



**A PERFORMANCE MANAGEMENT FRAMEWORK FOR
BUSINESS ANALYSIS**

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A PERFORMANCE MANAGEMENT FRAMEWORK FOR
BUSINESS ANALYSIS

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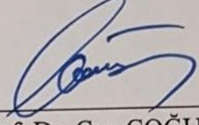
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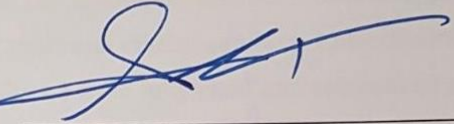
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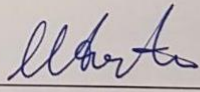
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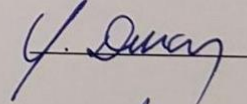

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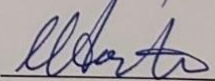
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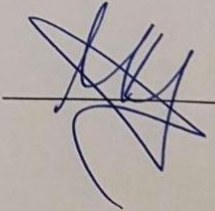
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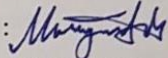
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ABSTRACT

A PERFORMANCE MANAGEMENT FRAMEWORK FOR BUSINESS ANALYSIS

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A performance management framework for business analysis (BA) is a road map for project managers and business analysts to evaluate their processes while delivering high quality products and services. Performance measurement according to key performance indicators (KPIs) provides insights into how BA process is managed. BA process is one of the supportive processes for project management (PM) and is critical for an information systems (IS) project's overall success. Bottleneck points are highlighted via proper KPIs determined for performance management. The objectives of this thesis are (1) to investigate meaningful KPIs measuring the performance of BA process for IS projects, (2) to provide a four-layer (BA Knowledge Area (KA), Project Management (PM) KA, KPIs, and PM Process Groups) performance management framework, and (3) to investigate requirements engineering elicitation process and

create process flow diagrams. Proposed performance management framework is validated by Delphi method and illustrated via a real-life software project. Additionally, insights into business practice are provided for the proposed framework.

Keywords: Performance Management, Key Performance Indicators, Business Analysis Process, Project Management, Information Systems Project, Software Project, Delphi Study



ÖZ

İŞ ANALİZİ İÇİN BİR PERFORMANS YÖNETİMİ ÇERÇEVESİ

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İş Analizi için önerilen Performans Yönetimi Çerçevesi, kaliteli ürünler ve hizmet elde edebilmek için iş analizi ve proje yönetimi süreçlerini değerlendirmek üzere proje yöneticileri ve iş analistleri için yol haritası niteliğindedir. İş Analizi sürecinin performans yönetimini gerçekleştirebilmek için uygun süreç tanımlamaları sırasında belirlenen Anahtar Performans Göstergelerine (APG) göre ölçümlenmeler yapılmalıdır. Belirlenmiş bu anahtar performans göstergelerine göre toplanan veriler bilgiye dönüştürülerek performans yönetiminin gerçekleştirilmesine sağlanır. İş Analizi Süreci, Proje Yönetim Sürecine destek bir süreçtir. İş Analizi sürecinin doğru ve etkin olarak yürütülmesi Bilgi Sistemleri projelerinin sonunda elde edilecek ürün / hizmetin başarılı olarak müşteriye sunulmasında kritik seviye de önem arz etmektedir. Dolayısı ile performans yönetiminde etkili olan anahtar performans göstergelerinin doğru ve tam olarak belirlenmesi iş analizi sürecinin verimli ve etkin yönetilmesi için gerekli olduğu gibi proje yönetim sürecinin etkin ve verimli yönetilmesinde de önemli bir husustur. Bu tezin gerçekleştirilmesi ile (1) Bilgi Sistemleri projelerinde İş Analizi

sürecinin performans yönetiminin gerçekleştirilebilmesi için anlamlı, uygun Anahtar Performans Göstergelerinin araştırılması, (2) dört katmanlı (İş Analizi Bilgi Alanı, Proje Yönetimi (PY) Bilgi Alanı, Anahtar Performans Göstergeleri, PY Süreç Grupları) İş Analizi için Performans Yönetimi Çerçeve Tasarımı, (3) gereksinim toplama sürecini araştırmak ve süreç akış diyagramlarını oluşturmak amaçlanmaktadır. Tez çalışması ile önerilen performans yönetimi çerçevesi Delfi çalışması ile doğrulanmış ve gerçek hayattan bir yazılım projesi için uygulanmıştır. Bununla beraber, iş uygulamaları için görüşler verilmiştir.

Anahtar Kelimeler: Performans Yönetimi, Anahtar Performans Göstergeleri, İş Analizi Süreci, Proje Yönetimi, İş Analizi Bilgi Alanları, Proje Yönetimi Bilgi Alanları, Bilgi Sistemleri Projesi, Yazılım Projesi, Delfi Çalışması

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CHAPTER 1

1 INTRODUCTION

Today, a number of enterprises work on maximization of products (or services) quality that are delivered by projects. A well-defined scope affects the quality of product. Product scope is reflected on the project scope and defined by business analysts in the analysis phase of the information systems project with project manager. Therefore, both project managers whom outline the project scope and business analysts should be aware of scope management process which is one of the Knowledge Areas (KA) (PMBOK, 2013) of Project Management (PM). Scope management process begins with collecting requirements with respect to the contract or operational concept document. The elicitation / collection of requirements task is handled by business analysts and is one of the KAs of Business Analysis (BA). Here, it can be seen that PM KAs and BA KAs coincide with each other. In this thesis, BA KAs and PM KAs are studied simultaneously and a meaningful correspondence between each another that would lead to proper Key Process Indicators (KPIs) is found.

To define how well the project delivers the product, processes which are performed by both project managers and business analysts should be well managed. Management of processes can be accomplished by controlling process performance. To control process performance, the process owners should work on KPIs and determine KPIs on their projects. In this thesis, I propose some useful KPIs in line of both PM and BA KAs in

an applicable framework. Since BA activities place the foundation infrastructure for the project, a performance management framework for BA is proposed. In this framework, project managers and business analysts will oversee the big picture of the project trend. Several studies can be cited from the literature about performance management, process design, and various performance management frameworks. On the other hand, to the best of our knowledge, the performance management of BA as a framework has not been analyzed with a combined perspective of PM process groups, PM KAs, KPIs and BA KAs. Therefore, the proposed framework has four intertwined layers. The first layer refers to the BA KAs which are 1) Business Analysis Planning and Monitoring, 2) Elicitation and Collaboration, 3) Requirements Life Cycle Management, 4) Strategy Analysis, 5) Requirements Analysis and Design Definition, 6) Solution Evaluation (BABOK v3, 2015). The second layer explains PM KAs: 1) Integration, 2) Scope Management, 3) Time Management, 4) Cost Management, 5) Quality Management, 6) Risk Management, 7) Human Resources Management, 8) Communication Management, 9) Procurement Management and 10) Stakeholder Management. The third layer refers to KPIs which will be gathered during the project. The fourth (and the last) layer indicates PM Process Groups 1) Initiating, 2) Planning, 3) Executing, 4) Monitoring and Controlling, 5) Closing (PMBOK v5.0, 2013).

First, the functions and features of the product are transformed into atomic requirements. Later, all the requirements are documented on the Requirements Specification Document (RSD) by business analysts. If the project is mainly software project, then it is generally called as the Software Requirements Specification (SRS) document or if the project is a hardware project, then it is called the Hardware Requirements Specification (HRS) document. In some cases, both SRS and HRS documents will be the deliverables of the project. Several stakeholders of the project may propose change requests on the requirements. Therefore, original requirements and revised requirements must be traceable along the project lifecycle. Hence, change management concept is of vital importance. The changes in the RSD (may include SRS and HRS Documents) must be managed carefully since it affects the cost and schedule of the project. Therefore, when the stakeholders start to work on change impact analysis, they need to study changes about the time, scope and cost of the

project. Tracing the changes in these aspects is accomplished by measuring process outputs and comparing them with RSD. Performance management is done primarily by gathering information about KPIs of such processes and evaluating the results of them than taking corrective and preventive action items to improve the processes. The proposed performance management framework helps to overview the trend of analysis phase of project management and to improve analysis process. The proposed performance management framework is useful to study on BA process improvement.

The objectives of this thesis are (1) to find the key performance indicators from business analysis perspective using its implications on project management life cycle (2) to propose a performance management framework for business analysis (3) to illustrate the application of the proposed framework by an real-life case study (4) to draw BA Process Flow Diagrams.

The research methodology followed for this study is given in Figure 1. The literature review is the first step of methodology behind this thesis. The requirements engineering, process design, business analysis, performance management framework, scope management are researched in detail. The next step is the design of performance management framework. In this step, all the layers of framework are explained in detail. After designing phase is completed, the proposed framework is applied on a middle-sized software project. The Delphi method is used to validate the framework's effectiveness (Brancheau and Wetherbe (1987), Linstone and Turoff (1975), Mulligan (2002), Okoli and Pawlowski (2004), Schmidt *et al.* (2001), Güleç and Yılmaz (2016)) The insights into business practice are discussed as well as the conclusion and limitations of this thesis are given in the last step.

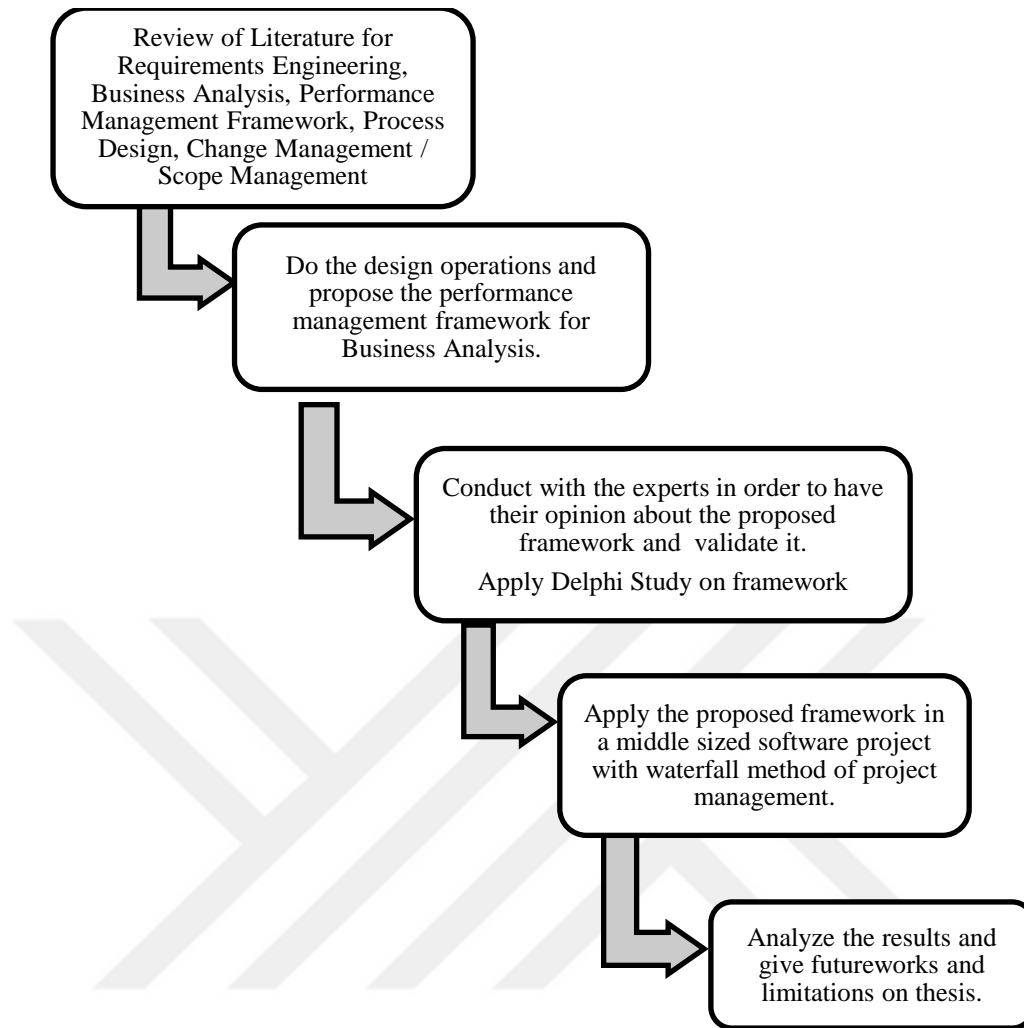


Figure 1 The Research Design Process

Delphi Method is used to validate the framework. In the Delphi study, five participants including two business analysts, two project managers and one program manager are asked about their view on the proposed framework. The opinions about the proposed framework is gathered and then those opinions are evaluated by five experts. The information about this qualitative research is given in 3.6. *Validation of the Proposed Framework* section of the thesis in detail.

The rest of the thesis is given as in the following chapters. In the literature review chapter, studies about BA, Performance Management of BA, relations with scope management and change management and frameworks for performance management related with BA are investigated. In the third chapter the proposed framework is

explained layer by layer. Additionally, the proposed framework is validated by a Delphi Study with having opinions of participants. In the fourth chapter, an application of the proposed framework for a small-sized software project is given. For the fifth chapter, insights into business, BA Process definition by establishing a **RACI** (**R**esponsible, **A**ccountable, **C**onsultant, and **I**nformed) Matrix and the BA process flowcharts are created and explained. Finally, the findings and possible avenues of future research are given in the conclusion part.

Nomenclature to follow the chapters of this thesis is given in Appendix A (Terms and Acronyms). Readers without much acquaintance with project management and business analysis terminology should consult Appendix A first. Some of the terms explained in Appendix A are: requirement (solution requirement, functional / nonfunctional requirement), requirement specification document, traceability of requirements (or traceability matrix), change request, functional baseline, requirements analysis, requirement prioritization, change management, product scope, project scope terminologies, and KPIs.

CHAPTER 2

2 LITERATURE REVIEW

This thesis focuses on creating a framework for performance management of Business Analysis (BA). Therefore, in this literature review studies related with BA, performance management of BA, and frameworks related to performance management of BA from the perspective of software project management lifecycle are covered. BA provides a foundation infrastructure for the projects. Hence, many organizations emphasize BA process as well as interrelated disciplines such as project management, change management, scope management, business process modeling, process design, performance measurement, and performance management. Generally, the success in the BA Processes results with successful projects and high-quality products.

For studies on definitions of BA and Requirements Engineering (RE), the reader may refer to Rubens (2007), Sommerville and Sawyer (1997), Aurum and Wohlin (2005) and the references therein, respectively. Rubens (2007) explained the role of Business Analysts and the difference between a Business Analyst and a Requirements Engineer. Rubens (2007) considers that Business Analyst is a broader term than requirements engineer. Rubens (2007) emphasizes that Business Analysts are not only just note – takers, but also the ones who guide stakeholders to use their technical background. Sommerville and Ransom (2005) describe the viewpoints, principles, problems and a practical approach to requirements engineering. Hass (2008) lists some of the roles of Business Analysts as:

- “1) Identify and understand the business problem and impact of proposed solution on the organization’s operations,*
- 2) Document the complex areas of project scope, objectives, and the added value or benefit expectations using an integrated set of analysis and modeling techniques,*
- 3) Translate business objectives into requirements using powerful analysis and modeling tools,*
- 4) Evaluate customers’ business needs, thus contributing to strategic planning of information systems and technology directions,*
- 5) Assist in determining the strategic direction of the organization*
- 6) Liaise with major customers during preliminary installation and testing of new products and services.” (Hass, 2008)*

Further, Lamsweerde (2000) asserts that modeling is the key to the RE / BA process and modeling provides a central input to the documentation of requirements. Lamsweerde (2000) explains the RE tasks from perspective of goal oriented modeling, since the author claims that RE is related with identification of the goals. The author argues that goal oriented modeling is more powerful than object oriented modeling.

Implementation of BA relies on proper definition of BA processes. BA Processes can be classified as Elicitation and Collaboration, Business Analysis Planning and Monitoring, Requirements Lifecycle Management, Strategy Analysis, Requirements Analysis and Design Definition, and Solution Evaluation according to the BABOK Guide v3 prepared by the International Institution of Business Analysis (IIBA). Kauppinen *et al.* (2004) explain critical factors of RE implementation. They argued that BA is one of the challenging issues in an organization.

BA process results with requirements specification. Specified requirements are realized during the project. After Requirements Specification Document (RSD) (may include Software Requirements Specification Document, Hardware Requirement Specification Document or both of them) – (which is a document including all of the requirements of project prepared by Business Analysts) - is approved by the customer and baselined, Change Management process is initiated. In practice, customer or other stakeholders of the project may request somehow changing(s) for requirements. Therefore, initial requirements must be traced during the project lifecycle with a matrix

called *traceability matrix*. Change management can be considered as one of the core concepts of PM and BA Processes. Ferreria and Otley (2009) study about requirements volatility in software engineering. They emphasize that requirements management is not simply the key point of analysis phase of project's application lifecycle management (ALM). They assert that requirements change for several reasons and must be managed. Moreover, Jones (1996) states strategies for managing requirements creep. The author explains the reasons for changing requirements and ways of stabilizing requirements. Jones (1996) concludes that there is no way to eliminate changes fully, but the rate of creep can be minimized. On the other hand, Strebel (1996) discusses why employees resist to changes. This thesis study emphasizes change management and investigate ways to incorporate change requirements in measuring the performance of BA.

Further, one of the related processes that affect BA / RE is scope management. Business Analysts are responsible to develop the product scope. Atkinson *et al.* (2006) provide analysis on the importance of scope management and its effect on uncertainties of project ALM. This thesis analyzes scope management from the BA perspective. Kassab *et al.* (2007) study scope management of non-functional requirements (NFRs) and ways to adopt NFRs.

To provide an effective BA Process, performance of all interrelated processes should be measured and managed. Lebas (1995) explains what performance is and why organizations need to measure the performance of their processes. Atkinson *et al.* (2006) consider critical success factors of project management practice. Bedloy *et al.* (2007) explain performance metric portfolios. They focused on tactical and strategic level metrics.

Moreover, Barclay *et al.* (2010) give an approach for developing performance criteria and measures for information systems (IS) projects. They provide a formal methodology to develop a large set of performance criteria grounded from the perspective of the project stakeholders. Bourne *et al.* (2000) report about designing, implementing, and updating performance measurement systems on sample companies. Neely *et al.* (1997) provide recommendations for performance measures. Costello (1995) consider that measurement of metrics mitigates the risk effects of misunderstanding, defects, and errors in requirements. They present essential metrics

whereas they do not build these metrics' relationship with performance management. In this study several newly defined KPIs for BA process performance management are proposed.

Some of the studies on performance measurement and management provide frameworks to easily evaluate their respective performance metrics. Alcazar and Monzon (2000), suggest a process framework for requirement analysis and specification whereas they did not take PM process and KAs into account. The interrelations between PM and BA KAs are put forward in this thesis. Alcazar and Monson (2000) analyze the requirements by modeling the problem domain. Danesh *et al.* (2013) propose a business process and performance management framework for service oriented virtual organization. In this thesis, unique KPIs for BA and PM relative to KAs are defined. Najmi *et al.* (2015) suggest a framework that describes the review of performance management system design according to the CMMI and European Foundation for Quality Management (EFQM) standards. Besides, Cocca *et al.* (2010) propose a framework to utilize performance measurement systems in small to medium sized enterprises (SMEs). They discussed the features of a good performance management system. Loucopoulos and Prekas (2003) propose a framework for requirements engineering using system dynamics including ontology modeling, goal modeling, process modeling, and scenario generation.

Further, Medori and Steeple. (2000) propose a framework for auditing and enhancing performance measurement of manufacturing systems, here the thesis study focuses on information systems (IS) projects. Torabi *et al.* (2014) suggest a framework for business impact analysis in business continuity management. Robinson (2006) suggests a framework for requirements monitoring in enterprise systems.

A complete summary of the studies that I review and their position in the literature based on our taxonomy is given in Table 1. Although there are several studies focusing on different aspects of a performance management framework, the thesis emphasizes performance management framework with respect to KAs of both PM and BA. In some process groups of PM, some activities intertwine with each other. Therefore, there is a literature gap on a performance management framework based on the interrelationship between PM and BA KAs.

Table 1 Taxonomy of Related Literature on Performance Management Framework of BA

Article	BA / RE	Scope Management	Change Management	Process Design	Performance Management Framework
Aurum and Wolfin (2005)	X				
Lebas (1995)				X	
Jones (1996), Robinson <i>et al.</i> (2006), Rubens (2007)	X				
Paul Strebel (1996), Costello (1997), Lavazza, and Valetto (2000), Ferreira <i>et al.</i> (2009)	X		X		
Neely <i>et al.</i> (1997), Bourne <i>et al.</i> (2000), Neely <i>et al.</i> (2001), Danesh <i>et al.</i> (2013)				X	
Sommerwille and Sawyer (1997) Lamsweerde (2000)	X				
Medori and Steeple (2000), Williams <i>et al.</i> (2000), Najmi <i>et al.</i> (2005), Bedloy <i>et al.</i> (2007), Barclay <i>et al.</i> (2010), Torabi <i>et al.</i> (2014), Cocca and Alberti (2010)					X
Alcazar and Monzon. (2000), Loucopoulos and Prekas (2003), Kauppinen <i>et al.</i> (2004), Ferreira and Otleyb (2009),	X				X
Sommerville and Ransom (2005)	X			X	
Atkinson <i>et al.</i> (2006)		X			
Kassab <i>et al.</i> (2007)	X	X			
Our Study	X	X	X	X	X

CHAPTER 3

3 A PERFORMANCE MANAGEMENT FRAMEWORK FOR BUSINESS ANALYSIS

3.1 Introduction

As seen in the literature review chapter, several frameworks describing a performance management system can be cited. In our thesis, a novel performance management system that has four intertwined layers is proposed. In the first layer of framework I give BA KAs with respect to the BABOK (BABOK v3, 2015). In the second layer of framework, PM KAs are given with respect to the PMBOK (PMBOK v5, 2013). The framework represents the third layer with KPIs to measure performance of BA process. At last, the fourth layer defined as PM process groups such as Initialization, Planning, Monitoring and Controlling, Executing and Closing. A logic behind the proposed framework is given in **Figure 2**. As can be seen in **Figure 2**, the PM KAs and PM process groups are given in columns and the BA KAs are given in the rows of the framework. Furthermore, the KPIs for measurement of BA process performance are given inner part (i.e.cells) of the matrix. This framework helps to see improvements of BA in the PM lifecycle. As it is mentioned before, this framework is useful primarily for business analysts and project managers.

	PMKA PG1,PG	PMKA2 PG1.PG2	PMKA3 PG1.PG2	PMKA PG1,PG	...	PMKA10 PG1,PG2,..
BAKA1			KPI24,KPI 25			
BAKA2	KPI1, KPI2,					
BAKA3		KPI1, KPI2,	KPI1, KPI2			
...		KPI1, KPI..,	KPI10, KPI6			
BAKA6					KPI18..	KPI..

Figure 2 Framework Design Definition

The users of the framework should be aware of both BA and PM KAs. Project managers should monitor all the KPIs mentioned in framework along the process groups and business analysts should monitor all the KPIs until the project ends and if there exists any problem on requirements or relatively related with design or implementations he / she should report to project managers.

To explain the framework, BA KAs and PM Process Groups are given in the following sections. The proposed framework is given in **Figure 3**. All the layers of the proposed framework are explained in the following sections.



	Integration I, P, E, M&C, C	SM P, M&C	TM P, M&C	CM P, M&C	QM P, E, M&C	HRM P, E	CoM P, E, M&C	RM P, M&C	ProM P, E, M&C, C	StkM I, P, E, M&C
BA Planning and Monitoring			KPI24: \sum estimated closure time, KPI25: \sum realized time			KPI38: \sum Business Analyst worked at project, KPI39: \sum HR charged on the		KPI21: \sum risks related with Reqs.		
Elicitation and Collaboration	KPI1: \sum newly added requirements (in project scope), KPI2: \sum newly added requirements (out of project scope), KPI3: \sum proposed functional reqs., KPI4: \sum proposed	KPI10: \sum proposed reqs., KPI32: \sum reqs (in scope) KPI33: \sum reqs (out of scope), KPI5: \sum approved reqs., KPI29: \sum meetings organized with stakeholders	KPI17: \sum elicitation time				KPI29: \sum meetings organized with stakeholders	KPI21: \sum Risks related with Reqs., KPI22: \sum eliminated risks., KPI23: \sum Occurred Risks	KPI37: \sum outsourced Reqs. KPI36: \sum Suppliers	KPI31: \sum stakeholders
Reqs. Analysis and Design Definition	KPI5: \sum accepted reqs. KPI8: \sum Rejected reqs	KPI5: \sum approved Reqs., KPI6: \sum approved functional Reqs., KPI7: \sum approved nonfunctional Reqs., \sum CRs, \sum UCs,	KPI26: \sum time for design, KPI27: \sum time to implement CRs on Reqs Doc., KPI28: \sum charged time of validation and verification of Requirements	KPI30: \sum cost of accepted CRs., KPI35: \sum cost of validation and verification of Requirements	KPI15: \sum opened bugs related with specific Reqs., KPI14: \sum closed bugs, KPI10: \sum proposed CRs, KPI11: \sum accepted CRs, KPI12: \sum rejected CRs, KPI20: \sum test cases, KPI19: \sum Stories			KPI21: \sum Risks related with Reqs, KPI22: \sum eliminated risks, KPI23: \sum Occurred Risks		KPI32: \sum reqs (in scope) KPI33: \sum reqs (out of scope) KPI11: \sum accepted CRs KPI18: \sum Use Cases (UCs)
Reqs Life Cycle Management		KPI34: \sum newly added Reqs (functional & nonfunctional), KPI6: \sum functional reqs., KPI7: \sum nonfunctional reqs., KPI32: \sum reqs (in scope), KPI33: \sum reqs (out of scope), KPI9: \sum changed reqs., KPI10: \sum proposed CRs., KPI11: \sum Accepted CRs., KPI12: \sum Rejected CRs., KPI13: \sum opened bugs, KPI15: \sum bugs opened related to the specific req., KPI18: \sum Use Cases (UCs), KPI16: \sum UCs for the specific reqs. \sum changed UCs, KPI19: \sum Stories	KPI26: \sum time for design, KPI27: \sum time to implement CRs on Reqs Doc., KPI28: \sum charged time of validation and verification of Requirements	KPI30: \sum cost of accepted CRs., KPI35: \sum cost of validation and verification of Requirements	KPI15: \sum opened bugs related with specific Reqs., KPI14: \sum closed bugs, KPI10: \sum proposed CRs, KPI11: \sum accepted CRs, KPI12: \sum rejected CRs, KPI20: \sum test cases, KPI19: \sum Stories			KPI21: \sum Risks related with specific Reqs, KPI22: \sum eliminated risks, KPI23: \sum Occurred Risks		KPI32: \sum reqs (in scope) KPI33: \sum reqs (out of scope) KPI11: \sum accepted CRs KPI18: \sum Use Cases (UCs)
Strategy Analysis		KPI11: \sum CRs, KPI6: \sum functional reqs, KPI7: \sum nonfunctional reqs, KPI18: \sum use cases								
Solution Evaluation		KPI6: \sum functional reqs, KPI7: \sum nonfunctional reqs, KPI18: \sum use cases, KPI10: \sum proposed CRs, KPI11: \sum accepted CRs, KPI12: \sum rejected CRs, KPI29: \sum meetings organized with stakeholders				KPI38: \sum of Business Analyst worked on the project, KPI39: \sum HRs charged on the project				

*BA: Business Analysis, C: Closing; CM: Cost Management; CoM: Communication Management; E: Executing HRM: Human Resource Management; I: Initiating; M & C: Monitoring and Controlling; P: Planning; ProM: Procurement Management; QM: Quality Management; RM: Risk Management; SM: Scope Management; StkM: Stakeholder Management; TM: Time Management

Figure 3 Performance Management Framework for BA

3.2 The First Layer: BA Knowledge Areas (KAs)

BA process is performed by following a series of activities. These activities are distributed into the KAs, which are explained below. Each of the KA activity is divided into several tasks.

Business Analysis Planning and Monitoring KA is the blueprint of Business Analysis. This KA is mostly related with documentation of plans. Business Analysis Performance Metrics, Business Need, Enterprise Architecture, Expert Judgment, Organizational Process Assets are taken as inputs of Business Analysis and Planning Process. Some tasks in the project are initiated with these inputs. While resolving those tasks bulleted below, Business Analysis Approach, BA Communication Plan, BA Performance Assessment, Business Analysis Plan(s), BA Process Assets, Requirements Management Plan, Stakeholder List, Roles and Responsibilities outputs are carried.

- *“Plan Business Analysis Approach,*
- *Plan Stakeholder Engagement,*
- *Plan Business Analysis Governance,*
- *Plan Business Analysis Information Management,*
- *Identify Business Analysis Performance Improvements” (BABOK v3, c)*

Elicitation and Collaboration KA takes the following as inputs. Those inputs provide to resolve Prepare for Elicitation, Conduct Elicitation Activity, Document Elicitation Results, and Confirm Elicitation Results tasks.

- *“Prepare for Elicitation*
- *Conduct Elicitation*
- *Confirm Elicitation Results*
- *Communicate Business Analysis*
- *Manage Stakeholder Collaboration” (BABOK v3, 2015)*

By operating tasks mentioned above, BA gets Elicitation Results, Scheduled Resources, Stakeholder Concerns, and Supporting Materials as outputs.

Elicitation process outputs become input to the **Requirements Life Cycle Management** KA. Those inputs are covered for the following tasks,

- *“Manage Solution Scope and Requirements*
- *Manage Requirements Traceability*
- *Manage Requirements for Reuse*
- *Prepare Requirements Package*
- *Communicate Requirements” (BABOK v3, 2015)*

As a result of Requirements Management & Communication process, BA gets some outputs such as Requirements (traced), Designs (traced), Requirements (maintained), Designs (maintained), Requirements (prioritized), Designs (prioritized), Requirements Change Assessment, Designs Change Assessment, Requirements Approved, and Designs (Approved). The distributed tasks of this KA are given in the following.

- *“Trace Requirements,*
- *Maintain Requirements,*
- *Prioritize Requirements*
- *Assess Requirements Change*
- *Approve Requirements” (BABOK v3, 2015)*

Strategy Analysis KA takes Needs, Influences (internal, external), Stakeholder Engagement Approach, Elicitation Results (unconfirmed), Elicitation Results (confirmed), Designs (prioritized), Requirements (Prioritized) as inputs of Strategy Analysis Process. To handle some issues, those inputs are vital in the process. The issues regarded as tasks. Tasks given in the following are resolved and closed successfully;

- *“Analyze Current State,*
- *Define Future State,*
- *Assess Risks,*
- *Define Change Strategy” (BABOK v3, 2015)*

results some crucial outputs such as Current State Description, Business Requirements, Business Objectives, Future State Descriptions, Potential Value, Risk Analysis Results, Change Strategy, Solution Scope.

Requirements Analysis and Design Definition KA takes Requirements (any state) Information Management Approach, Elicitation Results (any state), Potential Value, Solution Scope, Change Strategy as inputs. By using those inputs, BA resolves some tasks which are given in the followings. At the end of this process, some special outputs are obtained such as Requirements (specified and modeled), Requirements (verified), Requirements (validated), Requirements Architecture, Design Options, Solution Recommendation.

- *“Specify and Model Requirements*
- *Verify Requirements,*
- *Validate Requirements,*
- *Define Requirements Architecture,*
- *Define Design Options,*
- *Analyze Potential Value and Recommend Solution” (BABOK v3, 2015)*

Solution Evaluation KA takes Implemented Solution (external), Current State Description, Business Objectives, and Potential Value as inputs. Those inputs are used for performing the tasks, which are given in the following. After resolving those tasks, BA has outputs such as Solution Performance Measures, Solution Performance Analysis, Solution Limitation, Enterprise Limitation, and Recommend Actions.

- *“Measure Solution Performance,*
- *Analyze Performance Measures,*
- *Assess Solution Limitations,*
- *Assess Enterprise Limitations,*
- *Recommend Actions to Increase Solution Value” (BABOK v3, 2015)*

3.3 The Second Layer: Project Management (PM) KAs

The second layer of framework is explained with the project management perspective here. The proposed framework in this thesis presents the relation between PM KAs and Process Groups. Mainly there are five process groups of PM. The beginning phase of PM is referred as Initiation. In this phase the project charter prepared by the Project Manager and is related with the Integration part of the PM KA. The integration is highly related with Elicitation and Collaboration part of the BA KA. At the intersection of BA KAs and PM KAs, the Business Analyst and Project Manager should study the total number of newly added requirements (both of functional and nonfunctional), total number of proposed functional requirements and nonfunctional requirements.

The scope management is one the crucial KA of PM KAs. In this part, project manager defines project scope with respect to the contract. The management of project scope is very hard for project managers since there may be lots of CRs without scope of the project. Sometimes the composition of all CRs related with scope may be thought as subject of another different project.

Another important KA is Time Management. Time management affects the project schedule deeply. While analyzing the impact of CR, this is very important to take in account. If the CRs that affects the project schedule are accepted by Configuration Control Board then project manager will revise the project completion time.

The Cost management has relation with time management KA. The revision of project schedule may change the Human Resource Plan, project design-architecture, then the cost of project directly increases.

The quality management KA is an intersection of all of the PM KAs. If the time management, cost management, stakeholder management, Human Resource Management, Risk management and the other KAs are changed in the bad direction of project management then the quality management will be unsuccessful.

In additionally, Human Resource Management mainly has importance while the project manager defines the project, cost and time management plans.

The Communication Management KA is very nearly related with Stakeholder Management. The project manager must define the communication plan and the stakeholder list in order to elicit requirements, have approval of CRs and the all deliverables.

Managing the subcontractors is very hard for project managers since they affect the quality and performance of the project. The bad procurement management results bad project management in general. The quality of their deliverables affects the project en product directly.

There is one more hard to manage PM KA. This is management of the all risks which can be defined by project team. Determination of risk and analysis of risk affects the assessment of the risks. The risk assessment part is directly related with the project management process. Some of the risks may cause the termination of the project.

The preliminary part of the project management process starts with the determination of stakeholder list. The stakeholder list must be well defined. The project manager of the project is responsible for sharing this list with the project team. Everybody in the project team must be aware of it.

3.4 The Third Layer: Key Performance Indicators (KPIs) for BA Process

This part is related with Change Management process. When we explain or define any process, we usually express the KPIs of the process also. All of the processes should be measured and evaluated in order to improve the quality of application. To measure the performance of process, applicable and correct KPIs and metrics should be defined. In this layer, the framework focuses on KPIs of BA Process. In the framework I adjusted and distributed KPIs along the BA KAs, PM KAs, and PM Process Groups in a matrix.

All of the KPIs proposed to control BA process along the PM Process are given in Table 2.

Table 2 KPIs within the Proposed BA Performance Management Framework

No	Key Performance Indicator	Target (offered) / Definitions
1.	\sum newly added Reqs.(in project scope)*	The total number of newly added requirements should not be greater than %20 of total number of requirements.
2.	\sum newly added requirements (out of project scope)	The total number of newly added out of project scope requirements should not be greater than %5 of total number of requirements
3.	\sum proposed functional Reqs.	The total number of proposed functional requirements
4.	\sum proposed nonfunctional Reqs.	The total number of proposed nonfunctional requirements
5.	\sum Approved Reqs., Costello, R., J. (1995),	The total number of approved requirements
6.	\sum Functional Reqs., BABOKv3 (2015)	The total number of approved functional requirements
7.	\sum Nonfunctional Reqs., BABOKv3 (2015)	The total number of approved nonfunctional requirements
8.	\sum rejected Reqs.	The total number of rejected requirements
9.	\sum changed Reqs.(CRs), Costello, R., J. (1995),	The total number of changed requirements
10.	\sum proposed CRs, Najmi <i>et al.</i> , (2005)	The total number of proposed change requests affecting exist requirements should not be greater than %15 of total number of requirements
11.	\sum Accepted CRs., BABOKv3 (2015)	The total number of accepted CRs.
12.	\sum Rejected CRs., (BABOKv3, 2015)	The total number of rejected CRs.
13.	\sum Opened bugs.	The total number of opened bugs.
14.	\sum closed bugs	The total number of closed bugs.
15.	\sum bugs opened related to the specific Req.	The total number of bug opened to the requirement should not be greater than %2 of total number of bugs opened to the requirements
16.	\sum UCs for the specific requirement	The total number of use cases related with one requirement should not be greater than 1

Table 2 KPIs within the Proposed BA Performance Management Framework (Continued)

No	Key Performance Indicator	Target (offered) / Definitions
17.	\sum elicitation time	The total number of working days (man day) to elicit requirements from stakeholders.
18.	\sum Use Cases (UCs), PMBOKv5 (2013),	The total number of use cases
19.	\sum Stories, PMBOKv5 (2013),	The total number of stories prepared for requirements
20.	\sum Test Cases, PMBOKv5 (2013),	The total number of test cases for the assessment of requirements.
21.	\sum Risks related with Reqs.	The total number of risks related with the implementation of requirements.
22.	\sum eliminated risks	The total number of eliminated risks related with requirements
23.	\sum occurred risks	The total number of occurred risks related with requirements
24.	\sum estimated closure time	The total estimated time of the project closure
25.	\sum realized time	The realized time of the project
26.	\sum time for design	The total time charged for design
27.	\sum time to implement CRs on Reqs Doc.	The total amount of time to implement CRs on Requirements Definition Document
28.	\sum charged time for validation & verification of Requirements	The total amount of time charged on verification and validation of requirements.
29.	\sum meetings organized with stakeholders	The total number of meetings organized with stakeholders
30.	\sum cost of accepting CRs,	The total cost (time, human resources, etc.) of accepting CRs related with requirements
31.	\sum stakeholders, PMBOKv5 (2013),	The total number of stakeholders for the project
32.	\sum Reqs. (in scope)	Total number of requirements in project scope.
33.	\sum Reqs. (out of scope)	Total number of requirements, which are out of project scope

Table 2 KPIs within the Proposed BA Performance Management Framework (Continued)

No	Key Performance Indicator	Target (offered) / Definitions
34.	Σ cost of validation and verification of Requirements	The total cost of validation and verification of Requirements
35.	Σ Suppliers, PMBOKv5 (2013),	The total number of suppliers in the project.
36.	Σ Outsourced Reqs.	The total number of requirements outsourced to the suppliers.
37.	Σ business analysts worked on the project, PMBOKv5 (2013),	The total number of business analyst worked at project.
38.	Σ HR charged on the project, PMBOKv5 (2013),	The total number of HR on the project
39.	Σ changed UCs.	The total number of changed use cases.

3.5 The Fourth Layer: Project Management Process Groups

The fourth layer of the provided framework is a PM process group, which are initiating, planning, executing, monitoring and controlling process, and closing. The initiating process group is the beginning of project management. Project Manager defines the project charter with respect to the scope of work (SOW) and prepares the stakeholder list, which is crucial for the Planning and Monitoring KA of BA. In this process group, business analyst sees the big picture of the project by looking at the contract. In this point the number of contract (especially technical contract) terms is important. The stakeholder list is the key point for approval of requirements specification document and approval of change requests.

The planning process group is related with the managerial plans / documents of project management. If there exist a business analyst for the project, he/she (or the project manager) prepares the requirements management plan. In the requirements management plan, business analyst defines the KPIs that will be measured along the project life cycle.

The executing process group is the implementation part of the project. The project team starts to implement the project phases. The business analyst starts to perform the BA tasks along the six KAs of BA. At this process group, business analyst for measuring the performance of BA process gathers some crucial KPI values related with BA. In this process group, the business analyst accomplished the tasks of Elicitation and Collaboration KA of BA.

The Monitoring and Controlling process group is also called as the orchestration phase of the project. All the outputs of management processes such as BA, Test, and Development are reviewed, controlled by project manager and the experts of each phase. This process group coordinates all the works done in the entire project life cycle. The business analyst reviews and controls all the requirements and change requests with respect to the traceability matrix. The traceability matrix is the output of Requirements Life Cycle Management KA of BA and is also the main task of Requirements Management and Communication KA. Here, the total number of functional / nonfunctional requirements, requirements in project scope / out of scope,

proposed / approved / changed requests, newly added requirements, bugs affecting requirements / bugs opened for a specific requirement, use cases, changed use cases, stories are collected. As a result of these KPIs, Scope Management is accomplished, which is the most important part for any type of the project whether small, middle or big. In the proposed framework the specified KPIs can be seen at the intersection of Requirements Life Cycle Management and Scope Management.

The last process group is Closing Process Group. This process group including all the completed works, activities, project deliverables including all of the managerial plans, documents, Requirements, test reports, end product, source code / hardware. This process group formally verifies that project is achieved, and all phases are completed.

3.6 Validation of the Proposed Framework

To learn the opinions of experts about the proposed framework, a qualitative study is done with five (5) participants and experts. The detailed information about them is given in Table 3. As a qualitative research methodology, the Delphi Method is selected because of its wide application to information systems studies (Brancheau and Wetherbe (1987), Linstone and Turoff (1975), Mulligan (2002), Okoli and Pawlowski (2004), Schmidt *et al.* (2001), Güleç and Yılmaz (2016)). One of the main goal of Delphi Method is to take participants opinions about the research topic and then to evaluate these participants' opinions by experts. If the experts decide to go on with one more round, then the participants revise their opinions about the research and then send their opinions to the experts for a re-evaluation.

Table 3 Brief Information About Participants and Experts for the Delphi Study

Experts and Participants	Education	Position	Year of Expertise	Company Size (# of employees)
Participant 1	Computer Engineer	Entrepreneur, VC	14	1000
Participant 2	Computer Engineer	R&D Coordinator	16	~500
Participant 3	Computer Engineer	R&D Product Manager	14	~500
Participant 4	Computer Engineer	Business Development Manager	14	1500
Participant 5	Math & Computer Engineer	Program Manager	14	~1000
Expert 1	Statistics	Test Analyst	16	~3000
Expert 2	Computer Engineer	Co-Founder of a Company	10	~50
Expert 3	Computer Engineer	Co-Founder of a Company	14	~50
Expert 4	Statistics	Test Analyst	14	~1000
Expert 5	Computer Engineer	R& D Director	10	~50

The following three (3) questions are forwarded to the participants, whom work at different companies. The participants and experts work as a program manager or business analysts.

1. What do you think about the performance management framework layers?
2. What kind of suggestions can you make for further improvements of the framework?
3. What do you think about the contribution of the framework to practice?

One participant reported that:

Interview quotation: *“I think the layers of the framework are meaningful. I am responsible for the improvement of business analysis process in my company. Therefore, this framework will be useful to gather information by handling those KPIs*

with respect to the both project management and business analysis implementation. This framework should be used for large-scaled projects with different methodologies. And then the advantages and lack of framework may be discussed and improved as a result of lessons learned report for those projects. Consequently, the effectivity of this framework must be examined for different kinds of project methodologies. This may take long time. On the other hand, by looking forward to applying the framework, both project managers and business analysts may have task list and follow them with gathering proposed KPIs.”

Another participant acknowledged that:

Interview quotation: “In our company we are studying on performance management of business analysis knowledge areas and we defined somehow KPIs. The proposed KPIs within the Framework is useful for us. I will suggest my team to investigate this framework in detail. The referenced handbooks both BABOK and PMBOK are important for us. Therefore, the layers of the framework are well-determined. I suggest that apply this framework for many projects’ analysis phase and take the business analysts’ opinion for effectiveness of it. In my opinion this framework helps to look pictorial view”

As another participant stated that:

Interview quotation: “In order to practice this framework we need long time. This framework helps to business analysts, project managers and configuration managers. As it is mentioned in the framework after defining the baselines, the number of change requests and management of those changings became very important topic. Therefore, the KPIs related CR and the initiating stage of them is important. This framework is useful to follow and measure the performance of the process.”

Another participant declared that:

Interview quotation: “All the layers of the framework addresses and expands all the business analysis process. When I look to the framework, I can say that the layers of framework are well-designed. when the project manager and business analysts start to execute processes, usually some of the knowledge areas are forgotten or given less importance, especially risk management. Here, I can see all the knowledge areas of

both project management and business analysis. Furthermore, the suggested KPIs in this framework is valuable for following and analyzing performance of whole process and benchmarking the results with the other projects' outputs. Since the as-is framework addresses efficiently all the business analysis process, there is no need to do big changings. Moreover, it can be re-designed easily when the BABOK and PMBOK are revised. Besides, first of all the suggested framework adjusts both business analysis and project management process in a standard. While it brings all the stakeholders together, it provides to derive project within the common language and it increases the effectivity of business analysis process management. Another contribution of the framework is the providing continuity of process with additive transparency.”

As another interviewee stated that:

Interview quotation: “I think this is mostly useful for the business analysts instead of project managers. This framework application may have different applications with respect to the methodology of project management. This framework is good point to start performance management of business analysis process. The process card and flow diagrams are useful to see segregation of duty. Because, usually the roles and responsibility definitions may cause chaos. I suggest separating this framework with respect to the agile or waterfall methodology”

To sum up all the interviews opinions and experience, reviewers declare that the first, second, third and fourth participants as positive whereas four experts evaluated the fifth participant's opinions as neutral. Therefore, the proposed framework is found to be useful for both project management and business analysis domains. Those results are given in Table 4.

Table 4 Evaluation of Qualitative Study

	Participant1	Participant2	Participant3	Participant4	Participant5
Expert1	Positive	Positive	Positive	Positive	Positive
Expert2	Positive	Positive	Positive	Positive	Neutral
Expert3	Positive	Positive	Positive	Positive	Neutral
Expert4	Positive	Positive	Positive	Positive	Neutral
Expert5	Positive	Positive	Neutral	Positive	Neutral

3.7 Summary

In this chapter, the proposed framework is explained in detail. All the layers and design of framework are defined. Besides, to validate the proposed framework's usefulness and effectivity, a qualitative study is done via Delphi method. The opinions of the participants are evaluated by the experts. As a result of this study, the proposed framework is found to be meaningful to apply. An application of the framework is done in a small-sized software project in the next chapter of this thesis to illustrate an application of the proposed framework.

CHAPTER 4

4 AN APPLICATION OF THE PROPOSED FRAMEWORK

4.1 Introduction

The proposed framework is applied for an online learning marketplace. The company needs a platform for giving various courses to thousands of students. In this platform, there will be many instructors from large-scaled universities. By the help of this platform many students will increase their knowledge and skills. This will be a valuable software project because of its online learning features. The company's needs on the platform are documented as in the following. The project team has one business analyst, one project manager, one test analyst, one software architect and one senior software developer. In this application we will analyze the needs of company and gather the KPIs as it is indicated in the proposed framework. As a result of framework application, some preventive and / or corrective actions are advised to the project team. While doing elicitation operation for requirements, the contributed flow diagram (**Figure 6**) is followed. After elicitation operation is done, the requirements analyzing part is studied with respect to the contributed flow diagram, **Figure 7**.

4.2 Software Requirements Specifications and Application of Framework

Initial Requirements of the Application

At the initial part of the project, business analyst newly added and proposed requirements in below.

Table 5 Initial Requirements of the Application / Project

Software Requirements Specifications (SRS)
User shall sign up to the application
User shall sign in to the application
User shall sign out from the application
User shall search for free course
User shall select paid courses
User shall see the predecessors of course
User shall see the description of the course
User shall compare one course center with the other
User shall see the information (rate, # of reviews, # of students, #of courses he / she educates) about course instructor(s)
User shall see the other courses of selected course instructor
User shall become an instructor
User shall messages sent to him
User shall see all the courses
User shall add the course to the chart
User shall go to chart
User shall remove the course from the shopping chart
User shall update the course list
User shall see the total price of selected course
User shall checkout course
User shall go to course

For the project, the requirements given in above table should be managed systematically. Business analyst of the project should handle these requirements as written and specified in project management plan or requirements management plan. He / She will define the priority of the requirements, validation methods of each requirement, and type of the requirements, at last gives unique identifier number to all

of the requirements. The studied software requirements specifications (SRS) are stated in table given below. All SRSs are saved with unique SRS number, SRS definition, the software implementation priority, type of the requirement whether Functional or Non-functional, validation methods (Test or Analyze or Declaration) and the state of SRS at that moment. Furthermore, the priorities of the SRSs are handled with 1, 2 and 3. If the SRS is decided as high priority to implement then its priority is stated as 1 and else if the SRS is decided as low priority to implement, then its priority is stated as 3.



Table 6 Requirements Identifiaiton (At initial State)

Req. No	Requirements (SRS)	Priority	Req. Type	Validation Method	State
1.	User shall sign up to the application	1	Functional	Test	Added, Proposed
2.	User shall sign in to the application	1	Functional	Test	Added, Proposed
3.	User shall sign out from the application	1	Functional	Test	Added, Proposed
4.	User shall search for free course	2	Functional	Test	Added, Proposed
5.	User shall select paid courses	1	Functional	Test	Added, Proposed
6.	User shall see the predecessors of course	2	Functional	Test	Added, Proposed
7.	User shall see the description of the course	1	Functional	Test	Added, Proposed
8.	User shall compare one course center with the other	1	Functional	Test	Added, Proposed
9.	User shall see the information (rate, # of reviews, # of students, #of courses he / she educates) about course instructor(s)	3	Functional	Test	Added, Proposed
10.	User shall see the other courses of selected course instructor	2	Functional	Test	Added, Proposed
11.	User shall become an instructor	2	Functional	Test	Added, Proposed
12.	User shall messages sent to him	3	Functional	Test	Added, Proposed
13.	User shall see all the courses	1	Functional	Test	Added, Proposed
14.	User shall add the course to the chart	1	Functional	Test	Added, Proposed

Table 6 Requirements Identifiaiton (At initial State) (Continued)

Req No	Requirements (SRS)	Priority	Req. Type	Validation Method	State
15.	User shall go to chart	1	Functional	Test	Added, Proposed
16.	User shall remove the course from the shopping chart	1	Functional	Test	Added, Proposed
17.	User shall update the course list	1	Functional	Test	Added, Proposed
18.	User shall see the total price of selected course	1	Functional	Test	Added, Proposed
19.	User shall checkout course	1	Functional	Test	Added, Proposed
20.	User shall go to course	1	Functional	Test	Added, Proposed

After preparation of SRS Document, business analyst proposes these requirements to the customer. Next, Customer reviews the requirements whether covers all their needs or not. Then the customers approve the SRS Document. Approving SRS Document means that the functional baseline is launched. After freezing twenty requirements written in above table, all the actions on requirements should go on change management. In other words, if there exist any new proposed requirements, they will be handled with Configuration Control Board (CCB) and an impact analysis will be performed.

Business Analyst starts to analyze requirements and states the priority of requirements at three levels: 1 for high, 2 for moderate, 3 for low as it is mentioned before. In additionally, Business Analyst decides on the validation method for each requirement.

Table 7 Requirements (Approved and newly added / proposed)

Req. No	Requirements (SRS)	Priority	Req. Type	Validation Method	State
1.	User shall sign up to the application	1	Functional	Test	Approved
2.	User shall sign in application	1	Functional	Test	Approved
3.	User shall sign out from application	1	Functional	Test	Approved
4.	User shall search for free course	2	Functional	Test	Approved
5.	User shall select paid courses	1	Functional	Test	Approved
6.	User shall see the predecessors of course	2	Functional	Test	Approved
7.	User shall see the description of the course	1	Functional	Test	Approved
8.	User shall compare one course center with the other	1	Functional	Test	Approved
9.	User shall see the information (rate, # of reviews, # of students, #of courses he / she educates) about course instructor(s)	3	Functional	Test	Approved
10.	User shall see the other courses of selected course instructor	2	Functional	Test	Approved
11.	User shall become an instructor	2	Functional	Test	Approved
12.	User shall messages sent to him	3	Functional	Test	Approved
13.	User shall see all of the courses	1	Functional	Test	Approved
14.	User shall add the course to the chart	1	Functional	Test	Approved
15.	User shall go to chart	1	Functional	Test	Approved
16.	User shall remove the course from the shopping chart	1	Functional	Test	Approved
17.	User shall update the course list	1	Functional	Test	Approved

Table 8 Requirements (Approved and newly added / proposed) (Continued)

Req. No	Requirements (SRS)	Priority	Req. Type	Validation Method	State
18.	User shall see the total price of selected course	1	Functional	Test	Approved
19.	User shall checkout course	1	Functional	Test	Approved
20.	User shall go to course	1	Functional	Test	Approved
21.	User shall see the categories	2	Functional	Test	Added, Proposed
22.	User shall search for course instructor	2	Functional	Test	Added, Proposed
23.	User shall select course language	3	Functional	Test	Added, Proposed
24.	User shall see the course properties	3	Functional	Test	Added, Proposed
25.	User shall select the level of course as All, Preintermediate, Intermediate, Upper intermediate	1	Functional	Test	Added, Proposed
26.	User shall select free courses	1	Functional	Test	Added, Proposed
27.	User shall list the selected courses from the most relevant one to the less relevant	3	Functional	Test	Added, Proposed
28.	User shall see the rate of course	3	Functional	Test	Added, Proposed
29.	User shall rate the course	3	Functional	Test	Added, Proposed
30.	User shall see the syllabus	2	Functional	Test	Added, Proposed
31.	User shall add the selected course to the wish list of him	3	Functional	Test	Added, Proposed
32.	User shall reset password	1	Functional	Test	Added, Proposed
33.	User shall see the top 10 courses	3	Functional	Test	Added, Proposed
34.	User shall apply coupon code	2	Functional	Test	Added, Proposed

Table 8 Requirements (Approved and newly added / proposed) (Continued)

Req. No	Requirements (SRS)	Priority	Req. Type	Validation Method	State
35.	User shall keep shopping	2	Functional	Test	Added, Proposed
36.	User shall see the new courses	3	Functional	Test	Added, Proposed
37.	User shall refund the course	1	Functional	Test	Added, Proposed
38.	User shall see frequently asked questions	3	Functional	Test	Added, Proposed

While analyzing requirements Business Analyst realize that some requirements in scope are missing. Then, Business Analyst tries to define the newly added requirements (in scope). Business Analyst prepares a change request and proposes some new requirements to the customers. The requirements list updated in table given below.

Table 8 Requirements List (Updated)

Req. No	Requirements (SRS)	Priority	Req. Type	Validation Method	State
1.	User shall sign up to the application	1	Functional	Test	Approved
2.	User shall sign in application	1	Functional	Test	Approved
3.	User shall sign out from application	1	Functional	Test	Approved
4.	User shall search for free course	2	Functional	Test	Approved
5.	User shall select paid courses	1	Functional	Test	Approved
6.	User shall see the predecessors of course	2	Functional	Test	Approved
7.	User shall see the description of the course	1	Functional	Test	Approved
8.	User shall compare one course center with the other	1	Functional	Test	Approved
9.	User shall see the information (rate, # of reviews, # of students, #of courses he / she educates) about course instructor(s)	3	Functional	Test	Approved

Table 8 Requirements List (Updated) (Continued)

Req. No	Requirements (SRS)	Priority	Req. Type	Validation Method	State
10.	User shall see the other courses of selected course instructor	2	Functional	Test	Approved
11.	User shall become an instructor	2	Functional	Test	Approved
12.	User shall messages sent to him	3	Functional	Test	Approved
13.	User shall see all of the courses	1	Functional	Test	Approved
14.	User shall add the course to the chart	1	Functional	Test	Approved
15.	User shall go to chart	1	Functional	Test	Approved
16.	User shall remove the course from the shopping chart	1	Functional	Test	Approved
17.	User shall update the course list	1	Functional	Test	Approved
18.	User shall see the total price of selected course	1	Functional	Test	Approved
19.	User shall checkout course	1	Functional	Test	Approved
20.	User shall go to course	1	Functional	Test	Approved
21.	User shall see the categories	2	Functional	Test	Approved
22.	User shall search for course instructor	2	Functional	Test	Approved
23.	User shall select course language	3	Functional	Test	Approved
24.	User shall see the course properties	3	Functional	Test	Approved
25.	User shall select the level of course as All, Preintermediate, Intermediate, Upper intermediate	1	Functional	Test	Approved

Table 8 Requirements List (Updated) (Continued)

Req. No	Requirements (SRS)	Priority	Req. Type	Validation Method	State
26.	User shall select free courses	1	Functional	Test	Approved
27.	User shall list the selected courses from the most relevant one to the less relevant	3	Functional	Test	Approved
28.	User shall see the rate of course	3	Functional	Test	Approved
29.	User shall rate the course	3	Functional	Test	Approved
30.	User shall see the syllabus	2	Functional	Test	Approved
31.	User shall add the selected course to the wish list of him	3	Functional	Test	Approved
32.	User shall reset password	1	Functional	Test	Approved
33.	User shall see the top 10 courses	3	Functional	Test	Approved
34.	User shall apply coupon code	2	Functional	Test	Approved
35.	User shall keep shopping	2	Functional	Test	Approved
36.	User shall see the new courses	3	Functional	Test	Approved
37.	User shall refund the course	1	Functional	Test	Approved
38.	User shall see frequently asked questions	3	Functional	Test	Approved

The CCB (customer, project manager, proposer, design architecture, business analyst) does impact analysis on proposed change request. CCB decides to approve CR. According to the approved CR Business Analyst added eighteen (18) requirements more to the requirements in SRS Document. The updated requirement list is given in below.

Table 9 Requirements List (Added new Reqs)

Req. No	Requirements (SRS)	Priority	Req. Type	Validation Method	State
1.	User shall sign up to the application	1	Functional	Test	Approved
2.	User shall sign in application	1	Functional	Test	Approved
3.	User shall sign out from application	1	Functional	Test	Approved
4.	User shall search for free course	2	Functional	Test	Approved
5.	User shall select paid courses	1	Functional	Test	Approved
6.	User shall see the predecessors of course	2	Functional	Test	Approved
7.	User shall see the description of the course	1	Functional	Test	Approved
8.	User shall compare one course center with the other	1	Functional	Test	Approved
9.	User shall see the information (rate, # of reviews, # of students, #of courses he / she educates) about course instructor(s)	3	Functional	Test	Approved
10.	User shall see the other courses of selected course instructor	2	Functional	Test	Approved
11.	User shall become an instructor	2	Functional	Test	Approved
12.	User shall messages sent to him	3	Functional	Test	Approved
13.	User shall see all of the courses	1	Functional	Test	Approved
14.	User shall add the course to the chart	1	Functional	Test	Approved
15.	User shall go to chart	1	Functional	Test	Approved

Table 9 Requirements List (Added new Reqs.) (Continued)

Req. No	Requirements (SRS)	Priority	Req. Type	Validation Method	State
16.	User shall remove the course from the shopping chart	1	Functional	Test	Approved
17.	User shall update the course list	1	Functional	Test	Approved
18.	User shall see the total price of selected course	1	Functional	Test	Approved
19.	User shall checkout course	1	Functional	Test	Approved
20.	User shall go to course	1	Functional	Test	Approved
21.	User shall see the categories	2	Functional	Test	Approved
22.	User shall search for course instructor	2	Functional	Test	Approved
23.	User shall select course language	3	Functional	Test	Approved
24.	User shall see the course properties	3	Functional	Test	Approved
25.	User shall select the level of course as All, Preintermediate, Intermediate, Upper intermediate	1	Functional	Test	Approved
26.	User shall select free courses	1	Functional	Test	Approved
27.	User shall list the selected courses from the most relevant one to the less relevant	3	Functional	Test	Approved
28.	User shall see the rate of course	3	Functional	Test	Approved
29.	User shall rate the course	3	Functional	Test	Approved

Table 9 Requirements List (Added new Reqs.) (Continued)

Req. No	Requirements (SRS)	Priority	Req. Type	Validation Method	State
30.	User shall see the syllabus	2	Functional	Test	Approved
31.	User shall add the selected course to the wish list of him	3	Functional	Test	Approved
32.	User shall reset password	1	Functional	Test	Approved
33.	User shall see the top 10 courses	3	Functional	Test	Approved
34.	User shall apply coupon code	2	Functional	Test	Approved
35.	User shall keep shopping	2	Functional	Test	Approved
36.	User shall see the new courses	3	Functional	Test	Approved
37.	User shall refund the course	1	Functional	Test	Approved
38.	User shall see frequently asked questions	3	Functional	Test	Approved
39.	User shall give the selected course as a gift	3	Functional	Test	Added, Proposed
40.	User shall see what to learn part in selected course	2	Functional	Test	Added, Proposed
41.	User shall preview the course video	2	Functional	Test	Added, Proposed
42.	User shall see the feedback of students rate distribution in percentage	3	Functional	Test	Added, Proposed
43.	User shall see comments about the course	3	Functional	Test	Added, Proposed
44.	User shall see the courses that he had taken before	2	Functional	Test	Added, Proposed
45.	User shall see the notifications	2	Functional	Test	Added, Proposed
46.	User shall see the help menu	3	Functional	Test	Added, Proposed

47.	User shall view the "You Might Also Like" courses in shopping Cart page	3	Functional	Test	Added, Proposed
48.	User shall save course for later	3	Functional	Test	Added, Proposed
49.	User shall move course to wish list	3	Functional	Test	Added, Proposed

Now, Business Analyst defined thirty-eight (38) requirements in SRS Document. After executing the software application life cycle management on the project, it can be said that we are in design phase. After this phase the project team proposes some change requests and new requirements given below.

The CCB Board does the impact analysis for the CR and decides to approve CR. According to the approval of CR, Business Analyst adds these requirements to the SRS Document and update the states of the requirements. At the end of the project Business Analyst states that totally forty- nine (49) approved Requirements exist in the project.

Table 10 Updated SRS

Req. No	Requirements (SRS)	Priority	Req. Type	Validation Method	State
1.	User shall sign up to the application	1	Functional	Test	Approved
2.	User shall sign in application	1	Functional	Test	Approved
3.	User shall sign out from application	1	Functional	Test	Approved
4.	User shall search for free course	2	Functional	Test	Approved
5.	User shall select paid courses	1	Functional	Test	Approved
6.	User shall see the predecessors of course	2	Functional	Test	Approved
7.	User shall see the description of the course	1	Functional	Test	Approved

Table 10 Updated SRS (Continued)

Req. No	Requirements (SRS)	Priority	Req. Type	Validation Method	State
8.	User shall compare one course center with the other	1	Functional	Test	Approved
9.	User shall see the information (rate, # of reviews, # of students, #of courses he / she educates) about course instructor(s)	3	Functional	Test	Approved
10.	User shall see the other courses of selected course instructor	2	Functional	Test	Approved
11.	User shall become an instructor	2	Functional	Test	Approved
12.	User shall messages sent to him	3	Functional	Test	Approved
13.	User shall see all of the courses	1	Functional	Test	Approved
14.	User shall add the course to the chart	1	Functional	Test	Approved
15.	User shall go to chart	1	Functional	Test	Approved
16.	User shall remove the course from the shopping chart	1	Functional	Test	Approved
17.	User shall update the course list	1	Functional	Test	Approved
18.	User shall see the total price of selected course	1	Functional	Test	Approved
19.	User shall checkout course	1	Functional	Test	Approved
20.	User shall go to course	1	Functional	Test	Approved

Table 10 Updated SRS (Continued)

Req. No	Requirements (SRS)	Priority	Req. Type	Validation Method	State
21.	User shall see the categories	2	Functional	Test	Approved
22.	User shall search for course instructor	2	Functional	Test	Approved
23.	User shall select course language	3	Functional	Test	Approved
24.	User shall see the course properties	3	Functional	Test	Approved
25.	User shall select the level of course as All, Preintermediate, Intermediate, Upper intermediate	1	Functional	Test	Approved
26.	User shall select free courses	1	Functional	Test	Approved
27.	User shall list the selected courses from the most relevant one to the less relevant	3	Functional	Test	Approved
28.	User shall see the rate of course	3	Functional	Test	Approved
29.	User shall rate the course	3	Functional	Test	Approved
30.	User shall see the syllabus	2	Functional	Test	Approved
31.	User shall add the selected course to the wish list of him	3	Functional	Test	Approved
32.	User shall reset password	1	Functional	Test	Approved
33.	User shall see the top 10 courses	3	Functional	Test	Approved

Table 10 Updated SRS (Continued)

Req. No	Requirements (SRS)	Priority	Req. Type	Validation Method	State
34.	User shall apply coupon code	2	Functional	Test	Approved
35.	User shall keep shopping	2	Functional	Test	Approved
36.	User shall see the new courses	3	Functional	Test	Approved
37.	User shall refund the course	1	Functional	Test	Approved
38.	User shall see frequently asked questions	3	Functional	Test	Approved
39.	User shall give the selected course as a gift	3	Functional	Test	Approved
40.	User shall see what to learn part in selected course	2	Functional	Test	Approved
41.	User shall preview the course video	2	Functional	Test	Approved
42.	User shall see the feedback of students rate distribution in percentage	3	Functional	Test	Approved
43.	User shall see the courses that he had taken before	2	Functional	Test	Approved
44.	User shall see the notifications	2	Functional	Test	Approved
45.	User shall see the help menu.	3	Functional	Test	Approved
46.	User shall view the "You Might Also Like" courses in shopping Cart page	3	Functional	Test	Approved
47.	User shall save course for later	3	Functional	Test	Approved
48.	User shall move course to wish list.	3	Functional	Test	Approved

When the project passed to the implementation phase, the technical team again proposes seven (7) CRs to the customer. In that case some of the requirements given below proposed to change somehow technical reasons.

Table 11 Proposed Change Requests related with Requirements

Req. No	Requirements	Priority	Req. Type	Validation Method	State
1	User shall sign up to the application	1	Functional	Test	CR Proposed
2	User shall sign in application	1	Functional	Test	CR Proposed
3	User shall sign out from application	1	Functional	Test	CR Proposed
21	User shall see the categories	2	Functional	Test	CR Proposed
39	User shall give the selected course as a gift	3	Functional	Test	CR Proposed
32	User shall reset password	1	Functional	Test	CR Proposed
15	User shall go to chart	1	Functional	Test	CR Proposed

At this point again CCB analyzed the CRs impact on the project and decided to approve those CRs. As a result of approving CRs, Business Analyst changed the requirements given above table.

At the end of the project, Business Analyst states the following KPI values.



	Integration I, P, E, M&C, C	SM P, M&C	TM P, M&C	CM P, M&C	QM P, E, M&C	HRM P, E	CoM P, E, M&C	RM P, M&C	ProM P, E, M&C, C	StkM I, P, E, M&C
BA Planning and Monitoring			KPI24: \sum estimated closure time=3			KPI38: \sum Business Analyst worked at		KPI21: \sum risks related with Reqs.=0		
Elicitation and Collaboration	KPI1: \sum newly added requirements (in project scope)= 20, KPI2: \sum newly	KPI10: \sum proposed reqs=18., KPI32: \sum reqs (in scope)=20 KPI33: \sum reqs (out of scope)=0, KPI5: \sum approved reqs.=38, KPI29: \sum meetings organized with stakeholders=10 days	KPI17: \sum elicitation time=30 man-days				KPI29: \sum meetings organized with stakeholder	KPI21: \sum Risks related with Reqs., KPI22: \sum eliminated risks., KPI23: \sum Occurred Risks	KPI37: \sum outsourced Reqs. KPI36: \sum Suppliers	KPI31: \sum stakeholders
Reqs. Analysis and Design Definition	KPI5: \sum accepted reqs.=20 KPI8: \sum Rejected reqs=20	KPI5: \sum approved Reqs.=(20 + 18=38), KPI6: \sum approved functional Reqs.=38, KPI7: \sum approved nonfunctional Reqs.=0, \sum CRs=18, \sum UCs=38	KPI26: \sum time for design, KPI27: \sum time to implement CRs on Reqs Doc., KPI28: \sum charged time of validation and verification of Requirements	KPI30: \sum cost of accepted CRs.=7 man-days, KPI35: \sum cost of validation and verification of Requirements=15 man-days	KPI15: \sum opened bugs related with specific Reqs.=0, KPI14: \sum closed bugs=0, KPI10: \sum proposed CRs=26, KPI11: \sum accepted CRs=26, KPI12: \sum Rejected CRs=0, KPI20: \sum test cases=49, KPI19: \sum			KPI21: \sum Risks related with Reqs, KPI22: \sum eliminated risks, KPI23: \sum Occurred Risks		KPI32: \sum reqs (in scope) KPI33: \sum reqs (out of scope) KPI11: \sum accepted CRs KPI18: \sum Use Cases (UCs)
Reqs Life Cycle Management		KPI34: \sum newly added Reqs (functional & nonfunctional)=11, KPI6: \sum functional reqs.=49, KPI7: \sum nonfunctional reqs.=0 KPI32: \sum reqs (in scope)=49, KPI33: \sum reqs (out of scope)=0, KPI9: \sum changed reqs.=11, KPI10: \sum proposed CRs.=20 + 6=26, KPI11: \sum Accepted CRs.=20, KPI12: \sum Rejected CRs.=0, KPI13: \sum opened bugs=0, KPI15: \sum bugs opened related to the specific req.=0, KPI18: \sum Use Cases (UCs)=49, KPI16: \sum UCs for the specific reqs.=1 for each req. \sum changed UCs=11, KPI19: \sum Stories=49	KPI26: \sum time for design, KPI27: \sum time to implement CRs on Reqs Doc.=7 man-day, KPI28: \sum charged time of validation and verification of Requirements=30 man-days	KPI30: \sum cost of accepted CRs.=7 man-days, KPI35: \sum cost of validation and verification of Requirements=15 man-days	KPI15: \sum opened bugs related with specific Reqs.=0, KPI14: \sum closed bugs=0, KPI10: \sum proposed CRs=26, KPI11: \sum accepted CRs=26, KPI12: \sum Rejected CRs=0, KPI20: \sum test cases=49, KPI19: \sum Stories=49			KPI21: \sum Risks related with Reqs=0, KPI22: \sum eliminated risks=0, KPI23: \sum Occurred Risks=0		KPI32: \sum reqs (in scope)=49, KPI33: \sum reqs (out of scope)=0, KPI11: \sum accepted CRs=26 KPI18: \sum Use Cases (UCs)=49
Strategy Analysis		KPI11: \sum CRs=26, KPI6: \sum functional reqs=49, KPI7: \sum nonfunctional reqs=0, KPI18: \sum use cases=49								
Solution Evaluation		KPI6: \sum functional reqs, KPI7: \sum nonfunctional reqs, KPI18: \sum use cases, KPI10: \sum proposed CRs, KPI11: \sum accepted CRs, KPI12: \sum rejected				KPI38: \sum of Business Analyst worked on				

*BA: Business Analysis, C: Closing; CM: Cost Management; CoM: Communication Management; E: Executing HRM: Human Resource Management; I: Initiating; M & C: Monitoring and Controlling; P: Planning; ProM: Procurement Management; QM: Quality Management; RM: Risk Management; SM: Scope Management; StkM: Stakeholder Management; TM: Time Management

Figure 4 Applied Frameworks

Consequently, the framework given in Figure 3 represents the evaluation of the project. The number of Requirements was twenty (20) whereas at the end of the project it increased to forty-nine (49) in scope. The business analyst should be more careful about elicitation and collaboration part of the BA. It can be concluded that the business analysis phase of the project is failed. The cost of handling and implementing missed requirements is high, which results in expanded time schedule and cost of the whole project. The project manager must take some corrective actions on requirements analysis phase. Moreover, as it is mentioned at the third layer of the framework, newly added requirements number should not be greater than 20% of the total number of requirements. Nevertheless, after functional baseline is launched or in other words the customer approved the RSD, the percentage of newly added requirement number / total requirements number $((18 + 11) / 49 = 0,61)$ is 61%, so the goal is not achieved. The managers should force business analysts and may be project managers to have education about analysis. At last, the following figure illustrates the flow of requirements (proposed / approved / and proposed CRs).

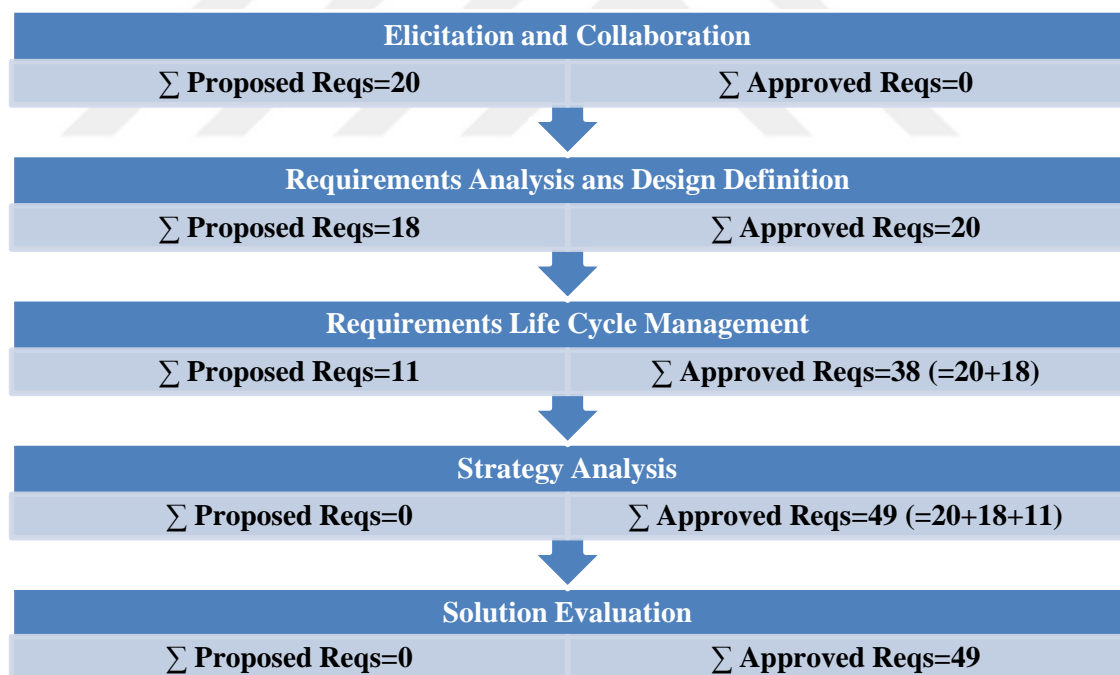


Figure 5 Flow of Requirements Along Business Analysis Knowledge Areas (Proposed-Approved-Change Requested)

4.3 Summary

In this chapter, the proposed performance management framework is applied in a small-sized software project. All the functional software requirements specifications are defined, and framework is applied. The results of KPIs are followed and some preventive and corrective actions are suggested. The insights into business and some other contributions such as business analysis process card and flow diagrams are given in Chapter 5.



CHAPTER 5

5 INSIGHTS INTO BUSINESS PRACTICE

5.1 Introduction

There are some important points for both business analysts and project managers while analyzing the proposed framework. The third layer of proposed framework – KPIs – have some parallel meanings for business analysts and project managers. Some of the proposed KPIs' value do not have the same meaning for each phase (analysis- design- implementation-test) of the project. For instance, a high KPI_1 (\sum newly added requirements-in project scope) have less critical importance for the project's analysis phase rather than implementation phase of the project. This may result with (1) revision in RSD, (2) revision in design, which means more time should be dedicated for design, (3) extension in project schedule, and (4) delay on deliverables. On the other hand, a high value of KPI_1 on the design or implementation phases might stem from either (1) business analyst's lack of experience on BA KAs, (2) the customer may be unaware of the real needs on the project, (3) the lack experience of project managers on project management. In this case, the business analyst and project manager must take some corrective and preventive actions. For example, the business analyst should take courses about BA KAs and project managers should give more importance to the stakeholder management.

Furthermore, KPI_2 (Σ newly added requirements-out of project scope) number is very important for the scope management of the project. A higher KPI_2 results with a higher KPI_9 (Σ changed requests). If the value of KPI_2 is high, then the project manager must give importance to scope management. This may cause a big deal for the analysis phase. More number of alterations may cause more differentiations for the design and implementation. The change in design and implementation usually results with a highly additive cost to the project. At this point, the project manager should revise the cost and cost management strategy.

Value of each KPI does not have the same meaning on each phase. Therefore, having and measuring the same KPI on more than one phases advised. Moreover, the meaning of one KPI have not usually the same meaning for the other phases. The preventive and corrective actions on KPIs can be different for project managers and business analysts. To facilitate the use of the framework by project managers and business analysts, BA process is explained in more detail in the following sub-sections.

5.2 BA Process Definition and Process Flow Diagrams

Business Analysis Planning and Monitoring is the starting point of BA Process. In this part business analyst inspects the contract, operational concept document, project management plan, and scope plan. When the inspection of documents is finished, business analysts decide the business analysis model, which is planning how to apply BA process on the project. Later, requirements management plan is prepared by business analysts and approved by project managers.

In the requirements management plan business analyst decides also how to elicit the requirements from the stakeholders, the tools and techniques (Ref. BABOK v3), how to trace the requirements along the project life cycle. In other words, to start elicitation, Business Analyst takes contract, operational concept document, stakeholder list, project management plan and some organizational assets as inputs. Before starting elicitation, Business Analyst decides on the technique to be used on the project requirements elicitation sub-process. In practice, Business Analysts usually prefer to work with focus groups and adjust lots of meetings, take notes (Business Analyst and the stakeholders must agree on the meeting notes).

After determining the BA model, tools and techniques, the requirements analysis should be done. Prioritization, determination of requirements type (functional / nonfunctional), area paths, and validation method are completed. The elicited requirements may have some modifications via Change Requests (CRs). Business analyst and Project Managers track those changes and evaluate the requirements of the product. Solution evaluation is performed at last.

RACI (Responsible, Accountable, Consultant, and Informed) Matrix, which I propose in this thesis, for these processes are given in the following. RACI Matrix (BABOK v3. 2015) explains the roles and responsibilities for the tasks of BA Process. Figuring out the roles and responsibilities in each task is vital for proper application of each process. I acknowledge that the lack of roles & responsibility definition results with the lack of integrity and quality.

Table 12 RACI* Matrix for BA Process

	BA Planning & Monitoring	Elicitation & Collaboration	Requirements Life Cycle Management	Enterprise Analysis	Strategy Analysis	Solution Evaluation
Executive Sponsor	I	I	I	I	I	I
Business Analyst	R	R	R	R	R	R
Project Manager	A	A	A	A	A	A
Developer	I	I	I	I	I	I
Tester	I	I	I	I	I	I
Application Architect	I	I	I	I	I	I
End User	I	I	I	I	I	I
Subject Matter Expert (SME)	C	C	C	C	C	C
Other Stakeholders	I	I	I	I	I	I

*(Responsible does the work, Accountable Decision maker (only one), Consulted must be consulted prior to the work and gives input, Informed means that they must be notified of outcome)

The RACI Matrix is prepared for the tasks usually given in a process card. Therefore, a sample process card for BA, which is given in Table 13 is proposed in this thesis study.

Table 13 BA Process Card enables easier tracking of the BA process. In the process card a summary information is given. Process cards are called as “organizational assets” in PMBOK v5. The business analyst(s) assigned by project managers should be aware of the “*BA Process Card*”. To apply BA process within the analysis phase of the PM lifecycle, business analyst should review the process card and the referenced sub processes. Project managers should review the PM process card in addition to BA Process Card. The key fields in the BA Process Card can be listed as the following:

- Process Name / Process Owner / Process Responsible / Revision Date and No
- Aim of the Process
- Inputs
- Tasks
- Tools and Techniques
- Outputs
- Key Performance Indicators
- Related Processes

Table 13 Business Analysis Process Card

Process Name:	Business Analysis Process	Revision No /Date:	dd.mm.yyyy / <version number> (e.g. 12.12.2017 / v1.0)
Process Owner:	Mostly BA Leader / Senior Business Analyst	Process Responsible:	Business Analysts
Aim of the Process	Handling all the KAs of BA with high quality standards and with respect to BABOK (the last updated version published by International Institute of Business Analysis)		
Inputs	Contract, Operational Concept Document, Project Management Plan, Scope Management Plan, Stakeholder List		
Tasks	·Business Analysis Planning and Monitoring ·Elicitation and Collaboration ·Requirements Analysis and Design Definition Requirements Life Cycle Management	·Requirements Management & Communication ·Strategy Analysis Solution Evaluation	
Tools & Techniques	Elicitation Tools And Techniques (described in BABOK) Microsoft Team Foundation Server (TFS)	Confluence, Doors, Microsoft Team Foundation Server etc.	
Outputs	Requirements Specification Document, Change Requests (CRs), Use Cases (UCs)		
Key Performance Indicators (KPIs)	·∑ newly added Reqs (functional & nonfunctional) ·∑ functional reqs ·∑ nonfunctional reqs ·∑ reqs (in scope) ·∑ reqs (out of scope) ·∑ proposed functional reqs ·∑ proposed nonfunctional reqs ·∑ approved Reqs. ·∑ approved functional Reqs. ·∑ approved nonfunctional Reqs. ·∑ changed reqs ·∑ proposed CRs ·∑ accepted CRs ∑ rejected CRs	·∑ CRs ·∑ UCs ·∑ cost of accepted CRs ·∑ cost of validation and verification of Requirements ·∑ of Business Analyst worked on the project ·∑ of people charged on the project ·∑ meetings organized with stakeholders ·∑ of outsourced Reqs. ·∑ opened bugs ·∑ bugs opened related to the req. ·∑ Use Cases (UCs)	
Related Processes	Project Management Process, Change Management Process, Configuration Management Process, Quality Management Process, Peer Review		

This process starts when the PM life cycle has started. In the diagram, the tasks done by roles can be followed easily. Elicitation tools and techniques, which are defined in BABOK (BABOK v3, 2015) is assumed to be known by the business analyst. The scope of the project must be well understood by the business analyst. Business analyst should read the project management plan, which covers the project contract. After learning about the project scope, business analyst must decide on the analysis model, available and applicable elicitation techniques. The next action covers the elicitation of requirements from the customer. All the requirements will be proposed to the customer written in document, which is called requirement specification document (RSD). The customer reviews the proposed RSD. Business analyst revises the RSD according to the comments of the customer. Later, the revised RSD is proposed to the

customer to get the final approval. When the customer approves the RSD, the functional baseline is launched.

In **Figure 6**, I propose a requirements elicitation process flow diagram that presents all the roles and actors of BA Process as well as the interactions among them.

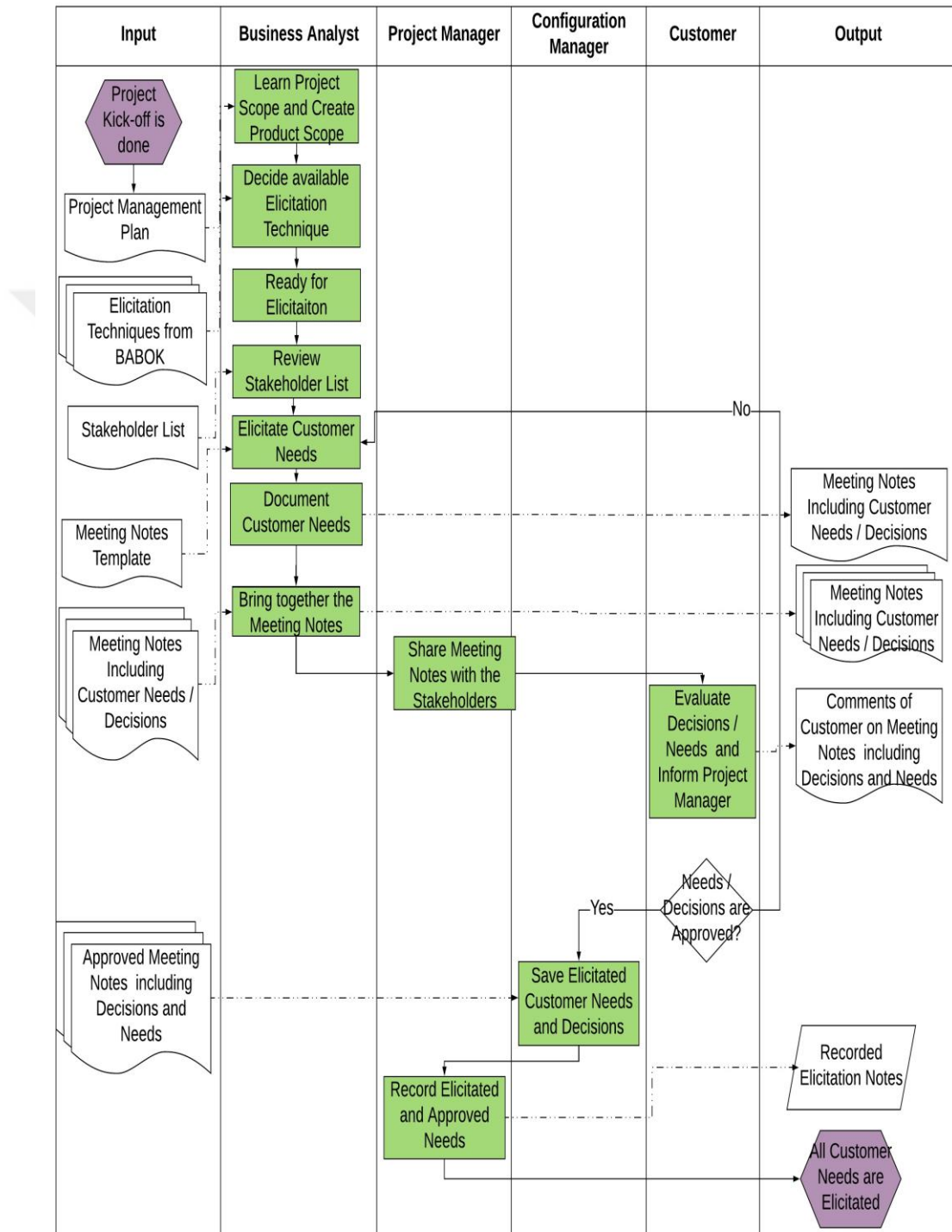


Figure 6 Requirements Elicitation Process Flow Diagram

The requirements analysis process flow diagram is given in below. After eliciting all the requirements, business analysts decide on requirements engineering tools such as IBM Rational DOORS®, Microsoft Team Foundation Server®, etc. All the requirements are documented in pre-defined requirement templates. To understand the requirements analysis process flow diagram, the reader is advised to get acquainted with the roles of Business Analyst, Project Manager, Test Analyst, and Configuration Manager using Appendix A.



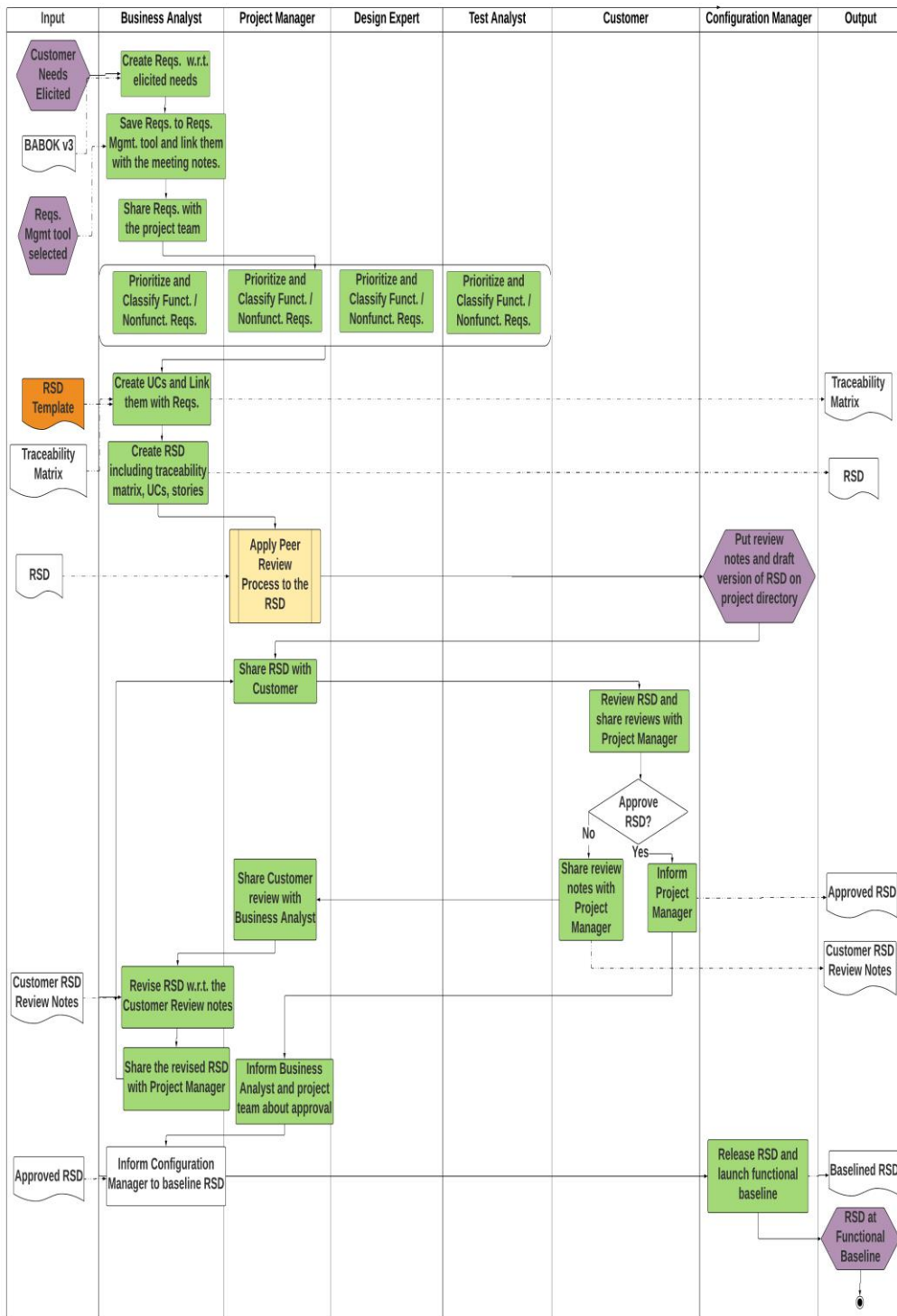


Figure 7 Requirements Analysis Process Flow Diagrams

In this thesis we propose a process Supplier-Input-Process-Output-Customer (SIPOC) diagram in **Figure 8**. It represents the BA Process SIPOC Diagram, which describes the **source process**, **supportive process**, and **customer process** and **input & outputs of the BA Process**. Furthermore, the framework diagram shows the whole process as a map. By the help of this diagram a researcher can see the closed form of BA Process.

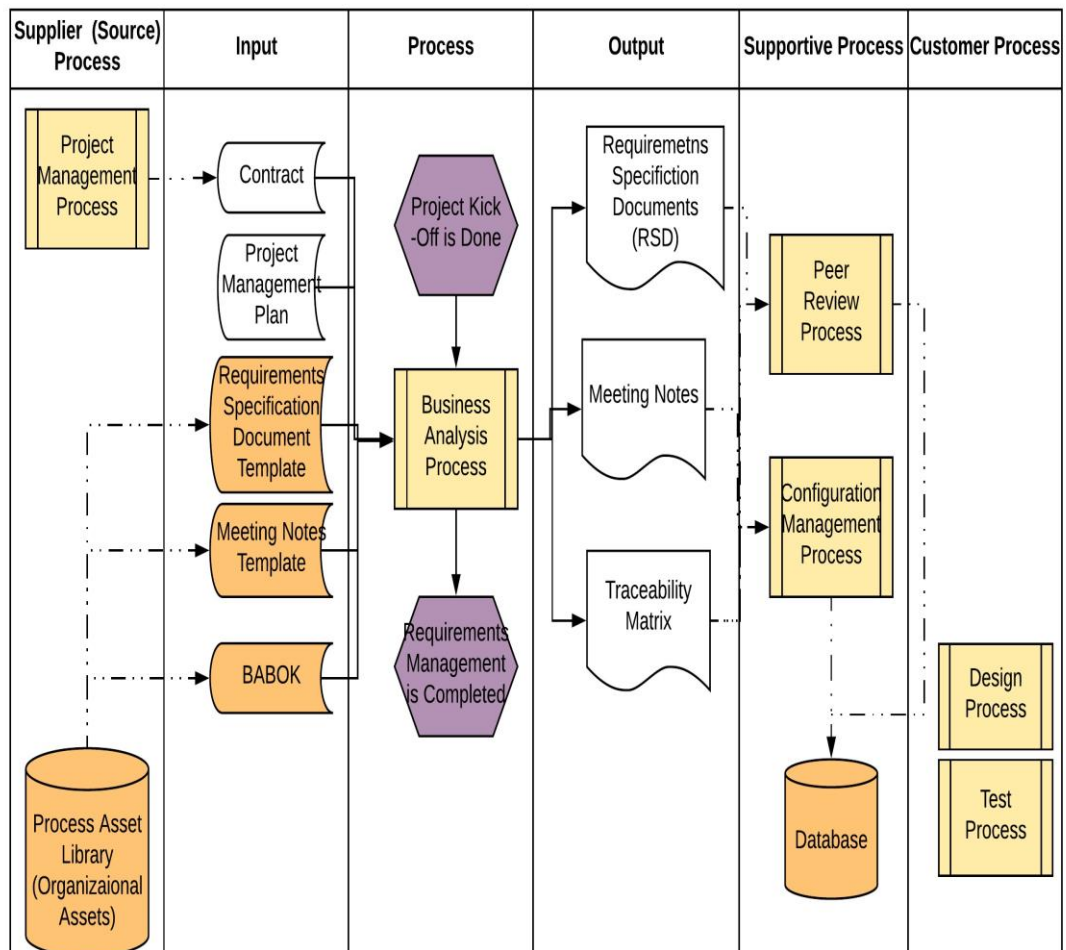


Figure 8 Business Analysis Process SPIOC Diagram

5.3 Role of Business Analysts for The Top Three Processes of PM

Business Analysts have roles and responsibilities almost on every KA of PM. In this thesis Business Analyst's role on scope management, time management and cost management topics are heavily researched.

Scope Management is the primary key KA of PM. As it is mentioned before, Business Analysts define solution scope, Project Managers define project scope. In general project managers prepare the scope management plan that describes how to manage scope of project and defines the future work. At the beginning of the project, PM should be aware of what is left in and out of scope. After project scope (i.e. how will the solution be created) is defined in the scope management plan and project management plan, Business Analyst defines the product scope (i.e. what is needed by the business). As a result, Business Analyst prepares BA Plans, which explains how to elicit requirements (business, stakeholder, solution (functional, nonfunctional) and transition).

Time Management is another core concept of PM. Time is usually described as a constraint by project managers. To manage effectively, time should be taken as a resource of the project. Project Managers prepare the schedule of project. BA tasks can be defined by collaborating with the Business Analysts. Sometimes, analysis phase takes long time because of the key stakeholders' unavailability. For this reason, BA tasks should be flexible in schedule. BA should be careful with the deadlines of BA process deliverables. All the deliverables should be produced on time. All the meetings, workshops should be completed with respect to the project schedule. If Business Analyst expects any risk to complete work items, he / she should inform the project managers.

Cost Management is another crucial part of PM. It is a parameter to measure project success directly. Project Managers should control cost in all project phases by the help of project team. Project Management Lifecycle (PML) phases are defined as Analysis Phase, Design Phase, Implementation Phase, Test and Closure Phase. It is an accepted fact that the cost of handling bugs and defects is more in later phases than in earlier phases of PML. Therefore, finding missing requirements, bugs and defects earlier is essential. Cost with respect to time graphics show exponential growth. Managing defects / bugs in the analysis phase is the cheapest stage of project life cycle as it is shown in the following. According to **Figure 9**, if Business Analyst or anybody in project team finds missing requirements at the beginning of the Analysis phase, the cost multiplier will be between 0.1 and 0.2. At this point Business Analyst may need some meetings with stakeholders. After having consensus on missing requirement(s),

Business Analyst role is to document them as a newly added /updated requirement (and use cases). If Business Analyst finds the missing point before requirement specification document is base lined, well done. In the worst case, if anybody in the project team finds missing point at the user acceptance test or maintenance phase, the cost multiplier increases to 20. In real, this is unwanted thing that project need. In order to implement new requirement, Business Analyst should define requirements, do impact analysis, and define requirements and related use cases. These issues take many time and cost for the project. If the design is affected then design specialist should update the design or make new design, and if the missing requirement affects all the other solution requirements, the project fails. As it is understood that Analysis phase of any kind of project is not very important, it is essential.

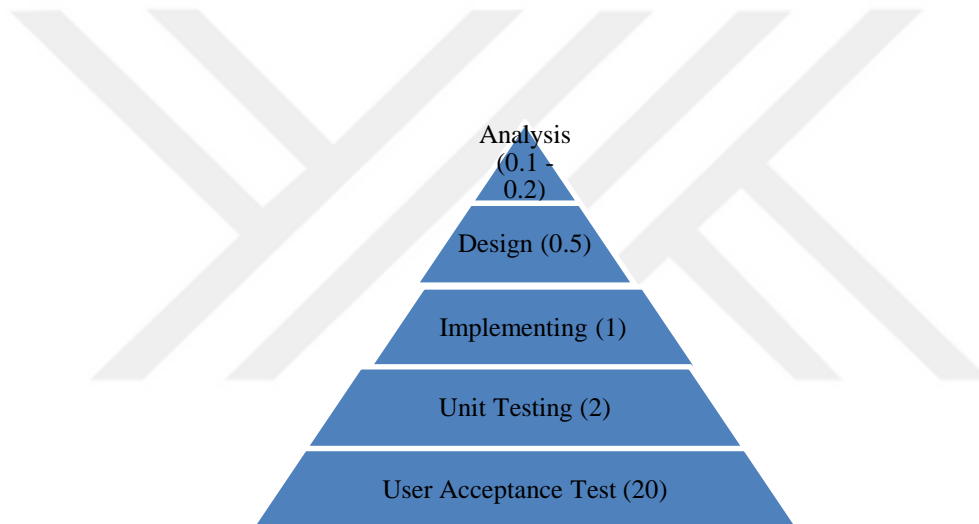


Figure 9 Measurement Cost of Defects (Lavazza et al., 2000)

In **Figure 9**, the cost of handling defect (bug) or missing requirements is explained. It is very much related with change management. As can be understood, the cost of defects, hence change requests is much higher if demanded at later phases. Any change can be requested by any stakeholder from the project team. To handle or manage this change, Project Managers, Business Analyst, Design Expert, Developer, Integrator, Customer should come together and measure the change of effect on the project. All the costs of changes should be added to the cost of project.

5.4 Summary

In this chapter, the business analysis process card, roles and responsibilities with respect to the BA knowledge areas are contributed. Furthermore, the role of business analysts for the top three processes of project management.



CHAPTER 6

6 CONCLUSION

This study focuses on Business Analysis process, its sub-processes, the relations with Project Management (PM) Knowledge Areas (KA) and Project Management process groups applied on information systems projects. Every project has an analysis phase. Scientists in International Institute of Business Analysis (IIBA) call this process as Business Analysis (BA). This phase is important for the end product and services delivered by the project, since all other phases of the project are launched based on this analysis. Many researchers and practitioners acknowledge that the success in analysis usually results with a success in the overall project. The thesis study focuses on the roles and responsibilities of business analysts and project managers on a project lifecycle. One of the main indicators of being successful on a project is the performance of the BA process. Being in line with the stakeholders about the scope and the schedule of project affect the cost of the project and the quality of the end product or service. Therefore, BA phase is mainly studied.

The processes are usually set as organizational assets. While executing the analysis phase of the project, assigned business analyst and project manager measures the performance of the project. Therefore, I propose several additional Key Performance Indicators (KPIs) for BA Process. Furthermore, I designed a framework, which illustrates the relationship between BA and PM Processes. The proposed framework includes BA KA, PM KA, PM Process Groups and respective KPIs. At the end of this

thesis, I present a middle-sized information systems software project to illustrate how to use the proposed framework in practice. Converting gathered data into meaningful information is of vital importance. Therefore, I gave somehow brief explanation, preventive and corrective actions on the results, performance measurements.

This thesis helps directly business analysts and project managers to follow the recent advancements in the analysis process. While preparing the framework presented here, I studied both BABOKv3 and PMBOK v5, which are the most up-to-date versions of these books of knowledge. Therefore, the proposed framework is a contemporary combination of BA and PM process.

Application of the proposed performance measurement framework for BA is highly depended on the right data gathering since the performance is measured with KPIs. This issue is significantly important. A business analyst and a project manager should be careful about monitoring the data and the process trend. To facilitate this task for practitioners, a BA Process Card in which the inputs, tasks, tools and techniques is proposed, Key Performance Indicators and outputs are summarized.

This thesis explained the importance of BA process by presenting the scope management, cost management and time management as an inner part of the framework. Those three KAs of PM can be defined as the triangle of the successful project with a successful analysis phase. Therefore, the information about the application of our performance measurement framework to the basic elements as well as to the broader knowledge areas of both BA and PM is provided with this thesis study. Hence, practitioners can monitor and control the product scope, project scope with the planned schedule and minimum cost by the contributed framework.

The opinions about the proposed framework is validated with the qualitative study. One – Round Delphi Study is done with five (5) participants and evaluated the opinions of those participants with five experts. As a result of this Delphi Study, the proposed framework is stated as positive and valuable.

As a future work, understanding of the proposed framework and application challenges can be investigated by studying more than one large-scaled project and short-scaled projects. Measurement of KPIs on those kinds of projects can be analyzed systematically. Moreover, the proposed framework should be analyzed and revised

when the BABOK and PMBOK are updated. The effectivity of this framework can be analyzed by both project managers and business analysts and then revised with respect to their experience. Moreover, the preventive and corrective actions taken by project managers and business analysts with respect to the results of each KPIs on each phase can be analyzed. Furthermore, the proposed framework can be studied and related with the ISO / IEC IEEE 12207 Systems and software engineering -- Software life cycle processes.

In this thesis, the different project management methodologies like agile project management have not been discussed. The case study applied for the proposed framework is middle-sized software project with waterfall project management methodology. The other project management methodologies (such as Agile project management) and business analysis methods can be studied as future work. This framework can be applied for large-sized software projects, large-sized hardware and software integrated projects.

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APPENDIX A – TERMS AND ACRONYMS

Terms	Descriptions
Business Analysis (BA)	<i>“Business analysis is the practice of enabling change in an enterprise by defining needs and recommending solutions that deliver value to stakeholders.” (Ref. BABOK v3)</i>
Business Analyst	<i>“Business analysts are responsible for discovering, synthesizing, and analyzing information from a variety of sources within an enterprise, including tools, processes, documentation, and stakeholders. The business analyst is responsible for eliciting the actual needs of stakeholders—which frequently involves investigating and clarifying their expressed desires—in order to determine underlying issues and causes.” (Ref BABOK v3)</i>
BABOK	<i>“Business Analysis Body of Knowledge is the globally recognized standard for the practice of business analysis. The BABOK® Guide describes business analysis knowledge areas, tasks, underlying competencies, techniques and perspectives on how to approach business analysis.” (Ref BABOK v3)</i>
Configuration Control Board (CCB)	A board that does impact analysis on requested changes for any item of project, product, design, requirement, schedule, contract and etc, then decides on request to approve or reject it.
Project Manager	A person whom assigned in project charter initiates, executes, monitors and controls, and closes the project.
Configuration Manager	A person whom controls the version of deliverables, software versions, executes CCB, decides on change request with CCB, and provides project team to access updated documents, sources, codes, hardware specifications, designs and etc.
Test Analyst	A person whom verifies that the approved requirement is done / developed / designed properly by the project team. Test Analyst prepares test cases, test scenarios and then do some kind of software/ hardware test with respect to the written test cases / stories.
Requirement	<i>“A requirement is a usable representation of a need. Requirements focus on understanding what kind of value could be delivered if a requirement is fulfilled. The nature of the representation may be a document (or set of documents), but can vary widely depending on the circumstances.” (Ref BABOK v3)</i>

Appendix A Terms and Acronyms (Continued)

Terms	Description
Business Requirements	<i>“statements of goals, objectives, and outcomes that describe why a change has been initiated. They can apply to the whole of an enterprise, a business area, or a specific initiative”</i>
Stakeholder Requirements	<i>“describe the needs of stakeholders that must be met in order to achieve the business requirements. They may serve as a bridge between business and solution requirements”</i>
Solution Requirements	<i>“describe the capabilities and qualities of a solution that meets the stakeholder requirements. They provide the appropriate level of detail to allow for the development and implementation of the solution. Solution requirements can be divided into two sub-categories: Functional and Non-Functional Requirements”</i>
SRS	<i>Software requirement specification</i>
Functional Requirements	<i>“describe the capabilities that a solution must have in terms of the behavior and information that the solution will manage”</i>
Non-Functional Requirements or Quality of Service Requirements	<i>“do not relate directly to the behavior of functionality of the solution, but rather describe conditions under which a solution must remain effective or qualities that a solution must have.”</i>
Transition Requirements	<i>“describe the capabilities that the solution must have and the conditions the solution must meet to facilitate transition from the current state to the future state, but which are not needed once the change is complete. They are differentiated from other requirements types because they are of a temporary nature. Transition requirements address topics such as data conversion, training, and business continuity.”</i>
Use Case	<i>“Use cases describe the interactions between the primary actor, the solution, and any secondary actors needed to achieve the primary actor's goal”</i>
Change	<i>“The act of transformation in response to a need.”</i>
Stakeholder	<i>“A group or individual with a relationship to the change, the need, or the solution. Stakeholders are often defined in terms of interest in, impact on, and influence over the change. Stakeholders are grouped based on their relationship to the needs, changes, and solutions.” (Ref BABOK v3)</i>

Appendix A Terms and Acronyms (Continued)

Terms	Description
Traceability	<i>“Traceability is used to help ensure that the solution conforms to requirements and to assist in scope, change, risk, time, cost, and communication management.”</i>
IIBA	<i>“IIBA is the independent, non-profit, professional association serving the growing field of Business Analysis to the international business community.” (www.iiba.org)</i>
Product Scope	<i>“The features and functions that characterize a product, service, or result.”(PMBOK v5)</i>
Project Scope	<i>“The work performed to deliver a product, service, or result with the specified features and functions. The term project scope is sometimes viewed as including product scope.”(PMBOK v5)</i>

