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Increasing Effectiveness Of The Zachman Framework Using The Balanced Scorecard

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INCREASING EFFECTIVENESS OF THE ZACHMAN FRAMEWORK USING

THE BALANCED SCORECARD

A Thesis

Submitted to the Faculty

of

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by

Anagha Gokhale

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To my family for their love, encouragement and blessings.

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GLOSSARY

Within this document certain terms are used which need to be defined. The definitions are given as follows:

- Enterprise Architecture (EA): EA is a strategic information asset base, which defines the business mission, the information necessary to perform the mission, the technologies necessary to perform the mission, and the transitional processes for implementing new technologies in response to the changing mission needs. (USA Federal CIO Council).

- Enterprise Architecture Framework (EAF): EA framework is a framework or a schema for an Enterprise Architecture which defines how to organize the structures and views associated with the Enterprise Architecture. (Pereira, C.M., Sousa, P., 2004).

- Zachman Framework: The Zachman Framework is an Enterprise Architecture framework for enterprise architecture, which provides a formal and highly structured way of viewing and defining an enterprise. (Zachman, J.A., 1999).

- Balanced Scorecard (BSC): Management practice that attempts to complement drivers of past performance (financial measurements) with the drivers of future performance, such as customer satisfaction,

development of human and intellectual capital, and learning. (Kaplan, R., Norton, D., 1996).

- Business-IT Alignment: Business-IT alignment is the correspondence between the business objectives and the Information Technology (IT) requirements of an enterprise. (Papp, R., 1999).

ABSTRACT

Gokhale, Anagha. M.S., Purdue University, August 2010. Increasing effectiveness of the Zachman Framework using the Balanced Scorecard. Major Professor: Jeffrey L. Brewer.

The purpose of this study is to explore the impact of integrating the use of Zachman Framework of Enterprise Architecture and the Balanced Scorecard (BSC) Framework for an effective business-IT alignment. The study tries to identify certain gaps in the Zachman Framework focusing on the motivational aspects of the framework, which have been discussed in the literature review. The aim is to achieve the integration by mitigating these motivational aspect's weaknesses in the Zachman Framework using the deliverables obtained from the BSC. Thus the author proposes to achieve business-IT alignment through this integration. No research studies in the past have tried to explore the motivational aspect of the Zachman Framework, although there have been similar studies conducted on other aspects of the framework.

CHAPTER 1. INTRODUCTION

This chapter introduces the research study by presenting the problem statement and associated research questions. The chapter concludes by stating the assumptions used in the study as well as defining the scope and significance of the problem statement.

Businesses evolve over a period of time, and so do their information systems to keep pace with the businesses. "The proliferation of IT and its consequent dispersal is an enterprise reality, although, most of the organizations do not have adequate tools and methodologies that enable the coordination of their management and information systems" (Pereira, C.M., Sousa, P., 2004). Information systems have become the organizational fabric for intra-organization and inter-organizational collaboration in business. This enables the organizations to transition from using disparate systems operating in parallel towards a more common shared architecture for the entire enterprise.

With the increase in size and complexity of information systems, it becomes necessary for the organizations to use some logical construct for defining, controlling and managing their system interfaces and integration of all the components of their systems. It also hopes for achievement of the business-IT alignment, which allows the business organization to use its information

technology effectively to achieve its business objectives (improved financial performance or marketplace competitiveness).

1.1. Problem Statement

The birth of the field of enterprise architectures is generally credited to an article published in the IBM Systems Journal in 1987, titled "A framework for information systems architecture" by J. A. Zachman (MSDN, 2006). Zachman later renamed his 'information systems architecture' to *enterprise architecture*. The Zachman Framework is one of the most popular and the most widely used standard frameworks for enterprise architecture. According to Jennifer Pfaff (CIO, March 2010), a successful enterprise architecture project can help unlock an IT department's true value to the business it supports. She considers enterprise architecture as a discipline that allows an organization to analyze its near-term business objectives and compare them with its current technological capabilities and use this analysis to make decisions about future business ventures (Pfaff, March 2010).

Cullen reported, in September-October, 2009, that Forrester conducted its State of Enterprise Architecture survey, which depicted a broad look of EA in the context of IT and business organizations (Forrester, 2009). In the survey the questions asked to the respondents ranged from where the architecture functions report, to the state of completeness of architecture domains, to the key technologies firms will be making sufficient architecture decisions about, to the

degree of support for EA. The survey results identified the current state of various parts of the EA program in an organization.
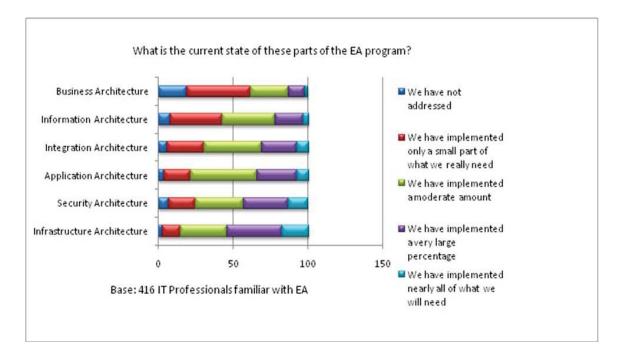
Figure 1.1. State of Enterprise Architecture (Forrester, 2009).

This shows that organizations focus more on the completeness of some viewpoints of architecture (as shown in the Figure 1.1.) than other, the importance being given to the technical architectures and less focus given to the business-focused architectures.

According to Armour, Kaisler and Liu, the disconnect and problem occurs when an enterprise's management knows when their information system must evolve with the business, but keeps patching the legacy systems to meet more requirements (Armour, F.J., Kaisler, S.H., Liu, S.Y., 1999). Niederman, Brancheau, and Wetherbe (1991) also have reported the most critical issues in IS management to be strategic planning and organizational alignment, and

technology infrastructure and architecture. It has been observed through various surveys conducted that even after implementing enterprise architecture frameworks, organizations fail to achieve their business objectives and ultimately fail in achieving their mission.

Zachman Framework does provide a conceptualization for the communication needed to achieve such an alignment. But as pointed out by Leon Kappelman (O'Rourke, C., Fishman, N., & Selkow, W., 2003) there is a huge communication gap between the Information technology which resides in the lower left corner of the Zachman Framework, and the enterprise management which resides in the top right corner. According to Varga (2003), the motivation abstractions of Zachman Framework are often neglected, nevertheless it should be considered the most influential driver in designing information systems within an enterprise.

According to Information Management Online (September, 2009) and Fierce CIO (September, 2008) not only the adoption of a successful enterprise architecture framework poses a huge problem in organizations in spite of their increasing complex information systems, but also trying to integrate the capabilities of business and IT strategies is considered today's CIO's top concerns.

1.2. <u>Scope</u>

Different organizations require different approaches to enterprise architecture and sometimes may even need to employ a combination of the

different approaches within the same organization. Gartner has identified four basic approaches to enterprise architecture implementation (cnet news, April 2010):

- Traditional – this approach has evolved over many years and results in strategy driven and highly prescriptive architecture. Traditional approach is supported by powerful governance structures that make sure the projects are compliant with organization's business strategies. It works well with organizations where decision making is largely centralized and who have clear defines business goals and strategies (silicon.com, April 2010).

- Federated – in such an approach towards enterprise architecture, the decision making power is split between various business units and the group levels. Some decisions may be standardized across the entire organizations but major decisions occur at business unit levels.

- Managed Diversity – in cases of weak governance, a total lack of compliance occurs also leading to no enterprise architecture at all. In such cases, managed diversity approach reduces complexity and costs by striking a balance between the chaos of no policy and the effect of very small number of standard choices.

- The Middle way – this approach focuses on achieving interoperability by defining a set of rigidly enforced interface standards while allowing a complete independence of decision making for specific technologies and products.

In this thesis, the author has chosen to limit her scope to the traditional approach of enterprise architecture implementation. Considering the traditional approach, the author chose Zachman Framework because it is the most widely used frameworks of enterprise architecture and was the first developed framework amongst other frameworks. The author has proposed an integrated framework that aligns an organization's business and IT for effective enterprise architecture implementation. The study uses a standard management practice for business-IT alignment called the Balanced Scorecard (BSC) and plugs in the results of this method into the Zachman Framework for enterprise architecture to achieve an effective enterprise architecture implementation. The author chose the Balanced Scorecard over other management practices because the balanced scorecard not only considers the financial aspect of business but takes into consideration the other three aspects, customer, learning and growth and internal business process. Thus it tries to clarify and gain consent on the organization's vision and strategy effectively. "The usefulness of the BSC has made it arguably the most successful and widely accepted mechanism that organizations adopt in order to achieve strategic alignment. The total usage of BSC has doubled between 1993 and 2006 with about 57% of global companies working with the BSC in one or more functions" (Ahuja, S., 2009). The application of this proposed framework will be illustrated with the help of an example which will enlighten the benefits of this proposed solution. The effectiveness of this solution will be measured on the basis of an evaluation by the subject matter experts.

1.3. Significance

Information technology has transformed organization's business trends and is the soul reasons for intra-organization and inter-organization collaborations in business. The increasing complexity of organization's Information systems and the technology behind those urged them to start implementing some kind of standard constructs which could describe the business structures and processes that connected those business structures (CMU, 2006).

According to Shaw (2010), more than 66% of enterprise architecture initiatives fail. This was a conservative estimate he derived from a Rotterdam University survey done in 2008. Before this survey, in 2007 the Gartner group had predicted that 40% of all the EA programs would terminate by 2010 because of failures. Shaw in his report threw light upon the fact that because of the implementation failures, EA success rates are not much improved even past 2010.

Ambler (April 2010) has reported results of his State of the IT Union survey on reality of enterprise architectures. A critical issue he wanted to explore was the adoption rate of enterprise architecture within organizations. Out of the total respondents only 47% of the respondents had some kind of enterprise architecture implementations in their organizations, only 9% indicated that their organizations were thinking of starting such programs, and 34% responded that they had no enterprise architecture program in place currently and had no intentions of starting one in the near future. Looking at the current status of

organizations adopting enterprise architectures, there seems to be a lot of room for improvement. In the same survey, Ambler (April, 2010) has pointed out the importance of implementing a successful and effective enterprise architecture through his 2010 State of the IT Union survey. The top five benefits as reported by the organizations that developed enterprise architecture programs were:

- Improved system integration.

- Improved IT governance.

- Greater chance that development teams follow a common technology infrastructure.

- Improved business efficiency.

- Increased data integrity.

Ambler observed that all of these significant factors focused on active involvement of the business leaders in the enterprise architecture programs, active involvement of the IT leaders in the enterprise architecture programs, enterprise architects must be active participants and must be trusted by the business leaders (Ambler, 2010).

A survey conducted by Forrester (2009) on the State of Enterprise Architecture presented a broader look at enterprise architecture in context of IT and business organizations. The survey threw light upon significant drivers for enterprise architecture implementation in any organization.
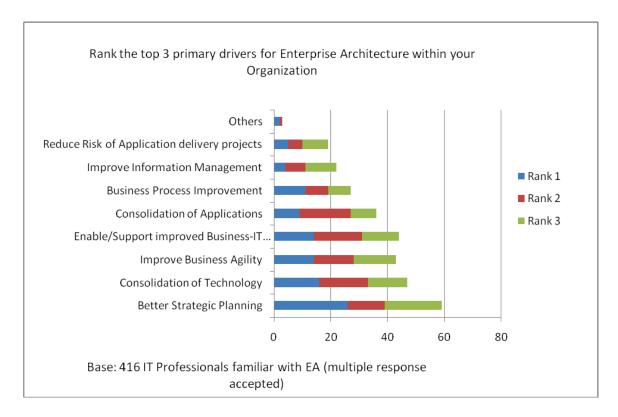
Figure 1.2. Primary drivers for EA (Forrester, 2009).

Ambler observed from his survey that the top drivers for enterprise architecture surprisingly focused on strategic and business context enabling better planning, improving business agility, and enabling better business-IT alignment. Architecture as it was practiced traditionally centering on technology and application consolidation has transitioned to being focused on better strategic planning, improving business processes and aligning the business with current technology.

Schekkerman (2004) presented results of a survey conducted by the Institute for Enterprise Architecture Developments (IFEAD) on the progress of EA usage and implementations in several organizations across the world. It was observed that enterprise architecture becomes more and more part of the

organization's Strategic Government. There has been an observed growth of 7% in the usage of enterprise architecture as a part of an organization's Strategic governance from 2003 to 2004. There is also a reported growth of 6% in establishing enterprise architecture in one's organization. It was evident from the survey that a lot of organizations define their own enterprise architecture frameworks based on the existing ones. The use of well known EA framework like Zachman has dramatically declined from 20% in 2003 to 13% in 2004 due to some issues in the framework implementation and usage.

According to Schekkerman (2005), by 2006 20% of Global 2000 organizations will integrate holistic enterprise architecture, enterprise program management, enterprise strategy planning, and IT portfolio management into a common set of IT management practices. By 2007, 50% of Global 2000 enterprises will move beyond a pure technology architecture focus to include enterprise business architecture, enterprise information architecture, and enterprise solution architecture (Schekkerman, 2005). The integration of information technology in-line with the needs of the business is the current problem most organizations are facing.

1.4. Research Question

Can the effectiveness of the Zachman Framework of Enterprise Architecture implementation be improved using the Balanced Scorecard?

1.5. Assumptions

The following assumptions are inherent to the design of this study:

- The study is entirely conceptual in nature at this stage and a practical implementation can only be undertaken at a more mature stage.

- The organization's work culture encourages them to use an enterprise architecture framework.

- Any organization working in any sector whether private or public can implement this, however it must focus on the enterprise architecture implementation.

- The organizations must be familiar with the Balanced Scorecard management practice to go ahead with this framework.

1.6. Delimitations

The research will be performed acknowledging the following delimitations:

- Only Zachman Framework and Balanced Scorecard are the limited set of tools chosen from a wide range of available tools for the purpose of this study.

- The proposed framework shall not provide metrics for each step in the framework as each organization must derive the metrics from its deployed strategy.

- The focus of the proposed framework is limited to the traditional approach of enterprise architecture implementation.

1.7. <u>Limitations</u>

The following limitations are inherent to the design of this study:

- This study will be limited to proposing an integrated framework, and so the framework may not be practically validated.

- The evaluation of the framework will be carried out by subject matter experts.

- The proposed framework is based on a literature review and does not include any data collection from industry for the purpose of this thesis.

1.8. <u>Chapter Summary</u>

This chapter introduced the study enlightening the research question contained within this research. This chapter also noted the assumptions used in the research study, along with the delimitations and the limitations according to the scope listed for the research study undertaken. It also talks about the significance of the research problem in the enterprise environment faced by the world currently.

CHAPTER 2. LITERATURE REVIEW

This chapter provides an overview summary of recent literature in the areas of Enterprise Architecture, Enterprise Architecture Frameworks, Zachman Framework, Balanced Scorecard (BSC), and Business-IT alignment providing a base understanding of all the subjects mentioned. It helps the research to try and provide for the gap in the research done in this area as well as provide for the motivation to go forward in this research study. The purpose of this chapter is to establish the need for implementing an enterprise architecture in organizations that is closely tied with the business strategy of the organization.

2.1. Introduction

The literature review will aim at reviewing the past research work done on the enterprise architectural frameworks specially the Zachman Framework, various aspects of the framework focusing on its motivational aspects and the issues surrounding that. It will also review the research work done in the field of Balanced Scorecard method of practicing business-IT alignment. Papers and journals from education, technology, and computer science and information technology were extracted and were used to review the literature surrounding the issue of enterprise application integration and business-IT alignment. The first

part of this chapter discusses some case studies of implementations of enterprise architectures and issues that the organizations faced in implementing various frameworks. It attempts to illustrate the commonalities between these cases in terms of issues the organizations faced in attempting to implement enterprise architectures. In the next part of this chapter, research work done around enterprise architectures and balanced scorecards is discussed.

2.2. Overview of the Literature

2.2.1. Architecture Alignment in a Large Government Organization

Wieringa, Van Eck, and Blanken (n.d.) have reviewed IT architecture as the structures present in the entire information technology support used by a large government organization which they name as BIGIT. As the researchers reported BIGIT has about 37000 users spread out in the Netherlands. BIGIT is a part of a large government organization which they want to call as BIG. BIGIT provides IT development and maintenance services for BIG. This case study focuses on the services provided by BIGIT to a department D within BIG organization.

In order to analyze the case, Wieringa, Van Eck, and Blanken decided to use a conceptual framework for information systems. They chose the GRAAL (Guidelines Regarding Architecture Alignment) framework for this purpose. The purpose of this study was to investigate the relationship between IT architecture

and business context in their enterprise architecture framework. The research group tried to analyze various architecture documents of the IT systems of the department D. Based on these documents they drafted an initial analysis of business-IT alignment at D. This was then verified with the IT architects of BIGIT working for D.

There were various findings that the researchers described.

- The very first finding was that there was a clear separation between applications and infrastructure in terms of acquisition and maintenance (Wieringa, R.J., Van Eck, P.A.T., Blanken, H.M., n.d.). A software system is classified as an application if it provides services for a specific user group in the BIG organization and contains knowledge that is specific for this user group. Failures are felt by this user group and in this business process only. A software system is considered a part of infrastructure if it provides services for the entire business and does not contain any knowledge particular to any user group. Failures are felt in the entire organization.

  The researchers conclude that application architecture has to be structured according to the user groups and their specific business processes. Infrastructure is not according to any particular user group and its architecture is structured according to technological domains.

- The research group observed some problem in implementing the application alignment scheme depicted by the GRAAL framework. Wieringa, Van Eck, and Blanken state that the application alignment at

BIGIT takes place in three steps. First a business strategy is laid down and a design of business processes is produced. Using this, architectural description of the entire application layer is stated. This becomes the basis for the architecture of each individual layer. This process of application alignment is not a rationally defined standard process. BIGIT needs a more rational standardized process for aligning their business context with their IT applications.

- Infrastructure architects at BIGIT follow their part of the technology. This highly technical orientation makes them less sensitive towards the business strategies and business problems (Wieringa, R.J., Van Eck, P.A.T., Blanken, H.M., n.d.). Thus a number of alignment failures occurred due to technological orientations.

- Highly specialist nature of infrastructure domain knowledge tends to isolate the domain specialists from each other.

- The researchers found that although the business goals and business issues were listed extensively, none of the infrastructure design decisions were related to the business issues. There was absolutely no traceability between the infrastructure and the business goals.

- The infrastructure design decisions were all technology driven decisions. Other decisions included in the IT goals were not followed by an action plan.

This case study shows that application alignment takes place in a different way from infrastructure alignment and these two can lead to a misalignment of

infrastructure architecture and application architecture. Also for architecture to be effective, support from customers, management as well as from all the application architects is required.

2.2.2. Enterprise Architecture Planning at Accenture

This case study shows the role of Accenture Enterprise Architecture Planning solution in achieving high performance (Accenture, 2007).

Accenture is a global management consulting, technology services and outsourcing company. Accenture collaborates with its clients to help them become high-performance businesses and governments. With more than 152,000 people in 49 countries, the company generated net revenues of US$16.65 billion for the fiscal year ended in 2006. (Accenture, 2007).

According to the management committee at Accenture, the foundation for any business capability is solid enterprise architecture. Enterprise Architecture helps them define their vision, principles, standards, and a road map that guides them to select, deploy, operate, and protect the technologies within their organization. Therefore, enterprise architecture plays a key role in effective and efficient IT operations within any IT organization.

Some findings which the management at Accenture found which could make an organization's IT functionality a failure were:

- Big gaps between layers of the organization instead of seamless relationships. Usually there are several layers within an organization such as the business layer, data layer, application layer, technology layer. Instead of a seamless relationship between these layers, there are huge gaps in the architecture.

- Operational and budget constraints result in incremental and contrasting and ineffective changes to the architecture, which in turn makes the organization unable to achieve the desired results and efficiencies.

- Technology operations risks steadily grow if appropriate investment is lacking.

The management at Accenture decided they needed a successful enterprise architecture implementation as a solution. According to them the key elements in helping to confirm a successful enterprise architecture implementation were organizational commitment, sponsorship, appropriate government, and alignment of their business goals with their IT strategies. The Accenture Enterprise Architecture Planning process is designed to facilitate collaboration and cooperation between IT and business stakeholders. Their comprehensive methodology is as follows (Accenture, 2007):

- The Accenture team evaluates and analyses the client organization's current assets, internal and external environments to help it achieve its objectives.

- Both the business and IT leaders team up to create blue prints and road maps for how the future business capabilities should operate. These

decisions can be translated into concrete actions for both business and IT

units.

- The Accenture team works with the client organization to translate their

  business and IT capabilities into practical plans with specified time frames,

  budget and resources so as to define a proper transition plan.

One example where Accenture has used its Enterprise Architecture

Planning solution is to help a state agency in United States who faced a massive

budget shortfall. The state agency needed to find ways to balance their budgets,

reduce costs incurred, and increase performance efficiencies. They needed to

streamline their duplicated services and assets, lack of coordination, and

inefficient and ineffective performances. Accenture provided the state agency

with a huge transformation plan by leveraging its Enterprise Architecture

Planning solution. It helped create an architecture strategy, and a streamlined

roadmap to help achieve an IT transformation to reduce costs.

2.2.3. Digital Library as an Enterprise

Abdullah and Zainab (2008) have presented a case study on building a

collaborative digital library meeting the needs of digital library stakeholders. The

collaborative digital library has been conceived to support secondary school

student's information needs in conducting school based projects (Abdullah, A.,

Zainab, A.N., 2008). According to them previous studies conducted in the field of

digital libraries have conceptualized and proposed several different frameworks

for the design, development, evaluation, and interaction of digital library systems. In this case study the researchers use Zachman Framework for Enterprise Architecture in designing a collaborative digital library for an urban secondary school in Malaysia.

The study adopted various data collection techniques to ensure the consideration all the aspects of a digital library system and the relationship of these dimension (aspects) in the framework used. A survey was conducted over 397 secondary 2 and 3 students to provide the type of information needed, problems faced, their willingness and motivation to collaborate and share their reports and resources, their ICT skills, their roles in this proposed digital library environment. Along with this, six focus group interviews involving 30 students were conducted to understand student's understanding and expectations. Interviews with six history subject teachers to ensure their readiness to participate in this digital library project as content managers were also done. The findings of these interviews were then used to populate the cells of Zachman Framework with contextual, conceptual, logical and module diagrams. Abdullah and Zainab felt motivation aspect of the framework should be first populated and given the most importance. The researchers found the following motivation factors from the surveys conducted (Abdullah, A., Zainab, A.N., 2008):

- School's technical readiness: ICT (Information and Communication Technology) infrastructure was set up, new infrastructure was planned, and implementation of ICT mediated learning was encouraged.

- Student's ICT readiness: high computer ownership, ease of computer access, advanced technological skills.

- Student's digital readiness: could use digital resources, adequate searching skills, familiarity with search engines.

- Teacher's readiness to collaboration: value of digital resources, value of integrating with subject learning.

- Strategic readiness: master plan for ICT integration, budget allowed by government and IPTA.

- Acceptance of the digital library: perceive digital library as useful, willingness to contribute contents.

The researchers chose to use Zachman Framework for the approach to investigate the initial requirements and define the digital library organization, technology, processes, and information flows for the following reasons:

- The digital library system requires a holistic view and control to investigate user requirements and the data gathering techniques.

- They need to consider all aspects of the digital library.

- Since the Zachman Framework is generic in nature it can be applied here perfectly.

- They need to align the digital library requirements with the stakeholder requirements and involve all the stakeholders in the library design and architecture.

2.2.4. Architectural Framework at RPC (Rapid Prototyping Capability) NASA

Stephen Marley (n.d.) agrees that architecture is the structure of enterprises, their components, and how the components fit and work together to fulfill the enterprise's goals. He analyzed the need of implementing an enterprise architecture framework at RPC NASA and concluded as follows:

- The basic problem with their organization is communications.

- No common problem solving space and common language to communicate with in the organization for people from different business units to discuss out the solutions.

- Some framework needed that can be leveraged to provide a starter set of issues and concerns that must be addressed in architecture development (Marley, S., n.d.).

- They needed some alignment method to have a seamless alignment between their organization mission and their IT initiatives.

Rapid Prototyping Capability (RPC) has to support NASA business goals. One of the goals it supports is "Study earth from space to advance scientific understanding and meet societal needs" (Marley, S., n.d.). The other Applied Sciences goals they aim at are – to understand earth's system and apply earth-system science to improve the prediction of climate, weather, and natural hazards; to enable a safer and more secure environmentally friendly air transportation system. Marley analyzed all the requirements and concluded that the framework needed for RPC should have the capability of 'business alignment' as he names it and the second should be technical capability.

2.2.5. Enterprise Architecture

Some researchers think of Enterprise Architecture as a blueprint of a business which depicts the elements of a firm. This concept of architecting the entire firm or organization, termed as Enterprise Architecture, developed after an intellect named John Arthur Zachman designed a framework for Information Systems Architecture.

In general terms, an *enterprise* is an organization or a firm formed to do business of products or services with other organizations. Architecture is a design of any type of structure, whether physical or conceptual, real or virtual. (O'Rourke, Fishman, Selkow, 2003, p.6). Organizations usually have one or more Information Systems supporting their business. These Information Systems help businesses in decision making, coordination and control, analyzing problems, and formalizing solutions to various business problems. Considering all these factors, it is extremely important that an organization defines its Enterprise Architecture to gain the associated advantages of that architecture.

The EACommunity defines *Enterprise Architecture* as a framework or a blueprint for how the organization tries to achieve its current and future business objectives. According to Pereira and Sousa (2004), enterprise architecture examines the key business, information, application, and technology strategies and their impact on business functions. The relationship between all these strategies is explained by enterprise architecture which integrates each of these disciplines into a cohesive framework. Thus the enterprise architecture achieves the previously set vision of the desired future state of the entire system by being

able to capture the entire organization/system with all its perspectives and

dependencies as described above.

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│                 ENTERPRISE ARCHITECTURE                 │
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│  │              BUSINESS ARCHITECTURE                │  │
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│  │         INFORMATION SYSTEMS ARCHITECTURE          │  │
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│  │  │   INFORMATION    │   │     APPLICATION      │  │  │
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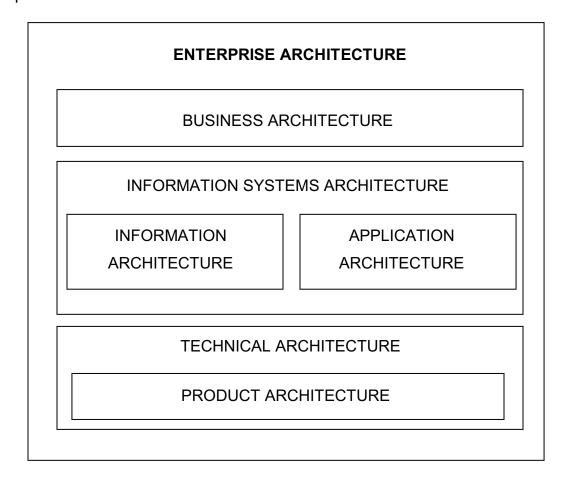
Figure 2.1. Architecture Relationships (Pereira & Sousa, 2004).

According to the published material in the Proceedings of the BUSITAL'06

Conference on Business-IT Alignment and Interoperability (Zarvic & Wieringa,

2006), an enterprise architecture is the structure of the IT systems of an

enterprise, consisting of the relationships among its IT systems, the external

properties of those systems, and the way these create emergent properties with

added value for the enterprise.

A study conducted in 1990's (Niederman, F., Brancheau, J.C., Wetherbe, J.C., 1991) addressed Information Architecture as one of the most important issues in IS management. As stated by J. A. Zachman, "with increasing size and complexity of the implementation of information systems, it is necessary to use some logical construct (or architecture) for defining and controlling the interfaces and the integration of all of the components of the system." (Pereira, C.M., Sousa, P., 2004). Pereira and Sousa believe that it is necessary to define an Enterprise Architecture in an organization to gain the following associated benefits of that architecture. (Pereira, C.M., Sousa, P., 2004).

- It enables an integrated vision and a global perspective of informational resources.
- It enhances the discovery and elimination of redundancy in the business processes reducing information systems complexity.
- It becomes a bridge between the business and technical domains.
- It imposes order and structure to the entire organization.

2.2.6. Enterprise Architecture Framework

According to J. A. Zachman, organizations are viewing the concept of Information systems architecture, which later developed as the concept of enterprise architecture and enterprise architecture frameworks, as less of an option and more of a requisite for establishing some order and control in the investment of information systems resources. This necessity or a need for a

controlling architecture led to coining the term *enterprise architecture framework* for the concept of architecting the enterprise, which provided a structured way of classifying and organizing the descriptive representations of an enterprise.

Zarvic and Wieringa (2006) define Enterprise Architecture Framework (EAF) as "a kind of implicit conceptual metamodel of the architecture of their IT systems." It describes the architecture of a business and its information technology (IT), and their alignment. The term EAF is mostly used to specify a list of important abstraction mechanisms such as perspectives, viewpoints, and dimensions. Thus an Enterprise Architecture Framework is a documentation structure for Enterprise Architectures.

As stated above, building enterprise architecture started with the Zachman Framework in 1987. Technical Architectural Framework for Information Management's (TAFIM) first draft called the TAFIM Technical Reference Model was completed in 1991, which was also one of the early implementation of the enterprise architecture frameworks. TOGAF (The Open Group Architecture Framework) was originally derived from the Technical Architectural Framework for Information Management. In recent years many frameworks such as DoDAF (the US Department of Defense Architecture Framework), MODAF (the UK Ministry of Defense Architecture Framework), and the like have been developed which have adopted the standard meta model that defines the critical architectural elements and the dependencies between them.
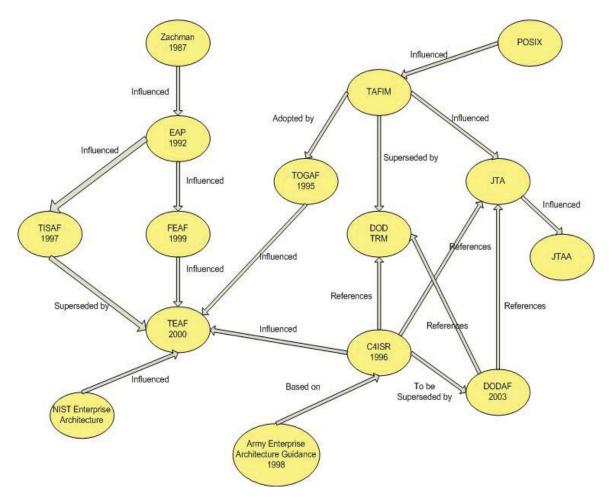
Figure 2.2. Enterprise Architecture Framework Evolution (Marley, S., 2003)

Contemporary federal studies on enterprise architecture think of the framework as having layers of the enterprise architecture.

- Business processes and activities.

- Data that must be collected, organized, secured, and distributed.

- Applications.

- Technology such as computer systems and telephone networks.

These layers show a hierarchy in the nature of all architectural views. The National Institute of Standards and Technology (NIST) in 1989 developed a reference model for Enterprise Architecture called the NIST Enterprise

Architecture Model (NIST EA Model). This framework got widely accepted and promoted in the US federal government as an Enterprise Architecture Management Tool. This architecture model is also developed on the layered view of the enterprise architecture. It is a five layered model which allows for organizing, planning, and building an integrated set of information and information technology architectures. The five layers are defined uniquely but are inter-related and inter-woven and have feedback mechanism to include the changes occurring in the lower layers into the upper layers of the framework model.

2.2.7. Zachman Framework of Architecture

J. A. Zachman, who is recognized internationally as an expert on Enterprise Architecture, introduced a well-defined framework of architecture having strong and logical connection between business processes, organization strategies and enterprise architectures. This is considered to be one of the major origins of the field of Enterprise Architecture. (Fatolahi, A., Shams, F., 2006). In his book, *Framework for Enterprise Architecture,* Zachman describes the aim of this framework as an architecture that represents the information systems' artifacts, providing a means of ensuring that standards for creating the information environment exist and they are approximately integrated. (Pereira, C.M., Sousa, P., 2004). This framework was first introduced by Zachman in 1987 and was called *Information Systems Architecture Framework* which then was extended in 1992. (Sowa, J.F., Zachman, J.A., 1992). Originally the Information

Systems Architecture Framework proposed by Zachman had only three aspects

Data, Function, and Network. In the extended framework which was then named

the Enterprise Architecture Framework by Zachman and Sowa, three more

columns or aspects of the enterprise were added namely People, Time, and

Motivation which represented the business aspects of the enterprise.

Zachman defines his framework as,

> The Zachman Framework is a two dimensional classification
>
> schema, a normalized schema. It is the intersection between two
>
> historical classifications that have been in use for literally thousands
>
> of years, the universal linguistic communications classification of
>
> primitive interrogatives: What, How, Where, Who, When, and Why;
>
> and the classification of audience perspectives: Owner, Designer,
>
> Builder, bounded by the Scoping perspective, and the
>
> Implementation perspective. (Zachman, 2006).

Neaga and Harding (2005) suggest a similar definition of the framework.

According to the authors the Zachman Framework can also be defined as a

conceptual methodology which shows how all of the specific architectures that an

organization might define can be integrated into a comprehensive and coherent

environment for enterprise systems. It is an analytical model that organizes

various representations of architecture. It does not describe an implementation

process and is independent of specific guidelines (Frankel, D.S. et al., 2003).

Zachman Framework is typically depicted as a 6x6 matrix in which the

architecture is described using two independent aspects, rows represent the

different audience perspective used to view a business, and the columns

represent the various communication interrogatives which apply to each

perspective of the business.

	Data (What)	Function (How)	Network (Where)	People (Who)	Time (When)	Motivation (Why)
Scope (Contextual) Planner	List of things important to business	List of core business processes	List of business locations	List of important organizations	List of Events	List of business goals/ Strategies
Business model (Conceptual) Owner	Conceptual data / object model	Business Process Model	Business Logistics System	Work Flow Model	Master Schedule	Business Plan
System model (Logical) Designer	Logical Data Model	System Architecture Model	Distributed systems architecture	Human Interface architecture	Processing Structure	Business Role Model
Technology model (Physical) Builder	Physical Data / Class Model	Technology Design Model	Technology Architecture	Presentation Architecture	Control Structure	Rule Design
Detailed Representations (out-of-context) Subcontractor	Data Definitions	Program	Network Architecture	Security Architecture	Timing Definition	Rule Specification
Functioning Enterprise	Usable Data	Working Function	Usable Network	Functioning Organization	Implemented Schedule	Working Strategy

Figure 2.3. Zachman Framework (Zachman, J.A., 2003)

The following *Perspectives* are depicted by different rows in Zachman Framework.

- Scope (Planner's Perspective) – the planner is concerned with defining the context for the enterprise including specifying its scope.

- Business Model (Owner's Perspective) – the owner is interested in modeling the enterprise using business modeling techniques yielding business deliverables.

- System model (Designer's Perspective) – the designer had to ensure that the enterprise is so modeled that it fulfills the owner's expectations. He tries to logically model the IT environment.

- Technology Model (Builder's Perspective) – the builder is responsible for assembling and managing the various components of the system. The logical design models developed by the designer are mapped onto technology dependent design models to give rise to physical models.

- Detailed Representations (Subcontractor's Perspective) – the subcontractor has to manufacture out-of-context components for meeting the builder's expectations. He is responsible for the detailed implementation models.

- Functioning Enterprise – this includes the real working enterprise.

Columns of the Zachman Framework provide focus on each of the perspective while keeping others constant. They facilitate the abstraction of the enterprise's information in a way that is suitable for modeling purposes. (Fatolahi, A., Shams, F., 2006).

- Data (What?) – this column answers the question, 'What are the important things that the enterprise is dealing with?' It gives the material composition of the object, the bill-of-materials for enterprises, the data models. (Zachman, J.A., 2003).

- Function (How?) – the question, 'How does it run?' is answered by the function column. The rows in this column describe the translation process of the mission of an enterprise into more detailed objectives.

- Network (Where?) – this aspect is concerned with the geographic locations where the enterprise's activities are distributed.

- People (Who?) – it tries to answer the question, 'Who does what work?' So this aspect describes who all are involved in the business and what are their functions.

- Time (When?) – this aspect tries to answer the question, 'When do things happen relative to one another?' It describes the effects of time on the enterprise's business.

- Motivation (Why?) – the question, 'Why the enterprise does what it does?' is answered by this aspect. This domain is concerned with the translation of the enterprise's strategies into specific objectives.

Certain rules govern the framework which provide for the framework's integrity.

2.2.7.1. <u>Purpose of Zachman Framework</u>

The Zachman Framework of enterprise architecture is one of the most widely accepted frameworks amongst the other enterprise architecture frameworks. As Zachman proposed the foremost purpose of this framework is to provide a logical structure which classifies and organizes the descriptive representations of an enterprise that are significant to the management of the enterprise as well as to the development of the enterprise's systems. In his paper, *The Framework for Enterprise Architecture: Background, Description, and Utility,* Zachman has provided for the purpose of each row of his proposed framework. (Zachman, J.A., 1996).

- The purpose of row 1 artifacts described in the framework is to define the boundaries of the enterprise, which includes the scope of the enterprise.
- Row 2 artifacts' purpose is to conceptually define what the enterprise owners have in mind.
- Row 3 artifacts design how the concepts of the enterprise will be realizes systematically.
- The purpose of row 4 is to define the enterprise implementation keeping in mind the technology constraints.
- Row 5 artifacts' purpose is to specify the implementations to specific technology products being used for the implementation.

The Zachman Framework provides a perfect balance between the holistic contextual view and the implementation view of an enterprise. It also allows for abstractions proposed for simplification of understanding and communication

throughout the enterprise, clearly defining the focus of the enterprise for analytical purposes, making better choices in the context of the enterprise (acting as a planning tool), and enabling one to work with abstractions to simply and isolate simple variables without losing sense of the complexity of the enterprise as one.

According to Varga (2003), the purpose of Zachman Framework is to provide a basic structure that supports the organization, access, integration, interpretation, development, management, and changing of a set of architectural representations.

2.2.7.2. Why Zachman Framework?

As seen earlier there are many frameworks for enterprise architecture developed after the Zachman Framework for enterprise architecture. For this research study, the researcher has chosen to work with the Zachman Framework for enterprise architecture because of its vast popularity. According to Pereira and Sousa (2004), the Zachman Framework is the most widely known framework in the Enterprise Architecture context. It is the most referenced framework which makes itself a basis for evaluating, establishing, and customizing other enterprise architectural frameworks, methods, and tools. (Fatolahi, A., Shams, F., 2006). The reason for its extensive popularity and use is that it is an extremely flexible framework and just defines the logical structure of any enterprise. Thus it does not impose a particular method or any restrictions on users to use a particular set of pre-defined artifacts unlike other frameworks developed in this field.

Schekkerman (2003) in his survey has pointed out that quite a lot of organizations, almost 20%, do their enterprise architecture related activities upon the Zachman Framework, which is by far the highest rate amongst all the other frameworks. Although the US Federal Enterprise Architectural framework (FEAF) is gaining popularity amongst these organizations, but FEAF has been developed using the Zachman Framework as a basis and influence.

Zachman Framework differs from other architectural frameworks in its independent and holistic view of the enterprise. (O'Rourke, C., Fishman, N., Selkow, W., 2003). According to O'Rourke, Fishman and Selkow, Zachman Framework is neutral with respect to methodology, process, and technology, including the breadth of scope for the enterprise. Even if the external influences on the enterprise change, Zachman Framework remains the same.

2.2.7.3. Strengths of Zachman Framework

The Zachman Framework of architecture is the most popular framework in the area of Enterprise Architecture. It is also considered a basis for many other frameworks developed after the Zachman Framework such as Federal Enterprise Architectural Framework (FEAF). According to Zachman, this framework for enterprise architecture which was formerly known as the framework for information systems architecture, has proven quite valuable for (Zachman, J.A., 1999),

- Improving the communications within the information systems community.

- Placing a wide variety of tools and methodologies in relation to one another.

- Understanding the reasons for developing any architectural representation.

- Understanding the risks of not developing any architectural representation.

- Rethinking the classic approach of "application development process".

Also as pointed out by Fatolahi and Shams (2006) in their paper, most of the Enterprise Architectural tools such as *System Architect* have compatibility with Zachman Framework. Along with this the most applied and used methodology for Enterprise Architecture planning provided by Spewak (Fatolahi and Shams, 2006) is also intended to develop its products based on Zachman Framework for architecture.

2.2.7.4. Weaknesses of Zachman Framework

Although the Zachman Framework is amongst the most popular frameworks of architectures in the field of Enterprise Architecture but it has some drawbacks which researchers have shown concern for in the past. The Zachman Framework is very generic and can over simplify some of the enterprise issues such as its business performance and behavior, although it takes into consideration decision support systems, analytical processing and data exploration. (Neaga, E.I., Harding, J.A., 2005). Some researchers have argued in the past that it is not an easy task to build up architectures using the Zachman

Framework for architecture. Since the framework is firmly constrained using rigorous formal rules which govern the framework's integrity some difficulties appear in building up architectures if a full coverage on the framework is intended.

Fatolahi and Shams (2006) have summarized these difficulties in three major problems:

- A lack of methodology covering all the aspects of the framework.

- A lack of repository storing the framework in accordance with the integrity rules.

- Lack of a popular modeling notation for all of the framework's columns.

Leon Kappelman, Professor and Director of Information Systems Research Center, College of Business, University of North Texas, pointed out that IT lives in the lower left-hand corner of the Zachman Framework, but enterprise management is at the upper-right corner, this communication gap needs to be closed to have a real alignment in the Information Age.

2.2.7.5. Motivational Issues in Zachman Framework

With increasing size and complexity of the implementation of IT and its consequent dispersion, it has become a necessity of all the organizations to use some kind of logical constructs, or tools, or methodologies that enable the management to coordinate with their information systems. As rightly said by the scholar and a professor of Information Systems, Leon Kappelman, "in one form

or the other, the alignment of information technology with the rest of the
enterprise has been the key concern of the IT management since late 1960s."
(O'Rourke, C., Fishman, N., Selkow, W., 2003). This alignment is still not been
achieved by most of the organizations. Zachman Framework does provide a
conceptualization for the communication needed to achieve such an alignment.
But as pointed out by Kappelman there is a huge communication gap between
the Information technology which resides in the lower left corner of the Zachman
Framework, and the enterprise management which resides in the top right
corner.

In the past many researchers have tried to use the Zachman Framework
for their research studies, however, they have focused their studies on mainly
three aspects of the framework which are namely, Data (What), Function (How),
and Network (Where). According to Varga (2003), the motivation abstractions of
Zachman Framework are often neglected, nevertheless it should be considered
the most influential driver in designing information systems within an enterprise.
The columns in Zachman Framework represent different information systems
(enterprise's) abstractions. The *Motivation* abstraction is concerned with the
conversion of business goals and strategies into specific business objectives and
rules.

As stated by the definition of Information system, its objective is to
improve business process efficiency, support good quality management and
increase decision making reliability. This to a certain extent implies that no
information system can exist by itself; it is always a subsystem of some

enterprise. So a considerable amount of knowledge of the organization's function and structure are needed to design an information system. These enterprises/organizations ought to be able to give a reason behind its functions and processes by stating the motivation of their business. Varga (2003) states that motivational abstractions are key drivers in the development of enterprise's other abstractions such as data, function, network, people, and time. Thus defining motivation column in the contextual perspective is the source of information for defining other columns in the contextual perspective as it first defines major business goals and business plans of the enterprise. Also defining motivation column in the logical perspective is the source of information for defining other columns in the logical perspective and so on.

Motivation in the contextual perspective is mainly represented by the enterprise's vision. A vision statement is a company's inspiration, a framework for all the future strategies. Whether for all or part of an organization, the vision statement answers the question, "where do we want to go?" This vision statement is made operative by mission and strategy. Varga (2003) brings up this issue stating that no standard methods are available to express the enterprises mission, vision, and strategy. These vision, mission and strategy are then translated into a business plan in the conceptual perspective.

The idea is to use a standardized well developed methodology to build these mission and strategy statements from an enterprise's vision statement and follow it up with the business plan, business goals and specific objectives. This

would enable the businesses, business units, and functional business areas to drive the strategies based on goal definition and measurement.

2.2.8. Balanced Scorecard (BSC)

By the simplest definition, a Balanced Scorecard (Kaplan & Norton, 1996) is a strategic alignment system that is generally used for alignment of business and IT strategies within an organization. The existence of an architectural framework for the entire enterprise does not guarantee that the architectural motivational abstraction artifacts are aligned with the business and IT strategies of the enterprise. In order to avoid situations of inefficient and ineffective business processes, it is important to use an alignment mechanism. The Balanced Scorecard (BSC) is a strategic planning and management system that is used extensively in industry and business to align business activities to the vision and strategy of the organization, improve internal and external communications, and monitor organization performance against strategic goals (Balanced Scorecard Institute [BSCI], 2009). With time and with its usefulness, BSC has arguably become the most successful and widely used business standard that organizations adopt to achieve strategic alignment.

The Balanced Scorecard Pyramid shown in figure 2.4 addresses the question of building an entire balanced scorecard for an organization right from their mission statement down to the initiatives they have to take to accomplish their mission. The pyramid assures the traceability from the bottom layer (initiatives) to the top layer (mission).
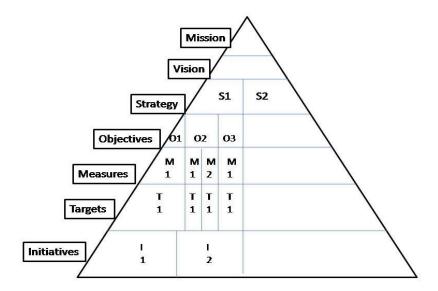
Figure 2.4. Balanced Scorecard Pyramid (Kaplan & Norton, 1996)

The *mission* statement is a clear and to the point representation of the organization's purpose for existence. It basically tells the world what is the purpose of the organization and what do they do. Mission statement is the top most level of our balanced scorecard pyramid. Normally, the mission statement represents the broadest perspective of an enterprise's mission. After any organization has their mission statement ready, they should further drill down and try to formalize their vision statement. Basically the vision statement describes the company's picture of future. It defines the desired or intended future state of any specific organization or enterprise in terms of its fundamental objectives and its strategic plan direction. So a vision statement says what you want to accomplish tomorrow. Further going down in the balanced scorecard pyramid,

after an organization's vision is clear, they need to build on some strong

strategies to accomplish their vision of the future of their company. "Strategy is

the direction and scope of an organization in the long run, which achieves

advantage for the organization through its configuration of resources within a

challenging environment to meet the needs of market and to fulfill stakeholder's

expectations." (Johnson, Scholes, 2002). To accomplish the strategic results and

move along the strategies identified for any organization, they need to develop

some objectives to fulfill. Thus drilling down a bit more in the pyramid of balanced

scorecard an organization now has to define the objectives for the listed

strategies. An objective defines a sub-goal of any organization which tries to

achieve the strategic results laid out in the previous step in the balanced

scorecard. It identifies a short-term measurable step within a designated period

of time that is moving towards achieving a long-term goal. So the objectives

which are aligned with the specific strategies tell us what continuous

improvement processes or activities are needed to get those strategic results.

Laying out objectives is not the only thing which would help any organization to

achieve their strategic goals. The objectives laid out in the above step of the

balanced scorecard need to be measured accurately to identify what needs to be

achieved and thus help in achieving the goals. The measures described in the

previous step of the balanced scorecard need to have some target value, which

the organization should try and achieve in order to take the greatest advantage of

these measures. After defining targets to these measures, an organization knows

that how each objective will be measured and how each measure should try and

reach its target to fulfill the requirements. The last part or the lowest level of the balanced scorecard pyramid talks of the initiatives to be taken by the company in order to achieve all the upper layers.

For organizations to realize their specific business goals successfully, Balanced Scorecard provides with four specific domains. These four views play a key role in identifying the business's critical success factors (Chavan, M., 2007).

- The *Financial Perspective* captures the business value created from different investments. It makes sure that right initiatives are taken to capture return on capital, improved shareholder value, and asset utilization.

- The *Customer Perspective* represents the user evaluation. It ensures that the customers are satisfied with the business and its deliverables by measuring the product/service attributes, customer relationships, and image and reputation of the organization.

- The *Internal Business Perspective* evaluates the IT processes and other operational purposes. It measures developed products and services, post-sale services and so on.

- The *Learning and Growth Perspective* tries to address the concern of sustaining the ability of the business to change and improve over time to achieve the organization's vision. It measures employee capabilities, information system capabilities, motivation, and empowerment and alignment.
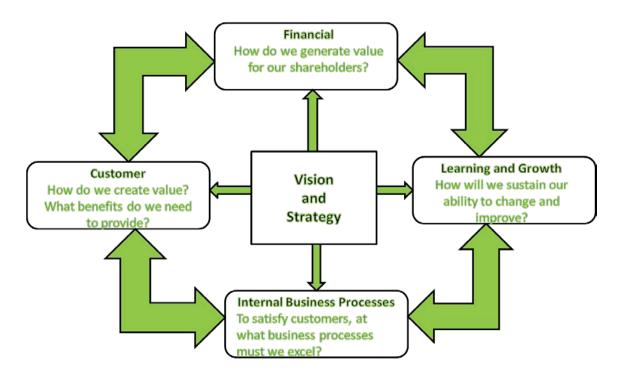
Figure 2.5. Balanced Scorecard Perspectives (Kaplan & Norton, 1996).

These four perspectives aim for a complete description of what you need to know of your business. They ensure a comprehensive understanding of the overall organizations mission and vision and thus enable the organizations to build right strategies. Keeping in mind these four domains, the organizations strategies are built which relate to the mission and vision statements of the organization. Objectives are defined for each of the four perspectives which correspond to the strategies established earlier. Additionally, a set of measurement metrics are established to ensure the benchmarks that can provide a scale for measuring success. Targets which correspond to the set measurement metrics are established. After setting the targets, specific initiatives are laid out for management to attain those targets.

2.2.8.1. <u>Benefits of using Balanced Scorecard</u>

The purpose of a Balanced Scorecard is to guide, control and challenge an entire organization towards realizing a shared conception of future (Chavan, M., 2007). There are two main problems in business and IT management and alignment as addressed by Van Der Zee and Jong (1999). The very first problem is the time lag between business and IT processes, and the second problem is the lack of a common language between business and IT management. Van Der Zee and Jong (1999) proposed to use Balanced Scorecard approach to tackle both the problems considering the incontrovertible benefits of the BSC method in contrast to traditional methods.

- Business and IT management can use the same 'performance measurement' language thus integrating IT planning and evaluation fully into business context.

- Integrating the business and IT management processes considerably reduces the time lag between the two. IT functionality can be planned more quickly and therefore the time to market of business changes will be shortened.

- Using a balanced scorecard approach IT can be managed using an integrated planning and evaluation cycle. Balanced scorecard provides for overall goals and targets for the organization, including those for IT.

- By using the measures defined by Balanced Scorecard, one can calculate the strength of relation between the value drivers.

- Integration using BSC will lead to shared visions and harmonized actions which in turn will lead to effective and efficient business solutions.

- It helps the organizations to understand their key performance indicators that drive businesses.

2.3. <u>Chapter Summary</u>

This chapter summarized the existing literature on the enterprise architecture and the frameworks used for the implementation. It also signified the importance of enterprise architecture frameworks in the area of business-IT alignment and why should enterprises try and use the architecture frameworks in terms of increasing their performance and effectiveness. Additionally the chapter covered previous work in the fields of enterprise architecture and business-IT alignment emphasizing the importance of Balanced Scorecard. It also provides a certain amount of motivation for further research in the area of using the architectural frameworks in IT governance.

CHAPTER 3. METHODOLOGY

This chapter will cover the study design and the research methodology used in this thesis. It also discusses the goals of this study and the verification criteria used.

3.1. Research Methodology

Research methods can be classified in mainly two ways, quantitative research methods and qualitative research methods. Quantitative methods were originally developed in the natural sciences to study natural phenomena (Myers, M.D., 1997). These methods include surveys, laboratory experiments, formal methods like econometrics, and numerical methods like mathematical modeling. Qualitative research methods were first developed in the subjects of social sciences to help the researchers to study the social and cultural phenomena. These include action research, case study method, ethnography, grounded theory, and phenomenology.

The author chose to use a case study research method in this thesis. Case study research is the most common qualitative method used in information systems (Alavi, M., Carlson, P., 1992). There are a numerous definitions

available for case study research methodology. Yin (2002) defines the scope of the case study as follows (Myers, M.D., 1997):

> A case study is an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident.

Case studies are not intended as a study of the entire organization, instead they are focused on a particular issue, problem, or a feature for analysis. Thus a case study research method is based on an in-depth investigation of a single individual, group, or event to explore causation in order to find underlying principles (Yin, R.K., 1981).

Noor (2008) has pointed out some advantages of case study method which try and justify why the author chose to use this research method (Noor, K.B.M., 2008):

- It enables the researcher to gain a holistic view of a certain phenomenon or issues since many sources of evidence are used.

- Case study is useful in capturing the emergent and immanent properties of life in organizations and the flow of organizational activity.

- This method also allows generalization as the result of use of the findings from multiple cases which can lead to some form of replication.

According to Myers (1997), "clearly case study method is well suited to Information Technology research since the object of discipline is study of

information systems in organizations and the interest has shifted to organizational rather than technical issues" (Myers, M.D., 1997).

In this thesis the author uses a case study approach to analyze different examples of enterprise architecture implementations and the successes, failures and issues experienced by the organizations. The sources of information used for the case study research method are limited to the documents, papers, and reports talked about in the literature review and the author does not involve any other methods of data collection.

The actual methodology of developing the proposed framework for effective enterprise architecture implementation is based on the life cycle process in software development, the waterfall model. It focuses on identification of problems and issues faced by organizations in implementing any kind of enterprise architecture framework, development of the proposed framework based on Balanced Scorecard, verification of the proposed solution by the subject matter experts.

The phase one of the framework development lifecycle is *Define scope and requirements*. The author has tried to establish the scope and requirements as specified in the problem statement of this proposed framework in chapter one of this document. The case studies employed in the literature review for implementation of this proposed enterprise architecture framework also help in formulating the requirements of the proposed framework. The findings from these case study examples illustrate the need for an effective approach towards enterprise architecture.

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│  Define scope and   │
│   requirements      │
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          │
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    ┌─────────────────────┐
    │     Analyze         │
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            │     Proposed        │
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            │  Application and    │
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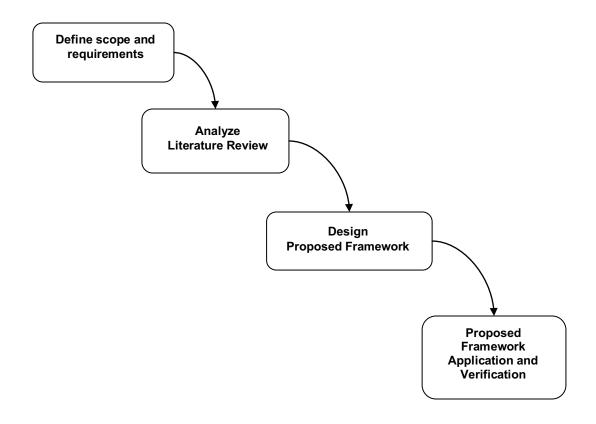
Figure 3.1. Framework Development Lifecycle

The phase two *Analyze Literature Review* of the framework development lifecycle includes the literature review done in the document. It helps the author to establish the need for implementing an enterprise architecture in organizations that is closely tied with the business strategy of the organization. Several case studies that have been explained in the literature review will help the author in analyzing the problems and issues faced by organizations in details. Furthermore, it gives an overview of the Zachman Framework of architecture which is the basis of the proposed framework, its benefits and weaknesses. It also covers the review of balanced scorecard method emphasizing the benefits

and characteristics of this method, which have been used in the development of the proposed framework. Phases one and two have been completed in chapter one and two respectively of this document.

The phase three of this framework development life cycle is *Design and development of proposed framework*. This phase will be covered in the next chapter of this thesis. It covers all the aspects of the proposed framework in detail. It gives an answer to the following questions: how to ensure a balanced view for architectural purposes, how to integrate the business requirements with architectural artifacts, how can measurement and traceability be ensured and so on. In this phase the author designed the proposed framework by plugging in the output of the Balanced Scorecard framework into the first three rows of the motivational aspects of the Zachman Framework. The output of Balanced Scorecard is in the form of business strategies, business objectives, goals, measurements, and initiatives which will be tied up in the business strategies and goals perspectives of the motivational aspect of the Zachman Framework.

The last phase, *Proposed Framework Application and Verification* covers the implementation and verification aspects of the proposed framework development. A checklist was generated by the author to verify whether the proposed framework delivers the requirements effectively and correctly. The application of this proposed framework uses one of the cases discussed earlier in the literature review to implement the proposed framework and justify its validity.

3.2. Research Goals

The analyses of enterprise architecture implementation failures or issues explained in the case studies signify the gap between information technology and enterprise management. This gap can be addressed effectively by using a balanced scorecard which tries to align the business strategy with the architectural motivation aspect. The proposed framework achieves the following goals:

- A strategic approach to the process of enterprise architecture implementation focusing on business strategies.

- Balanced view of all the stakeholders in deciding the business goals for the contextual scope of the enterprise architecture.

- Justification for investment in implementing enterprise architecture.

- Seamless integration of all layers of the organization based on the enterprise architecture framework.

- Allowing the use of other frameworks/standards/methodologies as plug-ins for addressing any other aspects of the framework.

3.3. Verification Criteria

A checklist developed by the author in the next section of this chapter, which will establish the success criteria of the proposed framework. This checklist will aim to validate whether the proposed framework effectively addresses the requirements and findings from the case study, also that the

balanced scorecard has been successfully engaged in the proposed framework. It will be developed based on the stated goals of the proposed framework.

The author will get the checklist reviewed and validated from the chair of the thesis committee, Prof. Jeffrey L. Brewer, and the other committee members, Prof. John A. Springer and Prof. Kevin C. Dittman. They are the subject matter experts in the field of enterprise architecture and balanced scorecard. Unfortunately the proposed framework is currently entirely theoretical and the real life implementations of this could happen only at a future mature stage, so the validity of the framework is entirely based on the validity of the checklist by the subject matter experts. The author has taken this into consideration in the limitations of this thesis.

3.4. Verification Checklist

The following checklist establishes the success criteria of the proposed framework. The checklist is based on the goals of the proposed framework illustrated above. The checklist intends to verify whether the proposed framework effectively addresses the findings or not. It also aims to validate that the discussed characteristics of the Balanced Scorecard framework have been successfully employed in the proposed framework.

Table 3.1. *Checklist for evaluating the success of the proposed framework*

Goals	Verification Criteria	Check
Balanced view of stakeholders from the four described perspectives	Does the proposed framework give due consideration of all the perspectives to be considered?	Yes/No
	Does the proposed framework mandate the participation of both business and IT experts in the development of the framework?	Yes/No
	Does the proposed framework help in establishing enterprise architecture strategies based on the four perspectives?	Yes/No
Holistic enterprise architecture approach keeping business strategies in focus	Are the EA objectives aligned with the business strategy of the organization?	Yes/No
	Do the EA objectives give consideration to the critical success factors or key performance indicators of the organization?	Yes/No

Table 3.1. *Checklist* (Continued.)

Goals	Verification Criteria	Check
	Does the proposed framework allow the use of quality assurance mechanisms in an enterprise?	Yes/No
Measurement of the framework objectives and traceability of actions back to the business strategies	Are the framework initiatives tied back to the overall organization's business strategy?	Yes/No
	Does the proposed framework provide scope for measurement of those framework objectives?	Yes/No
Ability for organizations to justify EA budgeting	Does the proposed framework take into consideration the financial aspect of the business strategy?	Yes/No
Act as a meta-framework that allows use of other industry standards/methodologies/fra meworks as plug-ins	Is the proposed framework flexible to allow the use of other standards, guidelines, methodologies, and/or frameworks for achieving the framework objectives?	Yes/No

Table 3.1. *Checklist* (Continued.)

Goals	Verification Criteria	Check
Seamless integration of all layers of the organization based on the enterprise architecture framework.	Does the proposed framework fulfill the objective of mitigation of the various gaps observed in the Zachman Framework?	Yes/No

3.5. Chapter Summary

This chapter has given an insight into the research methodology employed in the thesis along with the research goals and the verification criteria.

CHAPTER 4. THE PROPOSED FRAMEWORK

The chapter presents the proposed framework for addressing the issues or problems in the Zachman Framework of Enterprise Architecture illustrated in the literature review done along with a complete description of the four views adapted from the Balanced Scorecard. It also provides a high level implementation and application of the proposed integrated framework with the help of one of the cases discussed in the literature review. The chapter concludes with the evaluation of the proposed framework effectiveness.

This study is based on the conceptual development of a comprehensive framework for the Enterprise Architecture using Zachman Framework and Balanced Scorecard. In order to integrate these existing frameworks it is important to understand how they work individually and then conduct a detailed study of how they can be integrated.

4.1. Standalone use of Zachman Framework

The Zachman Framework as it applies to Enterprises is simply a logical structure for classifying and organizing the descriptive representations of an Enterprise that are significant to the management of the Enterprise as well as to the development of the enterprise systems. According to Sowa and Zachman

(1992), it compares the perspectives in describing the information system to the

perspectives produced by an architect in designing and constructing a building.

Therefore the rows in the Zachman Framework have the corresponding

perspectives as *Planner, Owner, Designer, Builder, Subcontractor, and* finally the

Functioning Enterprise. Each row represents a different role or perspective,

different set of constraints, and therefore different model structures. The columns

in the Zachman Framework describe *Data, Function, Network, People, Time, and*

Motivation. Inside the cells are the examples of notations used to describe the

corresponding perspectives on an information system.

Table 4.1. *Motivation aspect of Zachman Framework*

	Motivation (Why)	
Scope(Contextual) Planner	List of Business goals/strategy	Ends = mission / goals
Business model (Conceptual) Owner		Business Plan Ends=goals/ objectives Means=tactics/plans
System model (Logical) Designer		Business Rule Model Ends = structural assertion Means = action assertion

Table 4.1. *Motivation aspect of Zachman Framework* (Continued.)

Motivation (Why)		
Technology model (Physical) Builder		Rule Design
		Ends = condition
		Means = action
Detailed Representations (out-of-context) Subcontractor	Rule Specification	
		Ends = sub-condition
		Means = step
Functioning Enterprise		Strategy

This study focuses its research on the Motivation aspect or column of the Zachman Framework. The motivation (why) column consists of the descriptive representations that depict the motivation of the enterprise. Sowa and Zachman (1992) gave the basic columnar model for the motivation aspect to be *ends-means-ends*. Here ends are the objectives or goals of the business and means are the strategies employed to achieve those goal. In the contextual perspective for Motivation aspect, Zachman Framework defines the artifacts in terms of list of business goals and strategies. The artifact in the conceptual perspective is the business plan which basically shows the goals of the enterprise. Some of the proposed elements of a business plan are as follows: *vision* is a statement of the future state of an enterprise; it is made operative by a *mission,* and amplified by

goals. A goal is supported by *strategies.* It is quantified by *objectives.* An

objective is achieved by *tactics.* The logical model which is the designer's

perspective has business rule model for its artifact. There is no method defined

and standardized by Zachman or any other researcher to express the vision,

mission, strategy, goals, and objectives of the enterprise and to tie those with the

motivation strategies in the Motivation aspect of the Zachman Framework. Thus

there exists a huge gap which does not tie up the business strategies of an

enterprise with the strategies specified in the Motivational aspect of the Zachman

Framework. Also a gap exists between IT strategies and the business strategies

of enterprises which is not specified or shown in the Zachman Framework of

architecture.

4.2. Standalone use of Balanced Scorecard

The Balanced Scorecard is basically used to achieve a strategic alignment

between an organization's business strategies and IT strategies. This section

explains the various components of the Balanced Scorecard framework when

used individually, following a top-down approach starting from business

information and going down to information technology and enterprise architecture

initiatives and requirements.

The process of Balanced Scorecard can be used as a strategic

management system to manage strategy over the long run. It was originated by

Dr. Robert Kaplan (Harvard Business School) and Dr. David Norton as a

performance measurement framework that added strategic non-financial

performance measures to traditional financial metrics to give managers and executives a more balanced view of organizational performance. This broader focus brings in a long term strategic dimension to the business, by not only looking at the short term financial performance, but also at how the organization is going about delivering the results, and checking on the overall strategic health of the organization. The process of Balanced Scorecard in a nut shell:

- Clarify and translate vision into strategy.

- Communicate and link strategic objectives and measures.

- Plan, set targets and align strategic initiatives.

- Enhance strategic feedback and learning.

The mission and vision of the business are the driving factors behind the BSC (Balanced Scorecard) approach. The purpose of existence of the organization is determined by its mission and the value of the services it aims to provide is detailed in the vision. A strategy document is then drafted and formulated by the organizations upper management which ensures that the mission and vision are durably supported throughout the organization. This depicts the general strategy for the whole organization and maybe fine tuned by various business units within the organization to fit their purpose. Department level (like IT) objectives can be outlined and every business unit can follow its own specific objectives in accordance with those listed in the broader organization wide objectives document. A cascading BSC approach may be used for aligning the business strategy to the IT strategy. The objectives of the business balanced scorecard can be adopted in the IT balanced scorecard with

appropriate relevance. Targets are the benchmarks set by the organizations management for each objective and can be tweaked according to the business unit and organizational requirement.

4.3. The formulation of the integrated framework

The review of literature has provided insight into the characteristics of the Balanced Scorecard and its use. The Balanced Scorecard method develops organizational strategies on the concept of four views and works its way through its objectives, measures, targets and initiatives. The proposed framework for enterprise architecture, developed by integrating the Zachman Framework of enterprise architecture and the Balanced Scorecard, also employs these concepts. It also uses the notion of cascading of the Business Balance Scorecard with the IT Balanced Scorecard.

The earlier sections in this chapter talked about standalone use of Zachman Framework for Enterprise architecture implementation. This framework was identified with some weaknesses and having gaps in the framework itself. This research study is trying to minimize those weaknesses and mitigate those gaps by trying to integrate Balanced Scorecard output or deliverables into the artifacts in the motivation aspect of the Zachman Framework.

Starting from the Contextual perspective in the Zachman Framework, keeping the focus of this study in only the Motivation aspect, the artifact from the Planner's perspective is List of Business Strategies and goals. The ends-means-ends rule which defines the artifacts in the cells of the Motivation aspect of the

Zachman Framework does not define the method of deriving the specific business strategies or goals required in this cell. Also there is no standardized method defined which says that the specific business goals and strategies defined in the contextual perspective of the Motivation aspect are aligned with the enterprise's overall generalized business strategies. Using Balanced Scorecard method one can align specific business or IT strategies and goals to the organization's overall business goals and mission. Zachman defined the 'ends' for this perspective is the mission of the organization and the 'means' (from the ends-means-ends business rule) is the major business goal or strategy. The mission statement in the Balanced Scorecard deliverables states the organization's overall mission. The alignment gap found in the contextual perspective can be mitigated if the mission and goals used as the 'ends' for defining the business strategy be derived from the mission statement of the Balanced Scorecard.

In the business model or Conceptual perspective, Zachman has defined the artifact from the owner's perspective, which is the Business Plan. An organization's vision, mission and strategy are translated into a business plan in the conceptual perspective. Varga (2003) has commented that standards in this area hardly exist although many planners have attempted to use various planning methodologies over the years. The Business Rules Group has tried to provide a scheme or structure for developing and managing business plans in an organized way. They have identified factors that motivate the establishing a business plan, defined the elements of a business plan, and tried to indicate how

these factors and elements inter-relate. According to this group the proposed elements of a business plan are: Vision statement, Mission, goals, strategies, objectives, tactics. All these elements are developed from a business perspective but no standard method exists which tries to define these elements properly according to the business requirements and define the inter-relationship of an element with the others.

To characterize the inter-relation between these elements and to have a standard method to define these elements, the Balanced Scorecard deliverables should be plugged in these elements of the business plan. Balanced Scorecard, defines an organization's vision, mission, strategy, objectives, targets, measures, and initiatives aligned with its overall business requirements, and also shows a top down relationship between these elements. Here in the conceptual perspective according to the ends-means-ends rule, the ends are defined as the goals or objectives of an organization and means as the tactics or plans or the initiatives which the organization takes to make its mission and vision achievable.

The logical perspective in Zachman Framework called the System Model, which is from the Designer's point of view, defines Business Rule Model as the required artifact for the Motivation aspect. A business rule defines or constraints one aspect of an organization's business that is intended to assert business structure or influence the behavior of the organization's business (Ambler, S.W., 2003).

Motivation (Why)	
Scope (Contextual) *Planner*	List of Business goals/strategy Ends = mission / goals
Business model (Conceptual) *Owner*	Business Plan Ends = goals / objectives, Means = tactics / plans
System model (Logical) *Designer*	Business Rule Model Ends=structural assertion, Means = action assertion
Technology model (Physical) *Builder*	Rule Design Ends=condition, Means = action
Detailed Rep (out-of-context) *Sub contractor*	Rule Specification Ends = sub-condition Means = step
Functioning Enterprise	Strategy

Business Information → Business Processes

Mission Vision

Strategy

Objectives

Measures
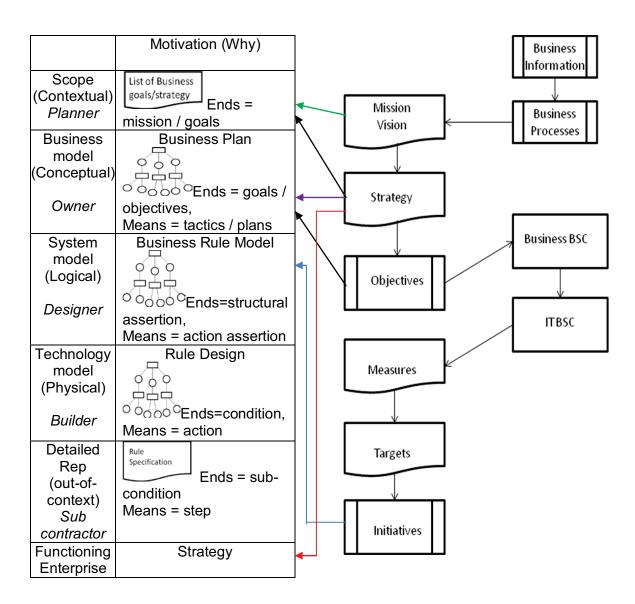
Targets

Initiatives

Business BSC → ITBSC

Figure 4.1. Formulation of Integrated framework

In the logical perspective the business rule model focuses on the information system perspective, pertaining to the facts that are recorded as data and constraints on changes to the value of those facts. The ends-means-ends rule states that the structural assertions are ends for the business rule model and the means to achieve those structural assertions are action assertions. A structural assertion is a statement that something is of importance to the business or exists in relationship to another thing of interest. It is expressed by *term* which is a word or a phrase having specific meaning for the business and *fact* which asserts an association between two or more terms. An action assertion describes a dynamic aspect of the business. It specifies the constraints on the results that an action produces. The constraints imposed by action assertion are expressed by 'must' or 'must not'. These business rules and the structural as well as action assertions are derived from the IT Balanced Scorecard initiatives. Since in the logical perspective the business rule model focuses on the information system perspective, the Balanced Scorecard cascading method is used so as to derive the IT initiatives aligned with the organization's business strategic initiatives. In Balanced Scorecard framework, Strategic Initiatives are the action projects that are needed to help the organization be successful with its strategy. Strategic Initiatives are tied to Strategic Objectives, are of significant importance to the whole organization. Strategic Initiatives make strategy actionable. The IT initiatives in the IT Balanced Scorecard also support the IT Balanced Scorecard Objectives which are aligned

with the Business Objectives so that the Information Technology action projects are in alignment with the organization's overall Business goals.

Lastly in the Motivation column the last row which depicts the entire Functioning Enterprise, Zachman suggested the artifact to be used here is the organization's overall Strategy. "Strategy is the direction and scope of an organization in the long run, which achieves advantage for the organization through its configuration of resources within a challenging environment to meet the needs of market and to fulfill stakeholder's expectations." (Johnson, Scholes, Exploring Corporate Strategy, 2002). So basically it is a plan of action designed to achieve a particular goal. Strategic results are built from four different perspectives in a balanced scorecard which are called strategic themes. Strategic themes define the main focus areas or "Pillars of excellence" of an organization's business. The strategic themes defined by balanced scorecard are – Customer, Financial, Internal Process, and Growth and Learning.

This is how the Balanced Scorecard (Business and IT both) deliverables fit in the Motivation aspect of the Zachman Framework in various perspectives of the framework and try to align the gap observed between the business and IT of an organization. The proposed framework also helps an organization to implement the Zachman Framework of Enterprise Architecture effectively and strategically according to the organization's vision and mission.

The proposed framework integrates the Zachman Framework of Enterprise Architecture and Balanced Scorecard and adapts features from both the Business Balanced Scorecard and IT Balanced Scorecard. The four views

ensure a balanced view in establishing enterprise architecture strategies. The business goals are established by the organizations top management who use the Balanced Scorecard methodology and therefore, the business strategies incorporated in the Zachman Framework are aligned with the overall mission and vision of the organization.

4.4. Case Analysis of Enterprise Architecture at Accenture

The analysis of Accenture and the need for them to implement effective enterprise architecture has been discussed in the literature review. Based on the analysis, the following has been observed:

- Big gaps between layers of the organization instead of seamless relationships. Usually there are several layers within an organization such as the business layer, data layer, application layer, technology layer. Instead of a seamless relationship between these layers, there are huge gaps in the architecture.

- Operational and budget constraints result in incremental and contrasting and ineffective changes to the architecture, which in turn makes the organization unable to achieve the desired results and efficiencies.

- Technology operations risks steadily grow if appropriate investment is lacking.

The Accenture Enterprise Architecture Planning process is designed to facilitate collaboration and cooperation between IT and business stakeholders. Their comprehensive methodology is as follows (Accenture, 2007):

- The Accenture team evaluates and analyses the client organization's current assets, internal and external environments to help it achieve its objectives.

- Both the business and IT leaders team up to create blue prints and road maps for how the future business capabilities should operate. These decisions can be translated into concrete actions for both business and IT units.

- The Accenture team works with the client organization to translate their business and IT capabilities into practical plans with specified time frames, budget and resources so as to define a proper transition plan.

The management at Accenture decided they needed a successful effective enterprise architecture implementation as a solution. The proposed framework not only enables a successful and effective enterprise architecture solution at Accenture but also facilitates a balanced view of all the stakeholders involved keeping in mind the four perspectives or views on which they would build their strategies. The proposed framework uses Zachman Framework of Enterprise Architecture as discussed in the previous section and tries to integrate it with the Balanced Scorecard framework deliverables where suitable in the Motivation aspect of the Zachman Framework. The adoption and implementation of Zachman Framework would be as per the section 'Standalone use of Zachman Framework' and as has been described by the founder John A. Zachman. This proposed integrated framework only tries to provide a standardized method to define the artifacts used in the Motivation aspect so as to

make the framework strategically effective and successfully aligned with the overall business goals of Accenture. Since it adopts the Balanced Scorecard method, this study first tries to build a balanced scorecard for Accenture based upon its mission, vision, and core values. Using the top-down approach the balanced scorecard will describe each level's deliverable and thus the top to bottom alignment of the objectives and project initiatives can be seen.

Mission statement- *"To collaborate with the clients to help them become high performance businesses and governments."*

The mission statement is a clear and to the point representation of the organization's purpose for existence. It basically tells the world what is the purpose of the organization and what do they do. Mission statement is the top most level of our balanced scorecard pyramid and everything else comes under the mission statement. Normally, the mission statement represents the broadest perspective of an enterprise's mission. Accenture is a global management consulting, technology services and outsourcing company which combines unparalleled experience, comprehensive capabilities across all industries and business functions, and conducts extensive research on the world's most successful companies.

Vision- *"To become one of the world's leading companies, bringing innovations to improve the way world works and lives."*

Basically the vision statement describes the company's picture of future. It defines the desired or intended future state of any specific organization or enterprise in terms of its fundamental objectives and its strategic plan direction.

So a vision statement says what you want to accomplish tomorrow. Further going down in the balanced scorecard pyramid, after an organization's vision is clear, they need to build on some strong strategies to accomplish their vision of the future of their company.

Strategies-

S1 – Become more quality driven

S2 – Maximizing Profitability

S3 – Allocate capital profitably towards enterprise architecture planning and implementation

S4 – Better exploitation of client organization's current assets, internal and external environments

S5 – Improve the overall EA implementation for further growth

Strategic results are built from four different perspectives in a balanced scorecard which are called strategic themes. Strategic themes define the main focus areas or "Pillars of excellence" of an organization's business. The strategic themes defined by balanced scorecard are – Customer, Financial, Internal Process, and Growth and Learning. The above identified and researched strategies of the Accenture can be fitted into the strategic themes as follows –

- Customer Perspective – S4 – Better exploitation of client organization's current assets, internal and external environments.

- Financial Perspective – S2 – Maximizing Profitability.

  S3 – Allocate capital profitably towards enterprise

architecture planning and implementation.

- Internal Business Process – S1 – Become more quality driven.

- Learning and Growth Perspective – S5 - Improve the overall EA

  implementation for further growth.
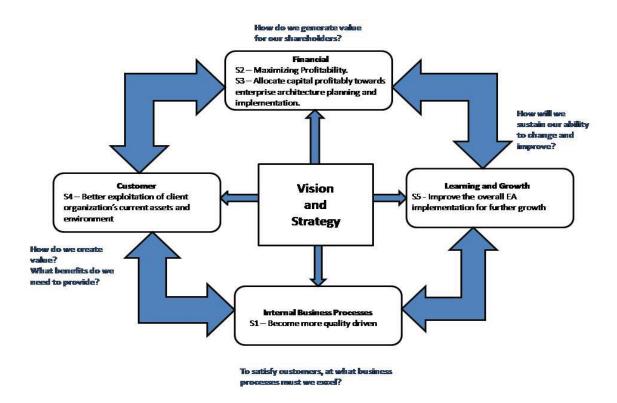

Figure 4.2. Four Perspectives for Accenture's Strategy development

Objectives-

To accomplish the strategic results and move along the strategies identified for

any organization, they need to develop some objectives to fulfill. Thus drilling

down a bit more in the pyramid of balanced scorecard the author now has to

define the objectives for the above listed strategies.

Table 4.2. *Accenture Objectives aligned with strategies*

Strategy	Objectives	Detailed Objectives	Perspective
S1	S1 – O1	Developing quality assurance practices	Become more quality driven
	S1 – O2	Developing quality improvement practices	
S2	S2 – O1	Establish their unique selling point	Maximizing Profitability
	S2 – O2	Increase revenue and maximize earnings	
S3	S3 – O1	Proper Budget Planning	Allocating capital profitably towards EA development
S4	S4 – O1	Improving relationship with clients and customers	Better exploitation of client's resources
	S4 – O2	Improving enterprise's resource usage	
S5	S5 – O1	Developing proper feedback mechanism for further growth	Improve the overall EA implementation for further growth

An objective defines a sub-goal of any organization which tries to achieve the strategic results laid out in the previous step in the balanced scorecard. It

identifies a short-term measurable step within a designated period of time that is moving towards achieving a long-term goal. So the objectives which are aligned with the specific strategies tell us what continuous improvement processes or activities are needed to get those strategic results.

Measures-

Laying out objectives is not the only thing which would help any organization to achieve their strategic goals. You need to be able to measure these in order to achieve them. As Professor James Goldman, Department of CIT, College of Technology, Purdue University says "If you cannot measure it, you cannot manage it", The objectives laid out in the above step of the balanced scorecard need to be measured accurately to identify what needs to be achieved and thus help in achieving the goals.

Table 4.3. *Measures for the strategic objectives*

Perspective	Detailed Objectives	Measure	Measurement Details
Become more quality driven	Developing quality assurance practices	S1 – O1 – M1	Mean Time To Failure
		S1 – O1 – M2	Defect Density Metric
		S1 – O1 – M3	% Customer Problem
		S1 – O1 – M4	% Customer Satisfaction

Table 4.3. *Measures for the strategic objectives* (Continued.)

Perspective	Detailed Objectives	Measure	Measurement Details
	Developing quality improvement practices	S1 – O2 – M1	% Defective Product
		S1 – O2 – M2	% On-Time Delivery
Maximizing Profitability	Establish their unique selling point	S2 – O1 – M1	# Opportunities/# Threats
		S2 – O1 – M2	# Strengths / # Weakness
	Increase revenue and maximize earnings	S2 – O2 – M1	Profitability Ratio
Allocating capital profitably towards EA development	Proper Budget Planning	S3 – O1 – M1	% increase in budget for EA
Better exploitation of client's resources	Improving relationship with clients and customers	S4 – O1 – M1	% Customer Problem
		S4 – O1 – M2	% Customer Satisfaction
	Improving enterprise's resource usage	S4 – O2 – M1	Activity Ratio

Table 4.3. *Measures for the strategic objectives* (Continued.)

Perspective	Detailed Objectives	Measure	Measurement Details
Improve the overall EA implementation for further growth	Developing proper feedback mechanism for further growth	S5 – O1 – M1	% increase in growth per year

Mean Time To Failure (MTTF): This metric measure the average time the product or a service runs before experiencing a crash. This is a statistical value which measures the mean over a long time period and large number of units. Thus by measuring mean time to failure, we can find out how reliable the system is and how quickly it can crash when an unusual situation arises real time.

Defect Density Metric (DDM): This metric measures the number of imperfections in the product per lines of code. We can also use the number of function definitions or the number of lines on input screen in place of the number of lines of code in the denominator. So basically this gives the density of error in the product.

Profitability Ratio: Profitability ratio indicates how effectively the total firm is being managed. It is the class of metric that is used to assess a business's ability to generate earnings as compared to its expenses and other relevant costs incurred during a specific period of time. Some examples of profitability ratio are profit margins, and return on assets.

Activity Ratio: Activity Ratio indicates how effectively a firm is using its resources. Thus, this would give the measure of how effectively and optimally the technological resources can be used by Accenture to leverage technology innovatively to provide consumers with outstanding creative content.

Targets-

The measures described in the previous step of the balanced scorecard need to have some target value, which the organization should try and achieve in order to take the greatest advantage of these measures.

Table 4.4. *Targets for the defined measures*

Perspective	Detailed Objectives	Target	Measurement Details	Target
Become more quality driven	Developing quality assurance practices	S1-O1-M1-T1	Mean Time To Failure	> 3 yrs
		S1-O1-M2-T1	Defect Density Metric	< 15%
		S1-O1-M3-T1	% Customer Problem	< 10%
		S1-O1-M4-T1	% Customer Satisfaction	> 75%
	Developing quality improvement practices	S1-O2-M1-T1	% Defective Product	< 10%
		S1-O2-M2-T1	% On-Time Delivery	> 80%
Maximizing Profitability	Establish their unique selling point	S2-O1-M1-T1	#Opportunities /	> 1
		S2-O1-M2-T1	#Threats	
			#Strengths / #Weakness	> 1

Table 4.4. *Targets for the defined measures* (Continued.)

Perspective	Detailed Objectives	Target	Measurement Details	Target
	Increase revenue and maximize earnings	S2-O2-M1-T1	Profitability Ratio	> 50%
Allocating capital profitably towards EA development	Proper Budget Planning	S3-O1-M1-T1	% increase in budget for EA	> 10%
Better exploitation of client's resources	Improving relationship with clients and customers	S4-O1-M1-T1 S4-O1-M2-T1	%Customer Problem %Customer Satisfaction	< 10% > 75%
	Improving enterprise's resource usage	S4-O2-M1-T1	Activity Ratio	~=1
Improve the overall EA implementation	Developing proper feedback mechanism	S5-O1-M1-T1	% increase in growth per year	> 25%

Initiatives-

After defining targets to these measures, we know that how each objective will be

measured and how each measure should try and reach its target to fulfill the

requirements. The last part or the lowest level of the balanced scorecard pyramid

talks of the initiatives to be taken by the company in order to achieve all the

upper layers.

Table 4.5. *Initiatives traceable back to strategic objectives*

Perspective	Detailed Objectives	Initiative	Initiative Details
Become more quality driven	Developing quality assurance practices	S1-O1-M1-T1-I1 S1-O1-M2-T1-I1 S1-O1-M3-T1-I1 S1-O1-M4-T1-I1	Implementing quality assurance program throughout the enterprise
	Developing quality improvement practices	S1-O2-M1-T1-I2 S1-O2-M2-T1-I2	Implementing six sigma training
Maximizing Profitability	Establish their unique selling point	S2-O1-M1-T1-I1 S2-O1-M2-T1-I1	Adopting SWOT analysis techniques
	Increase revenue and maximize earnings	S2-O2-M1-T1-I2	Implementing project management techniques

Table 4.5. *Initiatives traceable back to strategic objectives* (Continued.)

Perspective	Detailed Objectives	Initiative	Initiative Details
Allocating capital profitably towards EA development	Proper Budget Planning	S3-O1-M1-T1-I1	Adopting project management and budgeting-accounting methods
Better exploitation of client's resources	Improving relationship with clients and customers	S4-O1-M1-T1-I1 S4-O1-M2-T1-I1	Implementing Customer Relationship Management techniques
	Improving enterprise's resource usage	S4-O2-M1-T1-I2	Implementing Enterprise Resource Planning systems
Improve the overall EA implementation for further growth	Developing proper feedback mechanism for further growth	S5-O1-M1-T1-I1	Implementing iterative incremental development life cycle

This was the implementation of Balanced Scorecard method for Accenture to assure the traceability from the bottom layer (initiatives) to the top layer (mission) of the company. These Balanced Scorecard deliverables are to be used as inputs to the artifacts specified in the Motivation aspect of the Zachman Framework of Enterprise Architecture as described in the 'The Formulation of Integrated Framework' section of this chapter.
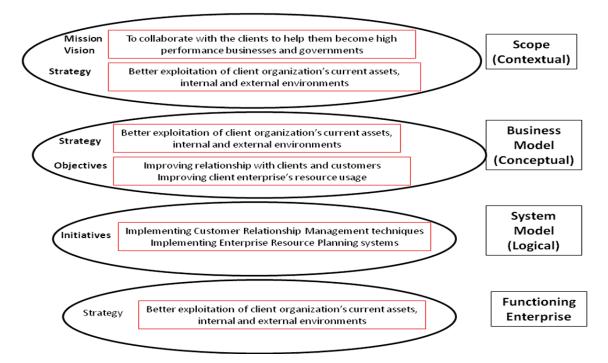

Figure 4.3. Mapping BSC deliverables to Zachman Framework aspects

The above figure shows mapping of the Zachman Framework's various perspectives with the Balanced Scorecard aspects/deliverables. The application of this integrated framework is done according to the process specified in the 'Formulation of integrated framework' section. The above figure is an example of such an integration focusing only on the Motivational aspect of the Zachman Framework. Thus by applying the Balanced Scorecard method on Accenture's

mission, vision we have all the other deliverables like the important strategies, objectives, measures, targets, and initiatives to be taken. As shown in the above figure, in the Contextual perspective, which is the Scope of the Motivation aspect in Zachman Framework, the 'artifact' is list of business goals or strategies. Thus for Accenture the list of business strategies would be:

- S1 – Become more quality driven

- S2 – Maximizing Profitability

- S3 – Allocate capital profitably towards enterprise architecture planning and implementation

- S4 – Better exploitation of client organization's current assets, internal and external environments

- S5 – Improve the overall EA implementation for further growth

In the figure only one is shown because of the space constraint. The 'ends' for this cell is the mission. Accenture's mission that would fit in this cell is "To collaborate with the clients to help them become high performance businesses and governments".

The conceptual perspective describes the business plan which has list of the strategies and the list of corresponding objectives. Here in the figure one such strategy and objective have been shown. One strategy can have more than one objective. Following is an example of a strategy and its corresponding objectives:

Table 4.6. *Objectives aligned with the business strategy for Accenture*

S4 - Better exploitation of client organization's current assets, internal and external environments	S4 – O1	Improving relationship with clients and customers
	S4 – O2	Improving enterprise's resource usage

In the logical perspective which is described by a system model, Zachman describes the artifact as business rule model having structural assertions and action assertions. These should be derived from the initiatives achieved by using the Balanced Scorecard method on the business strategies of Accenture. For example, the strategy used in this figure is 'Better exploitation of client organization's assets, internal and external environments. The initiatives which map into this are:

- Implementing Customer Relationship Management techniques.
- Implementing Enterprise Resource Planning techniques.

Considering the first initiative which is implementing a CRM solution, an example of structural assertion used here is:

Table 4.7. *Structural assertions linked to the initiatives from BSC*

Structural Assertion	Meaning	Implementation	Technical details
Two customers cannot have the same e-mail address.	The e-mail address attribute has to be unique.	Create a domain unique constraint within the class containing the e-mail attribute.	Set the primary property to false to indicate that the unique constraint is not used to define the primary key.

The action assertion which corresponds to this example of structural assertion is: 'Two customers must not have the same email-address'. Thus it imposes a constraint on the structural assertion. Similarly the various structural assertions and action assertions should be derived from the initiatives established using the Balance Scorecard method.

The last perspective in the Zachman Framework provides the view of the entire functioning enterprise. Here the list of strategies comes from the Balanced Scorecard business strategies. In the above figure an example of such strategy is given.

From the above description, it becomes clear that specific artifacts in various perspectives of Zachman Framework associated with the proposed framework addresses the weaknesses identified in the case study done on the Enterprise Architecture Implementation program at Accenture. The traceability of the initiatives to be undertaken back to the business objectives and strategies is ensured by the fact that the architectural requirements are a part of the need statement of Accenture's enterprise architecture implementation program and

also by using the Balanced Scorecard method to derive those initiatives. Hence the proposed framework achieves the important aspects of Balanced Scorecard which are objectives, measures, targets and initiatives along with the balanced view of stakeholders in Zachman Framework of Enterprise Architecture implementation.

4.5. Measuring the success of the proposed framework

Based on the proposed framework and its implementation details and application to the case of Enterprise Architecture Planning at Accenture, the chair of this thesis committee, Prof. Jeffrey L. Brewer, along with the other committee members, Prof. Kevin C. Dittman, Prof. John A. Springer, has evaluated the proposed framework. The scores for the stated goals (section 3.2) have been evaluated as per the established verification criteria checklist (section 3.4).

Table 4.8. *Verification criteria checklist*

Goals	Verification Criteria	Check
Balanced view of stakeholders from the four described perspectives	Does the proposed framework give due consideration of all the perspectives to be considered?	Yes/No
	Does the proposed framework mandate the participation of both business and IT experts in the development of the framework?	Yes/No

Table 4.8. *Verification criteria checklist* (Continued.)

Goals	Verification Criteria	Check
	Does the proposed framework help in establishing enterprise architecture strategies based on the four perspectives?	Yes/No
Holistic enterprise architecture approach keeping business strategies in focus	Are the EA objectives aligned with the business strategy of the organization?	Yes/No
	Do the EA objectives give consideration to the critical success factors or key performance indicators of the organization?	Yes/No
	Does the proposed framework allow the use of quality assurance mechanisms in an enterprise?	Yes/No
Measurement of the framework objectives and traceability of actions back to the business strategies	Are the framework initiatives tied back to the overall organization's business strategy?	Yes/No

Table 4.8. *Verification criteria checklist* (Continued.)

Goals	Verification Criteria	Check
	Does the proposed framework provide scope for measurement of those framework objectives?	Yes/No
Ability for organizations to justify EA budgeting	Does the proposed framework take into consideration the financial aspect of the business strategy?	Yes/No
Act as a meta-framework that allows use of other industry standards/methodologies/frameworks as plug-ins	Is the proposed framework flexible to allow the use of other standards, guidelines, methodologies, and/or frameworks for achieving the framework objectives?	Yes/No
Seamless integration of all layers of the organization based on the enterprise architecture framework.	Does the proposed framework fulfill the objective of mitigation of the various gaps observed in the Zachman Framework?	Yes/No

4.6. <u>Chapter Summary</u>

The chapter has provided the detailed description of the proposed framework along with its implementation details and application. It has also provided evaluation of the proposed framework and thus, answered the research question.

CHAPTER 5. FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

This chapter provides the author's concluding remarks to the research thesis done by illustrating the findings of the study, discussing the conclusion and any future recommendation for further study in the field of Enterprise Architecture.

5.1. Findings and Conclusion

The thesis has provided the author with an in-depth explanation of the proposed framework that aims to address the apparent lack of business-IT alignment in the Zachman Framework of enterprise architecture. In order to develop a comprehensive integrated framework for enterprise architecture, it is critical to consider the pre-existing Zachman Framework of architecture, the Balanced Scorecard method and the concept of business-IT alignment. This study done also gives important to the fact that development of such a framework must take into account organizational entities such as applications, information, infrastructure and people.

The author has based her research on the findings discussed in the literature review section of this document. The case examples of enterprise architecture implementation and their failures or problems along with the

enterprise architecture frameworks from the industry indicate that enterprise architecture implementation can be effectively addressed if it involves both the business aspect and the technology aspect together. The thesis has also hinted that instead of focusing on procedures, it is important to benefit from the approaches of the existing standards, guidelines, and frameworks to establish a matured road map.

The author using this research study shows that the Balanced Scorecard is a flexible and effective management framework and it can be effectively used in the enterprise architecture implementation. Apart from the evaluation mechanism employed in the thesis for measuring the effectiveness of the proposed framework, the discussed frameworks which are pre-existing standardized frameworks also emphasize the importance of integration of business strategy and the information. The success of the proposed framework is dependent on the establishment of traceability between people, business, processes, and technology.

This study has contributed to the field of enterprise architecture specially Zachman Framework of architecture by highlighting the fact that fusion of IT with business is changing the face of organization's business. It is important in today's scenario to realize the importance of this change and to try and apply those changes in one's organization. Hence, the author has focused on the need and recognition of the business-IT alignment.
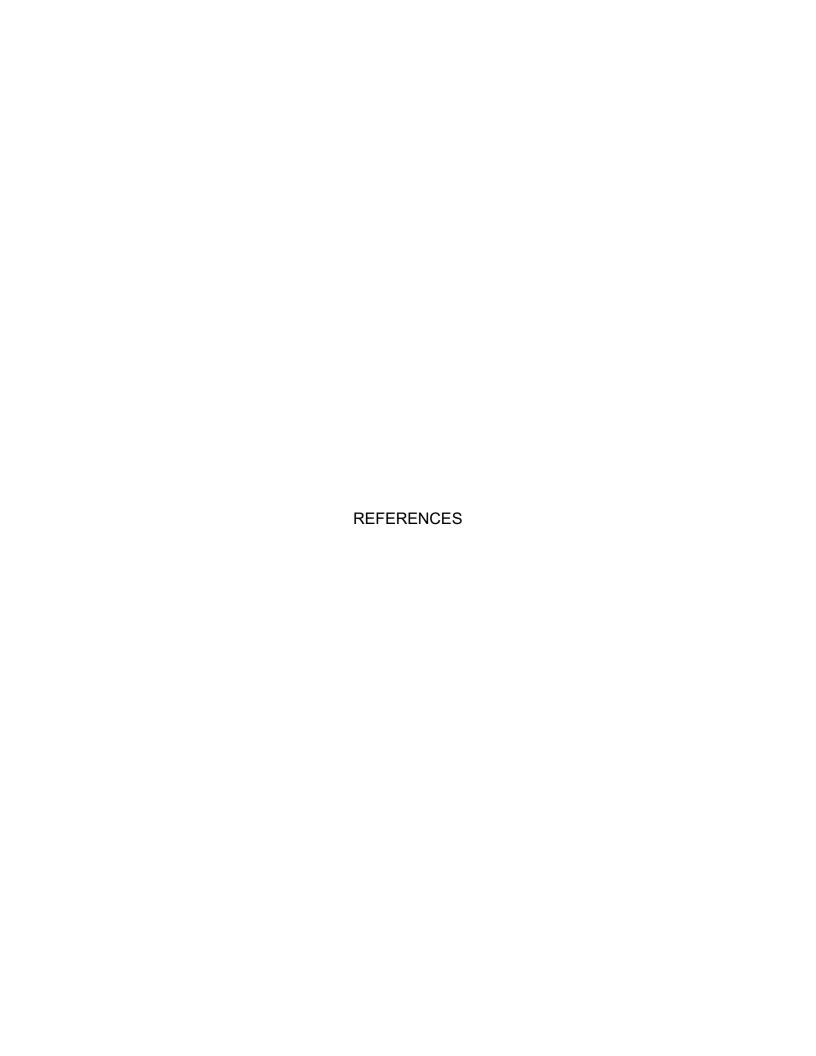
5.2. <u>Recommendations for future work</u>

The proposed integrated framework using the Zachman Framework and Balanced Scorecard for the purpose of effective enterprise architecture implementation is conceptual at this stage. Balanced Scorecard (BSC) is an intensive framework that needs training and takes a considerable time to implement and analyze. It would be difficult for an organization that does not employ such management methods to integrate it with its existent business processes and enterprise architecture framework solely to provide results for this research study. But the extensive use of BSC in academic research provides quality literature and credibility.

Hence the recommendations for future work related to this research study include:

- Implementation of the proposed integrated framework at a credible organization.
- Testing the proposed framework in diverse cases and scenarios.
- Assessing the ROI (return on investment) from the implementation of the framework.
- Integrating Quality Assurance practices in the framework for ensuring quality of the enterprise's business processes.

5.3. <u>Chapter Summary</u>

The chapter has provided insight to the findings, conclusions, and recommendations for future work in the field of effective Enterprise Architecture implementations.

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