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Building Blocks for Enterprise Business Architecture

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A unified meta-model of elements can lead to effective business analysis

Enterprise Architecture (EA) is the blueprint of an organization's vision and provides a comprehensive view of the business strategy, processes, information components, applications and technology platforms used by it. According to TOGAF [1], there are four kinds of architecture that are commonly accepted as subsets of overall enterprise architecture – business, data, applications and technology. The focus of this paper is on business architecture. Business Architecture provides the much needed link to business strategy and the other major architectures – information (data), applications and security [2]. The scope of business architecture can vary in practical scenarios and can be deployed at business unit level or department level and when performed with an enterprise-wide scope, it qualifies to become an Enterprise Business Architecture. Enterprise Business Architecture (EBA) is a definition of what the enterprise must produce to satisfy its customers, compete in a market, deal with its suppliers, sustain operations and care for its employees [3]. EBA becomes essential in the existing complex business scenario as it attempts to create a blueprint of why and how business is done while detailing the enterprise's vision, strategy, processes and strategy execution.

Various frameworks have been conceptualized by architects, industry players and research organizations since the beginning of EA practice. Each framework has a set of basic building blocks (commonly referred to as elements) defined. An architect would refer to multiple frameworks in order to architect the enterprise in accordance with the enterprise's requirement/constraint. This paper discusses extant frameworks and provides a comparative analysis of EBA elements used in each framework and later comes up with Composite EBA framework element list. Most of the EA today is based on Zachman Framework and we use the abstractions of Zachman framework for comparing the elements across various frameworks [4]. We also present a meta-model for EBA and identify some future possibilities.

COMPARISON OF EBA ELEMENTS ACROSS MULTIPLE FRAMEWORKS

Business Architecture defines the business strategy, governance, organization and key business processes [1]. An EBA defines the enterprise value streams and their relationships with all external entities, other enterprise value streams and events that trigger instantiation [3]. Ralph Whittle and Conrad Myrick in their book, 'Enterprise Business Architecture: The Formal Link between Strategy and Results' detail that almost every enterprise today lacks formal business architecture [3]. Such architecture and blueprints are critical in developing and maintaining complex business enterprises because one of the keys to successful strategic planning and engineering is an integrated architecture approach and it all begins with EBA and its component linkages. So, we can define EBA as the structure of components related to business and the manner these components interrelate among themselves and other architectures viz., data, application and technology, to create business value. In our study, we concentrate only on identifying an exhaustive list of business architecture elements from multiple EA frameworks and defining their relationships.

We find that Zachman framework is exhaustive in nature with multiple perspectives as well as abstractions. Many of the classic EA frameworks focus on software architecture and often neglect the first two rows of Zachman, that is, typically the business architecture [5]. However, we compare and contrast business architecture elements from eight other frameworks viz., TOGAF, FEAF, McDavid's Business Architecture description, Strategic Architectural model, Crompton Architectural Metamodel, Avancier Methodology, Japanese Government Enterprise Architecture framework and ArchiMate EA Metamodel with Zachman framework, to come up with our unified meta model for defining business architecture.

APPROACH FOR COMPARISON

There are few approaches for comparison of EA frameworks that are available in literature. Goethals [5] differentiates between two classes of frameworks namely, Classic Enterprise Architecture Frameworks and Federated Enterprise Architecture Frameworks. Urbaczewski and Mrdalj compare EA frameworks across multiple views and abstractions of Zachman framework [6]. They also provide a comparison of frameworks on the basis of software development lifecycle phases. Tang et al., in order to analyze frameworks, have grouped fundamental elements into goals, inputs and outputs [7]. Based on support for these elements, Tang et al., have classified frameworks as Software Architecture Framework and Enterprise Architecture Framework. Sessions [8], having compared four EA frameworks including Zachman, TOGAF, FEAF and Gartner concludes that these methodologies can be seen as complementing each other and for many organizations, the best choice is all of these methodologies, blended together in a way that works well within an organization's constraints. Deborah Weiss explores multiple EA frameworks (including TOGAF & Zachman) and their approaches to develop the business context, analyze business vision and strategy, environmental trends and their implications on the enterprise and concludes that there is no one framework that can provide all answers [9]. Regardless of which EA framework the organization subscribes to, it needs to review the various frameworks and adopt the concepts to create a process for developing business context for its EA programs.

Abstraction Framework	DATA *What*	FUNCTION *How*	NETWORK *Where*	PEOPLE *Who*	TIME *When*	MOTIVATION *Why*
TOGAF	• Business Services • Business Data Model	• Business Processes • Business Functions	• Locations	• Business Roles • Users • Organization Unit	NA	• Business Goals and Objectives
FEAF	• List of Business Objects • Semantic Model	• List of Business Processes • Business Process Model	• List of Business Locations • Business Logistics System	NA	NA	NA
Business Concepts Architecture	• Business Outcome • Business Resource	• Business Behavior • Business Function	• Business Location	• Business Role Player • Business Commitment	NA	• Business Situation • Business Purpose
SAM	• Business Component	• Business Process • Business Function	NA	• Organization	• Program/ Project	• Objective or Goal
CAM	• Product	• Business Process • Function	• Location	• User • Business • Interested Party • Supplier • IT System	NA	• Goal • Objective • Critical Success Factor (CSF) • Marketing Aim • Critical Assumption • Standard
AM	• Scope: Actors, Inputs and Outputs	• Processes	• Location	• Organizations • Sponsors and Stakeholders	• Plans	• Inputs: Goals, Requirements and Constraints
JEA	• Transient Information • Information Flow	• Business Processing • Workflow • Business Function	• Boundary • Environment	• Resource • Business Operation	NA	• Business Objective • Business Policy
ArchiMate	• Product • Value • Business Object • Representation • Meaning	• Business Process • Business Function • Business Interaction	• Business Interface	• Business Role • Business Actor • Organizational Service • Contract • Business Collaboration	• Business Events	NA
Composite EBA Framework	• Business Offering • Business Information • Business Resource	• Business Behavior • Business Functions	• Business Location	• Business Role Player • Business Commitment • Business Organization Unit	•Business Events	• Business Motivation • Business Situation

Table 1: *EBA Elements' Comparison Matrix* ***Source:*** *Infosys Research*

The approach we have adopted for comparison of EA frameworks for EBA components is two fold: i) identify business architecture elements from direct sources of the framework or from previous research on these frameworks that are available as references, ii) populate these exhaustive list of elements into different abstractions (what, how, where, who, when and why) of Zachman framework and compare them in order to derive the comprehensive list of elements for each abstraction. The intended result of the comparison exercise is to identify a unified list of elements and develop a meta-model where the relationships among these elements are established. In Table 1 abstraction frameworks alongwith their EBA elements identified are detailed in the comparison matrix.

The Open Group Architectural Framework (TOGAF): TOGAF's Architectural Development Methodology (ADM) prescribes certain business architecture building blocks or architectural models like — organization structure, business goals and objectives, business functions, business services, business processes, business roles, business data model and correlation of organizations and functions [1]. Even though TOGAF does not offer a meta-model of its ingredients, the abstracted business architecture elements or objects include *users* and *locations* [10]. There are nine EBA *objects* defined by or abstracted from TOGAF, excluding *correlation of organizations and functions* which is more to relate business functions to organizational units in the form of a matrix report.

Standard for Business Architecture Description: McDavid in his classic IBM paper, 'A Standard for Business Architecture Description,' details that a set of generic *concepts* and their inter-relationships organize business information content in terms of requirements of the business, the boundary of the business and the business as a system for delivery of value [12]. He contends that a set of standard business concepts can organize particular knowledge about any given enterprise. This organized business knowledge gives rise to requirements for enterprise business information systems. These requirements can be satisfied in two general ways, one by the traditional custom development approach and the other by matching patterns of requirements to patterns of existing assets. In his paper, McDavid provides a meta-model of *business concepts* that he calls *business concepts architecture*, a semantic framework relating common business concerns. There are nine concepts— business situation, business purpose and business outcome are the

Each Enterprise Architecture framework has a set of building blocks called elements that help model business in a structured way leading to effective business analysis

Federal Enterprise Architecture Framework (FEAF): FEAF uses a drill down process resulting in a four-level EA framework. Each level provides an understanding or frame of reference for the next as well for level IV which is the logical structure for classifying and organizing the descriptive representations of the Federal Enterprise. Zachman Framework and Spewak's Enterprise Architecture Planning (EAP) are the key elements in defining level IV and this level incorporates the five perspective rows and first three columns of Zachman [11]. The *planner* and *owner* rows focus on the business architecture definition and documentation. The business architecture element includes list of business objects, list of business processes, business locations of *planner view;* semantic model, business process model and business logistics model of *owner view*. To sum up, there are six elements or 'list of things' that form the building blocks for business architecture as described in FEAF.

drivers of the business; business role player and business commitment form *business boundaries* and business function, business behavior, business resource and business location form *business delivery systems.*

Strategic Architectural Model (SAM): Developed by Bob Jarvis, SAM is a more generic EA methodology and a specific version of SAM is the Microsoft Architecture Paradigm (MAP). SAM is based on a meta-model based approach and there are ten *structures* that form the ingredients of SAM [10]. The *structures* related to business architecture based on our conclusion include objective or goal, organization, business function, business process, business component and programme or project.

Avancier Methodology (AM): Developed by Graham Berrisford, Avancier Methodology for EA does not offer a definitive meta-model but guides in defining a meta-model [10]. AM details that an EA methodology involves a process and a product. The process involves three steps viz., scope architecture deliverables, define baseline architecture and define target architecture. The product is a model that describes an enterprise and this model defines a meta-model in itself. AM lists twelve areas of concerns within which the concerns related to business architecture include – *inputs*: goals, requirements and constraints, organizations, sponsors and stakeholders, locations; *scope:* actors, inputs and outputs, processes and plans.

Frameworks like SAM, CAM, AM and JEA define business architecture elements that can be modeled for conducting effective business analysis

Crompton Architectural Meta-model (CAM): Allistar Crompton developed CAM to capture the essence of his experience in a series of EA assignments. CAM is designated to be ready-to-go model and describes an extensive meta-model [10]. CAM is based on twenty eight ingredients known as *terms* that are most often needed to define practical EA assignments. The *terms* related to business architecture based on our conclusion include goal, objective, critical assumption, critical success factor, marketing aim, standard, user, business, interested party, supplier, IT systems, location, product, business process and function.

Japanese Government Enterprise Architecture (JEA): Hashimoto et al., in their paper 'Case study on RM-ODP and Enterprise Architecture', compare and contrast elements of EA between RM-ODP and Japanese Government Enterprise Architecture (JEA) [13]. In order to compare the interoperability between RM-ODP and JEA, the authors have derived the meta-model elements of JEA from JEA guideline book. There are four perspectives in JEA viz., business, data, application and technical. The authors list eleven business perspective *concepts* of JEA including business policy, business objective, business function, business operation, boundary,

environment, transient information, information flow, workflow, business processing and resource.

ArchiMate Enterprise Architecture Meta-model: ArchiMate is an open and independent modeling language for enterprise architecture, supported by different tool vendors and consulting firms. ArchiMate provides instruments to support enterprise architects in describing, analyzing and visualizing the relationships among business domains in an unambiguous way. The business layer meta-model of ArchiMate shows the *concepts* and the predefined relationships that can be used to connect them. There are fifteen business architecture elements described in the ArchiMate business layer meta-model under three categories, viz., *structural concepts* comprising of business actors, business objects, business role, business collaboration and business interfaces; *behavioral concepts* comprising organizational service, business behavior or business interactions, business function, business process and business events; and *informational concepts* comprising representation, meaning, product, contract and value [14].

business architecture elements of Zachman framework across the multiple abstractions of Zachman viz., what (data), how (function), where (network), who (people), when (time) and why (motivation) [15]. Assessing the EBA elements from multiple abstractions suggested ways to analyze, define and finalize a unified list of elements is gathered in Table 1 on page 7.

- **What (Data) Abstraction:** Products/services and information elements related to business is what multiple frameworks list out for this abstraction. Zachman calls it as 'list of things important to the business' – the understanding of and dealing with enterprise's data. McDavid bundles business information as part of *business resources* [12]. Business resources include all those things that are required by a business to sustain its processes and create its outcomes. Business resources fall under five categories — physical things, energy, monetary value, information resources and various kinds of capabilities. It can be noted that three elements comprehensively (what we term as *attributes* here onwards) cover this abstraction — *business offering* or products and services offered by business; *business information* or information/data flow in the business and *business resources*

A unified list of EBA elements is essential for categorizing elements and defining a meta-model to create a business architecture blueprint

COMPOSITE EBA FRAMEWORK ELEMENTS

Having listed the comprehensive set of business architecture elements from the eight frameworks discussed above, we compare them with the

or things that are required to sustain business and create outcome. In order to differentiate business information and model it exhaustively, we have listed it as a separate attribute. So, business resources shall include all the things that are required to sustain business sans information.

- **How (Function) Abstraction:** *Business processes* and *business functions* are the elements that multiple frameworks list out for this abstraction. Zachman terms it as *Business Process Models* or the process of translating the mission of the enterprise into successively more detailed definitions of its operations. Two attributes comprehensively cover this abstraction, *business behavior* — business processes that are aligned to achieve business goals and *business functions* – the virtual and idealized organization within the business.

- **Where (Network) Abstraction:** *Where* abstraction is all about the business locations and Zachman calls it as 'list of locations business operates' – the geographical distribution of the enterprise's activities. One attribute i.e., *business locations* – physical and logical location of business, comprehensively covers this abstraction.

- **Who (People) Abstraction:** The comprehensive list of attributes here includes *business role player* – actors/ users who perform business behavior; *business commitment* – binding of business with external and internal organization; and *business organization unit* – how the organization is structured and list of things related to it. Zachman framework includes list of organizations important to the business, roles and organization unit – describing who is involved in the business and an introduction of new technology. The attribute additional to Zachman framework is *business commitment* that binds business entities.

Elementary questions like what, how, where, who, when and why form the basis of multiple abstractions of the Zachman framework

- **When (Time) Abstraction:** Multiple frameworks do not detail much for *when* abstraction. ArchiMate terms its element as *business event*. SAM and AM term it as projects and *plans* respectively. Zachman calls it as 'list of events significant to business' describing the effect of time on business. One attribute viz., *business events* or things happening internally or externally, affects business behavior and comprehensively covers this abstraction.

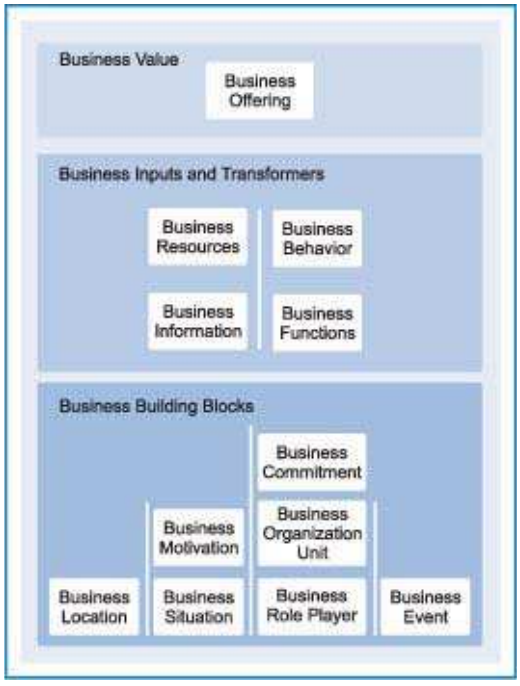

Figure 1: *Composite EBA Framework Attribute Category*
Source: *Infosys Analysis*

- **Why (Motivation) Abstraction:** Business objectives and goals are the elements that are common across multiple frameworks. Zachman calls it as 'list of business goals/strategy' – detailing translation of goals and strategies into specific ends and means. There are two aspects to be covered in this abstraction, business objectives/goals that affect business internally and business situations that are outside business boundary and affect business externally. We chose to go for a more abstract attribute called *business motivation* – internal factors that motivate to establish business plans, along with *business situation* – external forces that act upon the business, taking into consideration both internal and external factors that affect business. We include organizational values, culture and guiding principles as part of *business situation* though they are internal to the organization. *Business motivation* constitutes of *ends-means* concept and comprises of vision, goals and objectives as *ends* and mission, strategy and tactics as *means* comprehensively covering *why* abstraction [16].

To sum it up, the Composite EBA framework comprises of 12 attributes in three broad categories - *business building blocks* comprise of business location, business role player, business commitment, business organization unit, business events, business motivation and business situation; *business inputs and transformers* comprise of business information, business resource, business behavior, business functions; and *business value* comprises of business offering [Fig. 1]. Tables 2 and 3 provide a brief description of the *attribute categories* and *attributes* in a snapshot.

COMPOSITE EBA FRAMEWORK METAMODEL

Having finalized the attributes comprising EBA from multiple frameworks, we develop a meta-model by establishing relationships among the attributes. Of the eight frameworks compared, we find that the meta-model based *business concepts architecture* provided by McDavid [12] and ArchiMate Business Layer meta-model [14] are exhaustive in nature as relationships among elements are established. The CEBA meta-model is more closer to McDavid's business concept architecture definition as compared to Archimate Business Layer meta-model since McDavid's is more abstract in nature.

Let us understand in brief three of these attributes in the way they are structured and the

Attribute Category	Description
Business Building Blocks	This category includes attributes related to why the business exists, the business situations that are external to the organization, commitments that drive business, role players, the business organization structure, geographical locations and important events that drive business. All the attributes that are necessary to provide the basement for business are included in this category.
Business Inputs and Transformers	This includes attributes related to the resources that are necessary for the business, information that are required for the business, functions that are organized to carry on the business and the business processes that generate business products and services. All the attributes that provide input and transform input to create value to the customer are included in this category.
Business Value	This includes attributes like business offerings of the enterprise that satisfy the needs of the customer and provide value to the customers.

Table 2: *Attribute Category* ***Source:*** *Infosys Research*

method that can be utilized to construct these attributes. This will help one understand how the relationships are established at this abstracted level.

Business situation is affected by three major factors – external, internal and current business situation. External factors can be political, economic, social, technological, legal or environmental (PESTLE) factors. Internal factors include business policies and business standards of the organization. Internal strengths and weaknesses and external opportunities and threats form the current business situation. The methods that can be utilized to construct business situation models include PESTLE analysis, internal situation analysis and SWOT analysis.

Business motivation includes ingredients that define why the business exists – vision,

Attribute Category	Attribute	Description
Business Building Blocks	Business Motivation	Details *why* the business exists; factors that motivate to establish business plans and take advantage of the business situation
	Business Situation	Sources of requirements that are placed on the business externally; also includes internal aspects like values, culture and guiding principles of the organization that affects business decisions
	Business Commitment	Interaction that binds the organization and external/ internal entities
	Business Role Player	Actor who performs the business behavior
	Business Organization Unit	Details how organization is physically structured with the roles and responsibilities of role-players
	Business Location	Physical and logical geographical spread of the business
	Business Event	List of important happenings to the business; things happening internally or externally that affects business behavior
Business Inputs and Transformers	Business Resources	Things that are required to sustain business and create outcome - physical, energy, monetary value and capabilities
	Business Information	Information or data flow in the organization
	Business Behavior	Business processes that are aligned to achieve a business goal
	Business Functions	Virtual and idealized organization within the business
Business Value	Business Offering	Products and Services of the enterprise that creates value to the customer

Table 3: *Attribute Description* ***Source:*** *Infosys Research*

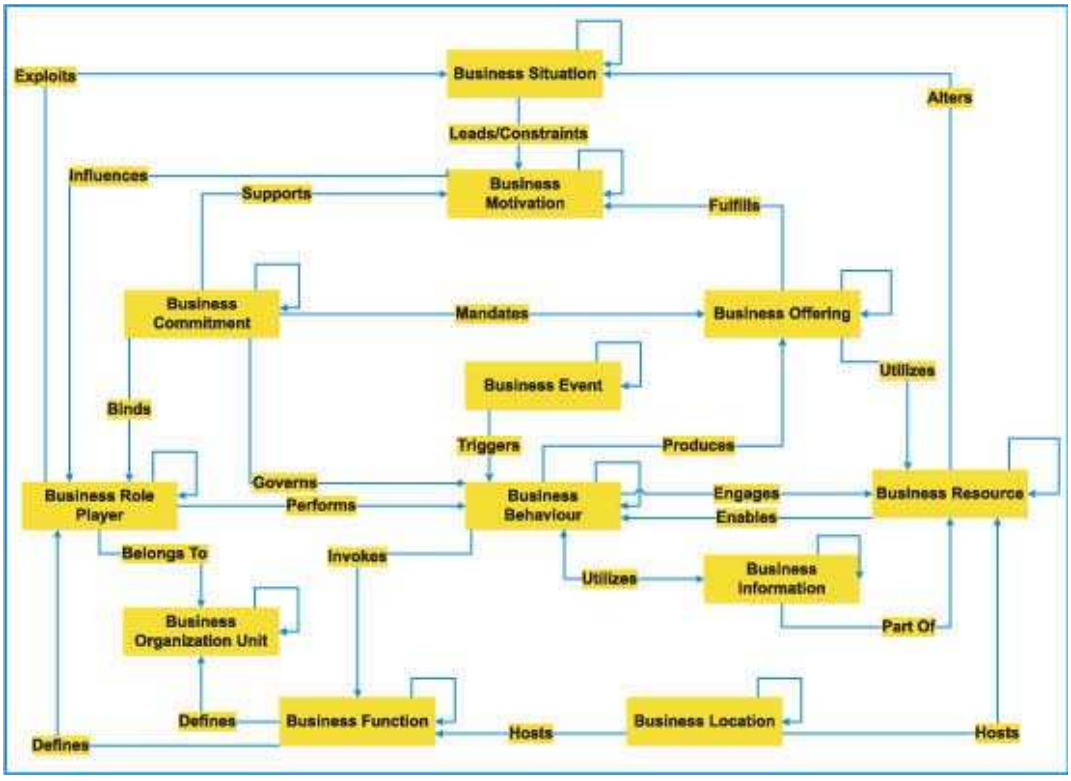

Figure 2: *Composite EBA Meta Model* ***Source:*** *Infosys Research*

mission, goals, strategies, objectives and key performance indicators of the organization. The methods that can be utilized to construct business motivation include Business Motivation Model - a scheme or structure for developing, communicating and managing business plans in an organized manner utilizing the ends-means concept - from Business Rules Group, Balanced Scorecard for Goal Modeling and Porter's Five Forces Model and Value Chain Analysis for defining business strategy.

Business behavior includes the ingredients that define the business processes for the organization – the value stream, high level business processes and sub-processes, business workflow, activities, business participants (business organization unit, department, business role player and systems) and the output entity. The methods that can be utilized to construct business behavior include value chain analysis, business context diagrams, value stream analysis, process modeling and analysis techniques.

Similarly for all the attributes, the underlying meta-model ingredients and the methods to construct them are utilized to establish the relationships in the CEBA Meta-model. The relationships established here are also based on our understanding from multiple frameworks that we have covered here and the reader/user is advised that these relationships can vary according to usage scenario in practical EA assignments and the meta-model can be tailored according to the context. Figure 2 depicts a network representation of our meta-model.

Establishing relationships between attributes help in developing a model that in turn helps in a structural view of a complex enterprise that is made up of multiple ingredients. Also, the attributes are recursive or hierarchical in nature and we can have a meta-model to define these attributes as discussed earlier in the paper.

CONCLUSION

Composite EBA framework developed in this paper is comprehensive with inputs from multiple frameworks and comprises of 12 attributes that detail the constituents of EBA. A meta-model based approach is advisable as an EBA can be defined more methodically and relationships can be established more effectively. The major contribution of this research is in defining business architecture in a structured manner, as the building blocks have been established now and can lead to effective business analysis and business architecture development. Also, the research has value in terms of contrasting elements across various *abstractions* of Zachman framework. As we find that the EBA attributes are highly abstract in nature and can be further decomposed hierarchically, the scope of work extends to defining deliverables and artifacts that need to be generated for each of these attributes of EBA.

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