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Business Process Improvements Using SSM and UML Activity Diagram

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Abstract: This paper presents an investigation into the use of Unified Modelling Language (UML)- Activity diagram and Soft System Methodology (SSM) to model complex processes in the Higher Education Sector, with reference to the process of Module Monitoring and Evaluation in Sudan. We argue that UML and SSM models are generally useful as a means for understanding, analysing and improving complex processes. Also, we show that using these models it is possible to discover process bottlenecks, to identify cross-functional boundary problems, and to focus discussion about automation of processes.

Keywords: Business Process Modelling, process of monitoring, Evaluation, role activity diagramming, case study, Soft System Methodology, Rich Picture Format (RPF)

I. INTRODUCTION

The introduction of the paper should explain the nature of the problem, previous work, purpose, and the contribution of the paper. The contents of each section may be provided to understand easily about the paper.
Organizations could improve their efficiency or effectiveness by identifying and modelling their most important business processes, and then use the models as a basis for the redevelopment of these processes. Piecemeal approaches that model one process at a time, as needs or opportunities arise, are unlikely to produce a coherent set of streamlined processes such as might be necessary for an organization to meet its strategic objectives.

An increased interest in applying information technology to the problem of representing knowledge about business processes has been manifested during the last decade in both business management and computer science communities. Because organizations are very complex artifacts it has been claimed that carefully developed models are necessary for describing, analyzing and/or enacting the underlying business processes ([1]). As a result, many formal notations for modelling business processes have been proposed. These can be broadly classified in high-level, visual notations, with an intuitive meaning, mainly addressed to the business management community and low-level foundational formalisms, with an elaborated formal semantics, mainly addressed to the computer science community ([2]).

Role activity diagrams (RAD hereafter) are a very popular high-level visual language that it is useful for capturing the dynamics and role structure of an organization ([1]). The RAD notation has been adopted in many applications involving business processes and has proved useful for various tasks like modelling ([3], [4]), simulation ([5]) and enactment ([6]).

Meanwhile, Soft System Methodology (SSM) (Checkland and Scholes, 1990) ([11]) focuses on problem formation within human activity systems, which are fundamentally social and political in nature, though they may include machinery.

SSM can be useful in identifying high level business processes, from first principles, in the conceptual modeling phase and a subsequent participative refinement of the models.

The study is divided in sections as follows. Section 2 contains some definitions of key terms encountered in the field of business process management and re-engineering. Section 3 is an introduction to the RAD high-level visual notation for business process modelling. Section 4 contains a description of a case study in using SSM and RAD for capturing a business process model. Section 5 concludes the paper.

II. BUSINESS PROCESSES: MODELLING AND RE-ENGINEERING

Informally, by a business process (BP hereafter) means a process that is carried out in an organization in order to achieve the organization's business objectives. An organization usually runs more than one business process. Some examples of business processes are: handling order for goods, recruiting staff, designing a new

product, building a software system according to a specification, installing a new telephone service. Ould ([1]) identifies three major types of BPs: core processes, support processes and management processes.

i) A BP is a set of partially ordered activities (carried out inside an organization) intended to reach a (business) goal ([3]);

ii) A BP is "a set of related activities that produces a result of value for the customer" and a "specific ordering of work activities across time and place with a beginning and clearly defined inputs and outputs" ([7]);

iii) Ould ([1]) avoids to give a precise definition of what a BP is. Rather, he describes the key features of a thing that he calls a BP: it contains a set of activities done for some reason; the activities are carried out by people and/or machines it is carried out collaboratively by a group; it often crosses functional boundaries; a functional unit is here understood as a part of an organization with specific responsibilities like personnel, manufacturing, marketing, finance, a.o. it is driven by the outside world (reactive in software engineering terms ?); i.e a BP has generic customers or clients

We conclude that a BP is set of logically interrelated activities in an organization carried out by people and/or machine to contribute to the achievement of the business objectives of the organization. So, a BP has: activities (also called tasks), participants and goals. The participants are artefacts (products, machines) and/or human beings (customers, workers). We must distinguish between active participants that execute activities and passive participants, i.e. the ones the process activities are directed to. The active participants are sometimes called resources and are organized in resource pools.

Business process modelling (BPM hereafter) is the task of producing an abstract description of a business process. The BP can be an existing process running in an organization or a new process existing only in the modeller mind

Curtis, Kellner and Over ([10]) mention the following purposes of BPM:

- to facilitate human understanding and communication;
- to support process improvement, which is based on a formal or informal assessment of the process model;
- to support process management, i.e the process model can be the basis for planning, monitoring and coordination of the underlying BP;
- to automate process guidance by capturing and reusing the process know-how;
- to automate process execution support, for example with the help of a workflow management system. According to Wieringa ([9]), an workflow management system monitors and controls the tasks to be performed in an organization.

BPMs are expressed using representation formalisms that should be able to capture all the relevant model information and also facilitate the analysis of the process (for example, in a BPR context).

The classical definition of BPR given by Hammer in [8] states that BPR is the radical redesign of business processes, usually enabled by information technology, in order to achieve dramatic improvements in their performance. Some examples of performance indicators of a BP are: cost, quality (of the products and/or services provided), speed, productivity.

The BP field is of interest for the software engineering community for several reasons.One reason is that the software process can be thought of as a BP with the goal of developing a program according to a set of specifications. Maybe this is why most of the BPM formalisms have their origin in the research on modelling the software process.

III. OVERVIEW OF AD

Unified Modelling Language (UML) is becoming increasingly important in software engineering, and since it includes Activity Diagrams as one of its techniques. We understood that UML aimed to provide system developers with a coherent set of notations which would help them visualize, specify, and build a software system (Scott, 2001, p.1). Several related notations are included in UML, including Use Case, Class, Interaction, State and Physical Diagrams as well as Activity Diagrams.

Because this appears to hold out the promise of an orderly development process from activity diagram to implementation, it seemed worthwhile to see whether UML activity diagrams could used to describe a business processes that we were interested in.

AD is a very popular visual notation specially tailored for business process modelling. It has originated from the work on coordination in programming environments ([12]). AD was used in various applications reported in the literature ([4], [5], [6]). In what follows we shall briefly introduce the AD concepts and graphical notation. The RAD notation is summarized in figure 1.

Roles group together activities into units of responsibility, according to the set of responsibilities they are carrying out. A role has one or more execution threads containing sequential activities, activities executed in parallel – part refinement and choices – case refinement. Roles are like classes in object orientation, i.e. they describe the behaviour of a class of individuals or role instances. A business process can contain one or more active instances of the same role. An actor is an agent that acts a role instance. An agent can be either a human or machine, single or group, which is capable of carrying out the work specified in the role.

Activities are the basic building blocks of a role. An activity can be carried out in isolation or it may require coordination with activities in other roles. In the last case the activity is called interaction and it requires the involvement of all the participating roles when it is carried out.

External events are points at which state changes occurring in the process environment influence on process.

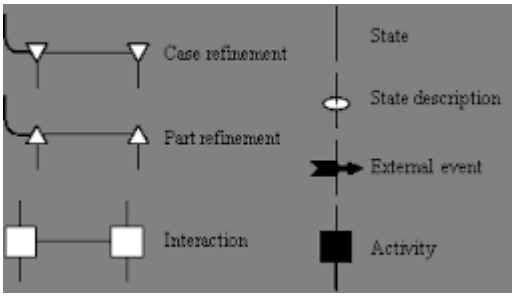

Figure 1: Summary of RAD notation

Roles have states similar to dynamic systems. Carrying out the activities inside a role can be seen as moving from state to state. States are useful for modelling point wise process goals, i.e. when a particular state has been reached it means that a certain goal has been fulfilled.

It should be said that Activity Diagrams are not an original part of UML, but were added later, and draw on a number of earlier techniques for modelling events, states, and workflows (Fowler & Scott, 2000, p. 129). They appear to be an attempt to project or extrapolate an object-oriented approach into the organizational context of the software development process. As such, they may reflect an underdeveloped conceptual framework for representing the activities of human beings in a business process (as distinct from software objects in a system). The opinions on UML differ as to what Activity Diagrams are good for: whereas Fowler and Scott call them "a great tool for workflow modelling" (p.137), Stevens and Pooley, rather more cautiously, remark that "although activity diagrams can be useful for modeling workflow, there is a lot more to business modeling than this." (p. 146). So ADs in UML do not yet present the clear focus on modelling business processes found in Ould's use of RADs.

IV. A MODELLING CASE STUDY

This section aims to develop new approaches to understand and improve business processes through process modelling, using Sudan Higher Education institutions module monitoring and evaluation as a case study.

Higher Education in general, and Module Monitoring and Evaluation process in particular, conform to Ould's (2005) characterization of processes as involving people and/or machines in the performance of collaborative actions and the pursuit of goals. Higher Education processes typically include different lines of activity, within a web of interactions, individuals, groups, departments, technologies, and goals. They have customers (students), boundaries, and inputs which need to be changed into outputs in order to meet process goals and customers' expectations. Patel (2000) has observed that higher education in general involves many sub- organizational groupings in complex interactions. In addition, one of the main objectives of most countries around the world is to improve their Education sectors.

Education processes commonly exhibit several complex features:

- a range of formal and informal interactions among a number of specialist or disciplines, both academic and administrative;
- the deployment of advanced knowledge, skill, and tools in an evolving socio-technical systems;
- a shifting population of intermittent customers (students, and staff); the pressure of decision making in customers future.

Education processes thus represent a serious and significant challenge for modelling and investigation. Other sectors may present similar levels of complexity, but particular interest in this area revolves around the

incorporation of advanced knowledge and machines into an institution's central process, and the urgent nature of the relationship between the institution and its customers (students).

The modules monitoring and evaluation, in Sudan as elsewhere, involves high level of interaction among individuals and groups within the specific institution as well as several institutions. The main objective of the process of modules monitoring and evaluation is to improve the administration of modules monitoring and the collection of information related processes cases, which would contribute in the longer term to better understanding of evaluation and reduction of the impact of the lack in education quality. Quality management needs a high degree of collaboration between faculty departments and centers of quality assurance within specific institution and ministry of higher education as well.. The general module monitoring and evaluation process has been investigated by studying the work at The National Ribat University and some other similar higher education institutions.

The monitoring and evaluation (feedback) process is an appropriate case study for this research in terms of complexity, accessibility and generality. Production and validation of a general methodology for business improvement would be difficult to achieve without grounding onto sufficiently complex and realistic case. Although the monitoring and evaluation process in Sudan, as an example of a higher education process, exhibits sufficient complexity to provide a worthwhile and demanding subject for study, the methodology developed in the succeeding chapters does not assume any particular features of education quality processes as fundamental to or typical of all institutions, and so should be abstract enough to be applicable in other equality complex but different settings.

The steps followed in the business process improvements was as follows:

Understand the Current Process.
Model the current Process.
Validate the Current Process Models.
Analyse and Evaluate the Current Process.
Redesign the Current Process.
Evaluate the Redesigned Process.
Implement the Redesigned Process.

The basic purpose of introducing the new business process improvement for MME process is to eliminate the difficulties that are currently being experienced.

To fully understand the current business process, elements of the Soft System Methodology (SSM) as developed by Peter Checkland (Eva 2004) were used. "This methodology is a way of dealing with problems where there is a high social, political and human activity component, this distinguishes SSM from other methodologies which deal with hard, more technically oriented problems" (Couprice et al 1997).

SSM deals with soft problems which are often difficult to define. Soft problems are thought of problem situations rather than the problem itself, because we realize that things are not working the way we want them to and eager to explore whether anything can be done about it, "It is a classic situation of it not being a 'problem' but an 'opportunity'" (Couprice et al 1997).

SSM was used to help start thinking about the whole problem systematically. Main encouragement point was to explore a new technique that has never been used by software engineers. This method was quite interesting and helpful in giving an insight into understanding the problem. Rich Picture Format (RPF) for the current problem situation is created to help in understanding the way people can look to the MME process. RPF can also help in proposing a new improved business process that can be implemented.

Five processes have been identified to represent the overall MME process, as follows:

Student Feedback;
Instructors Feedback;
Teaching Assistants Feedback;
Follow up; and
Faculty Committee Feedback.

Figure 2 below shows the RPF for the current situation.

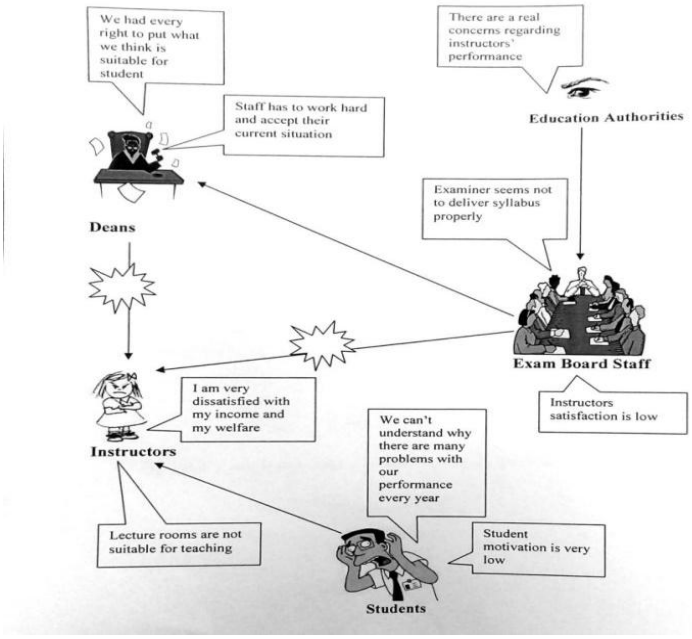

Figure 2: RPF for the current situation.

Each process has its separate objectives, and its own ways of achieving them, but, all the processes together aim to achieve the goals of the overall MME process.

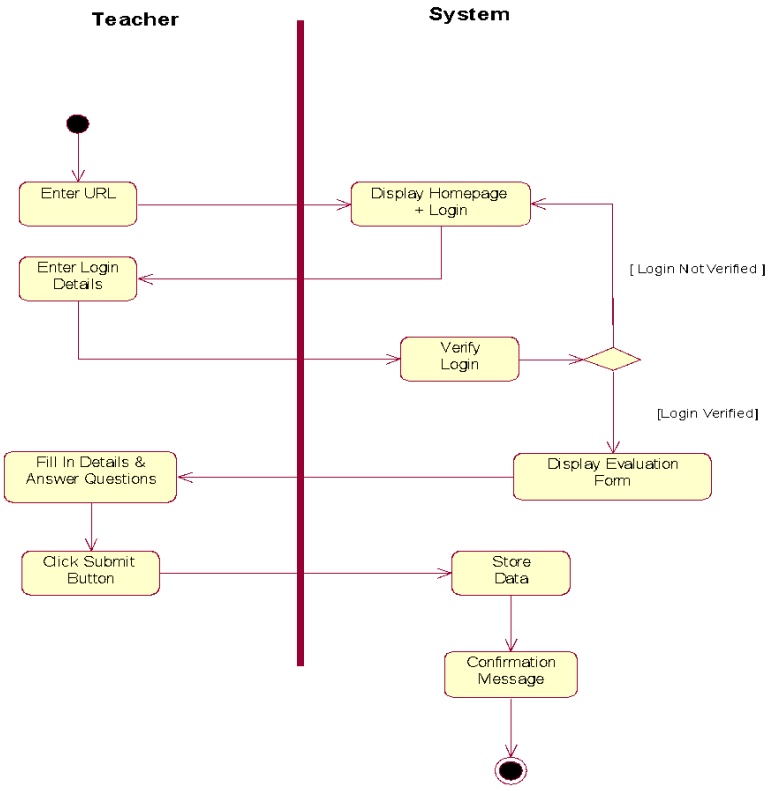

Figure 3: Activity Diagram for Teacher Questionnaire

V. CONCLUSIONS

Activity Diagrams and Soft System Methodology have proven a useful modelling notation for the case study considered in the paper. The resulting model intended to derive some guidelines for improving the business process through which an academic institutions can improve their module monitoring and evaluation procedure.

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