Research on the Value and Implementation Path of "Power-Economy" Bidirectional Data-Driven Decision Support

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Abstract. Data has become a fundamental strategic resource, and the power system is highly coupled with the economic system. The value of bidirectional data in the "power-economic" interaction remains to be further explored. This paper first defines the content of "power-economic" data, analyzes their coupling relationship, and constructs a bidirectional data-driven decision support value system for "power-economic" interaction. It then discusses the specific pathways to realize the value of decision support, providing practical guidance for the effective utilization of bidirectional data in the "power-economic" context.

Keywords: Power; Economy; Data; Decision Support; Value System; Implementation Path

1 Introduction

Electricity data comprises information generated during the operation of the electric power industry. Categorized by various operational phases in the power industry, it can be divided into construction data, investment data, production data, and operational data. Within the realm of production data, there are further distinctions such as generation data, transmission and distribution data, and consumption data. Electricity data possesses unique advantages, including authenticity, real-time availability, fine granularity, and substantial volume. Economic data, on the other hand, refers to the information generated by various market entities in the course of economic activities. Typically, economic data primarily pertains to macroeconomic data, which encompasses national-level data related to a country's economic performance. This includes the total size of a nation's economy, its economic composition, stages of industrial development, industry structures, and overall economic development. In the macroeconomic domain, economic data can be further categorized into industrial data, investment data, consumption data, foreign trade data, employment data, fiscal data, financial data, and price data, among others.

Electric power industry and economic growth exhibit a long-term, stable relationship [1-6]. Electricity serves as one of the most fundamental and crucial production factors in the national economy. Electricity consumption data, including both overall

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and sector-specific figures, can effectively reflect the overall economic performance and sectoral operations in China. It acts as a barometer for assessing the national economic development and performance. The variations in indicators such as the growth rate, structure, driving force, and energy efficiency level of electricity consumption provide valuable insights into the high-quality development of the economy. Economic development is the most significant factor affecting the growth of electricity demand at the national and regional levels, as well as impacting grid planning, electricity resource allocation, and the supply-demand dynamics in the electricity market. The relationship between "Power-Economy" bidirectional data is shown in Fig. 1. Research on the value and implementation pathways of bidirectional data-driven decision support in the "power-economic" interaction holds significant importance in harnessing the value of electricity and economic big data and enhancing the overall societal governance level.

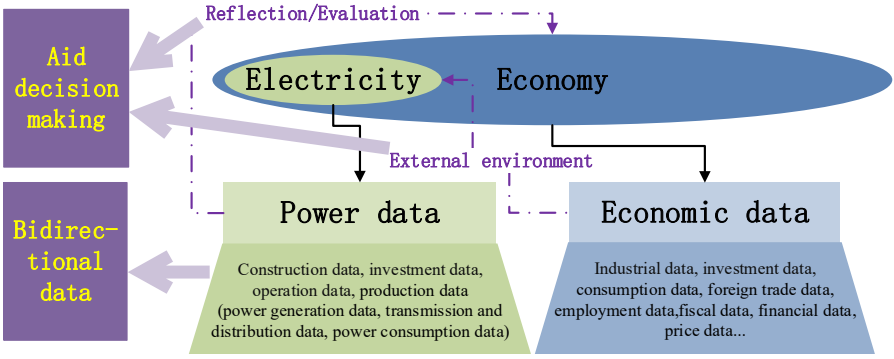

Fig. 1. Schematic Diagram of Bidirectional Relationship between "Power" and "Economy"

2 Value Research of Bidirectional Data-Driven Decision Support in the "Power-Economy" Interaction

2.1 Stakeholders and Their Needs in Bidirectional Data for "Power-Economy" Interaction

Drawing inspiration from Bryson's stakeholder analysis framework [7], stakeholder analysis is carried out in the following three steps: First, delineate the stakeholders involved in the application of relevant data. Second, assess the stakeholder's level of interest and relevance. Third, based on the level of interest and relevance of stakeholders in electricity and economic data, rank them accordingly and cross-reference to identify the core stakeholders for bidirectional "power-economic" data, with a particular focus on their decision-making behaviors and data requirements.

By employing methods such as brainstorming, stakeholder surveys, and literature analysis [8-9], the stakeholders for bidirectional "power-economic" data are determined. Surveys were conducted by the research team, which involved over 150 individuals from key departments in companies, national economic management units

(National Development and Reform Commission, Ministry of Industry and Information Technology, Energy Administration), national think tanks (Development Research Center, National Information Center, Chinese Academy of Social Sciences), securities firms, and economic and financial databases. Additionally, the literature and documentation analysis method involved the examination of texts from the China National Knowledge Infrastructure and related literature, reports on data applications. A comprehensive score for the relevance of stakeholder needs in "Economy to Power," "Power to Economy," and bidirectional "Economy-Power" data is assigned, with scores ranging from 1 to 10, where higher values indicate greater relevance.The results are shown in Table 1.

Table 1. Stakeholders and Their Relevance Ratings

Type	Stakeholders	Primary stakeholder needs	Relevance
"Economy to Power"			
Government	Government department	Is the national power supply secure and adequate	7
Industry upstream	Primary energy company	The impact of electricity demand trends on the coal, oil, and gas energy product markets	5
	Electric power equipment suppliers	The pull effect of electricity demand and its investment growth on the space of the electric power equipment market	3
Industry midstream	Power generation companies	The impact of the electricity demand situation on the capacity and efficiency of power supply	8
	Power supply companies	Balancing power supply and demand, and increasing investment capacity	10
Industry downstream	Other	Is there a guarantee of electricity supply for production and daily life	3
"Power to Economy"			
Government organization	Legislative body	Data security and lawful data utilization	1
	Economic department	Timely and accurate understanding of the economic situation	10
	Non-economic department	Timely and comprehensive understanding of the development and issues within one's responsible domain	3
Non-governmental organization	Business organization	Using electricity data for production and investment decisions	5
	Research institution	Conducting research using electricity data	4
	Social organization	To gain a more comprehensive understanding of industry operations, market conditions, and other related factors	3
	International organization	Enhance understanding of China's economic operations and production	2
Individual	Public	Understanding macroeconomic and industry trends	1
	Scholars	Conducting independent research	2
	Investors	Providing data references for investment decisions	2
"Power-Economy" bidirectional			
Central government	Economic department	Macroeconomic policy formulation and economic functional planning	3
	Non-economic department	Assessment of non-economic sector performance and non-economic functional area planning	2
Local government	Economic department	Local macroeconomic policy formulation and economic functional planning	3
	Non-economic department	Assessment of local non-economic sector performance and planning for non-economic functional areas	2

2.2 Construction of the Value System for Bidirectional Data-Driven Decision Support in the "Power-Economy" Interaction

Taking into account the analysis of the content of electricity data, economic data, the relationship between electricity and the economy, and the core needs of key stakeholders, we construct a value system for bidirectional data-driven decision support in the "power-economic" interaction, see Fig. 2.

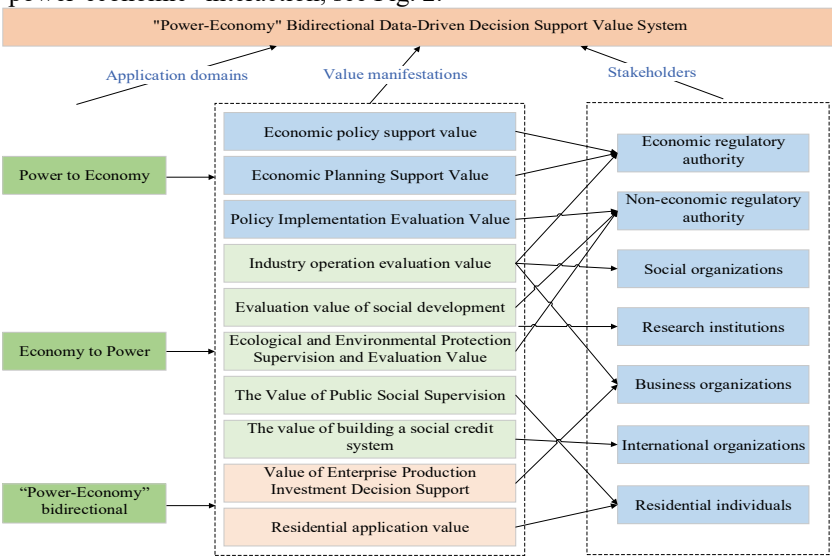

Fig. 2. Value System for Bidirectional Data-Driven Decision Support in the "Power-Economy" Interaction

From the perspective of the value system, it comprises two major aspects: application directions and value representations. The former includes three directions: "Economy to Power," "Power to Economy," and "Bidirectional Power-Economy Data." The latter encompasses macro-level values, including economic policy support value, economic planning support value, policy implementation evaluation value, intermediate-level values, such as industry operation assessment value, social development evaluation value, ecological and environmental supervision assessment value, public and social oversight value, and social credit system construction value, and micro-level values, including enterprise production and investment decision support value, and residential life application value, totaling ten categories of value. Regarding the main components of the value system, it includes two main categories: value demand entities and value implementation entities. From a macro, intermediate, and micro perspective, these mainly encompass three dimensions: government, businesses, and individuals. The relationship between these two categories is bidirectional, as the relevant value demand can be proposed by value demand entities or be the result of proactive communication by value implementation entities. The realization of the value of "power-economic" data involves multiple iterations of interactions between value

demand entities and value implementation entities, characterized by "supply-feedback-optimize supply."

3 Research on the Implementation Path of Value for Bidirectional Data-Driven Decision Support in the "Power-Economy" Interaction

3.1 Value Creation Matrix for Bidirectional Data-Driven Decision Support in the "Power-Economy" Interaction

In this section, drawing from Lepak's value creation and value capture theories [10], we consider three categories of stakeholders: government, businesses, and individuals. We construct a 3x3 matrix to represent the 9 dimensions of value generation in bidirectional "power-economic" data, see Fig. 3. This matrix explores the following five aspects to study the implementation path of value: creator analysis (who creates), creation content analysis (what is created), creation process analysis (how it is created, including technical methods), value recipient analysis (who receives), and value acquisition method analysis (how it is acquired).

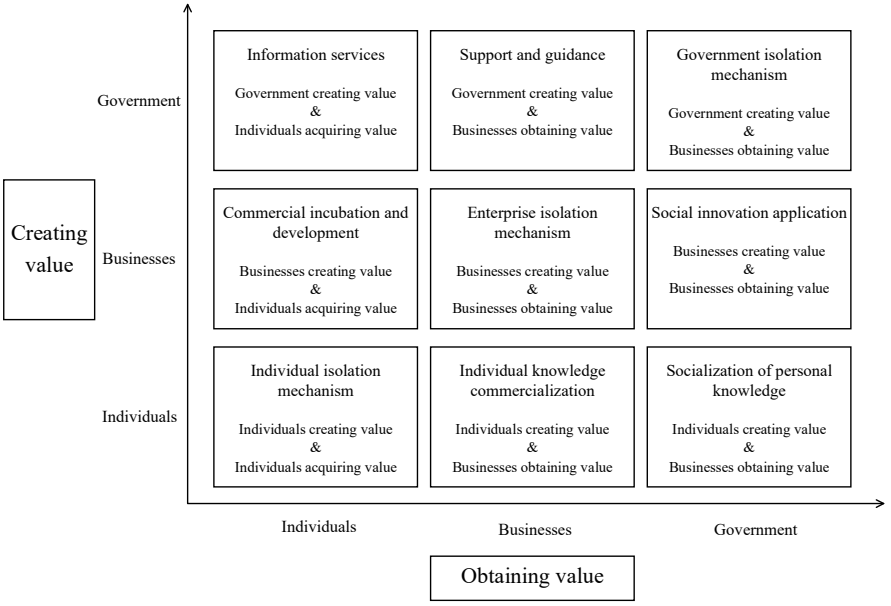

Fig. 3. 3x3 Matrix of 9 Dimensions for Value Generation in Bidirectional "Power-Economy" Data

3.2 Analysis of Implementation Paths for Value Creation in Bidirectional Data-Driven Decision Support in the "Power-Economy" Interaction

Path 1: Information Services: Emphasizes that the government provides information product services for individual decision-making. The government innovatively uses online service platforms and user behavioral big data to create precise "power-economic" data information services, assisting users in making informed decisions and thereby improving public living standards. Path 2: Support and Guidance: Highlights that the government influences business decisions through policies and projects. Government departments, in conjunction with various business domains, guide the development direction of electricity big data companies through policy directives, using big data platforms as the link to achieve innovative applications. The government creates open development projects for "power-economic" data, providing stable financial support and guiding businesses to participate in the development and operation of electricity big data. Path 3: Government Internally: Involves the opening and analysis of electricity big data to achieve data sharing and departmental interconnectivity within the government. By utilizing government data unified sharing and exchange platforms, cross-department data resource sharing and usage are accelerated. Simultaneously, cloud computing integrates government operations across departments, breaking down information silos, reducing redundancy, and improving government efficiency and governance structure. Path 4: Commercial Incubation and Development: Emphasizes how electric grid companies provide "power-economic" products and services to individuals to influence their decisions. Electric grid companies can comprehensively analyze customer energy consumption behavior through electricity data, providing data service support for users' energy-related decisions, promoting the widespread application of energy data in individual households and residential life. Path 5: Role of Electric Grid Companies: Describes electric grid companies as guarantors of the national economy, proponents of energy revolution, and providers of improved quality of life. Electric power enterprises must use "power-economic" big data for safe, efficient, and scientifically efficient operation within the company. Furthermore, they should make full use of resource advantages to integrate business flows, data flows, and capital flows across the entire industry chain, driving the shared development of the industry chain. Path 6: Social Application Innovation: Refers to businesses, especially electric grid companies, using "power-economic" big data to provide think-tank services to the government. Electric grid company power data platforms support national strategic implementation and government decision-making working groups. They align with relevant national departments, actively assume research responsibilities for innovation in power data analysis theories, management, and applications, and provide decision analysis and support for the development and implementation of national major strategic deployments. Path 7: For the Public: Using "power-economic" big data to create value can promote individual informed decision-making and improve living efficiency. Path 8: Personal Knowledge Sharing: Involves individuals transferring their knowledge to businesses, which in turn transform individual knowledge into corporate knowledge, influencing business product or service development decisions. Path 9: Personal Knowledge Socialization: Highlights

that personal knowledge influences government decisions. Scholars, trained in specialized research, provide policy recommendations to the government based on their expertise, significantly influencing policy outcomes. Additionally, they can publicly share research outcomes related to "power-economic" big data, creating research value and influencing government decisions through public opinion.

4 Conclusion

This paper initially confirmed the existence of a close and reciprocal interaction between electricity and the economy, with each influencing and mapping onto the other. After defining the content and coupling relationship of bidirectional "power-economic" data, and examining the perspectives of "Economy to Power" and "Power to Economy," a diverse range of methods, including brainstorming, literature analysis, and field research, was used to identify stakeholders and conduct a needs analysis. Employing a three-step stakeholder analysis, a value system for bidirectional data-driven decision support in the "Power-Economy" interaction was constructed. Finally, drawing from value creation and acquisition theories, and considering government, business, and individual stakeholders, a 3x3 matrix representing the nine dimensions of value generation in bidirectional "power-economic" data was created. This matrix provided clarity on who creates, what is created, how it is created, who receives, and how it is obtained in the implementation of value for bidirectional "power-economic" data-driven decision support. It offers practical guidance for the effective utilization of bidirectional data in the "Power-Economy" context.

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