

# Process Modelling and Activity Coordination in an Academic School within a Higher Education Enterprise: an ISO 9001:2000 Certification Process

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**Abstract.** To gain a leading edge in today's competitive environment, higher education enterprises are implementing and obtaining International Standard Organisation (ISO) 9001:2000 certification for their quality management system (QMS). In this paper, the use of ARIS (Architecture of Integrated Information Systems) methodology to assist in process understanding when implementing QMS is discussed. Introduction of the ISO certified QMS into the School of ABC, XYZ University – the first ever for an academic school in Australia, is used as a case study to illustrate both the notion of a process-oriented HEE and the elegance and power of ARIS.

## 1 Introduction

Reducing government funding, intense cost pressures, increasing student numbers, rising competition for international students, growing need for self-reliance, demands for greater accountability and quality are changing the landscape for higher education in Australia. Consequently, higher education enterprises (HEEs) are moving away from more traditionally collegial styles towards corporate management styles characterised by high student/staff ratios; introduction of stringent financial planning and spending; centralisation of power structures; increased focus on efficiency and effectiveness of individuals' and departments' research and teaching standards; and introduction of information support to gain a leading edge [1].

Most of the corporate management concepts adopted by Australian HEEs centre on business processes and have long been expected to obtain competitive edge for process-oriented enterprises. They include activity-based costing, benchmarking, balanced scorecard and quality initiatives like quality assurance system to ISO 9001:2000 (ISO from now onwards) standards and total quality management model. Relevant literature including the discussion of these activities in the context of a HEE include for examples, Cribb & Hogan [4], Ellis-Newman & Robinson [8], Goddard & Ooi [9], Hafner [10], Lundquist [13], Massaro [14] and Piper [18].

A business process-oriented enterprise is seen to include the following key factors: a *process view* of the business; *structures* that match these processes; *jobs* that operate these processes; *management and measurement systems* that direct and assess

these processes; and customer focused, empowerment and continuous improvement oriented *values and beliefs (culture)* that are embodied in all components [15].

In view of this, it is important to understand the concept of process-orientation in the context of higher education as process-orientation paves the way for a number of corporate management concepts, in particular quality management system (QMS) to ISO standards which become prominent in Australia after the introduction of quality evaluation by the government due to lack of community confidence and funding cut-backs.

The objective of this paper is, therefore, two-fold:

- to study the industry specific issues of how the implementation of an ISO quality management system within an academic school serves as a facilitator for a business process modelling exercise; and
- to illustrate how ARIS methodology is utilised in the process of ISO certification

This paper closely follows the case study methodology [25] with elements of formal theoretical process analysis and design being incorporated into it

The contribution of this paper is that it reports on the first ever case of ISO certification undergone by an Australian academic school [16] and puts it into a coherent framework of process-orientation and process modelling.

This paper is organised as follows: Section 2 presents an overview of ISO certification, Section 3 provides a brief description of the ARIS methodology while in Section 4 the case of the School of ABC, XYZ University, Australia and its ISO implementation process are introduced. This is followed by a discussion of the case study findings in Section 5 and an overview of the overall description of the ARIS models developed in Section 6. Section 7 provides further discussions on the case study and finally Section 8 contains a brief summary and conclusion.

## 2 ISO 9001:2000 Certification

Process is defined in ISO as “*a system of activities that utilises resources for the transformation of inputs into outputs*” while in classical business process management literature, Davenport ([5], p.5) define a process to be “*a specific order of activities across time and place, with a beginning and an end and clearly identified inputs and outputs with a structure of action*”. There are definitely similarities between these definitions.

The ISO *process-based approach* refers to the management of processes and the interactions between processes within the organisation. It emphasises the importance of understanding and fulfilling quality requirements, considering value adding processes, constant monitoring of the results of process performance and ongoing improvement of processes based on objective measurement [19]. Implicit in this approach is the assumption that quality of processes should guarantee quality of outcomes.

*Process-based approach* makes it easier for employees to share in the construction of the QMS because routine day-to-day tasks are expressed. Involvement of staffs in the process of detailed procedure creation and updating advances user acceptance of this system as well as inspiring staffs to continuously improves and enhances it [21].

The benefits obtained from ISO certification have long been recognised by the manufacturing industry [7]. However, the application of these standards to higher education is a fairly recent trend and is an attempt to respond to the increased pressures to ensure accountability and quality in the industry [2], [3]. It is also used by HEEs to increase their credibility of promoting commitment to excellence and continuous improvement in all its processes to take full advantage of the latest education reform which allows Australian HEEs to increase Higher Education Contribution Scheme (HECS) fees up to 25% of current HECS fees, all of which go directly to the HEEs [17].

It is important to note that whilst the implicit assumption of quality of processes leads to quality of outcomes is often taken for granted by ISO as well as organisations undergone ISO certification, whether this is always the case will be discussed in Section 5.

### 3 Process Modelling with ARIS

A business process model is a blueprint that keeps a list of relevant interrelated organisational dynamic activities from beginning to end, and their structure and close relationship with other related resources that support them.

ARIS framework was first introduced by Scheer [20] and further developed by Davis [6], Loos & Allweyer [12], and Scheer [22] to amalgamate both business processes and major components of information systems into a coherent integrated architecture for organisational information support which became one of the well-documented classical process modelling methodologies. It is not the purpose of this paper, therefore, to provide a “mini-tutorial” on ARIS modelling but rather we briefly recall the basic concepts of ARIS that are relevant for our discussion.

The ARIS methodology is based on the concept of a process chain model - a collection of value-oriented individual processes [20]. Presenting the overall business process model in one big schema in order to describe the real complexity of underlying business processes reduces the clarity of the model.

Davis [6] suggests decomposing the business process model into three hierarchical layers: *conceptual layer*, *process layer*, and *procedural layer*. Fig. 1 depicts the three hierarchical layers in ARIS model where a value-added process in Fig. 1(a), decomposes into an overall sequential activities of that process in Fig. 1(b) and decomposes further into more specific details of a particular activity in Fig. 1(c).

Davis [6] also proposes the decomposition of *conceptual* and *process layers* into several detailed levels to improve clarity of more complex processes. An *assignment icon symbol* is used as a navigation tool in ARIS to link one process to another process or to another view as indicated by Fig. 1(a).

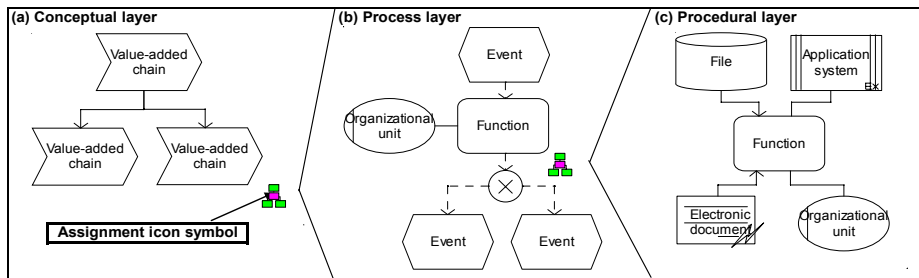


Fig. 1. Hierarchical layers in ARIS model

There are many potential uses of graphical ARIS process models once they are developed. According to Scheer [21] these benefits include among others, storing corporate knowledge in reference models, optimising organisational changes, utilising process documentation for ISO-9000 and other certifications, improving cost calculation and leveraging process information to implement and customize standard software solutions or workflow systems.

#### 4 Case Study Settings

The School of ABC was established in 1988 and is the second largest school out of the eight schools within the Faculty of DEF - the second largest faculty in XYZ University. It offers two undergraduate degrees and six postgraduate degrees. Currently the school is made up of 49 full-time staff: 35 academics, 11 administrative staff, and 3 technical staff. The school also employs approximately 60 sessional assistant lecturers each semester to help run tutorials.

The implementation of the school's QMS, known as business management system (BMS) is part of the faculty's BMS and stems directly from the Faculty Operational Plan 2002. The faculty recognises the need for quality assurance program to gain a competitive edge due to the current downturn in information technology sector and rapid technology advances, among other factors discussed in Section 1. The school was chosen to implement BMS because it already has procedures in place for its day-to-day operations.

The eight steps adopted by the school in achieving ISO certification for its administrative and academic processes include: form two units; establish objectives and key processes; develop process maps; document procedures, preliminary audit of documentations, in-house audit of procedure manuals; on-site audit of procedure manuals; and certification of ISO 9001:2000. These steps are depicted as an ARIS procedural model in Fig. 2 using *extended event-driven process chain* model (eEPC), the central modelling technique in ARIS *process layer*.

The four types of objects used in the *process layers* are: *events*, *functions*, *rules* and *resources* (refer Fig. 1(b)). An *event* represents the changing state of the world as process proceeds. *Function* is an activity that is carried out as part of a business that adds business value. A logical Boolean connector (*AND*, *OR*, *XOR*) is used as *rules* to

segregate and/or join the events and functions. *Resources* may include organisation, systems, data, knowledge and the like.

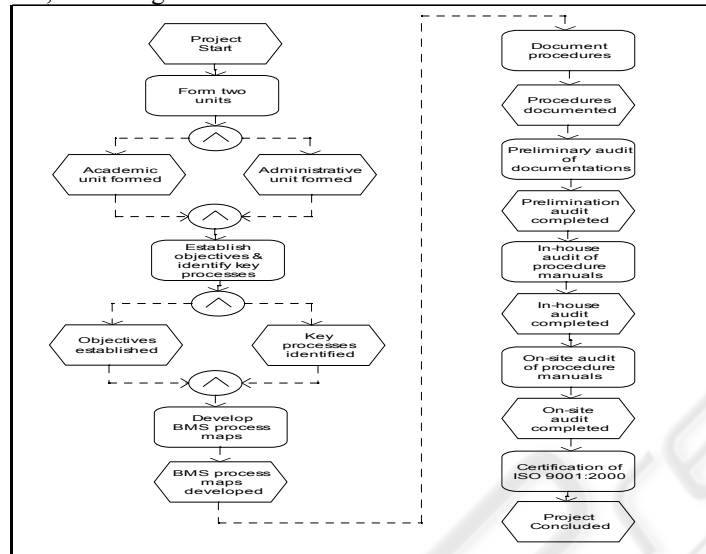


Fig. 2. Overview of the strategy adopted by School ABC

Despite the potential benefits of ARIS, the ARIS methodology discussed in Section 3 is not chosen by the school for its ISO process description, instead Microsoft Word is used. We argue that using ARIS methodology is beneficial and in Section 6 we demonstrate how the process description could have been simplified and simultaneously enhanced by ARIS.

## 5 Case Study Findings

The case study findings reported upon in this paper can be roughly classified into two broad categories.

### 5.1 Academic versus Administrative Processes

Based on our case study, it is found that nine academic processes compared to 78 administrative are documented by the school staff members. The large discrepancy may be due to the nature of the processes, academic being less structured hence more difficult to procedurised than administrative. This is evident by the fact that the nine academic processes documented tended to be more administrative related for example, *new course approval process*, *staff induction*, *staff development* and the like.

Another reason may be due to the fact that administrative staff members operate in an “enterprise” mode thus more receptive towards change and teamwork environment than academics. Academics tend to value their freedom, incline to be less flexible and

prefer to operate autonomously hence documenting academic processes may be seen as an intrusion into their freedom and privacy. It correlates well with the general observation that academics are less likely to operate in an “enterprise” mode when the current academic reward system is very much based on individual research outputs. Understandably academics tend to gain more if they devote time and energy towards those aspects of teaching and research which tend to be less “formularisable”.

The certification process increased administrative staff members’ awareness of the school’s core processes. They focused on these processes to help enhance the transparency of them and to identify activity owners hence have better appreciation of each other’s roles and tasks.

Since administrative staff members tend to adopt proactive leadership management and facilitated greater communication and teamwork, they have higher coordination level. Academics, on the other hand, have much lower coordination level as they tend to operate autonomously.

## 5.2 ISO: Processes versus Outcomes

The impact of ISO certification on the school have not been analysed as yet since the whole certification process was completed at the end of 2003. However, following from our discussions with the school management, the specific benefits of ISO certification to the school included streamlined processes by eliminating redundant and duplication activities. In addition administrative staff members have better understanding of the school’s activities, thus are no longer perform activities that are supposed to be done at academic faculty level.

Recall the discussion in Section 2 about the implicit assumption of ISO certification that quality of processes guarantees quality of outcomes. This may not necessary be the case. *Efficiency* is producing maximum (a given) level of outputs for a given (minimum) set of inputs while *effectiveness* looks at how well the objectives of the entity are achieved. Efficient processes may not necessary be effective and vice versa. Therefore quality of processes does not guarantee quality of outcomes. As discussed in Seng and Churilov [24], in order for process to be both efficient and effective, *mean objectives* of the process must be aligned with *fundamental objectives* of a HEE using Keeney’s *value focused thinking* [11] where *fundamental objectives* are specific objectives that an organisation wants to achieve while *mean objectives* are objectives that help accomplish fundamental objectives. For example, the set of *fundamental objectives* for a HEE include among others: provide facilities for study and evaluation; give instruction and training; aid advancement of knowledge; and confer degrees, while *mean objectives* include among others: increase revenue; improve customer service; reduce operating cost; and manage fixed assets.

Consequently the implicit assumption of ISO certification should not be taken for granted. On the contrary, it is important that the objectives of the processes identified for documentation be aligned with the objectives of the HEE.

We have just demonstrated the findings of the case study that did not use the power of ARIS. Below we demonstrate how the ARIS methodology can be used to improve process modelling and understanding.

## 6 Case Study Revisited: an ARIS-based Approach

The School of ABC is made up of both the Academic Unit and Administrative Unit therefore all the key processes are separated accordingly. As part of the ISO certification process, the school produced documentation for 87 processes: nine academic and 78 administrative.

The Academic Unit is in charge of four core processes: *Teaching*; *Research*; *Curriculum development & review*; and *Industry liaison* as depicted in Fig. 3. The *Curriculum development & review process* is decomposed into four sub-processes: *New course approval*; *Unit review*; *New unit or major amendments*; and *Unit minor amendments* as shown in Fig. 3(b). Further, as illustrated in Fig. 3(c), the Academic Unit is responsible for six core processes within its resources management: *Recruitment*; *Staff industry*; *Staff development & training*; *Teaching allocations*; *Mentoring*; and *Staff performance management*.

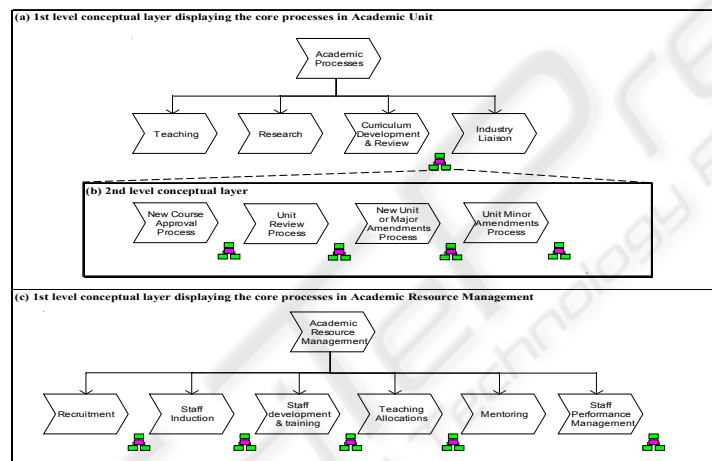


Fig. 3. Conceptual layer of the Academic Unit

In contrast, within the Administrative Unit there are five core processes as illustrated in Fig. 4: *Marketing*; *Staff services*; *Student services*; *Technical services*; and *Student support services*.

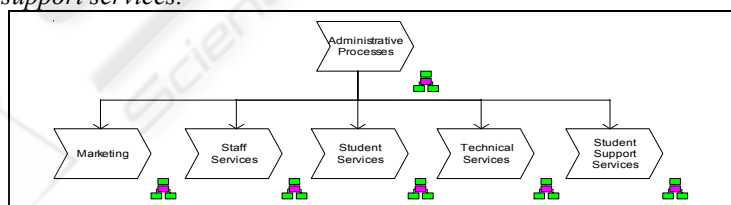


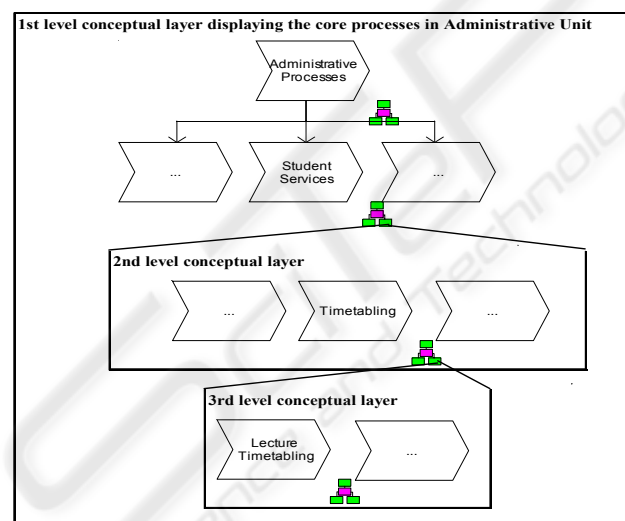
Fig. 4. High-level conceptual layer of the Administrative Unit

Each of these decomposes further into several other levels of conceptual layer. The *Marketing process* into two 2<sup>nd</sup>-level: *Publications*; and *Open day*, and two 3<sup>rd</sup>-level conceptual layers. *Staff services process* consists of five 2<sup>nd</sup>-level: *Financial re-*

sources; Human resources; Physical resources; Teaching resources; and BMS documentation, 19 3<sup>rd</sup>-level and 20 4<sup>th</sup>-level. Student services process comprises of eight 2<sup>nd</sup>-level: Admission; Enrolments; Timetabling; Assignments; Examinations; Results; Scholarships and Research, 18 3<sup>rd</sup>-level and 10 4<sup>th</sup>-level. Technical services process encompasses four 2<sup>nd</sup>-level: IT support for staff & research student; IT teaching & leaning support; File, web & application servers; and Network & account management, 17 3<sup>rd</sup>-level and 12 4<sup>th</sup>-level. Student support services process includes two 2<sup>nd</sup>-level: English conversational classes; and Online textbook listing, and two 3<sup>rd</sup>-level.

The processes of the school are modelled using *ARIS value-added chain diagrams* for conceptual layers, *ARIS eEPC* for process layer and *ARIS function allocation diagram (FAD)* for procedural layer. In total 102 ARIS process models are developed. Nine ARIS process models for the Academic Unit: four for *Curriculum development & review*; and five *Resource management* and 93 ARIS process models for the Administrative Unit: three *Marketing*; 33 *Staff services*; 26 *Student services*; 28 *Technical services*; and three *Student support services*.

The *lecture timetabling process* is discussed to illustrate the power and elegance of ARIS methodology in enhancing process understanding. This process is chosen because it is one of the “deepest” processes with several levels of conceptual layer (see Fig. 5) and eEPCs as well as a FAD.



**Fig. 5.** Decomposition of the conceptual layer of the administrative process

As depicted in Fig. 6, the high-level eEPC is used to capture the chain of activities that is happening at the *lecture timetabling process*.



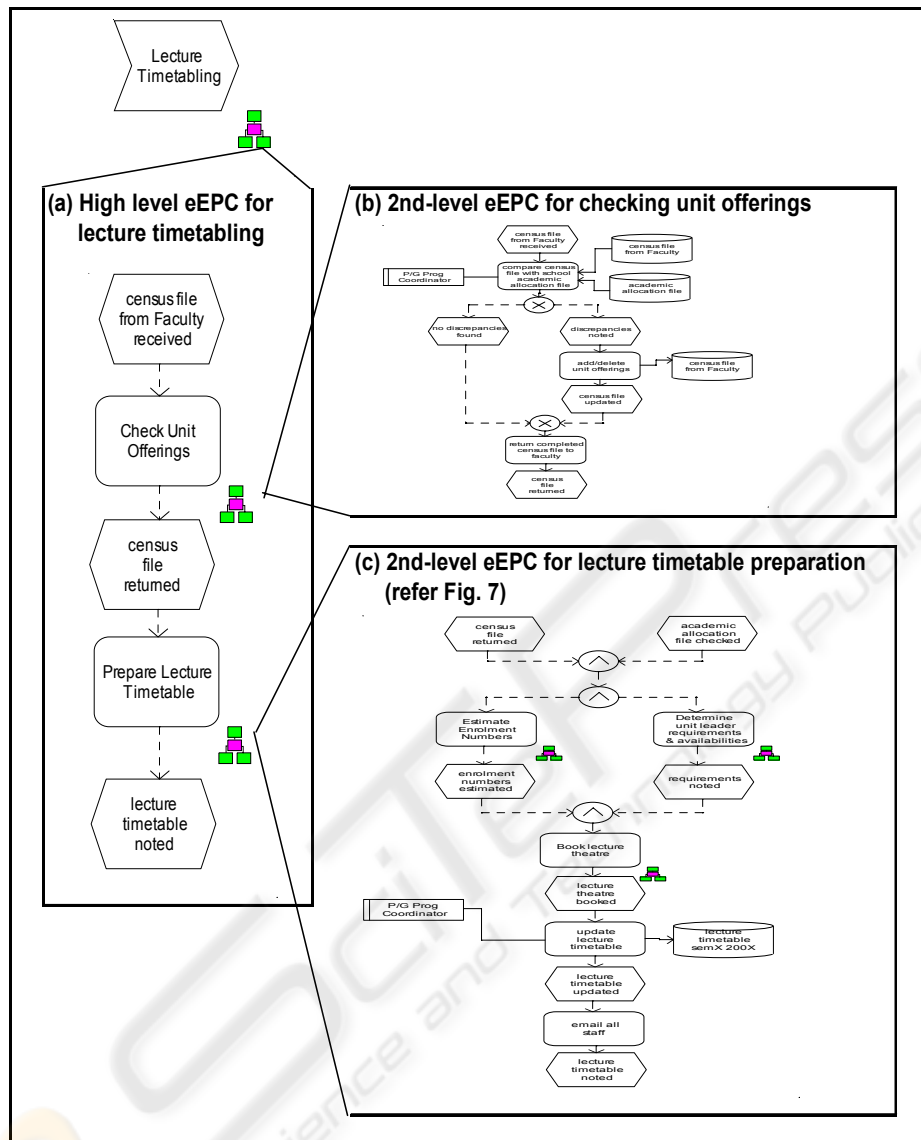


Fig. 6. Overview of the 1st-level and 2nd-level eEPCs of the lecturing timetabling process

This process is initiated by the arrival of the faculty's census spreadsheet event and is supported by two 2<sup>nd</sup>-level eEPCs: *check unit offerings* and *prepare lecture timetable* and ends once all the school's staff are notified of the updated lecture timetable. It is further supported by three 3<sup>rd</sup>-level eEPCs and one FAD as depicted in Fig. 7 and Fig. 8 respectively.

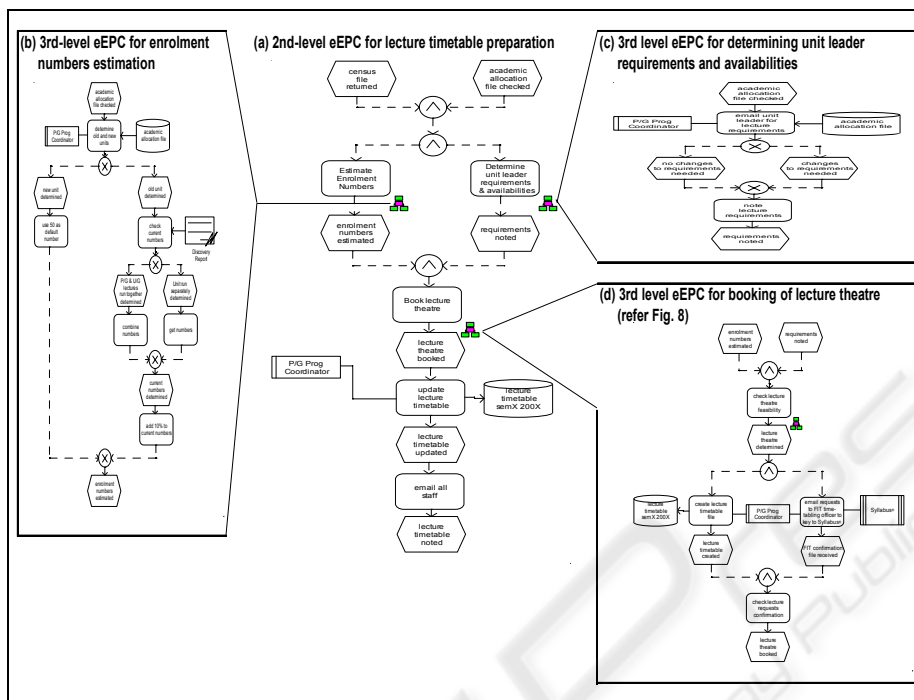


Fig. 7. Decomposing from 2<sup>nd</sup> to 3<sup>rd</sup>-level eEPCs of lecture timetabling process

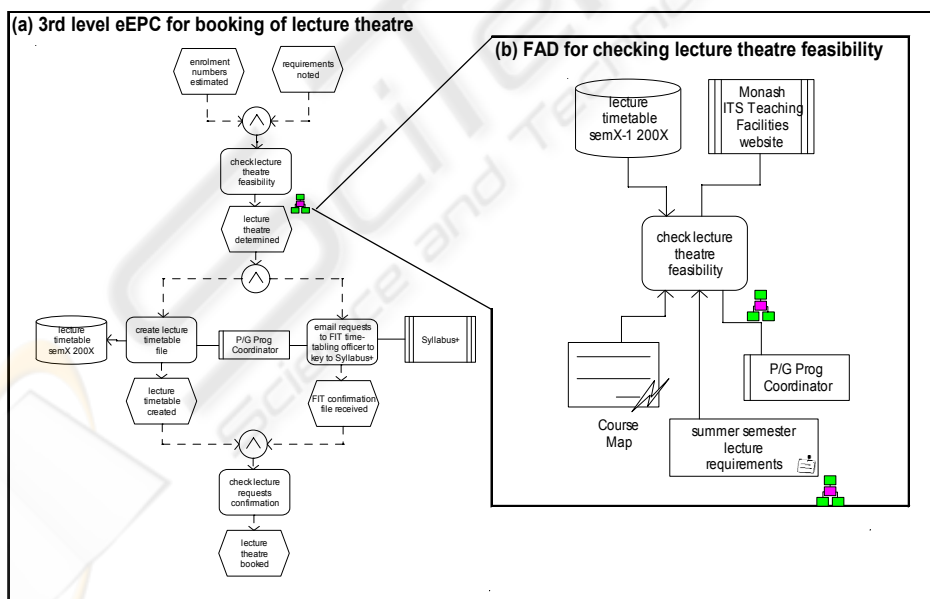


Fig. 8. Decomposing from 3<sup>rd</sup>-level eEPC to FAD of lecture timetabling process

## 7 Discussion

Describing business processes with ARIS ensures consistent modelling and elimination of paper versions of documentation. Further storing processes in ARIS repository meets most certification requirement that processes should be available at all times to respective people in the organisation.

During the ARIS modelling, 102 process models are developed. Nine models for the Academic Unit: four for *Curriculum development & review* and five for *Resource management*; and 93 for the Administrative Unit: three for *Marketing*, 33 for *Staff services*, 26 for *Student services*, 28 for *Technical services*, and three for *Student support services*.

These models act as reference models ensuring the school's knowledge is not lost and smooth transition of processes due to staff movements or departures. On top of that they facilitate greater process understanding and reconciliation of different viewpoints through ARIS methodology of decomposing complex processes into hierarchical layers. Thus the adoption of such methodology greatly enhanced the level of activity coordination among the people involved.

In addition these models may be modified for other purposes which may include activity-based costing, process improvement and/or design, process benchmarking, simulation, balanced scorecard and the like for improving the school's decision making processes, quality of processes as well as efficiency and effectiveness of the school's operations.

Taken together with the findings described above, the "administrative-related" corporate knowledge seems to have higher potential to become explicit while the "academic-related" knowledge seems to have a reasonably high tacit component.

## 8 Summary and Conclusion

In this paper the process of the ISO certification for an academic school within Australian university is discussed. The concept of a process-oriented HEE developed by Seng and Churilov [24] provides a convenient starting point for addressing the issues of ISO certification in a university. As the ISO set of standards is very much process-oriented on its own, it is rather natural to expect a "better fit" and fewer problems when implementing ISO certification by the enterprise with process-oriented organisational structures.

The competitiveness in the area of higher education puts a strong emphasis on the HEE to adhere to an internationally recognised set of quality standards. As a part of this study, the strategy adopted by the School of ABC in regards to ISO certification was discussed and a number of tangible benefits were formulated. These include streamlined processes, better understanding of the school's activities, increased awareness and staff member focus on core processes, transparency of processes, and better appreciation of different roles and tasks within the school.

In the course of the school's ISO certification process, more administrative processes were identified and documented when compared to academic processes. The reasons behind this may be firstly, documenting academic processes is seen as an

intrusion into academic freedom and privacy and secondly, academic processes are less structured than administrative processes and hence harder to procedurised.

Needless to say, having a powerful and flexible process modelling framework and methodology becomes very important when dealing with process-oriented tasks such as ISO certification. In this study we demonstrated how the ISO certification processes can be better managed and documented using ARIS methodology. It is argued that although ARIS was not chosen as a modelling tool for the actual process of ISO certification, the use of this or another sophisticated process modelling tool could have potentially delivered even more benefits to the enterprise in question.

As the whole process of ISO certification was completed at the end of 2003, natural directions for future research include longitudinal studies of the impact of the process of ISO certification on the school as well as research into comprehensive reference models for ISO certification of an academic school and the dissemination of modelled procedural knowledge within HEE.

This research can be extended by addressing potential benefits of academics and administrative staffs within HEE and how process-orientation facilitates quality improvement for students. These issues are partially explored in Seng [23] and require future consideration.

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