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Enterprise Transformation Through A Zachman-Bayesian Framework To Improve Efficiency & Productivity

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ENTERPRISE TRANSFORMATION THROUGH A ZACHMAN-BAYESIAN FRAMEWORK
TO IMPROVE EFFICIENCY & PRODUCTIVITY

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By

Ramakanth Gona

2011

Dedication

To the four pillars of my life:

God (SaiRam Baba),

My Mom (Padmavathi Gona),

My Father (Murali Dhar Babu Gona),

My Brother (Harish Gona).

Without you, my life would fall apart.

I might not know where the life's road will take me, but walking with You, God, through this
journey has given me Strength.

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TO IMPROVE EFFICIENCY & PRODUCTIVITY

by

RAMAKANTH GONA, BSME

THESIS

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for the Degree of

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Abstract

Although organizations are aware of the benefits of enterprise architectures models, organizations have difficulties determining deficiencies in their business architecture. Organizational assessment tools often do not achieve expectations as sold to management. Performance measures often fail to properly represent necessary holistic measurements. Methods for capturing deficiencies in current business models and deterring improvements to optimize business processes are rare. This thesis develops a new experimental architecture modeling approach for enterprise transformations. The approach is efficient in capturing deficiencies and finding correlations which can become targeted goals for improvements. The Zachman enterprise architecture framework provides a holistic view of organizational models and Bayesian methods provide an efficient way to experiment with impact translations in order to find and utilize correlations among major organizational aspects. This work provides a new direction for organizations to model impacts or benefits obtained when investments are made in the technology, business, operational and systems areas.

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Chapter 1: Introduction

Because of growing pressures to reduce costs and increase competitiveness, and overall effectiveness, large and complex enterprises face very difficult challenges to improve their business processes. Although complex enterprises are investing billions of dollars every year in business improvements the enterprise transformation are often not successful.(Valerdi, Nightingale, 2011, p. 2). Understanding the factors involved in implementing an improvement process is not enough. Accomplishment depends in increasing executives strategies for enterprise level alterations and implementations. A “*Successful enterprise transformations involve holistic approach that integrates viewpoints of multiple stakeholders, methods, and disciplines*” (Valerdi, Nightingale, 2011, p. 2). Transformational influences are studied by enterprise system research and its applications for the transformation of traditional product organizations such as those in the aerospace, electronics and automotive sectors, but also increasingly in service enterprises such as hospitals, financial institutions and government’s agencies. There are clearly some very significant challenges that we need to understand and help address. It is increasing evident that applying multidisciplinary engineering and management approaches to transformation of large scale social-technical enterprises (Valerdi, Nightingale, 2011, p. 2) will be useful. The growing data base of enterprise transformation experiences, combined with growing academic community interest, provides the ideal time to launch a journal like the Journal of Enterprise Transformation (JET) which was established to “promote a holistic approach to advancing the understanding of enterprise transformation by addressing the challenges from technical, behavioral, and social perspectives.

The “Zachman Framework,” which is an Enterprise Architecture framework for enterprise architecture, provides a formal and highly structured way of viewing and defining an

enterprise. In Chapter 3 two case studies on Zachman framework has been discussed. With the help of a Bayesian methodology applied within this thesis, “Zachman-Bayesian Framework was established to draw a few mathematical models with assumed benefits for experimentation. This idea for experimentation idea provides a new way of transforming enterprise by considering the benefits produced by investments or interventions within the enterprise, which is categorized by business, system, technology, component and operational levels and concurrently in the areas of processes, networks, organization, timing, motivation and inventory. This new method provides a mathematical basis of calculations, as well as a new perspective for high level management to think about their current work processes at each level in their enterprises. With the help of this methodology, transformations can be accomplished by decisions of management to improve weak work processes by redesigning models or eliminating causes for the deficiencies (Rouse, 2005, p. 284). By showing problems with process flow or bottlenecks in organizational performance, assessments provide a key tool in identifying opportunities for improvement (Perkins, Valerdi, Nightingale, Rifkin, 2010).

1.1 Research Objectives

The following list provides the main objectives of this study:

- Find new ways of determining challenges in an enterprises and transforming the enterprise so that inefficient processes are changed to efficient processes by capturing deficiencies and eliminating deficiencies
- Determine a new method of experimentation with the combination of Bayesian Methodology and with the Enterprise Architecture Framework known as Zachman Framework

- Experiment on providing a holistic view of the benefits produced with investments in all categories within the enterprise to show the money flow and return of investments

1.2 Motivation

- This study provides a new technique to enable high level management to take decisions for their enterprises in order to improve inefficient processes.
- Organizations use different kinds of methods and techniques for capturing and eliminating deficiencies in their enterprises, but it is still a challenge for high level managers to find a better way of capturing deficiencies from high level to low level within their enterprise.
- To show a holistic view of any kind of enterprise which integrates models from high level management to low level workers, a new way of experimentation was introduced through this thesis, which leaves a low chance of hiding defects within the organization.
- The new way of experimentation for enterprise transformations with a Bayesian mathematical approach is an efficient way to capture deficiencies and find correlations on the benefits produced with investments made in an enterprise
- Utilize the calculated correlations to reach targeted goals for improvements.

1.3 Organization of report:

This thesis has been divided into 6 chapters. Chapter 1 includes the introduction of objectives, and scope of work. Chapter 2 contains a review of relevant literature regarding a review of enterprise architecture, an Introduction to Zachman Framework and Its strengths and weakness, enterprise Transformation. Chapter 3 presents the case studies to the application on Zachman Framework by examining data of UTEP College of Engineering Master Theses and Educational Enterprises. Chapter 4 presents enterprise transformations according to the Zachman-Bayesian

framework and shows working principles of Bayes' Theorem. Chapter 5 presents a case study of the Texas Manufacturing Assistance Center (TMAC) by applying working principles of the Zachman –Bayesian Framework. Observations of the data in the case study was included and illustrated. Chapter 6 presents conclusions and possible future research.

Chapter 2: Literature Review

2.1 What is Enterprise Architecture?

Organized structures and views associated with Enterprise Architecture (EA) was determined by a schema called EA 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. In order to operate organization in a desired way and respond quickly for the changes in the environment there should be well document and good understanding of enterprise architecture within that organization. Therefore well-documented enterprise architectures assess impacts changes for each enterprise architecture components and ensures on smooth operational conditions to the components with these changes. In an enterprise, there exist several views and Different people seek for good enterprise models for several needs. Most researchers and Business executives consider Enterprise Architecture is kind of blue print which shows all the elements in their organization and that's how concept of architecting the whole organization named as enterprise architecture. The major advantage of using enterprise architecture was not only it acts as blue print it tries to achieve the current and Future business objectives in organization by examining the Technology strategies, Information and Operational strategies and shows how it impacts on business functions. The relationship between all these strategies is explained by enterprise architecture which integrates each of these disciplines into a cohesive framework.

2.2 What is a Model?

A model is an abstract representation of reality. The aspects of the real system are of interest and which system elements are to be modeled was determined by Modeler. Enterprise “Modeling lies not with developers or analysts, but with management. Models, requirements, and processes can

and should evolve along with the Enterprise-think of it as a living database that you can investigate at any time, examining the processes of a specific part of an enterprise, provides a Baseline and used to create a plan for the next project” (Whitman, Ramachandran, Ketkar, 2001, p. 850).

A “symbolic representation of the enterprise and the things that it deals with “can be defined as enterprise model and thus it contains representations of individual facts, objects, and relationships that occur within the enterprise” (Whitman, Ramachandran, Ketkar, 2001, p.851) the use of symbols to represent the enterprise presents these facts, objects, and relationships in an easy to understand manner. The typical uses of modeling are:

- To help reduce complexity
- To gain stakeholder buy-in
- To analyze and design the enterprise and its processes prior to implementation
- To communicate a common understanding of the system
- Act as a documentation tool for ISO 9000, Total Quality Management, Concurrent Engineering, and other efforts.

If all data about in the enterprise attempt to hold by a single model, the model would grow to an unusable state. Therefore, models typically are restricted to representing a single view or perspective of the enterprise. The integration of diverse views is very important for achieving a complete illustration of the enterprise. While this promotes good understanding by reducing the complexity in the model, it can also lead to disjointed and incomplete understanding of the entire enterprise.

Managers need to look at problems in a non-myopic fashion for better decision making, global organizational view should be taken into consideration instead of individually biased perspectives. Depending on the situation for a problem being investigating, manager's change between different perspectives and level of details when looking for the related pieces of knowledge required providing for an appropriate answer. However, lacking a centralized knowledge management facility, individual managers' access to knowledge is restricted to a relatively small subset of the collective organizational knowledge, depending on their status and function within the organization, which inhibits the recognition of all interactions and interdependencies relevant to the problem under study. Because many enterprise scenarios are too complex to be fully understood, models are developed to help decision-makers analyze specific situations. Models are constructed by choosing a particular view and by introducing assumptions, abstractions, and approximations (SulinBa, Whinstone, Lang, 1995, p. 315).

2.3 What is Enterprise Transformation?

“Enterprise transformation concerns change, not just routine change but fundamental change that substantially alters an organization's relationships with one or more key constituencies, e.g., customers, employees, suppliers, and investors Transformations can involve new value propositions terms of products and services, how these offerings are delivered and supported, and /or how the enterprises are organized to provide these offerings” (Rouse, 2005, p. 286).

The change can determined as contrasting organizations levels of significance or extent of desired change and the impacts of such changes. Listed below three perspectives below may act as criteria for distinguishing transformation by defining characteristics of transformations from the other more modest forms of change, this helps to stimulus for further discussion on what constitutes enterprises transformation.

1. A response to radical changes in the economic, market, or social environment;
2. A fundamental alternation of context;
3. A step change in performance.

2.4 A Response to Radical Change in the Economic, Market, or Social environment

(Rouse, 2005) argues that enterprise transformation is prompted by significant changes within the economic and market context, which leads to experience or expected value deficiencies requiring fundamental change to reverse. “Such changes might include for example legal or regulatory changes, which impact on market competition or changing market trends. Such changes in environment cannot be handled within the existing paradigm and organizational routines requiring a change in the taken –for-granted assumptions and the ways of doing things around here” (Parry, Valerdi, Nightingale, Mills, 2011, p. 14–15). They point out that for some company’s incremental change is not always enough and suggest that a more fundamental shift may be needed to address the challenges faced.

2.5 A Fundamental Alteration of Context.

Some companies do not need to improve themselves, they need to reinvent themselves. Reinvention is not changing what is, but creating what isn’t. They argues that when companies engage in reinvention, they alter their context and therefore can alter their culture and performance. The context is the sum of all past conclusions reached concerning how they operate their relation with customers and their sources of past success.

2.6 A Step Change in Performance

Another perspective that may be useful in distinguishing transformation relates to the magnitude of results achieved:

“Rather than routine, transformation tends to be discontinuous, perhaps even abrupt. Change does not occur continually, yielding slow and steady improvements. Instead, substantial changes occur intermittently, hopefully yielding significantly increased returns to the enterprise” (Parry, Valerdi, Nightingale, Mills, 2011, p. 16).

2.7 What is Transformation?

The transformation from adaptation and from strategic innovation should be differentiated because the differentiation is to be accomplished for the reason to identify what is recognized about adaptation and innovation in order to see if organizations apply to transformation, too. For the purpose of implementing transformation, To respond internal change in their organizations, the identification for specific steps are to be taken by organizations to adaptively fit into the perception of their environment and see how they innovate organizational forms and manage the adaptation and innovation processes (Rifkin, 2011, p. 47). One of the reasons for pursuing this line of differentiation or integration, depending upon your point of view, is to see if—and what—we can borrow from the rich literature on how organizations respond strategically to what is always characterized as rapidly and complexly changing environment.

2.8 Introduction to Zachman Framework:

John Zachman Invented The Zachman Framework for IBM in 1980. The significance of Zachman framework is, it provides a way of viewing an enterprise from different perspectives to the information systems. John Zachman while he invented this framework, it looks like he borrowed some business design principals in architecture and manufacturing.

Due to a lack of internal understanding many multifaceted business organizations and Great organizations including Engineering fields and health care fields are facing trouble responding to change and of the complex structure and components in different areas of the organization,

where legacy information about the business is locked away in the minds of specific employees or business units, without being made explicit.

In an organization for existing functions, process, and elements are used by a single model which should be build with proactive business tool like Zachman framework, because this framework provides a means of classifying organization architecture .It also helps in decision making to managers for business change by providing a logical structure for classifying and organizing the design artifacts of an enterprise that are significant to the management. Zachman framework is not limited to one field, though it was invented for information system architecture, currently this framework is used by health care, and Engineering, Design fields and became a standard for classifying the artifacts developed in enterprise architecture.

“The term “architecture” in “Information System Architecture” shows the analogy between “the construction of a computer system and the construction of a house (Alain Wegmann, Anders Kotsalainen).”

The initial Zachman framework consisted of three columns (for data, process, and network descriptions, respectively) and five rows, making a 15-cell grid structure (Zachman, 1987, p.280). The Framework is comprehensive, primitive, and generic. The framework distinguishes an issue by answering all the six primitive linguistic interrogatives Who, What, Where, When, Why and How, hence they cannot be fragmented further after analyzing (Zachman, 1999, p.460). These are vertical dimensions (the rows) describes the perspectives of those who use the models or descriptions contained in the cell. The top row represents the most generic perspective of an organization, while lower rows are successively more concrete. The bottom row represents a description of the actual data, code and people that make up the enterprise (Rezaei, Shams, 2008).

Perspectives or roles include following.

- Contextual perspective (planner role)
- Conceptual perspective (owner role)
- Logical perspective (designer role)
- Physical perspective (builder role)
- Component perspective (sub-contractor role).

The Zachman Framework elaboration typically proceeds with the Communication Interrogatives as columns and the Reification Transformations as rows. The Framework classifications are represented by the cells, that is, the intersection between the Interrogatives and the Transformations. This scheme would constitute the total set of descriptive representations that are relevant for describing anything in particular an enterprise” (Zachman Associates). In addition to that, it is a logical structure for descriptive representations (i.e. models, or design artifacts) of any complex object and it is neutral with regard to the processes or tools used for producing the descriptions. For this reason, the Framework, as applied to Enterprises, is helpful for sorting out very complex, technology and methodology choices and issues that are significant both to general management and to technology management (Zachman, 1987, p. 280).

2.9 Description of a Process

First, the designers analyze and represent the organization across the cells of the different rows and columns of the ISA (Information Systems Architecture) matrix; they also define the intra-row matrices that relate the elements of the different cells within the rows of the ISA matrix. This model describes the as-is situation.

Second, the designers analyze the existing situation and understand the problem to address. At this point, they design different possible solutions; each one described in a set of ISA and intra-row matrices. The designers compare these solutions and select one. The corresponding ISA and intra-row matrices describe the situation to-be, i.e. what the designers need to implement.

Last, the designers implement the changes to the organization and to the IT system according to what the matrices describe. Zachman does not propose matrices to relate the cells between rows (e.g. owner row's data cell-to- data cell in designer row – all within a same column). Not having such matrices is problematic to the designers, as they cannot check the relations between the different rows of the ISA matrix. (Wegmann, Kotsalainen, Matthey, Regev, Giannattasio, 2008, p. 4). Zachman derived the Framework from analogous structures in the Traditional engineering disciplines such as architecture, which classify and organize the design artifacts created in the process of designing and producing complex products (e.g. buildings).

The engineering disciplines have accumulated considerable knowledge of their product development and management. This knowledge has enabled great increases in product sophistication and product change management over time (Varga, ITI, 2003, p. 162). Figure 2.1 shows detail representation of Zachman Framework to ISA (Information Systems Architecture). Zachman enterprise framework is represented and promoted by the ZIFA (Zachman Institute for Framework Advancement) organization. It is not yet a standard but there are similar enterprise frameworks that have been derived from it, such as the Federal Enterprise Architecture Framework (FEAF), The Open Group Architecture Framework (TOGAF), and the Department of Defense Architecture Framework (DoDAF).

	What	Who	Where	How	When	Why
Scope	List of things important to business	List of business processes	List of important locations	List of important organizations	List of events	List of business goals & strategies
Business	Conceptual data / Object Model	Business process Model	Business Logistics Systems	Work flow model	Master Schedule	Business Plans
System	Logical Data Model	System Architecture Model	Distributed Systems Architecture	Human Interface Architecture	Processing Structure	Business Rule Model
Technology	Physical Data/Class Model	Technology Design Model	Technology Architecture	Presentation Architecture	Control Structure	Rule Design
Component	Data Definition	Program	Network Architecture	Security Architecture	Timing Definition	Rule Specification
Operations	Usable Data	Working Function	Usable Network	Functioning Organization	Implemented Schedule	Working Strategy
	Data	People	Network	Organization	Timing	Motivation

Figure 2.1: Detail Representation of Zachman Framework for ISA

The horizontal dimension of the framework (the Rows) describes the types of abstraction that define each perspective.

Scope (Contextual): This is a planner's perspective which describes the models, architectures and representations that provide the boundaries for the organization and describe what senior executives must consider when they think about the organization and how it interacts (Sowa and Zachman, 1992, p. 600).

Business model (Conceptual): This is an owner's perspective which describes the models, architectures and descriptions used by the individuals who are the owners of the business process. They focus on the usage characteristics of the products.

System model (Logical): This is the designer perspective which describes the models, architectures and descriptions used by engineers and those who mediate between what is desirable and what is technically possible (Zachman, 1987, p. 280).

Technology Model (Physical): This is a builder's perspective which describe the models, architectures and descriptions used by technicians ,engineers and contractors who design and create the actual product .the emphasis here is on constraints and what will actually be constructed (Noran, 2003).

Detailed Representation or Component (Out of Context): This is a subcontractor's perspective. This describes the actual elements or parts that are included in make up the final product. Using the construction metaphor Zachman refer to it as a subcontractor perspective and this makes sense to software developers when the design is implemented with modules or components acquired from the others (Hay).

The Functioning Enterprise or Operations: The bottom row represents the actual deployed or running elements, data and people of the organization. It isn't perspective, as such, but the real world in all its complexity that underlies all of the more or less abstract perspectives above it. Finally, a system is implemented and made part of an organization (Rezaei, Shams, 2008).

In summary, each perspective focuses attention on the same fundamental questions, then answers those questions from that viewpoint, creating different descriptive representations (i.e., models), which translate from higher to lower perspectives. The basic model for the focus (or product abstraction) remains constant. The basic model of each column is uniquely defined, yet related across and down the matrix. In addition, the six categories of enterprise architecture components, and the underlying interrogatives that they answer, form the columns of the Zachman Framework and these are

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.

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 (Sowa and Zachman, 1992, p. 604).

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.

2.10 Horizontal and Vertical Integration

The models organized by row and column in the Zachman framework should be horizontally and vertically integrated. This means that you should not work models in a given cell without considering impacts to other cells in the same row and in the same column. (zachmanframeworkassociates.com). As an example of horizontal integration, consider a functional model developed in the How column. The inputs/outputs, resources, deployment, time constraints, and goals related to each function should be considered in the What, Who, Where, When, and Why columns, respectively, in the same row. As an example of vertical integration,

consider a requirement in the Physical (Technology) row, Why column for the performance of some aspect of a software component. This requirement should be linked to other motivational models in higher rows, such as an objective requirements document in the Concept row, Why column. This is nothing more than requirements traceability and is a common best practice for systems engineering. Through this traceability, we call the requirement in the Physical row vertically integrated with the requirements in the Concept row.

2.11 Zachman Framework Rules

Zachman provided the following rules to assist the reader in understanding ISA and its application.

Rule 1: The columns have no order. However, the order of columns can follow a user-dependent organizing principal that makes the framework easier to understand.

Rule 2: Each column has a simple, basic model. Each column represents an abstraction from the real world for convenience of description. These models include: Data (what), Function (how), Network (where), People (who), Time (when), and Motivation (why).

Rule 3: The basic model of each column must be unique (Mega & Zachman).

Rule 4: Each row represents a distinct perspective.

Rule 5: Each cell is unique.

Rule 6: Combining the cells in one row forms a complete model.

The sum of all cells in a given row is the most complete depiction of reality from the perspective of that row. As new cells in a given row are defined each new cell description must be consistent with the perspective of that row. Each cell in a given row can be defined and is independent of any other cells in the row, yet each cell is but one abstraction of the same perspective of reality. Therefore, each cell is related to every other cell in the same Row l.

2.12 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

- 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 (Zachman, 1999, p.460).the risks of not developing any architectural representation

2.13 Weaknesses of Zachman Framework

The few disadvantages which researchers have shown concern for in the past and considered that it is difficult to build an architectures using Zachman framework. 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. Below these difficulties are summarized as 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(Fatolahi, Shams, 2006).

2.14 Why the Zachman Framework?

After the Zachman framework was invented, many frameworks for enterprise architecture were created. Because of its flexibility, the Zachman framework can define logical structures for any type of organization. Different perspectives involved to share their models to build up an enterprise, which there was low possibilities with other frameworks. It is the most referenced framework which makes itself a basis for evaluating, establishing, and customizing other enterprise architectural frameworks, methods, and tools (Fatolahi, Shams, 2006). For this Thesis, there is need of a data from different perspectives in an organization, so we have chosen to work with the Zachman framework. In 2003, a survey was done by Schekkerman which has pointed out that there is vast difference between the usage of other frameworks and the Zachman framework, and a lot of organizations (almost 20%) do their enterprise architecture related activities upon the Zachman framework. Because of its independent and holistic view of an enterprise, it remains unique among architectural frameworks.

Chapter 3: Case Studies

In this section, case studies utilizing the Zachman framework are discussed. The data for the first study originated in the College of Engineering from the University of Texas at El Paso, from the Nugget Library Catalog.

3.1 UTEP College of Engineering Case Study

Considering the College of Engineering as a whole enterprise, the college was viewed and defined according to the Master of Science theses submitted. A set of example theses were collected and categorized in order to draw conclusions about the degree at which multidisciplinary work is done in different departments of engineering. 200 abstracts were collected and analyzed from the University of Texas at El Paso library database.

The interrogatives within this case study were 6 different departments in the College of Engineering. Careful review of each thesis abstract was performed and the resulting characterization data was categorized and mapped into the Zachman framework.

The labels on the right side of the Zachman framework are for understanding how these theses match the perspectives on the left side. An appendix is provided at the end of this document that details the numbering utilized. Mapping is done by matching the labels within the framework.

	ME	Metal/ Meta'll science	IE/MfG	EE	CE	CS	
Scope	46,49,57,58		120	95,108	8,10,11,12,16, 22,23,26,36	4	Mangement
Business	57,62,65,140,1 35,120	140	113,116,125,1 26,130,95,120	80,86,107	2,3,5,24,28,33, 35,41	41	Financial
System	6,47,50,51,52, 55,56,60,63,64 ,117		110,112,115,1 17,125,126	7,67,68,73,74,76, 83,85,88,90,96,9 9,101,104,106,70 ,79,39	3,12,14,15,16, 21,22,24,27,30 ,31,32,36,37	4,39,40,41,42, 44,45,91	Stimulation
Technology	1,141,63,84,6, 51,55,56,61,66 ,138	127,128,135	113,117,122,1 30,132,141,86, 110,117	7,68,71,72,73,76, 77,81,84,85,87,8 9,92,107,40,41,9 8	2,5,9,14,15,18, 19,21,30,31,37	4,40,43	Technology
Detail Representation	1,50,6,55,48,4 7,53,54,59,63, 66,80,84	127,128,129,130,13 1,132,133,134,136,1 37,138,139,148,50, 52,53,59,141,63,13, 70,79,98,110	112,114,119,1 24	78,79,7,69,67, 75,77,83,94,97 ,100,102,95,10 4,109,43	3,9,13,16,17,2 0,29,31,34	4,42,43,76	Implementation
Real Product	6,59,64,1,54,6 2,48,50,59	127,129,130,1 31,133,134,13 6,137,140,13,7 9	111,118,119,1 21,123	69,78,82,93,10 3,105,91,95,76	2,8,9,10,24,25, 27,32,33,36,37 ,38	4,39,44	Case Study

Figure 3.1: UTEP College of Engineering theses Mapped in Zachman Framework

Visual Patterns:

Mechanical Engineering
Metal and Metallurgy science Engineering
Industrial and Manufacturing Engineering
Electrical Engineering
Civil Engineering
Computer science Engineering

Description:

Scope: Corresponds to an executive summary for a planner or investor who wants an overview or estimate of the scope of the system, what it would cost, and how it would relate to the general environment in which it will operate. But, in our example, labeled “management,” mapping was done by considering these theses, which are accomplished on and have impacted on some management backgrounds.

Business: Here in this row usually it corresponds to the enterprise (business) models, which constitutes the designs of the business and shows the business entities and processes and how they relate. But, we labeled it as financial because the theses that fall in this row will have impacted some financial models to that corresponding engineering.

System Model: they correspond to the system model designed by a system analyst who must determine the data elements, logical process flows, and functions that represent business entities and processes. For this example we labeled it as stimulations because some of these theses have produced stimulations work for their research.

Technology model: Some of the theses work, which has impact on technology or soft wares, falls in this level. Small number of theses deals with multiples software to get efficient outputs, like mat lab, Minitab etc. If Computer Programming is used in a thesis, this thesis falls into the Technology level-Computer Engineering column because these theses get impacted from Computer Engineering Software. If a thesis uses Auto CAD, this type of thesis falls into the Mechanical Engineering column - Technology level because Auto CAD deals with mechanical engineering and it is a technology. If one of the theses uses circuit magic software, this falls in electrical engineering –technology level.

Detail Representation: Usually these correspond to the detailed specifications that are given to programmers who code individual modules without being concerned with the overall context or structure of the system. In this example we labeled it as implements because the thesis does calculations on some of the readings, for example scanning electron microscopy was used on one of the theses. Thus, theses, which use particular equipment, fall in these cells.

Real System: These cells deal with case studies done on their research work, because this is actually a functioning enterprise.

Note: Here in this example some of the theses are split in cells in other engineering disciplines. This shows us that the work done in these theses were used or may be influenced by other engineering disciplines. Therefore these are known as multidisciplinary theses.

3.2 Educational enterprises with Teaching Models (Case Study 2)

Column 1 (what)

Scope: The category that we choose to view and define, as enterprise is education. Educational enterprises would have listed rules, students, faculty, universities and fields among the list of things important to education. By considering the advantage of education to the students we are testing and defining the scope of our chosen enterprise. We do not have enough room in this paper to cover all Education enterprise models. That would take thousands of models. Therefore, we only show slivers of educational models. For example, in column 1, we only look at the perspective with student carriers. In contrast, we could have looked at advantages by different types of education, or differences between people who are educated and uneducated. We use a different sliver for each column, but even at that, we did not restrict our models to only that one sliver.

Business model: For example the University of Texas system controls all the universities affiliated to UT systems. In this role, it has created rules governing the allowed standards and requirements for each department in each university. For example, a student should pursue 12 credit hours if the student is in the non-thesis program, or the student should pursue 8 credit hours if he/she is in thesis program. The UT system also determines the

cost of credit hours, etc. Financial models could be in every column. Those appropriate for column 1 include cost of credit hours, Student employments etc

System model: Each University should provide excellent academic standard professors or instructors and mentors to students for their skills development

Technology Model: Students will choose relevant courses and instructors or advisors.

Detailed representation: There are many models for a Student to get their study materials like books, eBooks or academic videos etc.

Real System: Let us assume that the physical product (data item) depicted in column 1 is the Student

Column 2 (How):

Scope: Introduction of learning and teaching models are set up by the educational community.

Business Models: The models of administration are responsible for hiring instructors or professors, tuition fees to students, and payments to faculty and staff.

System Models: The models of organizing schools are mapped in this category.

Technology Model: Technology support design models which are used in the university based on technology helps to students through which students can easily access from their home to in workplace etc.

Detail Representation: The models which instructor gives study materials and the way instructor teaches in the classroom to the students

Real System: The activity modeled in column 2 is interactions and Students response to it; the models which are based on students interaction in the class, fixes in cell.

Column 3 (Where):

Scope: All educational institutions at everywhere column 3

Business model: There are lots of educational institutions all over nationwide but, for now let's take Texas

System Model: For example all the departments located in UTEP

Technology model: Students are divided by their major and study courses from their respective departments

Detail Representation: Usually students attend the class in classroom and some students take a choice studying through online.

Real System: The sliver for column 3 is the for example El Paso

Column 4 (Who)

Scope: Decisions or changes in future education are made by people of high level management (Texas educational systems)

Business Model: Regents are responsible to sort out course curriculum depends on university standards He responsible to regulate all the rules

System Model: Provosts are responsible to evaluate professor's performance

Technology Model: To get the information about a particular department, faculty or students, and grades and performance of students etc. All this information is publicly available in university or colleges data base, This information is administrated by IT staff column

Detail Representation: Professors are responsible to teach in class and make students to interact with their class, develop student's skills to get good academic grades

Real System: Column 4 contains information about educational stakeholders. It should be possible for all this information about faculty and staff and students etc , to be contained in one system, with the information rolled up from the bottom to the top.

Column 5 (when):

Scope: Choices can be taken by the educational organizations at any time. It doesn't matter to particular period of time

Business Mode: For the future development to the university or educational organization, the current situation of the organization should be better maintained by excellence standards

System Model: The information regarding the class schedule and availability of space to desire class or term of service

Technology Model: The class sessions run for whole semester

Detail Representation: The studies usually goes at class sessions, the models based on class sessions will be mapped in this cell

Real System: The fundamental objective in an educational enterprise is studies

Column 6 (Why)

Scope: For the quality of life and for living in society as a knowledge person.

Business Model: For the state benefits or for the university benefits international students or poor financial background students with good academics should be supported by the university .column. What motivates educational enterprises owners? By providing good career opportunities by organizing career fairs etc .

System Model: For the academic excellence students should get some practical experience with theoretical studies. They are motivated to drive for success.

Technology Model: Educational organizations should have a tendency to motivate their students to achieve their future goals.

Detail Representation: Why does the instructors do wants to teach and evaluate by marking poor or good grades to students.

Real System: why people think the things they do and make the decisions they do, in this example self-improvement.

	What	How	Where	Who	When	Why	
Scope	Education	Learning & Teaching	Everywhere	People	Anytime	Quality of life	Boundaries
Business	UT System	Administration	Texas	Regents	Future	State benefits	Management
System	University	Organize schools	UTEP	Provost	Term of service	Academic Excellence	Requirements
Technology	Professors	Offerings	College	IT support	Semester	Transmission Of Knowledge	Technology
Detail Representation	Implements	facilitation	Classroom	Professors	Class sessions	Support teaching	Implements
Real System	Students	interactions	El Paso	Selves	Studies	Self improvements	Students




Figure 3.2: Educational Enterprises Mapped in Zachman Framework

3.3 Conclusion:

We have chosen college of Engineering and educational enterprise as a whole enterprise and may be these case studies may not draw the correct conclusion, but the significance of this work is to provide a formal and highly structured way of viewing and defining an enterprise at abstract level representation. The college of engineering case study work may be helpful for advisors to guide their students to develop multidisciplinary thesis in future.

Chapter 4: Zachman-Bayesian Framework Principals

4.1 Introduction to Bayes Theorem:

This theorem is named for Thomas Bayes and often called Bayes' law or Bayes' rule. Bayes' theorem expresses the conditional probability, or "posterior probability", of a hypothesis H (i.e. its probability after evidence E is observed) in terms of the "prior probability" of H, the prior probability of E, and the conditional probability of E given H. It implies that evidence has a confirming effect if it is more likely given H than given not-H. Bayes' theorem is valid in all common interpretations of probability, and it is commonly applied in science and engineering. However, there is disagreement among statisticians regarding the question whether it can be used to reduce all statistical questions to problems of inverse probability. Can competing scientific hypotheses be assigned prior probabilities?

Thomas Bayes addressed both the case of discrete probability distributions of data and the more complicated case of continuous probability distributions. In the discrete case, Bayes' theorem relates the conditional and marginal probabilities of events A and B, provided that the probability of B does not equal zero.

$$P(A|B) = \frac{P(B|A)P(A)}{P(B)}$$

In Bayes' theorem, each probability has a conventional name:

$P(A)$ is the prior probability (or "unconditional" or "marginal" probability) of A. It is "prior" in the sense that it does not take into account any information about B; however, the event B need not occur after event A. In the nineteenth century, the unconditional probability $P(A)$ in Bayes' rule was called the "antecedent" probability in deductive logic; the antecedent set of propositions

and the inference rule imply consequences. The unconditional probability $P(A)$ was called "a priori" by Ronald A. Fisher.

$P(A|B)$ is the conditional probability of A, given B. It is also called the posterior probability because it is derived from or depends upon the specified value of B.

$P(B|A)$ is the conditional probability of B, given A. It is also called the likelihood.

$P(B)$ is the prior or marginal probability of B, and acts as a normalizing constant.

Probability theory is a subject which is well-known for producing what seem at first sight to be counter-intuitive results. In addition, Bayes' theorem may seem difficult to grasp at first, because it seems to involve us in 'thinking backwards' in a way we are not used to. However, like most ideas, it is actually quite simple, and indeed obvious, once grasped. The problem is that having grasped it once may not guarantee that the understanding of it sticks – it may be necessary to think it through a second and even a third time. In probability theory and applications, Bayes' theorem shows how to determine inverse probabilities: knowing the conditional probability of A given B, what is the conditional probability of B given A? This can be done, but also involves the so-called prior or unconditional probabilities of A and B

4.2 Bayes Theorem Applications:

In the discussion of the conditional probability, we indicated that revising probabilities when new information is obtained is an important phase of probability analysis. Often, we begin the analysis with initial or prior probabilities estimates for specific events of interest. Then from the sources such as a sample, a special report or a product test, we obtain additional information about the events. Given this new information, we update the prior probability values by calculating

revised probabilities, referred to as posterior probabilities. Bayes theorem provides a means for making these probabilities calculations. The steps in this probability revision process are shown in Figure (4.1).

As an application of Bayes theorem, consider a manufacturing firm that receives shipments of parts from two different suppliers. Let A_1 denote the event that a part is from supplier 1 and A_2 denote the event that a part is from supplier 2. Currently, 65% of the parts purchased by the company are from supplier 1 and remaining 35% are from supplier 2. Hence, if a part is selected at random, we would assign the prior probabilities $P(A_1) = 0.65$ and $P(A_2) = 0.35$.

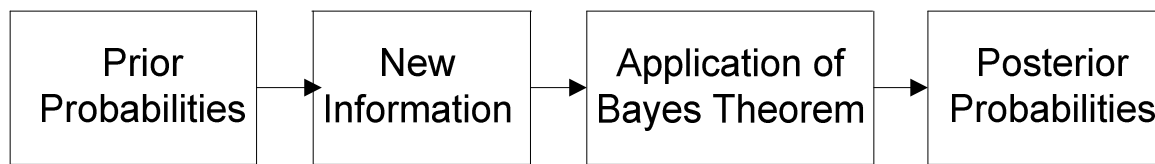


Figure 4.1: Probability revision using Bayes Theorem

The quality of the purchased parts varies with the source of supply. Historical data suggest that the quality ratings of the two suppliers are shown in the table:

Table 4.1: Historical quality Levels of Two Suppliers

	Percentage Good parts	Percentage Bad Parts
Supplier 1	98	2
Supplier 2	95	5

If we let G denote the event that a part is good and B denote the event that part is bad, the information in this table provides the following conditional probabilities values.

$$P(G|A_1)=.98 \quad P(B|A_1)=.02$$

$$P(G|A_2)=.95 \quad P(B|A_2)=.05$$

The tree diagram in Figure 4.2 depicts the process of the firm receiving a part from one of the two suppliers and then discovering that the part is good or bad as two step experiment .We see that four experimental outcomes are possible. Two corresponding to the part was being and two corresponding to the part being bad. Each of the experimental outcomes is the intersection of two events, so we can use the multiplication rule to compute the probabilities. For instance

$$P(A_1, G) = P(A_1 \cap G) = P(A_1)P(G | A_1)$$

The process of computing these joint probabilities can be depicted in what is called a probability tree. From the left to right through the tree, the probabilities for each branch at step 1 are prior probabilities and the probabilities for each branch at step 1 are conditional probabilities. To find the probabilities of each experiment outcome, we simply multiply probabilities on the branches leading to the outcome.

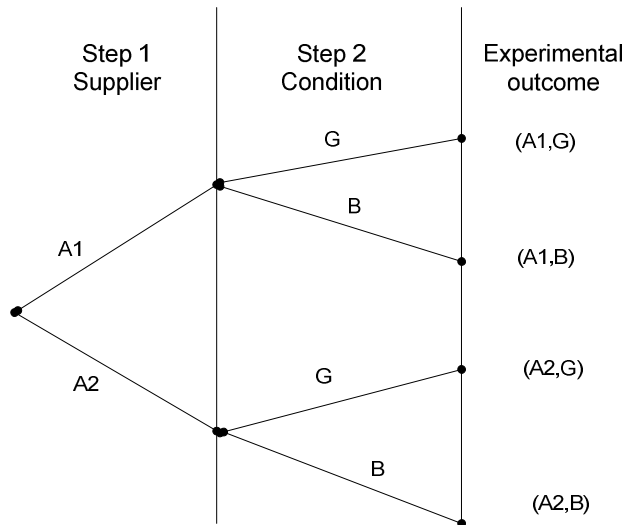


Figure 4.2: Tree Diagram for two Supplier Example

Note: Step 1 show that comes from one of two suppliers and Step 2 shows whether the part is good or bad.

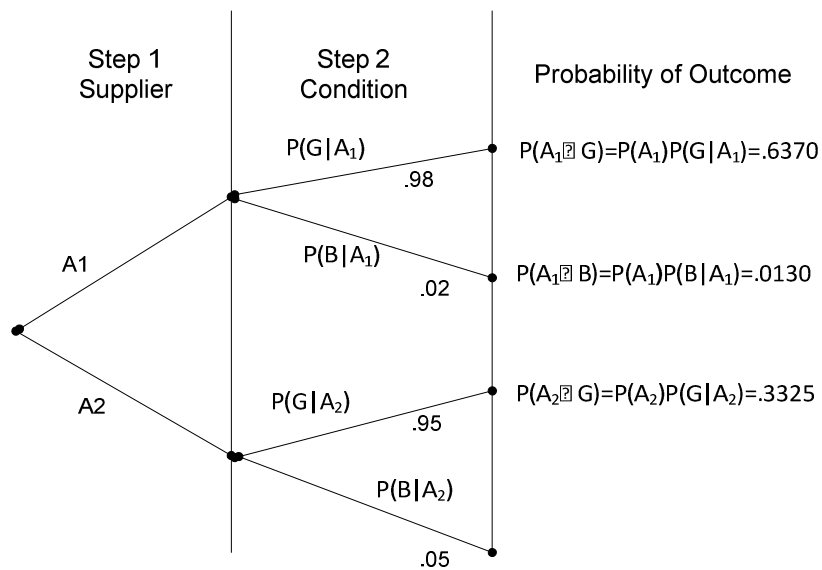


Figure 4.3: Probability Tree for Two-Supplier Example

Each of these joint probabilities is shown in figure along with the known probabilities for each branch Suppose now the parts from the two suppliers are used in the firm manufacturing process

and that a machine breaks down because it attempts to process a bad part. Given the information that the part is bad, what is the probability that it came from the supplier 1 and what is the probability that it came from supplier 2 with the information in the probability tree. Bayes theorem can be used to answer these questions. Letting B denote the event that the part is bad, we are looking for the posterior probabilities $P(A_1|B)$ and $P(A_2|B)$. From the law of conditional probabilities, we know that:

$$P(A_1 | B) = \frac{P(A_1 \cap B)}{P(B)}$$

Referring to the probability tree, we see that:

$$P(A_1 \cap B) = P(A_1)P(B | A_1)$$

To find $P(B)$, we note that event B can occur in only two ways: $(A_1 \cap B)$ and $(A_2 \cap B)$. Therefore, we have

$$\begin{aligned} P(B) &= P(A_1 \cap B) + P(A_2 \cap B) \\ &= P(A_1)P(B | A_1) + P(A_2)P(B | A_2) \end{aligned}$$

BAYES THEOREM (TWO EVENT CASE)

$$P(A_1 | B) = \frac{P(A_1)P(B | A_1)}{P(A_1)P(B | A_1) + P(A_2)P(B | A_2)}$$

$$P(A_2 | B) = \frac{P(A_2)P(B | A_2)}{P(A_1)P(B | A_1) + P(A_2)P(B | A_2)}$$

$$P(A_1 | B) = \frac{P(A_1)P(B | A_1)}{P(A_1)P(B | A_1) + P(A_2)P(B | A_2)}$$

$$\frac{(.65)(.02)}{(.65)(.02) + (.35)(.05)} = \frac{.0130}{.0130 + .0175}$$

$$P(A_2 | B) = \frac{P(.35)P(.05)}{(.65)(.02) + (.35)(.05)}$$

$$\frac{.0130}{.0305} = .4262 \qquad \frac{(.0175)}{.0130 + .0175} = \frac{.0175}{.0305} = .5738$$

Note that in this application we started with probability of .65 that a part selected at random was from supplier 1. However, given information that a part is bad, the probability that the part is from supplier 1 drops to .4262. In fact, if the part is bad, it has better than 50-50 chance that it came from supplier 2; that is, $P(A_2|B) = 0.5738$.

Bayes theorem is applicable when the events for which we want to compute posterior probabilities are mutually exclusive and their union is the entire sample space. For the case of n mutually exclusive events $A_1, A_2, A_3, \dots, A_n$, whose union is the entire sample space Bayes theorem can be used to compute any posterior probability $P(A_i|B)$ as shown here.

BAYES THEOREM

$$P(A_i | B) = \frac{P(A_i)P(B | A_i)}{P(A_1)P(B | A_1) + P(A_2)P(B | A_2) + \dots + P(A_n)P(B | A_n)}$$

With prior probabilities $P(A_1), P(A_2), \dots, P(A_n)$ and the appropriate conditional probabilities $P(B|A_1), P(B|A_2), \dots, P(B|A_n)$, can be used to compute the posterior probability of the events $A_1, A_2, A_3, \dots, A_n$.

A Comparison of the Bayesian Approach with the Frequentist Approach follows.

4.3 Bayesian Approach:

Bayesians express the uncertainty about a parameter value by a density distribution that assigns probabilities to all possible values. Bayesian refers to any use or user of prior densities on a parameter space, with the associated applications of Bayes' theorem, in the analysis of the statistical problems. In other words, Bayesians make inferences based on both the observed data and prior information.

4.4 Frequentist Approach:

Frequentists never talk about probability distributions as the true source for values of a parameter. Instead, they emphasis empirical data and procedures for analyzing phenomena those repeat themselves many times. The interpretations are usually not intuitive. Frequentists adhere to the objective school of analysis, where the reality of prior densities is denied, and where there is a tendency to interpret probability in terms of relative frequencies in large scale replications. In other words, Frequentists make inferences based on observed data.

4.5 Zachman Enterprise Frame work as a Basis for Enterprise Representation and Experimentation

An enterprise's state of health can be determined by conducting a quality assessment in each of the 36 cells, with the goal being to find areas for improvement. The cellular area can then be improved directly through investment. However, since a cell is an area formed both by a cross-cutting level and a cross-cutting aspect, there remains the question as to whether the presence of deficient quality was a condition possibly caused by insufficient investment in either the level or aspect associated with the cell. Investment may be more efficient if directed toward an enterprise-wide level or aspect. In fact, investment in a complete level or aspect assures investment in 1/6 of the enterprise, while investment in a single cell assures investment in only

1/36 of the enterprise. The question of whether to invest a cell, or in a row or column, is further elucidated by considering the possible impacts of investments.

4.6 Cells-to-Cell Experimentation

If an investment is made in a single cell, there can be impacts on 35 other cells. Employing Equation 1 for the number of relations in a fully-connected network, we considering that there are 36 cells (or nodes) in which an investment can be made.

$$\#Relations = \frac{N^2 - N}{2} = \frac{(36^2 - 36)}{2} = 630$$

Assuming the bi-directionality of the relations, there are a total of 1260 correlations to be determined. This represents a sizable commitment to experimentation, as well as to data collection and analysis. In practical terms, perhaps one month would have to be devoted to each experiment, calculating out to 3 year of experimentation. In a modern setting, with the both the enterprise and enterprise environment in flux, the significance of the experimental conclusions may be negated before they can be profitably employed. Figure illustrates.

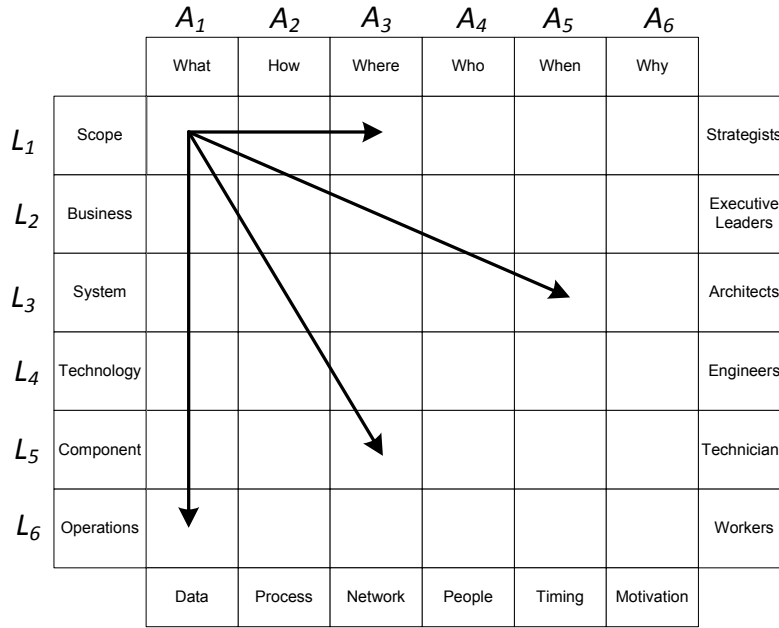


Figure 4.4: Cell-to-cell effects

4.7 Column-to-Row and Row-to-Column Experimentation

Assuming the separability of levels and the orthogonality of aspects, if an investment is directed toward a single level or aspect, there can be an impact on only 6 counterparts – either levels if the investment was in an aspect, or aspects if the investment was in a level. Considering that there are 12 levels and aspects in which an investment can be made, there are a total of 72 correlations to be determined, assuming directionality in the correlations. In comparison to cell-to-cell experimentation, row-to-column and column-to-row experimentation requires only 1/3 the number of experiments, and a determination of only 72 correlations, in comparison to 1260 correlations between cells. The purpose of reducing the unit of consideration from the cell to the row or column is to trade precision for efficiency, and thus become more effective in enterprise experimentation and characterization. Figure 4.5 illustrates.

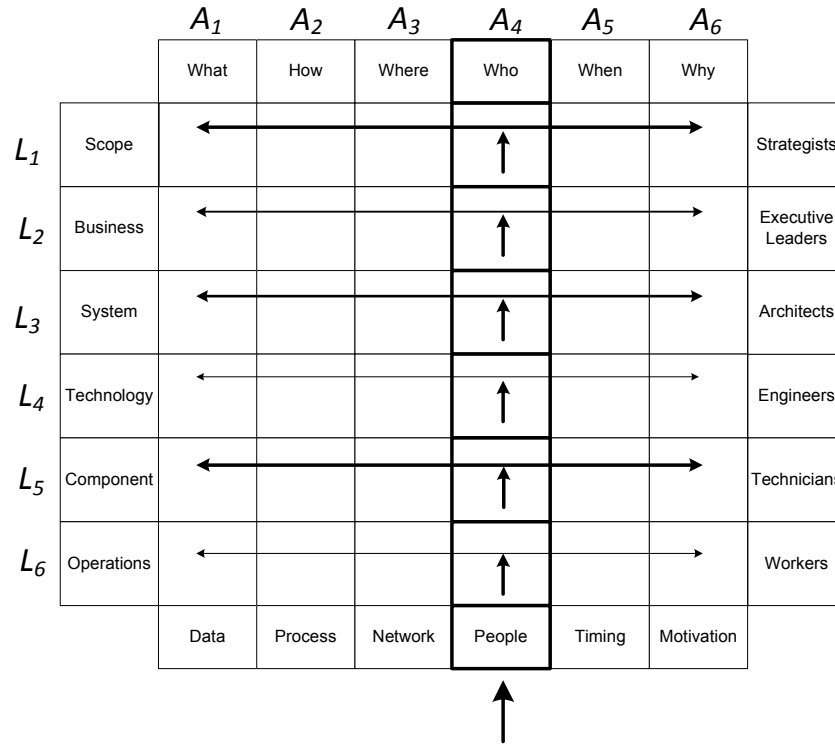


Figure 4.5: Column-to-row effects

Twelve (12) experiments are within the contemplation of an enterprise decision maker, who may in fact choose to perform a more limited number of column-to-row or row-to-column experiments, being guided by the consideration of relevant information, experience and intuition. Column-to-row and row-to-column experimentation is perhaps not as precise as cell-to-cell experimentation, because rows and columns are more abstract entities than more concrete cellular areas in the enterprise. However, column-to-row and row-to-column experimentation better matches the level of abstraction at which enterprise transformations are triggered by capable enterprise strategists, and thus is a more efficient and effective strategy for beneficial enterprise change.

Additional experiments include Row-to-Row experiments, which are strongly hierarchical, and Column-to-Column experiments, which observe translations between fundamentally different

aspects of the enterprise. These have not been included here in order to develop the more striking transformation of investments from columns to rows, or rows to columns.

Note the inherent challenge of making an investment “in an aspect,” or “in a level.” Such an investment must be made in such a way that it may have to be an abstract investment, created ingeniously and applied deftly. The reward is that a single investment can directly cover 1/12 of the enterprise as viewed through the rows and columns of the Zachman framework, and, the same investment can impact the complement of either rows or columns, and so influence and impact an additional ½ of the enterprise as seen in terms of Zachman levels and aspects.

4.8 Introduction to Zachman Bayesian Framework

The article Organizational Assessment Models for Enterprise Transformation defined as “Organizational assessment is becoming increasingly important, both as a cross-time and cross-industry measurement and as a guiding force in enterprise transformation. Assessments provide crucial information about strengths, areas for improvement and potential investment strategies for achieving performance benefits. As performance is being recognized as a complex and multifaceted construct, assessment tools seek to incorporate and reflect a holistic measurement of performance across multiple dimensions such as stakeholder value, leadership, culture and quality” (Perkins, Valerdi, Nightingale, Rifkin, 2010).

Holistic enterprise perspective is increasingly necessary to reduce overall costs and improve value delivery. While individual company costs might be reduced by a single company optimizing its operations, the impacts of such changes may be detrimental to the whole value systems .reductionism assumes that the enterprise is mechanical in its nature, with local improvements –giving rise to a like improvement at system level. Therefore, an enterprise

perspective may be needed to achieve significant and sustainable cost reduction. Inter-organizational cost management techniques, including the use of target costing, may deliver significant benefits if they adopted in an integrated manner (Valerdi, Nightingale and Blackburn. 2010).

The significance of choosing Bayesian analysis for this thesis is that Bayesian methods can answer complex questions cleanly and exactly. Bayesian techniques are particularly well suited for decision-making, under the condition that makes decisions hard, uncertainty. There is uncertainty about the consequences of any given decision, due to the lack of knowledge about relevant facts or parameters. Bayesian methods can quantify those uncertainties using conditional probability. Indeed, very often we explicitly derive a posterior distribution for unknown parameters based on the available evidence. This quantification of the uncertainties in a decision is a crucial component of rational, evidence-based decision-making. With this new Zachman Bayesian Framework experimentation provides a new direction for organizations to model impacts or benefits obtained when investments are made in the technology, business, operational and systems levels, as well as other aspects.

The Zachman enterprise framework is shown below, where the different cells are each characterized by one Level and Aspect of the enterprise, where:

$$L_i = \text{Level } i$$

$$A_k = \text{Level } k.$$

		A ₁	A ₂	A ₃	A ₄	A ₅	A ₆	
		What	Who	Where	How	When	Why	
L ₁	Scope							Strategists
L ₂	Business							Executive Leaders
L ₃	System							Architects
L ₄	Technology							Engineers
L ₅	Component							Technicians
L ₆	Operations							Workers
		Data	People	Network	Organization	Timing	Motivation	

Figure 4.6: Zachman framework with Levels and Aspects

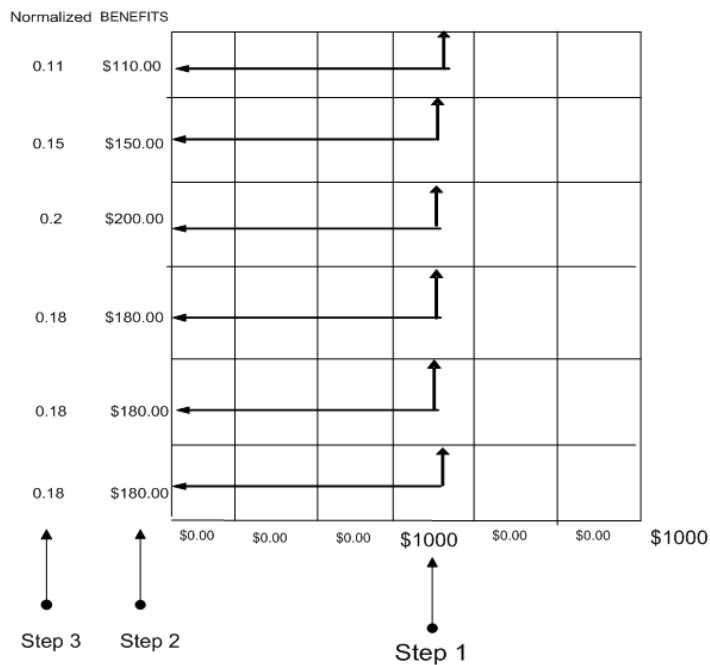


Figure 4.7: Experimentation with Dollars, to determine the conditional probabilities

Step 1 will be to determine the conditional probabilities or Benefits. We choose column 4 and make an experimental investment of \$1000. We invested the \$1000 in the total column; there will be many factors that will contribute in the observed benefits. (Example: The assessments from internal employees or customer surveys or executives evaluations etc.)

Step 2 will be to observe the benefits. For example, we observe in row 1 a benefit of \$180, and in row 6, we observe \$110. Finally, Step 3 will be to normalize the observed benefits for each of the rows. For example 11% of the benefits will appear on row 1 and 18% of the benefits are obtained at row 6.

By investing \$1000 in column 4, we are able to determine the percentage of benefits. After we have determined the fractions in step 3, we can now discover what the conditional probabilities (Benefits) are inside the matrix. Now we can fill in these fractions as conditional probabilities of column 4. So we do six experiments, that allows us to fill six columns of conditional probabilities. So now we know all the conditional probabilities. We know how the enterprise is going to react when we invest money in it, we know the conditional probabilities and interior characteristics, how the enterprise translate money from one side to other.

		Step 4		Conditional Probabilities				
Check		1.00	1.00	1.00	1.00	1.00	1.00	
Evidence	0.11	0.11	0.11	0.11	0.11	0.11	0.11	
	0.10	0.15	0.05	0.05	0.15	0.40	0.00	
	0.47	0.20	0.30	0.20	0.20	0.85	0.35	
	0.20	0.18	0.18	0.28	0.18	0.18	0.18	
	0.14	0.18	0.18	0.18	0.18	0.08	0.18	
	0.18	0.18	0.18	0.18	0.18	0.18	0.18	
Check		1.00	\$0.15	\$0.10	\$0.15	0.20	0.40	0.00
		Priors		Step 6				

investment in column 2 times the conditional probabilities in column 2 and so on for the other columns, so given all that we going to end up with some fractional evidence in each of the rows that Step 7 we know what the fractional evidence each of the rows.

Step 8						Posteriors					
1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
0.15	0.10	0.15	0.20	0.40	0.00	1.00					
0.24	0.05	0.08	0.32	1.68	0.00	1.00					
0.06	0.06	0.06	0.09	0.72	0.00	1.00					
0.14	0.09	0.22	0.18	0.37	0.00	1.00					
0.19	0.13	0.19	0.26	0.23	0.00	1.00					
0.15	0.10	0.15	0.20	0.40	0.00	1.00					
\$0.15	\$0.10	\$0.15	0.20	0.40	0.00	Check					
Priors											

Figure 4.9: Calculation to determine the Posterior values

We then use evidence in the Bayesian formula and now we are down to matrix number 4 where we also included the absolute value .we use the Bayesian formula for every cell .now the label is here the 36 cells contains posteriors. Each cell is going to be calculated by taking the prior or the corresponding prior time the corresponding conditional probability divided by the evidence and that is how the posteriors are determined.

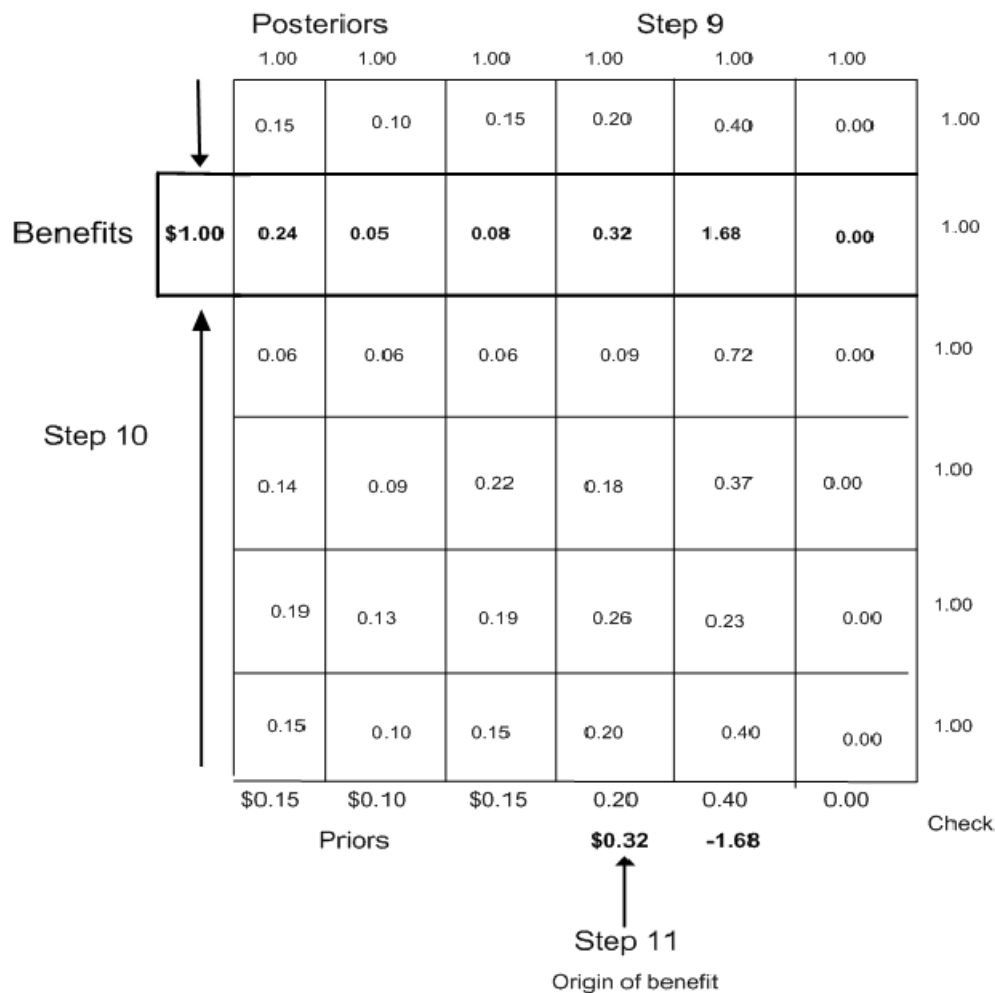


Figure 4.10: Calculation to determined the Observed Benefits

These posteriors tell us Information about translation in the reverse direction, when we went forward, we made an investment in column and we observed how much benefit is obtained as some benefit in a row. In the case of posterior, we are going in reverse, we are observing the benefits that we obtained in the rows and now we can answer the question, “How much of the benefit came from each column? And the question is answered by the posterior answer. So now we can look at Step 10. After observing benefits in a row, we look across the table through the

posteriors for one column and that tells us what portion of that benefit for that row came from every column .and that answer written down in Step 11.

Through the experimentation, what happen when priors are negative? The result is the evidence can go negative. The experimentation is done when the conditional probabilities are negative and the result is the evidence can also go to negative.

Third experiment we did is well the posteriors end up negative? And the answer is the YES posteriors end up with negative. Given that we observe positive benefits in a row, we also have negative posterior translation. For example, negative benefits could occur due to a lack of due diligence at the requirements phase of a software project, where important factors could be the level of skill in design and poor management judgment in selecting software engineers with the right skill sets.

4.9 Some Key factors for Negative benefits (www.bcs.org)

Business reasons for project failure

Business strategy superseded;

Business processes change (poor alignment);

Poor requirements management;

Business benefits not clearly communicated or overstated;

Failure of parent company to deliver;

Governance issues within the contract;

Higher cost of capital;

Inability to provide investment capital;

Inappropriate disaster recovery;

Misuse of financial resources;

Overspends in excess of agreed budgets;

Poor project board composition;

Take-over of client firm;

Too big a project portfolio.

Management reasons

Ability to adapt to new resource combinations;

Differences between management and client;

Insufficient risk management;

Insufficient end-user management;

Insufficient domain knowledge;

Insufficient software metrics;

Insufficient training of users;

Inappropriate procedures and routines;

Lack of management judgment;

Lack of software development metrics;

Loss of key personnel;

Managing legacy replacement;

Poor vendor management

Poor software productivity;

Poor communication between stakeholders;

Poor contract management;

Poor financial management;

Project management capability;
Poor delegation and decision making;
Unfilled promises to users and other stakeholders;

Technical reasons

Inappropriate architecture;
Insufficient reuse of existing technical objects;
Inappropriate testing tools;
Inappropriate coding language;
Inappropriate technical methodologies;
Lack of formal technical standards;
Lack of technical innovation (obsolescence);
Misstatement of technical risk;
Obsolescence of technology;
Poor interface specifications;
Poor quality code;
Poor systems testing;
Poor data migration;
Poor systems integration;
Poor configuration management;
Poor change management procedures;
Poor technical judgment.

4.10 Zachman Bayesian Experimentation Examples:

In the example that follows, we are predominantly interested in increasing the quality of the enterprise by influence the organization via the aspects, which can be enhanced through effort. It is assumed that only positive effects are present. For example, an increased focus in where things occur in the organization is usually modernly concurrent with an upgrade of the enterprise Network. Investment in the Network will, in a particular enterprise, have a different proportional impact on different levels of the organization So, in a specific example, an investment in the Network will have the following proportional impacts: 0.05 on the Scope level, 0.15 on the Business level, 0.30 on the System level, 0.15 on the Technology level, 0.20 on the Component level, and 0.15 on the Operations level. Figure 2 shows this example:

		A ₁	A ₂	A ₃	A ₄	A ₅	A ₆	
		What	Who	Where	How	When	Why	
L ₁	Scope			0.05				Strategists
L ₂	Business			0.15				Executive Leaders
L ₃	System			0.30				Architects
L ₄	Technology			0.15				Engineers
L ₅	Component			0.20				Technicians
L ₆	Operations			0.15				Workers
		Data	People	Network	Organization	Timing	Motivation	

Figure 4.11: Where/Network proportional impacts on levels

The proportional impacts can be phrased in terms that are used in Bayes' Theorem, namely, as conditional probabilities. In the example, the focus for improvement was in the Where/Network aspect A_3 ; this is the imposed “condition” that is a part of the conditional probabilities that L_1 , L_2 , L_3 , L_4 , L_5 or L_6 are impacted. The generic term for such conditional probabilities is

$$P(L_i \mid A_k)$$

This is the Conditional Probability of L_i , given A_k .

This can be read as:

Focusing on the condition of A_k .

Consider k as particular value, say $k=5$.

Focusing on A_5 , what is the ‘probability’ of L_i .

In other terms:

What is the proportion of quality effort at A_5 that goes into L_i , where $i = 1, 2, 3, 4$ and 5 .

In the example above,

$$P(L_1 \mid A_3) = 0.05$$

$$P(L_2 \mid A_3) = 0.15$$

$$P(L_3 \mid A_3) = 0.30$$

$$P(L_4 \mid A_3) = 0.15$$

$$P(L_5 \mid A_3) = 0.20$$

$$P(L_6 \mid A_3) = 0.15$$

The full Zachman framework can now be filled in with proportional impacts or, conditional probabilities in the formalism of Bayes' Theorem. See Figure 15:

		A ₁	A ₂	A ₃	A ₄	A ₅	A ₆	
		What	Who	Where	How	When	Why	
L ₁	Scope ←			$P(L_1 A_3)$				Strategists
L ₂	Business ←			$P(L_2 A_3)$				Executive Leaders
L ₃	System ←			$P(L_3 A_3)$		$P(L_3 A_5)$		Architects
L ₄	Technology ←			$P(L_4 A_3)$		etc.		Engineers
L ₅	Component ←			$P(L_5 A_3)$		$P(L_5 A_5)$		Technicians
L ₆	Operations ←			$P(L_6 A_3)$				Workers
		Data	People	Network	Organization	Timing	Motivation	

Figure 4.12: Conditional probabilities in each cell translation between levels and aspects

Note the necessary condition that the sum of conditional probabilities, for all possible outcomes, given one condition, should equal unity.

$$\sum_{i=1}^6 P(L_i | A_k) = 1$$

In the example, this says that the sum of conditional probabilities in each column should equal unity (1).

We have been examining the translation of quality/effort of a single aspect into quality/effort proportional effects at the levels L_1 - L_6 .

Next, let's examine what happen in the presence of some quality/effort in each of the aspects, A_1 - A_6 . Say, for example, that a total investment is made to improve the enterprise. The investment

is split into fractions that will be invested in the individual aspects A_1 - A_6 . These investments in the individual aspects can be written as:

$$P(A_1) = 0.03$$

$$P(A_2) = 0.09$$

$$P(A_4) = 0.13$$

$$P(A_4) = 0.17$$

$$P(A_5) = 0.25$$

$$P(A_6) = 0.33$$

First, let's examine how the investment in aspect A_3 , Where/Network, will impact the levels L_1 - L_6 , given the fact that the investment in Where/Network is only 0.13 of the total investment in the enterprise.

			A ₁	A ₂	A ₃	A ₄	A ₅	A ₆		
			What	Who	Where	How	When	Why		
$P(L_1 A_3)P(A_3)$	0.0065	Scope ←			0.05				Strategists	L ₁
$P(L_2 A_3)P(A_3)$	0.0195	Business ←			0.15				Executive Leaders	L ₂
$P(L_3 A_3)P(A_3)$	0.039	System ←			0.30		$P(L_3 A_5)$		Architects	L ₃
$P(L_4 A_3)P(A_3)$	0.0195	Technology ←			0.15		etc.		Engineers	L ₄
$P(L_5 A_3)P(A_3)$	0.026	Component ←			0.20		$P(L_5 A_5)$		Technicians	L ₅
$P(L_6 A_3)P(A_3)$	0.0195	Operations ←			0.15				Workers	L ₆
			Data	People	Network	Organization	Timing	Motivation		
			$P(A_1)$ =0.03	$P(A_2)$ =0.09	$P(A_3)$ =0.13	$P(A_4)$ =0.17	$P(A_5)$ =0.25	$P(A_6)$ =0.33		

Figure 4.13: Investment /quality translation to each level

What we are looking at is:

$$P(L_i | A_k)P(A_k)$$

$$P(L_i | A_3)P(A_3)$$

Next, we ask the question pertinent to a single level: What is the total effect on one level, given inputs from all six aspects? The answer is given in the following mathematical expression, which is illustrated in Figure 5.

$$P(L_k) = \sum_j P(L_k | A_j)P(A_j)$$

For this illustration, we need to know the six (6) conditional probabilities, which we will assume have values as follows:

$$P(L_2 | A_1) = 0.06$$

$$P(L_2 | A_2) = 0.16$$

$$P(L_2 | A_3) = 0.15$$

$$P(L_2 | A_4) = 0.26$$

$$P(L_2 | A_5) = 0.21$$

$$P(L_6 | A_6) = 0.16$$

		A ₁	A ₂	A ₃	A ₄	A ₅	A ₆		
		What	Who	Where	How	When	Why		
$P(L_2) = \sum P(L_k A_j) P(A_j)$ 0.1852	Scope							Strategists	L ₁
	Business	$P(L_2 A_1) = 0.06$	$P(L_2 A_2) = 0.16$	$P(L_2 A_3) = 0.15$	$P(L_2 A_4) = 0.26$	$P(L_2 A_5) = 0.21$	$P(L_2 A_6) = 0.16$	Executive Leaders	L ₂
	System	↑	↑	↑	↑	↑	↑	Architects	L ₃
	Technology							Engineers	L ₄
	Component							Technicians	L ₅
	Operations							Workers	L ₆
		Data	People	Network	Organization	Timing	Motivation		
		$P(A_1) = 0.03$	$P(A_2) = 0.09$	$P(A_3) = 0.13$	$P(A_4) = 0.17$	$P(A_5) = 0.25$	$P(A_6) = 0.33$		

Figure 4.14: Total effect on one level from inputs from all six aspects

In order to see the meaning of Bayes' Formula for the Zachman Framework, let us consolidate the six (6) multiplicative products we just used and show them graphically in Figure 18.

			A ₁	A ₂	A ₃	A ₄	A ₅	A ₆		
			What	Who	Where	How	When	Why		
<div>$P(L_2)=\sum P(L_k A_j)P(A_j)$</div>	0.1852	Scope							Strategists	L ₁
		Business	$P(L_2 A_1)P(A_1)$ =0.0018	$P(L_2 A_2)P(A_2)$ =0.0144	$P(L_2 A_3)P(A_3)$ =0.0195	$P(L_2 A_4)P(A_4)$ =0.0442	$P(L_2 A_5)P(A_5)$ =0.0525	$P(L_2 A_6)P(A_6)$ =0.0528	Executive Leaders	L ₂
		System							Architects	L ₃
		Technology							Engineers	L ₄
		Component							Technicians	L ₅
		Operations							Workers	L ₆
			Data	People	Network	Organization	Timing	Motivation		

Figure 4.15: Total effect on one level from inputs from all six aspects

Now, let's take the six (6) contributing additive components of the marginal probability

$$P(L_2) = \sum_j P(L_2 | A_j) P(A_j) = 0.1852$$

And normalize the six (6) contributing additive components of the marginal probability by dividing each one by the marginal probability of level 2. What we get is shown in Figure 20

	A ₁	A ₂	A ₃	A ₄	A ₅	A ₆	
	What	Who	Where	How	When	Why	
Scope							Strategists L ₁
→ Business	$P(A_1 L_2)$ =0.009719	$P(A_2 L_2)$ =0.077754	$P(A_3 L_2)$ =0.105292	$P(A_4 L_2)$ =0.238661	$P(A_5 L_2)$ =0.283477	$P(A_6 L_2)$ =0.285097	Executive Leaders L ₂
System							Architects L ₃
Technology							Engineers L ₄
Component							Technicians L ₅
Operations							Workers L ₆
	Data	People	Network	Organization	Timing	Motivation	

Figure 4.16: The marginal probability of level 2

These results are conditional probabilities, given the condition of having chosen a particular level.

$$P(A_k | L_i)$$

Note that the addition of the six of these conditional probabilities, called the posterior probabilities, add up to unity (1) for each row.

Now, we have translation probabilities in the opposite direction. That is, given the increase in quality at a certain level; we will know what fraction of that investment/quality comes from investment in each aspect.

All the above components are related through Bayes's formula as applied to the Zachman framework in this case study.

$$P(A_k | L_i) = \frac{P(L_i | A_k)P(A_k)}{\sum_j P(L_k | A_j)P(A_j)}$$

Now we can see the full significance of Bayes' Formula as applied in a quality investment scenario in an enterprise.

Note that Bayes' Theory calculates the Posteriors by multiplying the Likelihoods with the Priors, and dividing by the Evidence.

$$Posterior = \frac{Likelihood \cdot (Prior)}{Evidence}$$

The Benefits produced by the investments or interventions at each levels are considered as conditional probabilities, investments (assumed for the experiment) as Priors. The Posterior Values says performance of models through the Benefits from each level. If higher posterior values are delivered by Bayesian methodology, then it can be concluded that the model is efficient at that particular level, or if we obtain lower posterior values, it shows the models should be redesigned at that level for future better impacts.

4.11 Alternative Scenarios

There are some possible scenarios that will produce complications.

It is possible that in experimentation, the same investment stimulus will produce different benefit responses. It is possible that an investment made in a column will produce benefits in other columns, and that these columns will then produce their own benefits.

This Zachman-Bayesian framework will of necessity have to be applied over time, during which the enterprise changes, so the assumption of a static enterprise is never reasonable.

The application of this Zachman-Bayesian framework will have to be over a planning horizon and not just one point in present time, producing time-based contingencies.

Chapter 5: Enterprise Transformation with TMAC Case study

5.1 Introduction

The Main objective of this study is alignment of the intervention with challenge and another and the fact that may be the abstract framework this helps discussions of enterprise transformation. Looking at company interventions one after another serial interventions that are going to indicate, what kind of transformation the company is going through. It's probably look into company data base that have used many interventions and then look through the data, how the company is been transformed by those interventions. The data for this thesis was drawn from an outlet of the Texas Manufacturing Assistance Center (TMAC) at the University of Texas at El Paso (UTEP).

5.2 Description of TMAC

“The Texas Manufacturing Assistance Center (TMAC) is an organization that works to strengthen the economy by providing best business practice consulting and technical assistance to Texas industry. They are a part of the Hollings Manufacturing Extension Partnership, a program run by the National Institute of Standards and Technology (NIST) to help small and medium sized manufacturers (Wikipedia). TMAC is affiliated with the University of Texas at Arlington, University of Texas at El Paso, University of Texas–Pan American, Texas Tech, University of Houston, the Texas Engineering Extension Service (TEEX), and the Southwest Research Institute. TMAC was formed in 1995. In independent surveys, those customers have reported cumulative impacts totaling \$1.8 billion in new or retained sales, \$514 million in cost savings and cost avoidance on materials, labor, inventory and equipment. More than 16,000 Texas jobs are created or retained” (TMAC.com).

Enterprise transformation data is available for this study because TMAC, in having provided its services to over 4300 companies for 13 years, has accumulated data on many enterprise interventions.

5.3 TMAC Project Interventions in Client Companies

Technically, every company has their particular challenge which needs to get solved for desired or efficient output. So, when the company had challenges to be solved, those companies approach TMAC to solve their challenges.

	What	Who	Where	How	When	Why		
Scope			Ex/GE				Strategists	ID/GOP
Business		MP/S		C/CR			Executive Leaders	
System				Financing			Architects	
Technology			TN				Engineers	
Component							Technicians	
Operations							Workers	
	Data	People	Network	Organization	Timing	Motivation		TMAC Challenges
	PI	ER						

Figure 5.1: TMAC addresses challenges that companies face

TMAC addresses challenges that companies face. The set of challenges that TMAC addresses are seen in the following above Figure 5.1:

PI –Product Innovation

TN-Technology Needs

MP/S-Managing Partners/Suppliers

ER-Employee Recruitment

Financing

ID/GOP-Identification of Growth opportunities

CI/CR-Cont. Improvement/Cost Reduction

	What	Who	Where	How	When	Why	
Scope							Strategists
Business	L&M			P&ML	AM		Executive Leaders
System		ED		QM	GS		Architects
Technology							Engineers
Component		SAFETY					Technicians
Operations							Workers
	Data	People	Network	Organization	Timing	Motivation	

Figure 5.2: TMAC address their interventions or products to the companies

TMAC assists with their products to the companies who approach TMAC to get solved with their challenges. All TMAC products are mapped in Zachman Framework.

L&M: Leadership and Management were mapped at business level because according to TMAC data base financial fundamentals, planning/Policy Deployment, Value Stream Management was in Leadership and Management category. Business level deals with strategies and management in Zachman Framework, so this category was mapped in that level.

ED: Expert Development was mapped at Systems level –people, because people who are concerned at system level was impacted this product. The System level deals with implementation of business models, so TMAC has Lean Six Sigma and Lean Certification, which are interventions in expert development.

Safety: TMAC has interventions on safe....ty to the technicians and workers.

P&ML: Production and Material Logistics was mapped at business level –how because it consists of principals of lean manufacturing, cellular. Flow manufacturing. “How” cell in Zachman Framework represents the functions.

QM: Quality Management was mapped Systems level and Business Level because it deals with management .TMAC has ISO9000 Quality Management system, AS9100 Aerospace Management systems, Automotive Management as their interventions to Quality management.

AM: Asset Management was mapped at business level, because interventions on asset management were management interventions like total productive management.

GS: Growth Services touch both system level and Technology level because TMAC has interventions on design for manufacturing, facilities design which impacted in technology level, Value engineering impacts at system level.

Let us take a company Ace-World and Map this company challenges and Interventions in Zachman Framework and see how enterprise transformations obtained.

	What	Who	Where	How	When	Why		
Scope							Strategists	IDENTIFICATION GROWTH OPPORTUNITIES
Business							Executive Leaders	
System							Architects	FINANCING&CONT. IMPROVENT /COST REDUCTION
Technology							Engineers	
Component							Technicians	Red: Challenges
Operations							Workers	
	Data	People	Network	Organization	Timing	Motivation		<u>Ace World</u>

Figure 5.3: Ace World Challenges Mapped in Zachman Framework

The products and interventions that TMAC has available to somehow transform the enterprise and deal with the challenges shows in below figure maps out the TMAC interventions accomplished to Ace World challenges and then of course these products are applied to the companies, interventions is accomplished and then that produces some output to each company which are majorly monitored more less at the business level.

	What	Who	Where	How	When	Why	
Scope							Strategists
Business							Executive Leaders
System							Architects
Technology							Engineers
Component							Technicians
Operations							Workers
	Data	People	Network	Organization	Timing	Motivation	<u>Ace World</u>

Trainings
Technology/ Product Development
Black Intervention

Figure 5.4: Ace-World Interventions mapped in Zachman Framework

The intervention type is usually a type of methodology or technology applied in the company in order to try to achieve positive results. Every intervention is applied to the company via a project, which can be characterized by the following parameters:

For each project, data for the following are included:

1. Name of the project
2. Project Substance for example :Technology /Product Development
3. Total labor hours
4. Total labor cost
5. External third party cost
6. Internal third party cost
7. Materials/software cost

8. Project price
9. Price per hour
10. TCATS Substance :Example technical
11. TCATS Category: Production Planning &Control (MRP/ERP)
12. All Data contains numerical values.

	What	Who	Where	How	When	Why	
Scope							Strategists
Business							Executive Leaders
System							Architects
Technology	T/PD						Engineers
Component							Technicians
Operations							Workers
	Data	People	Network	Organization	Timing	Motivation	<u>Ace World</u>

Black
Intervention

Blue: Results/
Outputs

Red:
Challenges

Figure 5.5: Ace-world Enterprise Transformation mapped in Zachman Framework

Zachman framework is going to hold Ace World and in there we are going to show color coded and challenge that ace world has, and color coded intervention where ace world purchased from TMAC and used and a color coded output area (see above figure). The idea is to see if the interventions areas matched the reported problem or challenges areas so they should match ideally, so this just straight forward magic that interventions should be top of the challenge areas,

but what we really see is that more companies are seeing their challenges in financial terms and they are going to apply for lower level intervention which is sort of misalignment because if they stay challenges at the systems level and apply some intervention at technology level and they report output again at the financial level and there are doubts whether they are choosing the right intervention or not. Now they could be, because people of company who choose the intervention could be correct. In which they have chosen and may be it's not correct because they may choose someone blindly. They should probably be instead of stating up challenges here in financial area the challenges should be better diagnosed in wherever they are in enterprise and another intervention can be placed exactly on the top of where the challenges are and then at the end of financial can be reported.

5.4 Data collection process

TMAC evaluates these challenges and provides best solution by TMAC Strategies which are recorded as Project ID or so called as interventions within this thesis. Data was cranked out with highest Interventions or project ID conducted to the companies by TMAC. Each company has its own conducted survey with Respondent name and Respondent title about the interventions made by TMAC to that company, and projects associated view data will be available for that company. Once the companies with higher interventions or projects were found, they are pulled out with detailed summary of each Project individually. For this thesis, almost 10 companies with on average of 7 completed interventions or projects are pulled out.

Each survey provides.

1. What important factors may company consider to recommend TMAC to help their challenges The important factors may be for example TMAC was good in center/Staff

Expertise, Cost/Price of services, etc. This information varies from one company to another.

2. Important challenges which company need to be solved by TMAC like Continuous Improvement/Cost Reduction, Employee Recruitment etc.
3. Accomplished Projects with their name and number Identity
4. Survey Quarter and Date conducted
5. After TMAC complete solving each company challenges, respondent who is responding to the survey is going to provide on which aspects their company is benefited by TMAC interventions like on Cost savings amount, employee Retention amount, save on Investments, amount Plant or equipment etc.

Date (Actual Close)	Project ID	Name	Project Substance	TCATS Substance	TCATS Category	Labor Cost	Labor Hours	\$/Hour	External Third Party	Internal Third Party	Materials/ Software	TOTAL COST
	25877	Lean Six Sigma Champions & Sponsors Development DCCCD	Workforce Development	Training	Lean enterprise	15000	100	150	0	0	7250	23460
	26168	Production/Shipments Realization	Technology/Product Development	Technical	Planning &Control (MRP/ERP)	5000	40	125	0	0	0	5000
	26261	Production/Shipments Realization Phase II	Technology/Product Development	Technical	Production Planning &Control (MRP/ERP)	3000	24	125	0	0	0	3000
	25914	Lean Deployment and Coaching Block	Technology/Product Development	Technical	Lean enterprise	4950	33	150		0	0	5000
	26475	Prodcution Capacity Block Simulation Enhancements	Technology/Product Development	Technical	Strategic Management	2400	16	150	0	2600	0	5000
	26971	& Research Traverse ERP System Enhancement DCCCD	Technology/Product Development	Technical	Strategic Management Production Planning &Control (MRP/ERP)	1000	40	25	0	0	0	1000
	26937	R&D Tax Credit	Technology/Product Development	Technical	Financial	1600	16	100	3400	0	0	5000
	27515		Technology/Product Development	Technical	Financial	9000	60	150	36800	0	0	46000
	28436	Lean Leadership DCCCD	Technology/Product Development	Technical	Lean enterprise	4000	40	100	0	0	0	4000
	28466	Lean 101 Clam Session 1 DCCCD	Technology/Product Development	Technical	Lean enterprise	2000	20	100	0	0	0	4000
	28467	Lean 101 Clam Session 2 DCCCD	Technology/Product Development	Technical	Lean enterprise	2000	20	100	0	0	0	4000
	28468	Lean 101 Clam Session 3 DCCCD	Technology/Product Development	Technical	Lean enterprise	2000	20	100	0	0	0	4000
	28503	Value Stream Management DCCCD CLAM	Technology/Product Development	Technical	Lean enterprise	6000	60	100	0	0	0	7500
	28793	Lean Overviews DCCCD	Technology/Product Development	Technical	Lean enterprise	3000	30		0	0	0	3000
	28899	Lean Office(DCCCD) Additional 2Hr Lean Overviews DCCCD	Workforce Development	Training	Lean enterprise	6000	40	150	0	0	0	8000
	29216	Lean Six Sigma Champions & Sponsors Development DCCCD	Technology/Product Development	Technical	Lean enterprise	600	6	100	0	0	0	1043
	28438	Lss Green Belt Prep	Technology/Product Development	Technical	Lean enterprise	8000	80	100	0	0	0	16800
	26397		Technology/Product Development	Technical	Lean enterprise	1500	12	125	0	0	0	2000
Date Conducted	Quarter	Respondent	Title	Center/Staff Expertise	Cost/\$ of Services	Fair & Unbiased Services	Reputation for Results	Knowledge of Industry	Specific Services	Lack of Providers	Other	
10/12/2010	2010-3	Zac Bunnell	Lean & Six Sigma Coordinator	1	1	0	0	0	0	0	0	
				Product Innovation	ID Growth Opportunities	Cont. Improvement/Cost Reduction	Employee Recruitment	Financing	Exporting/ Global Engagement	Sustainability	Managing Partners/ Suppliers	Technology Needs other
				0	1	1	0	0	1	0	0	0
				Increase Sales \$	Employee Creation \$	Retain Sales \$	Employee Retention \$	Cost Savings \$	Plant or Equipment \$	Information Systems \$	Workforce Practices \$	Save on Investments \$
				0	0	450000	0	1650000	0	0	0	0

5.5 Observation of the data

1. Different challenges at different companies may result in different outcomes despite all other factors being identical.
2. Interventions to the challenges are not applied in solely one column or one row (refer to Figure 5.1 and 5.2).
3. Data for economic outputs or benefits is provided only by different assessors employed by each company receiving an intervention.
4. Most economic outputs or results are provided only once after the application several (anywhere 1 to 9) interventions that may not have targeted the same enterprise areas for improvement.

Technical Observations or Requirements for a statistically meaningful dataset:

1. In order to properly characterize the response of the entire enterprise to interventions, experiments should be conducted on all specific rows and column of the enterprise.
2. Resultant output from each intervention must be gathered consistently. Whether this mean employing the same assessor for each and every intervention in a company, or whether it is best to use various knowledgeable assessors in different projects.
3. In order to properly characterize the response of each row and column, 1260 of experiments for each column/row would be needed.

In total the number of experiments needed for the entire enterprise would be 1260.

5.6 Conclusion:

1. It is not possible to extract a meaningful series of experimental interventions and results from the TMAC database.

2. Perhaps the large software companies, which may employ repeated interventions in specific areas of their enterprises, have kept careful and objective records of the results of each intervention, so that a running series of experiments, each with associated inputs and outputs, are available to support a comprehensive examination of enterprise transformation according to the Zachman-Bayesian model, or a similar model.
3. This thesis research described the attempt to use the wide-ranging TMAC dataset to test the Zachman-Bayesian theory. However, TMAC's areas of work are not complete enough to cover the whole of enterprises, and company specific data sets are not complete enough.

Chapter 6: Conclusion

An Enterprise Architecture is a conceptual blueprint that defines the structure and operation of an organization which acts to effectively achieve its current and future objectives in the organization by examining the technology, information and operational strategies and showing impacts on business functions. In all enterprise architectures, the Zachman Framework has been used for this thesis because the different perspectives involved share their models to build up complete enterprise architecture, which is more difficult with other enterprise architecture frameworks. In this thesis, a new way of capturing deficiencies in current models was proposed, in which the benefits occurred with the investments, so that the models can change, eliminating captured defects to optimize the productivity. With mathematical calculations derived from the Bayesian methodology applied to the Zachman framework, a new framework for experimentation in the discipline of Enterprise Transformation has been defined and is called the Zachman-Bayesian Framework. The Zachman-Bayesian Framework embodies an abstract experimental approach that seeks to holistically evaluate the whole of any enterprise. Although the Zachman-Bayesian approach is theoretically sound, it is perhaps challenging to apply because of its abstract description, it may be difficult to find a data set that is broad and general enough to test the actual application of the Zachman-Bayesian approach.

Chapter 7: Future Research Work:

Future research work can occur on the collection of data from a company and experimentation can be run through the Zachman-Bayesian Framework to determine the 1260 correlations in the company between all cells, at all levels and aspects.

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Chapter 9: Curriculum Vitae

Ramakanth Gona was born on September 12, 1986 in Vijayawada, Andhra Pradesh. India. The second son of Muralidhar Babu Gona and Padmavathi Gona .In the fall of 2008, he graduated from Jawaharlal Nehru Technological University with a Bachelor of Science in Mechanical Engineering. He started to pursue his Master of Science degree from Industrial Engineering at University of Texas at El Paso from fall 2009. At UTEP, he worked as Research Assistant for RIMES and Teaching Assistant to Fundamentals of Systems Engineering Course, Masters Assistant at UTEP Library, Office Assistant at Sociology and Anthropology Department .

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