Research on the Driving Mode of Enterprise Architecture Based on Business Ability Decoupling for Digital Transformation of Power Industry

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Abstract. Due to the limitation of business capacity, the digital transformation of electric power industry faces great challenges. Therefore, the enterprise architecture based on business capacity decoupling is proposed to study the driving mode of digital transformation of electric power industry. Based on the analysis of the characteristics of electric power enterprises' business capabilities, this paper decouples them from the aspects of process design capability, business technology capability, process operation capability and organizational management capability. Based on the decoupling results, the organization constructs enterprise architecture with The Open Group Architecture Framework(TOGAF) and Cyber-Physical System(CPS) as guidance, and details the specific driving business ability content. In the test results, under the design-driven mode, the digitalization degree of the tested enterprise is the highest, reaching 79.92%.

Keywords: Business ability decoupling; Enterprise Architecture; Digital transformation of power industry; Driving mode; TOGAF The Open Group Architecture Framework; CPS Cyber-Physical Systems

1 Introduction

To promote the digital transformation and development of electric power enterprises to the greatest extent, it is extremely necessary to design a targeted driving mode based on the enterprise architecture without affecting the original business capabilities [1-3]. By analyzing the business ability of modern electric power enterprises, we can

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see its specific diversified attributes and characteristics. On this basis, for the driving stage of digital transformation of the power industry, how to ensure its fit with business capabilities has become one of the research hotspots that has attracted much attention. Among them, for enterprises at this stage, one of the effective ways to achieve high-quality development is to achieve digital transformation [4-5]. In-depth study of enterprise digital transformation can help electric power enterprises cope with increasingly complex market environment and changes, improve the efficiency and flexibility of business processes, optimize resource allocation, and provide more intelligent and convenient services. The digital transformation driving mode based on TOE theoretical framework is one of the more common application methods [6-8]. In the specific implementation process, the prerequisite of digital transformation driving is determined by means of Necessary Condition Analysis (NCA) and the specific implementation means is determined by means of fuzzy set qualitative comparative analysis (fsQCA). It can indicate the key factors and paths of digital transformation for enterprises and provide strategic basis for promoting transformation. In addition, the driving mode of digital transformation based on configuration perspective has also been widely concerned [9-10]. This driving mode is achieved by the level structure of "technology-organization-environment", and the driving mechanism of enterprise digital transformation under the collaborative form is established with six factors affecting data development as the core [11-12]. In terms of differences, the driving mode based on the TOE theoretical framework focuses more on the interaction between technological, organizational, and environmental factors, and comprehensively analyzes the key factors and implementation methods of enterprise digital transformation; The configuration-based driving mode focuses on the hierarchical structure of "technology-organization-environment" as the framework to guide the implementation of enterprise digital transformation. These two driving modes differ in theoretical basis, methodology, and implementation approaches, while both are committed to promoting high-quality development of enterprise digital transformation.

Based on the above information, this paper puts forward the research on the driving mode of digital transformation of power industry based on the enterprise architecture with business ability decoupling to provide a new perspective for the research of digital transformation and reference value for the practice of digital transformation of enterprises.

2 A enterprise architecture for the power industry digital transformation drive mode design

2.1 Decoupling Analysis of Power Enterprise's Business Ability

To ensure targeted driving mode design while maintaining the existing business capabilities during the digital transformation process of power enterprises, this paper conducts a detailed analysis of the business capabilities of power enterprises to ensure close alignment with the enterprise architecture methodology. According to TOGAF's

definition, business capability is a specific knowledge, skill, and ability possessed by an organizational entity to effectively execute its core business.

From the perspective of business capability characteristics, the business capabilities of power enterprises have the following significant features:

(1) Significant user value: Power enterprises indirectly establish their competitive advantage by providing unique user value to customers [13-14]. This requires continuous optimization and adjustment of the enterprise to maintain and increase user value. In addition to existing power products, relevant power services need to be provided.

(2) Scalability: The business capabilities of power enterprises have high scalability. Based on their core business capabilities, a series of new products and services can be derived to meet changing customer demands [15-16].

(3) Uniqueness: The business capabilities of power enterprises encompass technical expertise, operational excellence, management practices, and cultural characteristics that make them uniquely advantageous in competition.

(4) Dynamism: The business capabilities of power enterprises are progressively accumulated and supported by continuous business practices for long-term development. Over time, enterprise capabilities continue to strengthen and evolve, becoming a primary driving force for enterprise development [17-18].

(5) Non-transactability: As intangible assets, business capabilities play a crucial role in the overall value perception of power enterprises. Business capabilities are generally not directly tradable, hence possessing certain uniqueness and scarcity [19-20].

Based on the above analysis, this paper decomposes the business capabilities of power enterprises, as shown in Table 1.

Table 1. Decoupling Composition of Power Enterprise's Business Ability

Constitute	Meaning	Feature	Main points
Process design ability	*What power companies depend on whether they have the resources they need to do it (that is, who will do it with what). If there are resources, then the method of the enterprise to do this is bound to be affected by the allocation of resources.*	*The process must have the ability and efficiency, and the process quality determines the actual operation efficiency of the enterprise management. To ensure the high quality of the process, a reasonable and effective business process must be designed firstly.*	*One of the biggest constraints of business process design is the thinking mode of the organization, whose thinking mode is determined by the knowledge and experience of the organization when the business environment changes.*
Core business and technical capabilities	*The technical ability of the core business refers to the ability to develop and apply new technologies in the core business of enterprises, which is cultivated and established through the acquisition, selection, application, improved technology, and long-term technology learning process.*	*Technical capability includes four aspects: production capacity, absorption ability, innovation ability and technical management ability. The production capacity refers to the efficiency of the production system and the technical level of the products and processes.*	*The production capacity is related to the production equipment, technology level and proficiency of the workers; the absorption ability is related to the talent reserve and personnel accumulation of the enterprise and the application of creative thinking.*
Business process operation capability	*The operation ability of the business process is the ability to ensure that the business process can be run effectively and efficiently,*	*Employees must have certain knowledge and skills, and get full and effective play, to ensure the quality of enterprise*	*To give full play to the role of employees, we should not only grasp the knowledge structure and behavior characteristics of employees,*

	and that the process objectives are achieved. The operation ability determines the grade and quality of the product.	*business process operation, and to further ensure the quality of enterprise products or services.*	*but more importantly, protect the vital interests of employees, establish trust relationship and communication channels.*
Core business organization and management ability	*Organizational and management ability is the realization of the management as the target business, the ability to effectively use resources, the organic combination of design ability, technical ability, operation ability and organizational and management ability, coordinated development.*	*Human resource management, technology and equipment management, quality management ability, financial management ability, evaluation management ability, etc. are the abilities of enterprises to improve and promote organizational efficiency through the construction of organizational system or management information network system*	*The key to the organization and management activities of an enterprise is to organically integrate the employee ability, technical ability and production capacity into the business operation of the enterprise, giving full play to the value of various resources.*

According to the way shown in Table 1, the business capabilities of electric power enterprises are decoupled, and the characteristics and elements of different capabilities are defined [21-22], to provide a reliable execution basis for the subsequent digital transformation drive.

2.2 Enterprise architecture-oriented power industry digital transformation drive model

Combined with the results of decoupling analysis of business capabilities of electric power enterprises in Part 1.1, this paper fully considers the characteristics and elements of different capabilities [23-25] in the process of designing the digital transformation drive mode of power industry, and achieves the specific transformation drive with the guidance of enterprise architecture. In the design, the enterprise architecture is transformed into a TOGAF open organizational structure, which mainly includes project-oriented opportunities and solutions, as well as business migration planning for engineering. This involves analyzing and planning the strategic goals and standardizing business architecture, application architecture, data architecture and technical architecture of the enterprise to ensure that digital transformation is consistent with the overall goals and architecture of the enterprise, and to promote the competitiveness of the enterprise. On this basis, in the power industry digital transformation driving mode designed in this paper, the organizational enterprise architecture is divided into TOGAF open organizational architecture and CPS cyber-physical systems. Among them, CPS cyber-physical systems is mainly responsible for providing solution guidance for intelligent modules in TOGAF open organization architecture. In the TOGAF open organization architecture, it is mainly divided into two parts, which can be specifically expressed as follows:

$$T = \{C(x), Q(x)\} \tag{1}$$

Among them, T represents TOGAF open organization architecture, $C(x)$ represents project centric opportunities and solutions, $Q(x)$ represents engineering centric business migration planning.

It should be noted that this paper sets the digital implementation mode for, which is divided into two main modules: production intelligence and service networking. For the production intelligent module, the specific enterprise-driven architecture settings can be expressed as follows:

$$S = \{inside, web, datebase, transfer\} \tag{2}$$

Among them, represents the production intelligent module in the enterprise-driven architecture, represents internal intelligence of an enterprise, represents the intelligence of enterprise pipe network, indicates the intelligence of the enterprise library station, indicates the intelligence of data transmission. In this way, the management can be digitized.

For the service networking module, the specific enterprise-driven architecture settings can be expressed as follows:

$$F = \{Transactions,\ bu\sin ess,\ APP,\ call\_center\} \tag{3}$$

Among them, F represents a service networking module in an enterprise-driven architecture, $Transactions$ represents an enterprise online transaction, $bu\sin ess$ represents the business hall of an enterprise, APP represents an enterprise APP, $call\_center$ represents a call center. In this way, the business can be digitized.

According to the way shown above, the digital transformation drive of power industry is achieved with the help of enterprise architecture. Through the above design and based on the actual content of enterprise architecture, this article proposes a digital transformation driven mode for the power industry based on enterprise architecture, providing specific and feasible solutions for achieving digital transformation in the power industry.

3 Application testing

3.1 Test preparation

In the testing stage, the digital transformation driving mode based on TOE theory framework and the digital transformation driving mode based on configuration perspective are designed as the control group. By comparing the specific test results under three different driving modes, the performance of the design method in this paper is objectively evaluated. For the setting of test environment, this paper is based on an actual power enterprise. Among them, before the test, the degree of digitalization of the enterprise is shown in Figure 1.

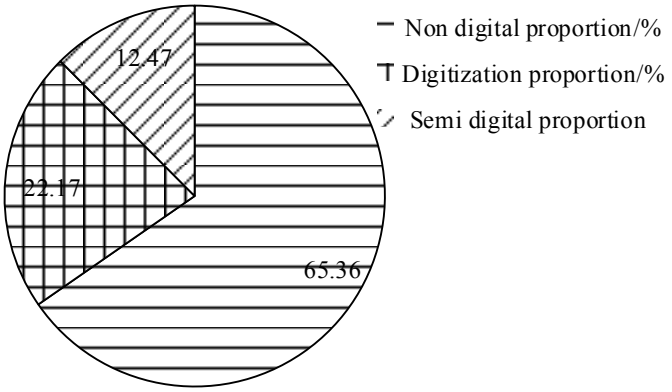

Fig. 1. Statistics of Digitalization Degree of Testing Enterprises

3.2 Test results and analysis

Based on the above test environment, the changes of digitization degree under different driving modes are compared, and the specific test results are shown in Figure 2.

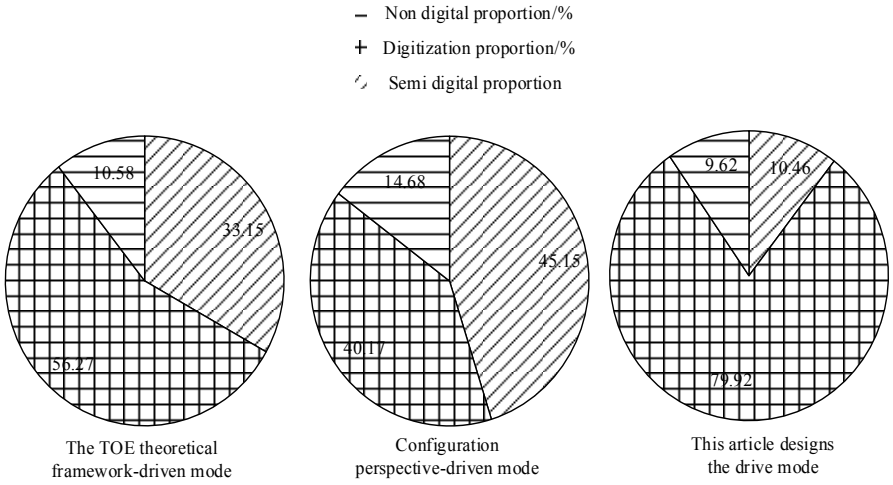

Fig. 2. Comparison Table of Test Results

Combined with the test results shown in Figure 2, under the driving mode designed in this paper, the digitization degree of the test enterprise is the highest, reaching 79.92%, which is significantly higher than that of the control group. This architecture will help power companies improve their digital level, provide more efficient, intelligent and sustainable services, and drive the power industry towards the goal of digital transformation.

4 Conclusion

This paper puts forward a study on the driving mode of enterprise architecture for digital transformation of power industry based on business ability decoupling. From the perspective of business ability characteristics of electric power enterprises, it is decoupled into process design capability, business technology capability, process operation capability and organization and management capability, and combined with it, a enterprise architecture is constructed, which fully drives the digital transformation of power industry and effectively achieves the purpose of improving the digitalization of enterprises.

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