The Human Side of Service Engineering, Vol. 143, 2024, 48–56
https://doi.org/10.54941/ahfe1005082

The Allocation of Decarbonization Responsibility and Institutional Innovation Under the Value Co-Creation of Service Ecosystem

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ABSTRACT

Any innovation and action will be stifled due to a lack of either institutional support, a certain density of resources, or effective collaboration among participants. At present, the basic theory to deal with climate change within the international community is generally based on the economic theory of external public goods, while the theory of policy tool design is mainly based on the Pigovian tax principle and the Coase Theorem of property rights. However, the future will be an era of service economy, and service is the basis of all exchanges. Based on the service- dominant logic, this paper intends to discuss the choice of responsibility allocation principle for emission cutting, propose an innovation scheme of decarbonization system based on the principle of shared responsibility, and then put forward thoughts and suggestions on the realization of decarbonization schemes by using the value co-creation theory of service ecosystem.

Keywords: Decarbonization, Service-dominant logic, Responsibility allocation, Institutional innovation, Service ecosystem

INTRODUCTION

On September 20, 2023, UN Secretary-General Antonio Guterres delivered a shocking warning at the Climate Ambition Summit: humans have opened the door to hell. Climate change is becoming a greater threat to human's survival than pandemics and wars. Implementing decarbonization is the only option placed in front of various countries, regions, enterprises, and individuals. Technological, methodological, and institutional innovation is crucial to achieving a fairer and more efficient emission-cutting goal at a lower cost. At present, countries generally adopt carbon market policy tools such as carbon tax and emission rights based on who produces and who is responsible, however the emission reduction effect is not good so far; Recently, the formulation of emission policies based on the principles of consumer responsibility and shared responsibility has received more and more attention, and there are some new institutional explorations. From the perspective of service science, the decarbonization initiative, which was first proposed in 1997, less than 30 years ago, is equivalent to adding a new value proposition to the traditional economic exchange behavior, that is, higher value of environment, sustainability and society, while either the policy tools or mechanism design

on both the supply and demand side, is institutional innovations to ensure effective carbon mitigation.

INSTITUTIONAL INNOVATION IS CRUCIAL TO REALIZING CARBON NEUTRALITY

As human beings share a common earth, all organizations and individuals in society shall be confronted with the increasingly serious problem of climate deterioration. From the perspective of institutional economics, greenhouse gases (GHGs), mainly carbon dioxide, are large-scale and complex public goods with negative spatial and temporal externality, which have always existed along with production or services supply in the industrial economy. However, characterizing stock pollution, neither has received much attention in the history, nor has been included as a cost item in the value components of products or services with its cost externality and difficulty in effective quantification. With the intensification of global climate change and the introduction of the decarbonization Initiative by international organizations in 1997, greenhouse gases have been getting more attention. As a new social demand, the effective management of such gases and the initiatives of decarbonization have come into the limelight. From a service science perspective, carbon emissions are a cost factor that has to occur, resulting in a loss or destruction of value; accordingly, decarbonization can be seen as an effort to reduce negative externalities, with a positive meaning of the behavior, which is equivalent to adding new value propositions to the traditional economic exchanges, that is, higher environmental, ecological, sustainable and social value. The realization of these value propositions is inevitably a value co-creation process based on the service ecosystem and win-win collaborations among the participants. Regime and institutional innovations are essential to enable the stakeholders of the carbon mitigation service ecosystem to reach a value agreement so as to act under a convergent institutional logic.

DECARBONIZATION MECHANISMS SHALL BE BASED ON THE PRINCIPLE OF SHARED RESPONSIBILITY UNDER THE SDL PERSPECTIVE

The determination and allocation of responsibility for carbon emission reduction is the foundation for the setup of national and regional decarbonization policies and is also the first challenge to be solved (Gao Yuan et al., 2023). The current theoretical research community divides the carbon emission responsibility into three types, namely the Production-based Principle, the Consumption-based Principle, and the Sharing Responsibility Principle. The Producer Principle is actually whoever renders the products or services with GHGs emission and gets interests shall be held accountable; the Consumer Principle is whoever gets benefit shall be held accountable. The determination of national decarbonization responsibilities under international climate agreements, such as the Kyoto Protocol and the Paris Agreement, is based on the accounting by producer principle, and the corresponding decarbonization measures are also mainly focused on the production sector. The current design theory of policy tools to address climate change within the international community is mainly based on the principle of the Pigouvian Tax

and Coase Theorem of property rights, which is also premised on producer responsibility.

According to statistics, greenhouse gas emissions in 2023 peaked at a new summit, while climate impacts intensified with temperature records refreshed repeatedly. The obviously unsatisfactory climate response over the past 30 years within the international community reveals that the producer principle may be one of the core reasons for the current global neutral process stagnation. From an economic point of view, the final cost of carbon emissions will be passed on from the front end to the end consumers or beneficiaries as part of the total cost of a product or service for an efficient market, So there is no big difference it whether the producer or the consumer bears the responsibility. However, for the ineffective market formed by energy and electricity supply or the international trade, the producer principle is likely to lead to "carbon leakage" in the import and export trade; at the same time, while the stock pollution characteristics of carbon emissions shall be taken into account to define emissions responsibility, the distinctive characteristics of carbon emissions of the negative externality in space and time makes the principle of producer responsibility not reasonable due to the division of labor in the industry and the different stages of development. This producer and product-centered decarbonization logic is the generally accepted goods-dominant-logic (hereinafter referred to as GDL) in the industrial economic era. GDL is the dominant theory of neoclassical economics in the twentieth century, which is compatible with the background of the industrial revolution, and mainly satisfies demand and creates value in the form of providing products to customers. The basic thought of GDL is that value is created by the producer enterprise alone by integrating resources and delivering to customers through market exchange, considering the enterprise as the only value creator and the customer as the consumer or waster of value.

"Liability for carbon emissions originates with consumers", and the formulation of carbon emission policies based on consumer responsibility is receiving increasing attention. The 2007 report of the New Economics Foundation of the United Kingdom pointed out that the focus of climate change discussion should be shifted from commodity-producing countries to commodity-consuming countries; Ferng (2003), based on the principle of beneficence, argued that the responsibility for carbon emissions should be attributed to the drivers of pollution rather than the direct producers of pollution. From an efficiency point of view, consumer responsibility is more conducive to the design and implementation of a decarbonization system, which can clearly guide the objectives of policy measures, make it easier to rationalize the relationship of responsibility and have higher regulatory efficiency and fairness. The premise of this mechanism is that the social costs of carbon emission externalities can be internalized in some way into the costs of the corresponding products or services so that it is rational that products or services purchased by consumers include these carbon emission costs. However, this principle assigns liability of carbon emissions at different stages in the supply chain to final demanders, magnifies the decarbonization responsibility of consumers, erases the responsibility of producers and intermediate links, and overestimates the motivation and ability of consumers to consciously fulfill their duties.

Logic is the underlying philosophy for understanding objective phenomena (Guan, Xinhua et al., 2017); the GDL of industrial economy era is not able to explain the rich and dynamic economic and social phenomena in the era of the service and the knowledge economy, and Service-dominant-logic (hereafter referred to as SDL), which was born at the beginning of the 21st century, as a kind of late-onset reconstructive alternative to dominant logic shall be of normative significance for all industries (Lusch and Vargo, 2006). Unlike the monolithic closure and binary linearity of traditional value creation, SDL considers all value co-creation or co-destruction as pluralistic and networked behaviors, emphasizing the co-involvement of producers, consumers, and other stakeholders, and the formation of interdependent and reciprocal ecosystems among the relevant participants. SDL is the most relevant logical framework for carrying out the design of value outputs and the allocation of resources (Vargo and Lusch, 2016), which is capable of providing a dynamic and continuous description of the resource integration and service exchange behaviors of the ongoing value co-creation activities, uncovering and capturing the hidden veins of generic value creation, identifying the major value inflection points and documenting the critical paths of value dependencies as well. Therefore, SDL may be able to provide a new type of cooperative and win-win path option for an effective solution to the global climate issue.

Both of the two principles assign all carbon responsibilities to only one target subject, either the enterprise as the producer or the consumer as the end-customer, and treat the two as dichotomous, which is fundamentally based on the GDL mindset of zero-sum game, limiting the collaboration among market participants and their contribution to value creation. The 2nd axiom of SDL states that value is co-created by multiple actors, always including beneficiaries. The 4th axiom of SDL states that value is always uniquely and phenomenologically determined by the beneficiaries.Thus based on SDL value is determined by consumers, while value is co-created or co-destroyed, idiosyncratic, experiential, contextually influenced, and meaningful as well. For decarbonization, without consumer demand, there will be no relevant emission, in each part of supply chain of product or service provision, carbon liability will be generated in the form of carbon emission, waste, or natural resource expending, and each participant should bear a certain amount of carbon liability in protecting the environment. Therefore, the decarbonization responsibility in accordance with SDL should be shared by the stakeholders to realize and capture the value, and the principle of shared responsibility is more reasonable because it is a collaborative relationship between the stakeholders in this process.

AN INNOVATION OF DECARBONIZATION SYSTEM BASED ON THE PRINCIPLE OF SHARED RESPONSIBILITY

Climate change caused by human activities is a by-product of industrial civilization, so the economic principles based on the development paradigm of industrial civilization cannot provide a complete solution to the climate change issue. New feasible solutions in harmony with human beings and

nature, both fair and efficient, shall be sought only based on the development paradigm of ecological civilization, by integration of sociology, law, service science, and economics, with all-round actions.

Recently, China's Dr. Baoming Yang proposed a new idea of carbon-neutral solutions on a global scale after years of systematic research. With the basic framework of consumers bearing the large percentage of emissions cost and the back-end of the industrial chain in charge of the total amount of emissions at the front-end, the initiative utilizes digital technology to establish a complete carbon footprint big data, establishes a negative carbon market to support the offsetting of social organizations' emission stocks, and internalizes the social cost of emissions by integrating the pricing methodology, which can drive decarbonization of the whole society and achieve carbon neutrality on a global scale.

With regard to the allocation of responsibility for carbon emissions, although the program emphasizes the responsibility of consumers, for the industrial chain of production, the back-end producer is the consumer for the front-end, and the producer also is obligated to bear the corresponding responsibility for emission reduction, thus building a closed loop of decarbonization responsibility for the complete industrial chain; meanwhile, the program emphasizes market-oriented mechanism in the allocation of responsibility and rights across the international, regional and industrial chains in terms of carbon emission and absorption so as to integrate organizations and individuals in the whole society into the decarbonization system, and then achieve a better allocation of resources in a wide range. Under this system, producers naturally take responsibility through the market mechanism: if the intensity of carbon emissions exceeds the industry average, producers will be at a competitive disadvantage in terms of cost and brand reputation, while products or services that fail to gain recognition and acceptance from consumers have no prospect and market, and may even be eliminated outright. By cutting carbon emissions, producers can realize two value gains: the economic value of lower product costs and the brand value of improved social responsibility. In the long run, the carbon responsibility mechanism is conducive to advocating for people to change their lifestyles and consumption patterns, promoting green and low-carbon consumption, encouraging the proliferation of green technologies, and promoting the cost-effectiveness and fairness of the policy as well, thus enhances the total welfare level of the society and the sustainable development of the environment.

Suggestions for the Realization of a Decarbonization System Based on Service Ecosystem Value Co-Creation

In recent years, more and more researchers have argued that the service ecosystem perspective, which meets the needs of the current complex network environment, is the main direction for the future development of SDL, which can explain and promote value co-creation within and between service systems, and also drive service innovation. Lusch and Vargo (2014) define service ecosystems as A2A-oriented systems that can be relatively independent and self-contained, self-adjusted via mutual value creation by resource

integrators through shared institutional arrangements and service exchanges. The service ecosystem theory believes that all economic and social participants are an important part of value creation, and that value is co-created through service exchange and resource integration in a loosely coupled complex and dynamic system. The "institutional" system of the value co-creation theory of service ecosystems is usually composed of three parts: institution, institutional logic, and institutionalization, in which institution refers to artificially designed rules or norms that coordinate or constrain the behavior of participants; institutional logic refers to the combination of institutions and corresponding action mechanisms that exist stably in a certain field; institutionalization refers to the maintenance, destruction, and change of institutions [14]. Therefore, an effective decarbonization solution should be a dynamic and complex win-win service ecosystem built on a global scale to support the core interaction between participants, and have the following characteristics:

(1) A Loosely Coupled A2A-Oriented Network Composed of a Wide Range of Participants, Focusing on the Role of Operational Resources.

"Wide range" means that all organizations and individuals need to be included in the emission reduction system and seek the optimal allocation of resources in the whole society; "A2A orientated" means that the role differences of "producer/provider" or "consumer/recipient" of value under GDL should be abandoned and replaced with "participant" to emphasize that value is co-created by all parties through behavioral interaction without discrimination, and "loose coupling" means that all participants should still maintain independence and autonomy when cooperating, and do not constitute a substantial integrated organization; "network" shows that there is a need to form a good collaborative relationship between all participants.

Operant sources are the driving force of value creation in service ecosystems (Vargo and Lusch, 2016). The decarbonization system in the context of artificial intelligence and big data must rely on these resources such as digital technology to build an efficient, transparent, standardized network infrastructure in different social and technical scenarios to support the corresponding value co-creation activities, optimize the network structure and management mechanism of the service ecosystem with information technology components, and design architecture with key functions such as "attracting participants, facilitating interactions, and matching demands" that can adapt to rapid scale changes and amplify the positive network effects, thereby realizing a self-driven and self-operating ecosystem.

(2) Institution System Play Central Role in Service Ecosystem Value Co-Creation Context

Vargo and Lusch (2016) emphasize the importance of institutions and institutional arrangements in the process of service ecosystem value co-creation. A complete institutional system includes mandatory rules such as regulations and standards, non-mandatory social norms such as ethics, and cognitive institutions such as beliefs, faiths (Scott, 2008). Formal rules and regulations are mainly formulated and played by the government in monitoring

and macro-control roles to constrain and coordinate the behaviors of the participants and maintain order within the system. Compliance with normative regimes is often considered a professional ethic and social responsibility, and appropriately designed social norms can mobilize the social forces that dominate multiple parties and guide the development, integration, and use of new technologies to drive market formation (Vargo, Wieland, Akaka, 2015). At the same time, due to the loosely coupled nature of ecosystems, participants often engage in interactions based on informal terms and informal contracts, and informal social norms are also essential to coordinate interactions and balance potential conflicts of interest within ecosystems. Cognitive institutional compliance is based on intrinsic understanding and agreement.

The nature of carbon emissions as public goods suggests that mandatory regulation alone is not an effective way to promote a green and low-carbon transition, whereas the formation of a green and low-carbon lifestyle is difficult to achieve through advocacy alone. Therefore, the realization of the decarbonization value requires complex formal and informal institutional constraints and coordination among different subjects internationally and domestically, and it is necessary to explore the composition of the system that has a guiding and supervisory effect on the consumption preferences and consumption tendencies of the majority of consumers, so as to guide the consumption pattern and promote the green transformation of carbon peaking and carbon neutrality from the consumption side, and at the same time, "forcing "enterprises to adopt long-term green production methods.

(3) Achieving Innovation is an Process of Institutionalization That Requires a Shift From a Competing Institutional Logic to a Convergent One

SDL believes that institutionalization is the key to an innovation's acceptance by the market and recognition by stakeholders (Elina et al., 2019). Achieving institutionalization requires identifying key players at the beginning of a project and striving to convergent perspectives and logic between different players. Greater potential benefits could be obtained when more and more players share the same institutional arrangements due to the incremental network effect of benefits. Key players, such as the demanders and active agents of change in the ecosystem, may significantly contribute to or hinder the institutionalization of innovation. There will be less incentive to realize the innovation if key participants do not feel a clear attraction to the innovation, or if the innovation triggers a large degree of change while benefiting a wider range of participants, or if participants are unsure of the new value that can be gained due to a lack of vision or clarity about the short-term benefits. For situations where most key players are unable or unwilling to comply with the new system, it is necessary for higher levels of the innovation ecosystem, such as the regulation-making authority or the regulator, to step in to push for change or to take enforcement action. Wallin and Fuglsang (2017) find that legitimacy to push for innovation is crucial, as this enables fundamental modifications to the existing system or institutional arrangements. At the same time, institutionalization is a non-linear process (Zietsma and McKnight, 2009) that requires multiple iterations until a solution is developed that is acceptable to all participants.

Different institutional logics can have heterogeneous effects on organizational structure and behavior (Thornton and Ocasio, 2008; Du Yunzhou and You Shuyang, 2013), and institutional logics in service ecosystems are often multiple, competing, or even conflicting. Innovation can locally or holistically change the value co-creation connotations or processes in service ecosystems, while the realization of innovation involves changes in institutions and institutional logics (Akaka, 2019) until new institutions and institutional logics are produced that resonate with needs, behavioral practices, values, markets, as well as the institutional structure of society as a whole in a new way. This is a process of breaking down old competing logic and forming new convergent logic (Elina et al., 2019). Competitive logics create tensions, forms competing or conflicting interests and goals, and creates rank differences, as well as value co-destruction between different behavioral actors (Öberg and Shih, 2014). Phenomena such as costs are borne by one group of participants while benefits are reaped by other groups of participants, or costs were incurred during the project phase while potential benefits will be only realized in the long term shall be avoided while implementing decarbonization. In addition, it shall be realized that there are differences in perceptions, values, and beliefs about the institutional logic in the area of public goods and services between government regulators and businesses: the former generally seek long-term, macro-level benefits, whereas the latter is more concerned with micro, realistic, and near-term goals, and focus on using the resources that are within their control to achieve change.

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