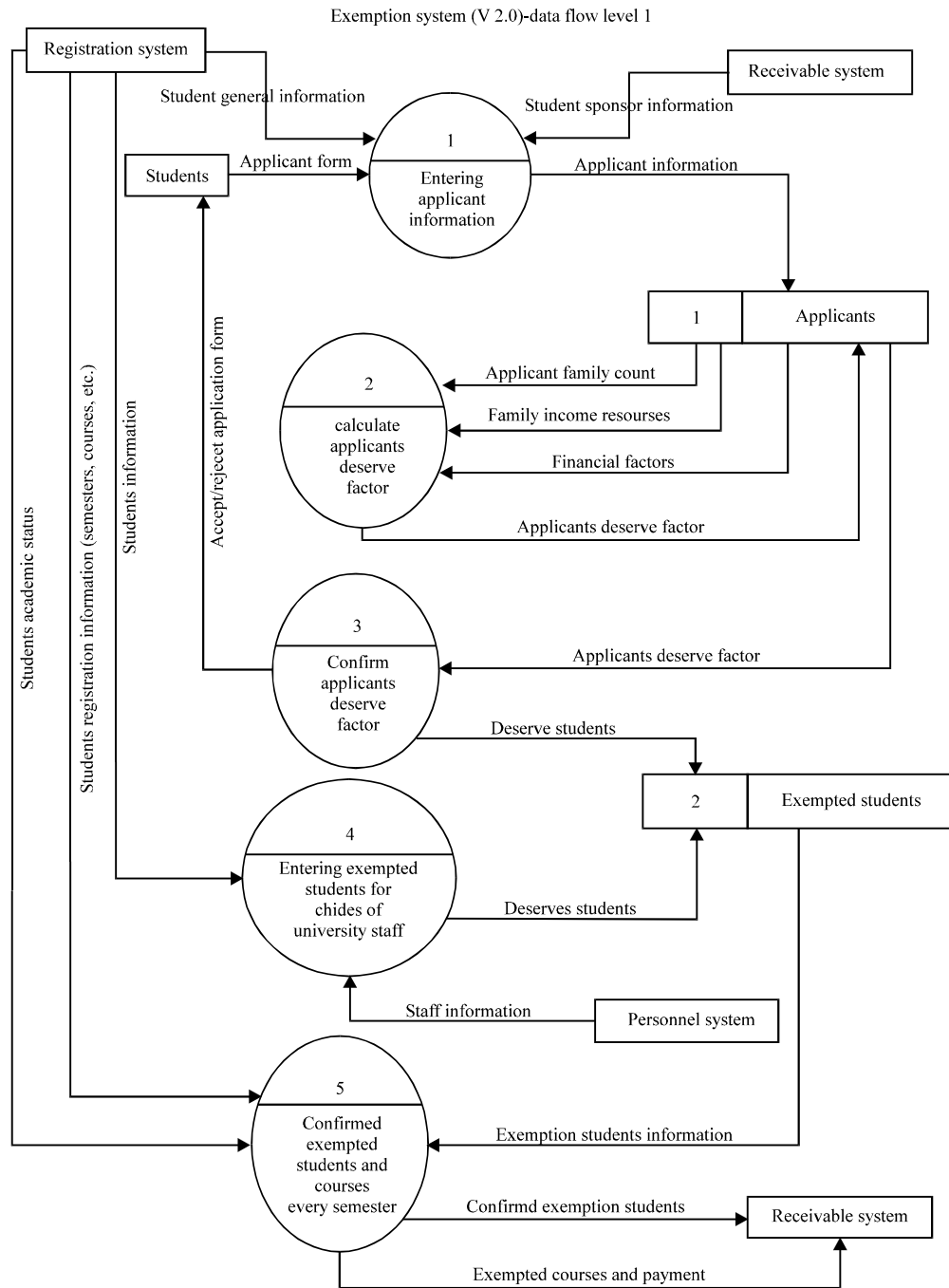


Fig. 5: Exemption system data flow

family income, number of dependents on the family, expenses of the family, number of courses applied for exemption, GPA records, withdrawal courses and other financial resources.

The list of students eligible for exemption is generated automatically with detailed reasons and priorities. The list automatically sent to a committee for approval. The members of the committee can verify items of information regarding any applicants. Student's performance through the

previous semester, attendance and transcript are all interlinked to the system and can be viewed by authorized decision maker personnel. Without having the management workflow system, the ability to manage processes becomes tedious, the cost will not be under control and process standardization becomes impossible.

CONCLUSIONS

This study addressed the workflow aspects of the students' exemption system in the University of Bahrain and the perspectives for using workflow management technology for more efficient services. Our system is based on object-oriented database management systems which include many of the required tools used to browse the database in order to communicate and coordinate.

The result shows that workflow integration is an essential process in any system that communicates with a number of tools. The functions that were performed by the system include entering applicants' information, calculating applicant's deserve factor, confirming applicants deserve factor, exempting staffs' relatives (children) and confirming the exempted students.

Although the student exemption system is integrated with a number of systems and tools such as authorized personnel tool, accounts receivable, registration office, student records and deserve factor solver, we recommend future versions to address the integration tools of the exemption system with other technologies such as project management, intelligent scheduling and optimization more efficiently.

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