

# Generic functional and management model of doctoral study

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**Abstract.** *Doctoral studies are specific virtual sub-organizations within institutions of higher education with specific research and education activities. They can be seen as complex systems with unique organizational complexity which needs to be explored in order to identify organizational structure and hierarchy, their composition and influence on resource planning and management. This is important, because this impacts business processes, within the institution of higher education which must be measured and managed effectively in order to allow the institution to operate with quality and within planned budget. In this paper we describe results of processes reengineering project at Doctoral study in Information science at University of Zagreb, Faculty of Organization and Informatics. In this research appropriate business process analysis methods were conducted and 15 complex business process models with sub-processes were developed. This finally led to a generic functional and management model of doctoral study. This model presents the management framework of a generic doctoral study. Model itself consists of multi-level hierarchical management bodies, in generic doctoral study, which are responsible for the execution of its processes and achievement of main strategic objectives. Generic strategic objectives map for doctoral study has been also proposed by using Balanced Scorecard methodology.*

**Keywords.** Doctoral study, management, strategic objectives, generic functional and management model

## 1 Introduction

The aim of the doctoral study is to broaden doctoral candidate's (future doctoral student's) knowledge in areas of special interest in interconnection with their professional or scientific research contribution and by that enabling them acquisition of academic titles. The achievement of the main objective is influenced by various factors with different impact levels. In this paper we present an analysis of internal factors that arise from the organization and management of doctoral study. The analysis consists of business

processes analysis, analysis of structure and multi-level interaction between management bodies, and by workflow analysis of documentation generated and used in doctoral study business processes. Our research was finally resulting in detailed business process model of doctoral study, generic functional and management model and a map of strategic objectives. The process models were developed in accordance with OMG process modelling standard BPMN 2.0 [10] using contemporary business process modelling and simulation tools BizAgi Process Modeler [2] and IBM Business Process Modeler [6] applying practical guidelines relevant to process modelling [11]. This part of research was not included in this paper, but as a result of this process reengineering project new management model of generic doctoral study was developed. As a main focus of paper we present a generic functional and management model for a generic doctoral study as a result of workflow and process analysis. As a business improvement guideline we made a map of strategic goals made by Balance Scorecard methodology presented in second part of paper. Research and analysis was based on a real case of one doctoral study and was conducted within an internal business process reengineering project *Process model of Doctoral study* at Faculty of Organization and Informatics Varaždin, University of Zagreb conducted in year 2012/2013.

## 2 Analysis of the processes and interaction of multi-level management bodies

Organizational structures and management procedures of each institution in higher education affects the resource planning and management system of their studies. Doctoral studies, as one specific type of studies are thereby no exception. The complexity of resource planning and management systems increases with the number of organization hierarchical levels. Management of doctoral study is complex by itself, but if it is part of the more complex whole, such as the position of doctoral studies in the context of

university bodies and committees, and the university senate, then the requirements for its' management are also becoming more complex.

In the aim to improve current state of doctoral study processes at our faculty a detailed business process models were made. In three months period business process reengineering team was entitled to developed current state process models, present these models to doctoral study management bodies and faculty management and finally propose improvements and new business process models, as well as give strategic guidelines to maintain quality and improve future performance of doctoral study.

This intentions are also supported by other authors as McCaffery in his manager's handbook for higher education [9] when he states that: "... recently higher education institutions have had to become more accountable for the way they manage their affairs or to do more (teach more students) with less (while working with less resources) while simultaneously maintaining quality."

During the research project, our team analysed several study programs, rule books and laws, made interviews with employees and scholars at all organizational levels and gather other relevant inputs. Finally, 15 detailed business processes were modelled and presented to faculty and doctoral study management. All processes were developed in three levels of detail, and analysed from several points of view (from student, faculty and professors perspective). Due to process analysis 45 documents and their workflows were analysed and new quality assurance processes were discussed and proposed. Project resulted in several large changes in doctoral study program execution plan and helped the management to redevelop new process flows which will improve achievement of overall doctoral study goals in the future. In next lines whole research procedure is presented and management and functional model of doctoral study is described in detail.

Managing processes at the first operational (executive) level, control level and other levels of decision-making is carried out with a goal to increase operational efficiency, quality control and reliability of decision-making. In this context of managing processes, we first have to identify and classify processes by their role in contribution to the organization's mission. In this context we need to distinguish management processes of the organization at least three levels: operational, governance and decision-making. The **operational level** includes the core business processes for achievement of the organization's mission. That includes processes by whose execution organization generates the profits, processes that are recognizable to the end-users such as manufacturing processes or processes that provide the service. These processes have a frequent interaction with the environment and they are enabling the transformation of inputs into outputs.

The next level is the second level of process **governance** and includes planning, approval, monitoring and organization of operational processes, taking into account feedback and environmental influences. The highest process level is the level of **decision-making**. This level has only one basic goal to define a framework, in which processes are running, by defining the mission, vision and goals of the organization. For this it is necessary to provide the accurate and timely information to holders of these processes. We should not forget the impact of the environment on the organizational system and core activities execution.

In the context of pre-written, we can conclude that if we create a general functional and management model of the doctoral study, then from it we can make conclusions about the doctoral study goals and goals structure and from that about the multilevel governance and its influence on this structure and doctoral study goals achievement.

Basic management levels of doctoral study and their interactions are explored and demonstrated at Fig. 1 which shows the **Generic functional and management model of doctoral study**. This model represents a generic general management model of doctoral study. It also shows the relationships of participants, a doctoral student in the function of the primary objective: transformation of doctoral candidates through the doctoral study into doctoral student an ultimately PhD holder. On this journey of transformation, a key role is played by doctoral study that runs through two key core operational business process groups or core business processes: 1) **Education** and 2) **Scientific research** and the third operational process group is 3) **Quality Management and Administration**. Three core operational business process groups have their own cycles of execution sequences that comprise the process of transforming inputs into outputs. Activities are interconnected so that the results of scientific research are used in the education as the theoretical basis of the subject, and the results are also presented as the professional work experience and practical examples of the theory application into the practice. Through the education, students are trained and they transferred the knowledge to the companies, in which they are working or would work, and allow the application of scientific and technical achievements. In this manner we need to interpret the model at Fig. 1, and follow the flows from left to right.

Basic operational inputs that come from doctoral candidate in Fig. 1 shows the input horizontal black arrows, while the main outputs of these tasks are presented with a black horizontal output arrows. The gray rectangle covers transactions at operational level during the study (education, research, and the quality management and administration) and includes the Doctoral study Council (DSC) as the governing body of these operational business processes. DSC is responsible for the creation of conditions for

execution of operational processes in line with the set institutional goals, monitoring of goals measures and reporting on the achievement of the objectives, coordination and scheduling of loads at the doctoral study, coordination and planning of personnel

changes in the scientific field and other activities in operations management.

Management of the doctoral study takes place on several levels. See Fig. 1. Generic functional and management model of doctoral study.

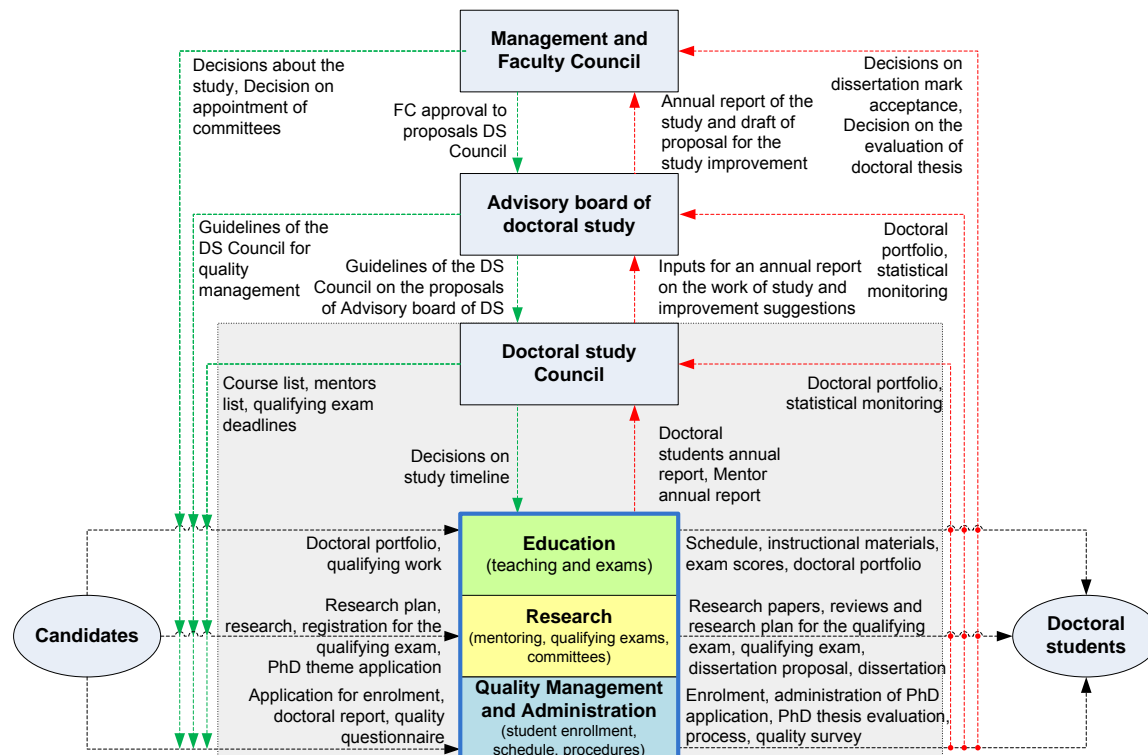


Figure 1. Generic functional and management model of doctoral study

Management tasks of the first level are related to: planning, organization, supervision and coordination of process execution, and they are in jurisdiction of the *Doctoral study Council*. The higher level of decision making and governance includes activities such as: coordination, planning and monitoring of mission, vision and business objectives, defining business rules and procedures, approval and motivation of employees, as well as the provision of financial and other resources required for the implementation of processes. There are recognized two bodies: the *Advisory board of doctoral study* which acts as an advisory and supervisory body and the *Faculty Council* respectively the *Faculty Management board* and *Dean* who are competent bodies to make decisions as specified in Faculty regulations. Resulting from that, at Fig. 1., red arrows show the basic data sets and direction of reporting to management bodies from lower to higher levels, while green arrows show the basic data sets and direction of corrective policies and decisions.

### 3 Strategic objectives map

The method used for identification of the structural map of strategic objectives in doctoral study was

Balanced Scorecard developed by authors Kaplan and Norton [7]. According to Kettunen and Kantola [8] the application of BSC in the management of higher education institutions must be incorporated into the information system of institutions in higher education. Dobrović et. al. [5] argue that the implementation of the BSC method in the public sector contributions and lead the organization towards achieving performance objectives with the optimum use of the organizational resources. Bruijin [3] provides examples of how to monitor the performance of higher education institutions based on "products" that higher education provides, and states that educational performance should be measured multi-faceted and as such it is difficult to measure, while on the other hand, the time required for correcting exams is an example of measurable factor. Tilaye [12] claims that BSC can be a management tool that will force the institution to identify key factors that contribute to the successful achievement of the goals and thus fulfilling the mission of organization existence. By this we can conclude as Bates and Sangra [1] state that strategic *thinking* is more important than plan, but also that there should be in place an annual program planning process that is integrated with the allocation of resources/financial plan and as part of this process, program proposals should contain a clear vision of

how the program will be designed and delivered, including the use of technology.

Measuring organizational success assists the management by providing information that helps them to manage organizational objectives through several perspectives. Measurement instruments such as BSC based strategic maps are influenced by order and significance of various hierarchical levels and the impact of strategic objectives to the organizational goals. Strategic maps help concentrate on what really

is important to measure supervise and manage, through perspectives and the inter-correlation of objectives classified into perspectives. These perspectives differ primarily for non-profit organizations (such as higher education institutions that are financed from the state budget and are focused primarily to accomplishment of organizational missions within the planned budget) and profit-oriented organizations.

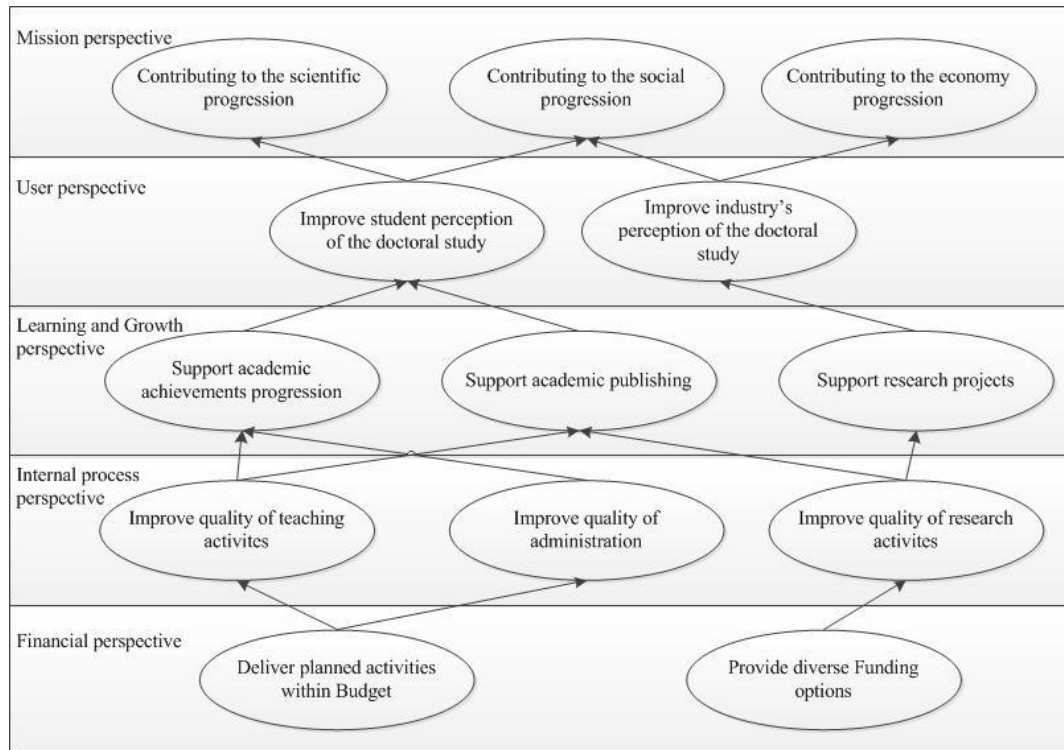


Figure 2. BSC strategic objectives map of doctoral study

Higher education institutions, which are primarily geared towards the achievement of their mission, want to increase or maintain the quality of service. At the other hand they need to remain within the limitation of their budget as a portion of higher education budget within the state budget. Therefore, the schedule of some perspective within which define the objectives, actions and measures to achieve the objectives are different for non-profit and for-profit organizations [4].

In Fig. 2 BSC strategic objectives map of doctoral study is proposed and the layout for BSC perspective for higher education institutions (generic for doctoral study) is shown. In strategic map for higher education or doctoral study five generic perspectives were used: 1) Mission perspective, 2) User perspective, 3) Learning and Growth perspective, 4) Internal process perspective and 5) Financial perspective. Within the proposed perspectives a generic performance objectives are deployed and interconnected.

The Financial perspective generally includes two generic objectives concerning the increase of revenue and reduction of costs. Sense higher education is non-profit institution and mainly funded from national

budget this perspective gets another weight and can be stated as two limitational objectives: *Deliver planned activities within Budget* and *Provide diverse Funding options*. The goal is to provide a good quality of service to citizens (students) and find additional funding sources outside the state budget by transfer of knowledge to economy. The focus on deliver planned activities within the budget means not to spend more than we have and maintain or increase quality of service to students. In other words, the financial limitations influence the way of “doing business” and their goals in the second perspective of Internal Processes: *Improve quality of teaching activities*, *Improve quality of administration* and *Improve quality of research activities*. Next perspective is dealing with the learning and growth which is forming the future of an organization by defining the real objectives derived from the vision for the future. Sense universities are appraised by their distinction in research and science contribution the important objectives are: *Support academic achievements progression*, *academic publishing* and *especially research projects*. This has an impact on the perception of university service users. The set of

objectives related to users are listed in the user perspective: *Improve student perception and improve industry's perception of the doctoral study*. User perception is crucial to the measurement of the level of accomplishing the universities mission of contributing to the society's prosperity. This contribution can be expressed by following objectives: *Contribution to scientific progression, to social progression and economy progression*.

The objectives read bottom to top are showing how activities of achieving objectives and objectives themselves are interconnected in order to support the achievement of institutions strategic orientation. Oppositely, read from top to bottom, objectives give clear guidelines of concentrating and focusing on what really matters in managing a doctoral study.

## 7 Conclusion

The analysis of doctoral studies showed that its specific areas and activities of "doing Business" can be seen as complex systems in which the unique organizational complexity is identified and the need for procedural horizontal and vertical integration in the execution of key business activities (processes) exists. Education, scientific research and quality management and administration are three main process groups which must be measured and managed effectively in order to allow the institution to operate with quality and within planned budget. For effective implementation of BSC methods in managing the business, organization must define its mission and vision for a future period of time; develop strategies to achieve the vision and objectives. The implementation of strategies should be monitored and managed by measuring the performance of business activities and processes. To accomplish the activities goals, actions and resources should also be planned and managed. As the complexity of resource planning and management systems increases with the number of organization hierarchical levels, then the requirements for its' management are also becoming more complex. Therefore, the use of operational methods like BSC in management of doctoral program must be coupled with the typical management processes such as planning and resource management, monitoring and control of operations that are performed on a number of levels. Understanding management relations and the management levels is the first step in designing an effective management system and to achieve strategic objectives.

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