

ЕКОНОМІКА ТА УПРАВЛІННЯ ПІДПРИЄМСТВАМИ

UDC 65.01

ENTERPRISE ARCHITECTURE IN THE COMPANY MANAGEMENT FRAMEWORK

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Enterprise Architecture in the Company Management Framework

The study aims to explore the role and importance of the concept of enterprise architecture in modern company management. For this purpose it clarifies the nature, scope, components of the enterprise architecture and relationships within it using the Zachman model. Based on the critical analysis of works by leading scientists, there presented a definition of enterprise architecture as a general description of all elements of strategic management of the company combined with description of its organizational, functional and operational structure, including the relationship between all tangible and intangible resources essential for its normal functioning and development. This in turn enables IT enterprise architecture to be defined as a set of corporate IT resources (hardware, software and technology), their interconnection and integration within the overall architecture of the company, as well as their formal description, methods and tools for their modeling and management in order to achieve strategic business goals of the organization. In conclusion the article summarizes the significance and role of enterprise architecture for strategic management of the company in today's digital economy. The study underlines the importance of an integrated multidisciplinary approach to the work of a contemporary company, and the need for adequate matching and alignment of IT with business priorities and objectives of the company.

Keywords: strategic company management, enterprise architecture, business enterprise architecture, IT enterprise architecture, the Zachman model.

Fig.: 6. Bibl.: 24.

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УДК 65.01

Божинов Б. В. Архитектура предприятия в рамках управления компанией

Целью исследования является изучение роли и важности концепции архитектуры предприятия в современном менеджменте компании. С этой целью уточняются характер, сфера применения, компоненты архитектуры предприятия и отношения внутри неё с использованием модели Захмана. На основании критического анализа работ ведущих ученых представлено определение архитектуры предприятия как общего описания всех элементов стратегического управления компании в сочетании с описанием её организационной, функциональной и операционной структуры, в том числе отношений между всеми материальными и нематериальными ресурсами, необходимыми для её нормального функционирования и развития. Это, в свою очередь, позволяет определить ИТ-архитектуру предприятия как совокупность корпоративных ИТ-ресурсов (аппаратное обеспечение, программное обеспечение и технологии), их взаимосвязь и интеграцию в рамках общей архитектуры компании, а также их формальное описание, методы и инструменты для их моделирования и контроля в целях достижения стратегических бизнес-целей организации. В заключение в статье рассмотрены значение и роль архитектуры предприятия для стратегического управления предприятием в условиях современной цифровой экономики. В исследовании подчеркивается важность комплексного междисциплинарного подхода к работе современной компании, а также необходимость надлежащего согласования ИТ с приоритетными направлениями деятельности и задачами компании.

Ключевые слова: стратегическое управление компанией, архитектура предприятия, бизнес-архитектура предприятия, ИТ-архитектура предприятия, модель Захмана.

УДК 65.01

Божинов Б. В. Архитектура підприємства в рамках управління компанією

Метою дослідження є вивчення ролі і важливості концепції архітектури підприємства в сучасному менеджменті компанії. З цією метою уточнено характер, сферу застосування, компоненти архітектури підприємства і відносини всередині неї з використанням моделі Захмана. На підставі критичного аналізу робіт провідних учених наведено визначення архітектури підприємства як загального опису всіх елементів стратегічного управління компанії у поєднанні з описом її організаційної, функціональної та операційної структури, в тому числі відносин між усіма матеріальними і нематеріальними ресурсами, необхідними для її нормального функціонування і розвитку. Це, в свою чергу, дозволяє визначити ІТ-архітектуру підприємства як сукупність корпоративних ІТ-ресурсів (апаратне забезпечення, програмне забезпечення та технології), їх взаємозв'язок і інтеграцію в рамках загальної архітектури компанії, а також їх формальний опис, методи й інструменти для їх моделювання і контролю з метою досягнення стратегічних бізнес-цілей організації. На закінчення в статті розглянуто значення і роль архітектури підприємства для стратегічного управління підприємством в умовах сучасної цифрової економіки. У дослідженні наголошено на важливості комплексного міждисциплінарного підходу до роботи сучасної компанії, а також на необхідності належного узгодження ІТ з пріоритетними напрямками діяльності та завданнями компанії.

Ключові слова: стратегічне управління компанією, архітектура підприємства, бізнес-архітектура підприємства, ІТ-архітектура підприємства, модель Захмана.

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Modern company management is a specific management of business processes to achieve pre-set tasks by effective combining available resources, optimizing cash flows and skillful taking into account external and internal factors affecting the managed company [1, p. 10]. The company management can be seen as strategic, financial and related to personnel management, the first one being of special interest for this study.

Strategic management of a company is usually associated with the process of determining the overall concept of its development, defining its objectives and specific tasks, implementing measures on achievement of these objectives, forming an optimal organizational structure as a factor in ensuring its effective functioning. Usually it is associated with higher levels of company management as it relates to solving global and fundamental problems of the institution. Strategic management can be viewed as a continuous process of implementation of five tasks: (1) determining the type of business activity and forming strategic directions of its development, (2) transforming common goals into specific areas of work, (3) skillful implementation of the selected plan to achieve desired results, (4) effective implementation of the selected strategy, (5) performance assessment, analysis of the market situation, making adjustments to long-term basic directions of activity, goals, strategy or its implementation in the light of the gained experience, changed conditions, new ideas or new opportunities [3, p. 292].

Strategic company management can be considered as a process of transformation of the company's vision and mission in the long-term corporate policies and strategies tailored to the specifics and changes of the environment and resource

availability of the company promoting the pursuit and realization of the goals of the organization and implementation of control over their achievement [1, p. 21]. In order to make strategic corporate management effective, it is crucial that those involved in this process would adequately perceive and understand the organization and functioning of the company and the relationships between its individual components (structure, processes, personnel, information, environment). One of the modern tools for effective management of the company is related to the application of the concept of enterprise architecture.

In scientific researches there are different opinions about the number and names to denote various components of **enterprise architecture**. According to K. Neimenn, information architecture is an integral part of applications architecture, the latter is built on system architecture (platforms, maintenance, infrastructure) and serves as the basis for business enterprise architecture [16]. S. Bernard believes that enterprise architecture should be considered at three levels: strategic, business and technology one [6]. A similar three-component model is offered by OpenText, according to which enterprise architecture comprises business architecture, system architecture, including the very architecture of applications and data, and technology architecture [17, p. 3]. According to the model of the National Institute of Standards and Technology (USA), enterprise architecture includes the following hierarchy of elements: business architecture, information architecture, architecture of information systems, data architecture, supporting systems architecture [13].

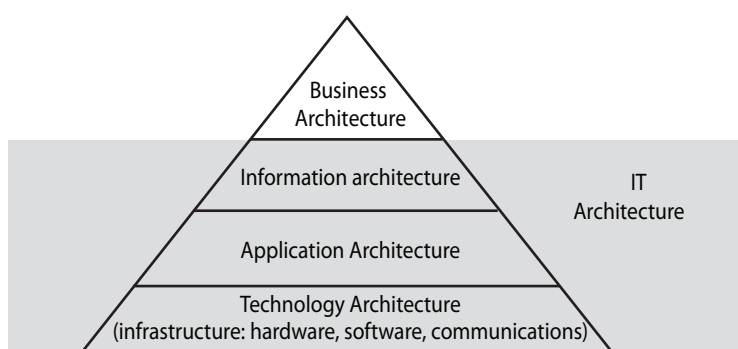


Fig. 1. Hierarchical relationship between enterprise architecture components [2, p. 124; 21, p. 52]

One of the most widely accepted concepts about the composition and scope of enterprise architecture is the Open-Group vision, according to which it can be divided into the following four key areas [22; 18, p. 27; 2, p. 123]:

- **Business Architecture** – includes a description of all business processes in the organization and their interrelationship;

- **Information Architecture** – describes the required information and data (incl. models) for ensuring a normal course of business processes at the company, as well as their reliability and long-term use in the applied information systems;
- **Applications Architecture** – determines what applications should be used or needed for data

management and maintenance of the business functions of the company;

- **Technological Architecture** (infrastructure, system architecture) –determines what supporting technologies (hardware, software, networks, communications) are needed to create a working environment for applications, ensuring smooth operation of business processes.

Enterprise architecture concept presents a powerful management tool that allows managers not only to formalize the business component of the managed activities of the company but also by integrating information technologies through its information architecture to optimize business processes, enhance their efficiency and information security as well as gain competitive advantage in today’s knowledge economy and technology. At the same time, through the use of this concept IT departments serving the company’s activities can get a clear understanding of business aspects of the processes, their relationship with the strategic objectives of the company, which in turn allows them to propose and introduce the most appropriate technological solutions and applications for implementation of business processes in the company.

In this study we perceive that **Enterprise Architecture is a general description of all elements of strategic company management combined with description of the organizational, functional and operational structure of the company, including the relationship with all tangible and intangible resources required for its normal functioning and development.** In this aspect, business enterprise architecture

is an integral and inseparable part of the overall architecture of the company.

Some authors consider **business architecture** as a concept that embodies «information about and relationships between organizational objectives, sub-objectives, policies, organizational structure, business functions and processes, and business rules and policies» [7 p. 33]. This view is largely consistent with Zachman’s interpretations of enterprise architecture as «a set of descriptive representations (models) that are used to describe the enterprise in accordance with the requirements of management (quality) and can be developed for certain period of time (dynamic)» [20, 2, p. 210; 8].

Among widely accepted definitions of the term of «business enterprise architecture» we can highlight the following one, which characterizes it as «an organized and repeatable approach to describe and analyze an organization’s business and operating models to support a wide variety of organizational change purposes, from cost reduction and restructuring to process change and transformation» (Forrester), «a description of the structure and interaction between the business strategy, organization, functions, business processes, and information needs» (TOGAF 9.1), «a blueprint of the enterprise that provides a common understanding of the organization and is used to align strategic objectives and tactical demands» (OMG Business Architecture Working Group) and «as enterprise activities that create deliverables to guide people, process and organizational change in response to disruptive forces and toward desired business outcomes» (Gartner) [23]. Some views about business architecture are that it describes «the fundamental or-

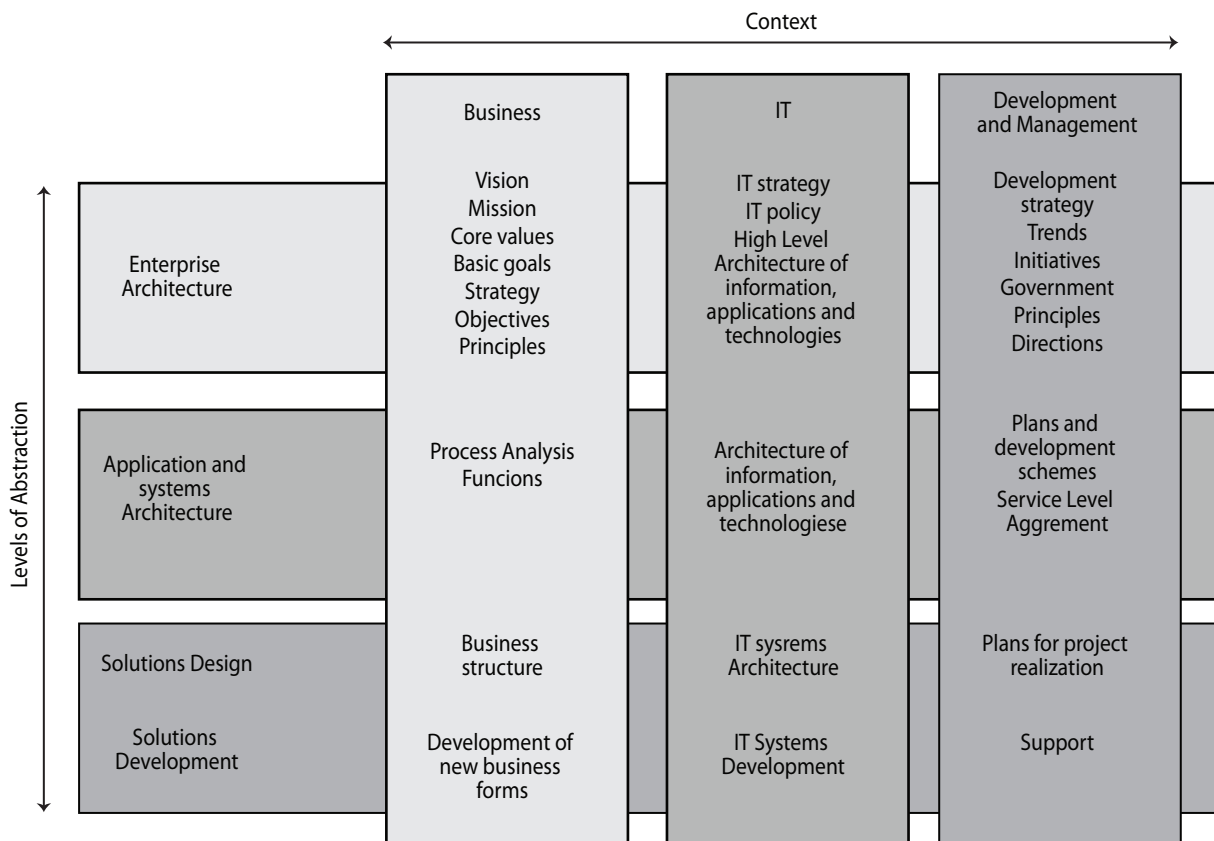


Fig. 2. Scope of various components of enterprise architecture depending on the level of abstraction [2, p. 104]

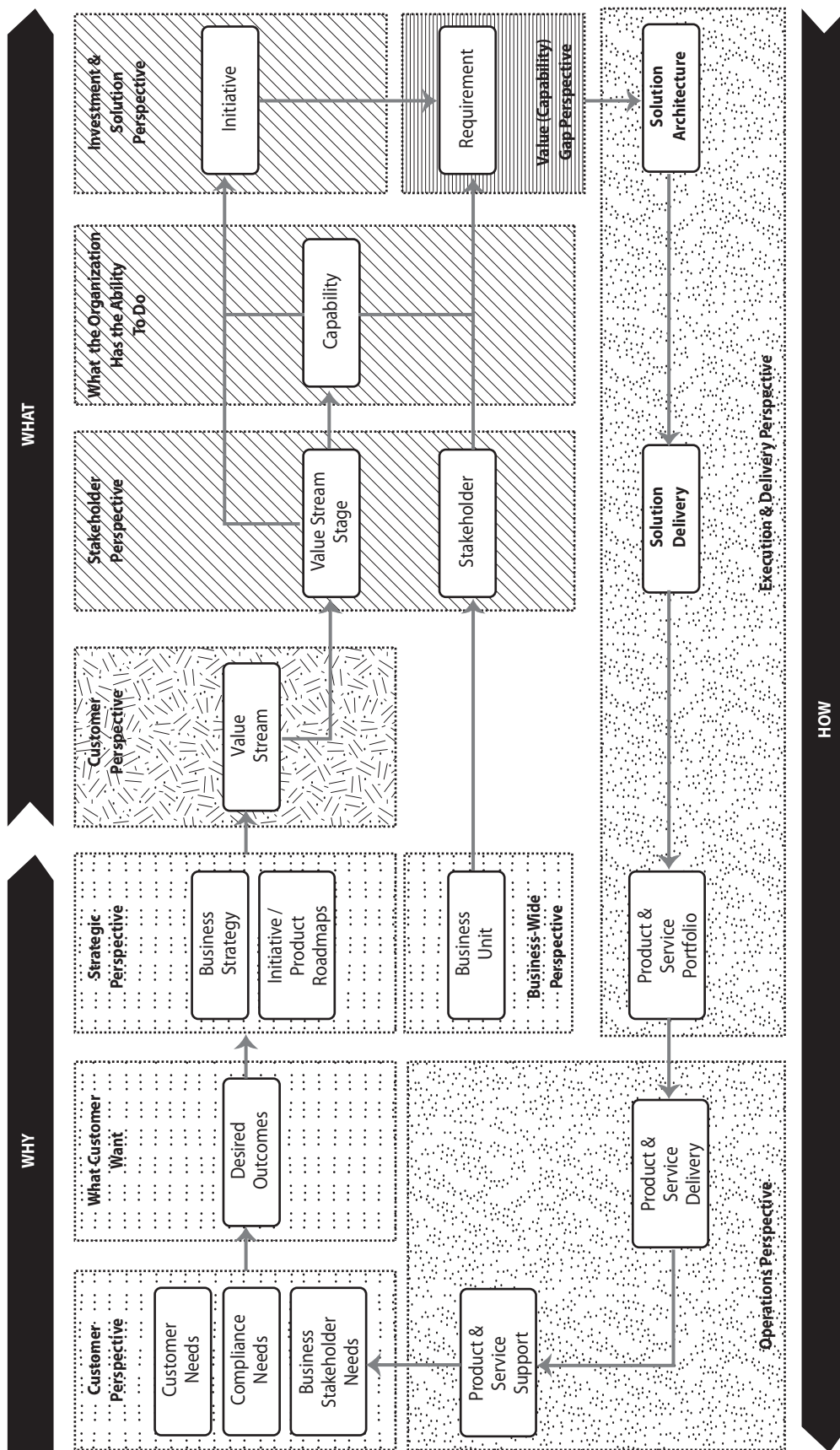


Fig. 3. Business architecture framework in terms of different actors [19, p. 7]

ganization of a system, embodied in its components, their relationships to each other and the environment, and the principles governing its design and evolution» (ANSI/IEEE Standard 1471-2000), «describes the fundamental relationships between a business entity's business environment and its intent, value, capabilities, processes, and resources (human, IT, knowledge, capital, facility, and material) (IBM/BizADS) [10, p. 2–3].

Business architecture as a means to describe the relationships between the components of the company can be presented as the following layers (Fig. 3) [11]:

- **Conceptual** – answers the question of «what is the business and what is to be done». This includes clarifying the strategic business goals of the company, applicable business principles (basic rules for management of the company to achieve its strategic goals), global business areas in which the company operates as well as business skills (basic activities that will be performed by the company);
- **Logical** – answers the question of «how do you achieve business goals of the company». It defines the business roles of individual employees and departments in the company, including their relationship, business processes through their detailed description and category of location in which the business processes are carried out (factory, office, workshop);
- **Physical** – presents a detailed description of the business activities and processes. It specifies the executors of the activities, the physical location of a particular activity, and the physical process that is to take place.

In literature there is no coherent view on the content and scope of **IT enterprise architecture**. The definitions range from «the method used to organize and integrate the components of the computer system», «a set of components, functions and interfaces, connections, and restrictions and the very architecture of the participating components» to «a vision, principles and standards governing the organization development and implementation of technologies» [2, p. 78–81]. In modern interpretations of the concept there prevails not purely technological aspect of the problem but an emphasis is made on the importance of effective connectivity and integration to achieve business goals of the enterprise. Gartner has similar views considering IT architecture of a company as a «formal description of its business operations (processes and functions), business applications and databases that support them, and the equipment and services that run the applications» [9].

The same argument can be found in some definitions where the concept is presented as «an organized set of consensus decisions on policies and principles, services and common solutions, standards and guidelines as well as specific vendor products used by IT providers both inside and outside the Information Technology Branch (ITB)» [15], «the organizing logic for data, applications, and IT infrastructure, captured in a set of policies, relationships, and technical choices to achieve desired business and technical standardization and integration» [18, p. 25], «a set of principles, guidelines or rules used by the enterprise to manage the process of acquisition, building, modification and interaction on IT resources (equipment, software, communications, methodologies development, modeling tools, and organizational structures) within the enterprise» [4].

Among the leading contemporary understandings of the concept we can highlight the view of the COBIT that IT architecture is a description of the basic design of the IT components of the company, the relationship between them and the way they support the organization's goals, and definitions of TOGAF and ANSI/IEEE Standard 1471 – 2000 stating that it constitutes «the fundamental organization of a system, embodied in its components, their relationships to each other and the environment, and the principles governing their design and evolution» [16, p. 11-12; 12]. This allows us to define **IT architecture as a set of corporate IT resources (hardware, software and technology), their interconnection and integration within the overall architecture of the enterprise, as well as their formal description, methods and tools for their modeling and management in order to achieve strategic business goals of the company**.

The first model for the IT enterprise architecture description was proposed by Zachman in 1987 under the name of «A Framework for Information Systems Architecture» and aimed at creating a comprehensive framework through which the components of enterprise architecture and relationships within it can be described and classified [24]. Although the Zachman model is undergoing a significant evolution of its original form, its initial set of ideas is still the core of this conceptual architectural framework and has a key impact on the established later architectural models of the company. By applying a systemic approach to building architecture of information systems and later to the organization itself, the Zachman model provides a detailed description of all basic components in the analyzed system, their coordination and interaction with other components, including the external environment, rules and conditions, resources used and driving forces motivating the system.

The first two rows of the Zachman framework focus more on business enterprise architecture, while the next three are directed at its IT architecture. Going into greater detail, the framework can be viewed as a set of specific models describing enterprise architecture (horizontal), namely [2, p. 213; 8]:

- **Business model** – covers the process of business planning in general (business model), in which quite common basic concepts defining business (products, services, customers) as well as formation of business strategy are introduced;
- **Conceptual model** – presents the key business terms to define the organizational structure, basic and auxiliary business processes;
- **Logical model** – describes business processes in terms of information systems, including various types of data, rules for their conversion and processing for the execution of certain business functions;
- **Technology (physical) model** – provides binding the data and operations with them to the chosen implementation technologies;
- **Specification of the implementation of the system**, including the description of specific models of equipment, network topology, manufacturer and version of the database management system (DBMS), development tools, etc.;
- **Description of the working system** – user's guides, physical databases, HelpDesk unit, etc.

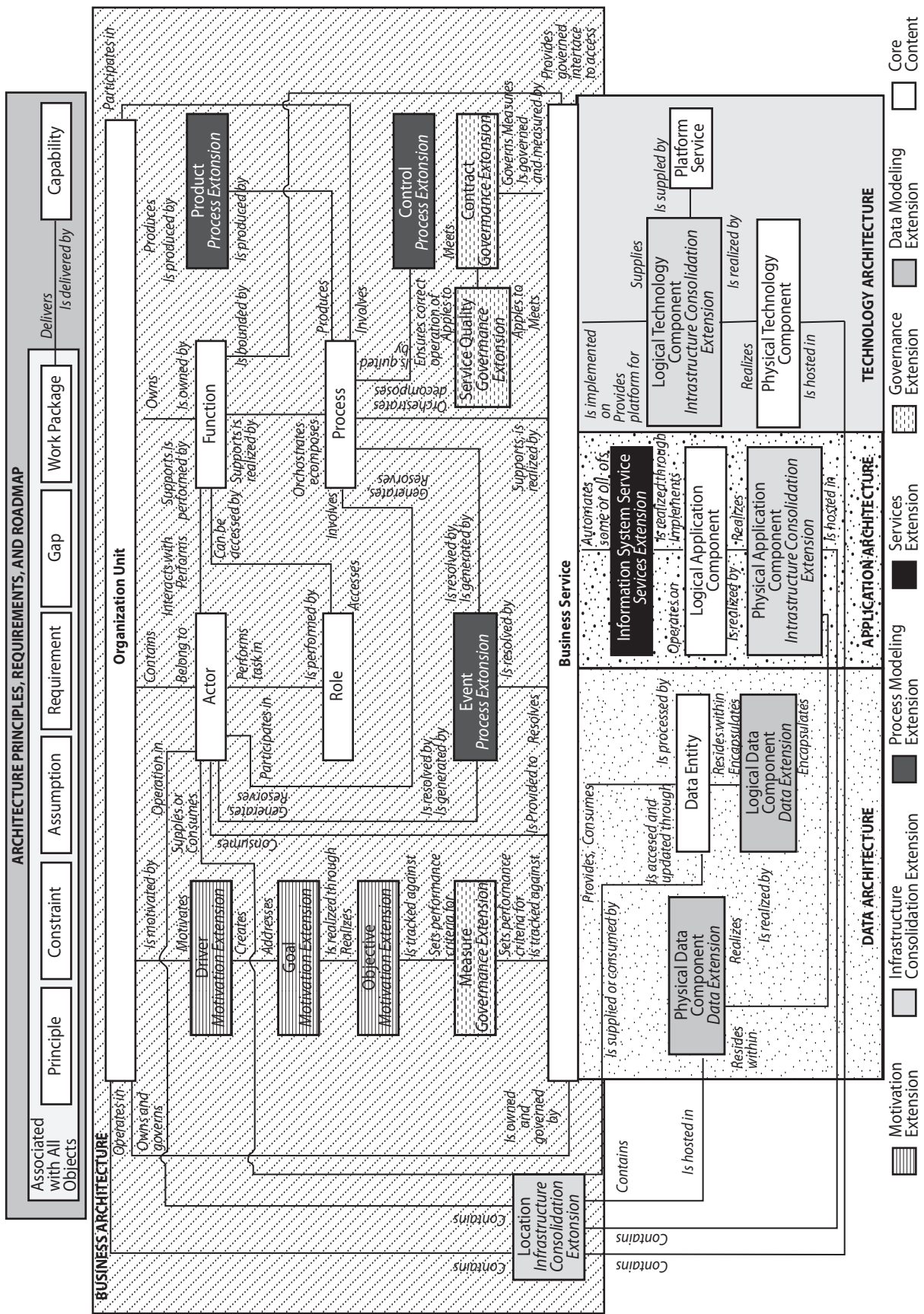


Fig. 4. Links and interactions between the components in enterprise architecture [5, p. 18]

	DATA	What	FUNCTION	How	NETWORK	Where	PEOPLE	Who	TIME	When	MOTIVATION	Way	SCOPE (CONTEXTUAL)
SCOPE (CONTEXTUAL)	List of Things Important to the Business 	ENTITY = Class of Business Thing 	List of Processes the Business Performs 	List of Locations in which the Business Operates 	List of Organizations Important to the Business 	List of Events/Cycles Significant to the Business 	List of Business Goal/Strategy 	SCOPE (CONTEXTUAL)	Planner				
BUSINESS MODEL (CONCEPTUAL)	ENT = Business Entity Rein = Business Relationship e.g. Logical Data Model 	ENT = Class of Business Thing e.g. Semantic Model 	Processes = Class of Business Process e.g. Business Process Model 	Node = Major Business Location e.g. Business Logistics System 	People = Major Organization Unit e.g. Work Flow Model 	Time = Major Business Event/Cycle e.g. Master Schedule 	Time = Major Business Goal/Strategy e.g. Business Plan 	SCOPE (CONCEPTUAL)	Planner				
Owner	Ent = Business Entity Rein = Business Relationship e.g. Logical Data Model 	ENT = Business Entity Rein = Business Relationship e.g. Logical Data Model 	Proc. = Business Process I/O = Business Resources e.g. Application Architecture 	Node = Business location Link = Business Linkage e.g. Distributed System Architecture 	People = Organization Unit Work = Work Product e.g. Human interface Architecture 	Time = Business Event Cycle = Business Cycle e.g. Processing Structure 	End = Business Objective Means = Business Strategy e.g. Business Rule Model 	Owner					
SYSTEM MODEL (LOGICAL)	Ent = Data Entity Rein = Data Relationship e.g. Physical Data Model 	ENT = Business Entity Rein = Business Relationship e.g. Logical Data Model 	Proc. = Application Function I/O = User Views e.g. System Design 	Node = L/S Function (Processor, Storage etc.) Link = Line Characteristics e.g. Technology Architecture 	People = Role Work = Deliverable e.g. Presentation Architecture 	Time = System Event Cycle = Processing Cycle e.g. Control Structure 	End = Structural Assertion Means = Business Assertion e.g. Rule Design 	Designer					
TECHNOLOGY MODEL (PHYSICAL)	Ent = Segment /Table/etc. Rein = Pointer/Key/etc. e.g. Data Definition 	ENT = Business Entity Rein = Business Relationship e.g. Logical Data Model 	Proc. = Computer Function I/O = Data Elements/Sets e.g. Program 	Node = Hardware/Systems Software Link = Line Specifications e.g. Network Architecture 	People = User Work = Screen Format e.g. Security Architecture 	Time = Execute Cycle = Component Cycle e.g. Timing Definition 	End = Condition Means = Action e.g. Rule Specification 	Builder					
DETAILED REPRESENTATIONS (OUT-OF-CONTEXT)	Ent = Field Rein = Address e.g. DATA 	ENT = Business Entity Rein = Business Relationship e.g. Logical Data Model 	Proc. = Language Statement I/O = Control Block e.g. FUNCTION 	Node = Addresses Link = Protocol e.g. NETWORK 	People = Identity Work = Job e.g. ORGANIZATION 	Time = Interrupt Cycle = Machine Cycle e.g. SCHEDULE 	End = Sub-condition Means = Stop e.g. STRATEGY 	Sub-Contractor					
FUNCTIONING ENTERPRISE	e.g. DATA	e.g. FUNCTION	e.g. NETWORK	e.g. ORGANIZATION	e.g. SCHEDULE	e.g. STRATEGY	FUNCTIONING ENTERPRISE						

Fig. 5. IT Enterprise Architecture (Zachman model) [24]

The Zachman model allows tracking with an increasing degree of detail the key aspects of corporate activity (vertical model), in particular [8]:

- **data** used in the system – starting from the highest level of abstraction, passing through the semantic model and description of their relationships and constraints, reaching their formalization and physical description;
- **functions** of the system and their details by a general description of the underlying business processes in their modeling and design to reach their physical implementation through a programming code;
- **location** of the system by describing the spatial distribution of the components of the system and the organization of the network in building a model of interaction of its individual components, and achiev-

ing the physical implementation of the network connections;

- **participants** in the process by describing the involved departments in the organizational chart and specification of the direct participants in the process and their roles according to the requirements for user interfaces, access rights and realization of code level;
- **time frame** by determining the timing of business processes and system for calendaring and scheduling physical realization of business events;
- **motivation** of the organization expressed through its strategies defined by detailed business plans, rules and regulations for the implementation of business processes.

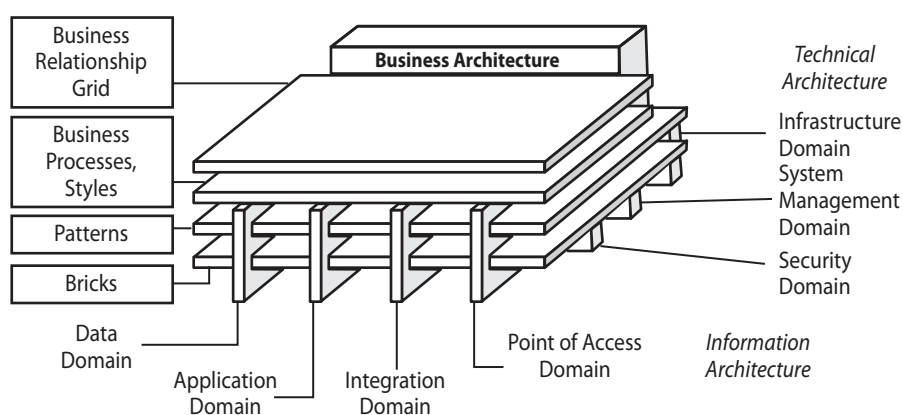


Fig. 6. Gartner Enterprise Architecture Framework [14, p. 15]

Zachman's ideas are reflected in almost all modern models for describing enterprise architecture. For example, the Gartner architecture model clearly distinguishes the layers of business and IT architecture [2, p. 221]:

- **business relationship grid** – covering not only the strategic aspects of corporate governance but also its interaction with other business entities in the market;
- **business processes (styles)** – describing how the organization performs its basic functions;
- **patterns** – describing models and algorithms used to solve different tasks in the workplace;
- **brick** – comprising the technical description of technologies, solutions and resources for realization of the process.

The embracing of Zachman's ideas in the leading contemporary models to build enterprise architecture shows the importance of an integrated multidisciplinary approach to the work of a contemporary company. Despite the growing over the last decade tendency to using new information technologies, their use is an end in itself if they are not adequately matched and aligned with business priorities and objectives of the company. This is a lesson that should be learnt by every manager of a modern company.

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