

Enterprise Architecture Proposal for Undergraduate Teaching in Higher Education Institutions

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ABSTRACT

This work, which is part of an ongoing project, presents the first steps of a proposal Enterprise Architecture (EA) for the area of Undergraduate Teaching in Higher Education Institutions. The University of Bío-Bío (Chile) is considered as a case of initial study, with the purpose of identifying strategic guidelines, processes, systems and information technologies, which will serve as a basis to define a model of AE, which will be validated in other institutions, in order to identify common patterns that allow building a general model of utility to support the development, management and operation of this area, and also collaborate, promote and facilitate the achievement of institutional goals.

Keywords: enterprise architecture, university higher education institutions

INTRODUCTION

Organizations have been permanently concerned about improving their performance (Araya and Chaparro, 2005), (Porter, 1980), (Robinson and Pearce II, 1998), (Rojas, Sánchez and Guerrero, 2015), (Scott, 2015). The achievement of better performance and competitive advantages may be associated with the alignment between Information Systems and Technologies Systems (IS/TS) and the organization's strategy (Kearns and Lederer, 2000), (Tian et al., 2010). In this business strategy – IS/TS strategy relationship, the Enterprise Architecture (EA) emerges as a holistic connection between business processes, information systems and information technology infrastructure (Lankhorst, 2005.)

This study, which is the first advance of an ongoing project whose objective is to propose an EA for the area of Undergraduate Teaching of University Higher Education Institutions in Chile, considering guidelines for quality assurance, presents the first advances after carrying out the initial phases established for the achievement of this objective. To this end, the University of Bío-Bío (Chile) has been considered as a case study base to obtain an initial vision of a possible enterprise architecture, which later, under the corresponding analyses and considerations, can be generalized to more institutions.

The general stages considered for the development of this research are: (i) a review of the literature on EA, (ii) the development of phases associated with the definition of an EA for undergraduate teaching, (iii) the validation of the EA proposal against a sample of these Institutions, (iv) the development of necessary adjustments, (v) the presentation of a definitive proposal. In this paper, the progress made up to the second stage is presented.

REVIEW OF THE LITERATURE AND PROBLEM STATEMENT

Improving organizational performance has been a permanent concern for organizations (Porter, 1980; Ramanujan et al., 1986; Robinson and Pearce II, 1998; Tian et al., 2010; Turban et al., 2015), where the achievement of better performance levels and competitive advantages may be motivated by the existing alignment between IS/TS and the organization's business strategy (Kearns and Lederer, 2000; Gupta et al., 1997; Chan and Reich, 2007; Gragg et al., 2002; Tian et al., 2010). In this sense, through a continuous process of aligning Information Technology (IT) and business strategies, organizations can develop these competitive advantages and improve their performance (Chan and Reich, 2007; Kearns and Lederer, 2000; Croteau and Bergeron, 2001; Bergeron et al., 2001; Rocha and Freixo, 2014; Rocha and Sá, 2015; Turban et al., 2015).

In this business strategy – IS/TS strategy relationship, there is a holistic, integrating alignment that contemplates business processes, information systems and technological infrastructure, called EA (Zachman, 1987). According to Lankhorst (2005), enterprise architecture "is a coherent set of principles, methods and models that are used in the design and implementation at the enterprise level of organizational structure, business processes, information systems and infrastructure", where all elements of information technology, processes, systems, organizational structure and people are integrated and work together as a whole (Lankhorst, 2005).

According to Bernard (2015), any organization can be structured according to three hierarchical levels: strategy, processes, and information systems. At the first level, the organization establishes the objectives it intends to achieve; at the process level, the necessary operations to achieve the objectives defined in the strategy are established, while at the third level, the aim is to provide the necessary support to systems for the development of the processes and the scope of the strategic purposes established, with the support of the appropriate information technology infrastructure (platforms, operating systems, databases, networks and telecommunications.)

A particular type of organization, which is also faced with a constant search for excellence, corresponds to Institutions of University Higher Education (Araya and Chaparro, 2005). These organizations have also been concerned about improving their performance levels, due, for example, to the overcrowding of higher education systems and limitations in public spending (Araya et al., 2007), and must incorporate and adapt to technological changes, where the use of information systems is relevant to improving their performance and competitiveness, in an increasingly demanding educational environment (Araya and Chaparro, 2005). These requirements have become a challenge for these types of institutions, where there has been a growing interest in improving the efficiency in the use and management of their human, financial, material, technological and information resources.

Higher Education Institutions, like any other organization, must have strategic guidelines that specify where they want to go and the path to follow to achieve it, where objectives and goals are established, as well as strategies for their fulfillment, defining and implementing processes, procedures, mechanisms, activities, tools, resources and capacities necessary to achieve the purposes pursued.

In Chile, Higher Education Institutions face a constant search for excellence (Ramírez-Correa et al., 2012), where a culture of quality has been developed, within the framework of continuous improvement, strongly promoted by the processes of institutional accreditation and accreditation of undergraduate and graduate programs. In this sense, the accreditation processes, at any level, require a look at a series of institutional aspects, considering elements related to teaching, management, research, outreach, technical assistance, planning, liaison to employers, follow-up and linkage with graduates, dissemination, student services, among others, which undoubtedly includes the set of institutional resources involved, whether human resources, infrastructure, equipment, facilities, financing, etc.

Studies, such as that of Rojas, Sánchez and Guerrero (Rojas, Sánchez and Guerrero, 2015), present the design of an Enterprise Architecture Model for the macro process of Academic Management of the University of Pamplona, pointing out that this model "provides a new way of seeing the macro process mentioned, where the control of the process can be improved, as well as its evolution and changes"

In this context, the definition and implementation of an Enterprise Architecture for Higher Education Institutions can be a convenient strategy that promotes the alignment between the purposes, processes and information systems that intervene in the work of these institutions. Moreover, if this alignment exercise includes aspects that are considered in the quality assessment (accreditation) within these organizations, it allows for the incorporation of elements that should be considered and that these institutions should take into account in order to improve their performance and quality levels (Araya et al., 2018.)

METHODOLOGY

The stages considered for the development of this research are: (i) a review of the literature on EA, (ii) the development of phases associated with the definition of an EA for undergraduate teaching, (iii) the validation of

Table 1. Strategic guidelines, processes

LE1	Undergraduate Teaching Educating Integral Persons of Excellence for the development of Society
OE1.1	Strengthen the systems of measurement, monitoring and control of the phases that comprise the process of harmonization of undergraduate programs with the institutional educational model, updating and tuning the corresponding standards and regulations.
OE1.2	Strengthen the process of permanent self-evaluation to achieve and maintain accreditation of all undergraduate and graduate programs that can be accredited.
OE1.3	Establish policies and manage resources to improve the infrastructure and equipment for the development of academic, teaching and extra-curricular activities of students at the Universidad del Biobío
OE1.4	To strengthen the processes of vertical articulation, with the secondary education, both scientific - humanistic and technical professional, the programs of insertion and adaptation to the university life with the purpose of improving the admission and positioning the academic offer of the Universidad del Biobío.
OE1.5	To strengthen the capacities and teaching skills of the academic staff of the Universidad del Biobío, to improve classroom performance and encourage the development of research in teaching.
P1	Formulate and update Educational Model
P2	Design Careers according to Educational Model
P3	To strengthen teachers according to the Educational Model
P4	Teaching according to the Educational Model
P5	Self-assessment of Careers
P6	Accredit Careers
P7	Execute Improvement Plan
P8	Manage academic, teaching, and extracurricular activities of students
P9	Manage Student Projects according to Educational Model
P10	Manage infrastructure and equipment
P11	Manage activities of vertical articulation
P12	Assess results vertical articulation
P13	To insert and adapt new students
P14	Manage tutoring programs
P15	Manage teacher support trainings
P16	Manage teaching results by teacher
P17	Manage Research in teaching
S1	Manage Educational Model
S2	Manage Undergraduate Programs
S3	Manage Design / Adjustment / Redesign Curriculum
S4	Manage Generic UBB Student Profile
S5	Manage Graduate Profile
S6	Manage Teacher Training and Development
S7	Manage Commitments by Faculty-Department-School-Faculty-Teacher
S8	Manage Teaching Resources
S9	Manage Teaching Session
S10	Manage career self-assessment-accreditation processes
S11	Manage follow-up of Improvement Plans
S12	Manage teaching, student and extracurricular activities of students
S13	Manage projects according to Educational Model
S14	Manage infrastructure and equipment
S15	Manage vertical articulation activities
S16	Follow-up of new students benefiting from Vertical Art.
S17	Inserting and adapting new students
S18	Manage tutorial and people receiving tutorials
S19	Manage Teacher's Training Plan regarding Teaching
S20	Manage results by teaching
S21	Manage teaching research

the EA proposal against a sample of these Institutions, (iv) the development of necessary adjustments, (v) the presentation of a definitive proposal. In this paper, the progress made up to the second stage is presented.

The phases of development associated with the EA for Undergraduate Teaching are the following:

1. Phase 1: Identification of defined strategic aspects.
2. Phase 2: Identification of processes associated with the development of strategic aspects (Business Architecture.)
3. Phase 3: Identification of information required for the execution of the established processes (Information Architecture.)
4. Phase 4: Identification of computer applications required to support the processing of information and the execution of the processes involved (Information Systems Architecture.)
5. Phase 5: Identification of the necessary information technology infrastructure (platforms, operating systems, databases, networks and telecommunications) (Technological Architecture) for the development and support of the computer applications established.

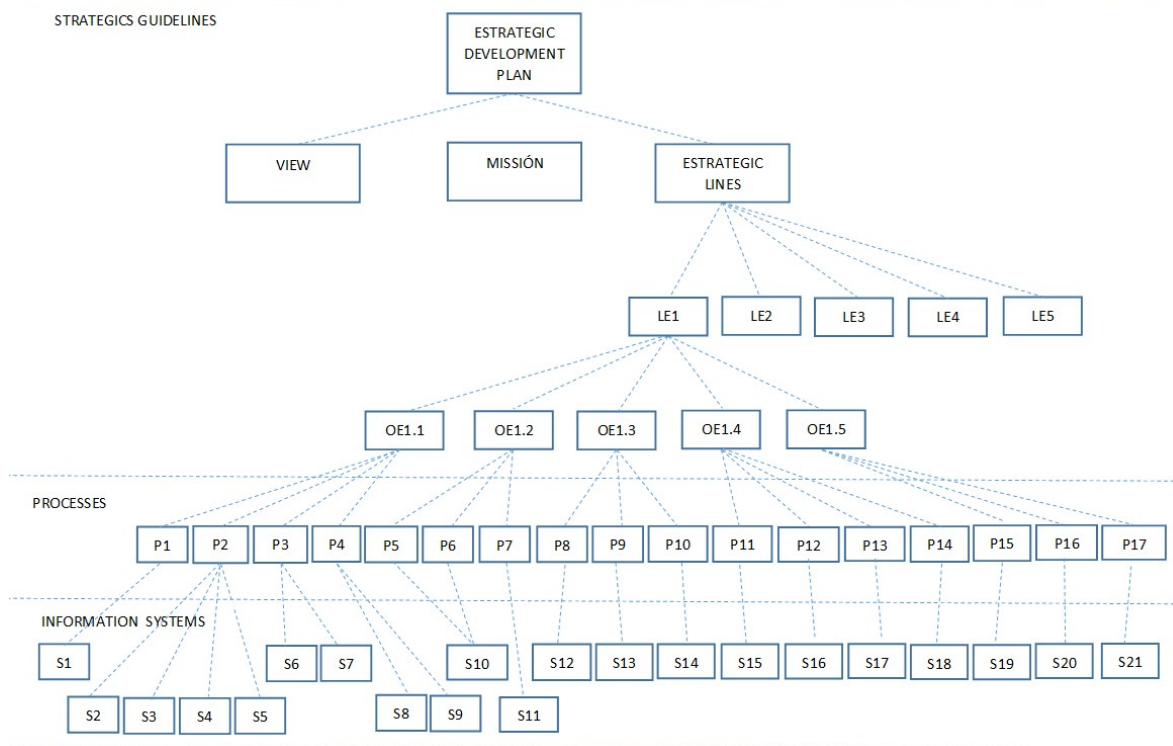


Figure 1. Graphical representation of strategic guidelines, processes and information systems, and their relationship to each other

RESULTS

The University of Bío-Bío has defined a strategic development plan which establishes that within its Mission is, among other elements, the quality Undergraduate Teaching, which includes the various aspects directly related to the training process. In its strategic development plan, it has defined five strategic lines, the first of which is directly related to Undergraduate Teaching, specifically: (LE1) "Undergraduate Teaching Educating Integral Persons of Excellence for the development of Society". This strategic line contemplates five strategic objectives that consider, in general, aspects or approaches similar to those of other universities, specifically: (EO1.1) design, adjustments and curricular redesign aligned with the educational model, under current regulations, (EO1.2) self-evaluation of undergraduate programs on a permanent basis to strengthen their quality levels, (EO1.3) infrastructure and equipment for the development of academic, teaching and extracurricular activities of students, (EO1.4) vertical articulation with secondary schools, and insertion and adaptation of new students to university life, (EO1.5) training of teachers to improve their performance in the classroom and the development of research in teaching.

Although Undergraduate Teaching is directly related to Strategic Line 1, it can also be related to the other strategic lines associated with Management, Research, Postgraduate Teaching, Linking with the Environment, etc.

Based on the strategic objectives stated, a first identification has been done of: processes associated with those objectives, information and computer applications required in such processes, which can be enriched in a subsequent revision and in the validation process with different institutions. It is also necessary to determine the information technologies required. **Table 1** presents the strategic guidelines, the processes identified, and the information systems required, which are shown graphically in **Figure 1**, where the relationship among them can be seen.

WORK TO BE DONE

The final model of the Enterprise Architecture for Undergraduate Teaching must be validated by different institutions, whose feedback will collaborate with the development of the necessary modifications and/or adjustments to establish a general model for these organizations under common standards.

In addition, the criteria for institutional accreditation of the Undergraduate Teaching area applied in Chile by the National Accreditation Commission will be considered, in order to ensure that all these criteria are covered

with the required information, necessary processes, defined strategic guidelines, and possible computer applications, or if necessary, modifications, adjustments or incorporating new aspects that ensure the coverage of the criteria mentioned above, which will contribute favorably to future accreditation processes.

CONCLUSIONS

University higher education institutions use a variety of information systems and technologies for the development of their activities, which when integrated with the strategic guidelines can produce better benefits. In this sense, EA is a powerful organizational tool for improving performance levels.

Since the area of Undergraduate Teaching is a key area in these institutions, it can be crucial to have an EA that provides support and back-up for their development, management and operation, collaborating, promoting and facilitating the achievement of the goals and objectives defined.

Undoubtedly, an EA for all the areas developed by these institutions would have a greater effect, which would constitute an expansion of this proposal and a great progress in the integration of the strategic guidelines and information systems of these organizations.

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