An Abductive Analysis of Debates on the Impact of the Sharing Economy: A Systematic Review in a Sustainable Framework

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Abstract: The sharing economy (SE) is a new production and consumption model that improves social efficiency through the usage-based acquisition of idle resources. Owing to its friendly economic and environmental attributes, the SE spans various regions, industries, and backgrounds worldwide. Given the complex and controversial outputs of the SE, there is an unmet need to perform a comprehensive and systematic survey of its impacts. We systematically review the recent studies of the multi-dimensional effects of the SE, including its profound impacts on the economy, society, and environment, from the WoS database via NVivo. A comparison of the positive, negative, and conditional attitudes among each dimension and an abductive analysis of the contradictions' underlying causes by deconstructing each conclusion into the cognitive background, empirical path, and supporting evidence is implemented to sort out the current debates. It is shown that the impacts on the social dimension are most debated, while the influences on the environment reach the strongest consensus. Notably, the effects on the economy are mostly hierarchical. Furthermore, the differences in the ontologically guiding ideology of sustainable development, the definitions of the SE, socioeconomic backgrounds, individual preferences, group interests, and empirical approaches co-trigger the varied conclusions and disputes. Hence, this study promotes a systematic and dialectical understanding of the SE's benefits and pitfalls, which is of significance to fundamental investigations and practical applications.

Keywords: sharing economy; impacts study; contradictory conclusion; abductive analysis; sustainability; literature review

1. Introduction

As sustainable development (SD) has been viewed and explained as a broad principle, its concrete implementation was broken down into 17 goals [1]. For any country, striving to change production and consumption patterns is the primary way to achieve these goals [2,3]. Only those endeavors can reconcile the present, future, and multiple development contradictions among the economy, environment, and society [4]. In reality, SD is challenged by massive resource consumption and environmental damage caused by human activities in a finite material world [5]. Current production and consumption patterns are no longer adequate due to ecological burdens and social inequities [6].

In this context, supporters treat the emergence of the sharing economy (SE) as a new and feasible way out for the "scarcity world". Many studies advocate it as an emerging service supply and consumption mode facilitated toward cleaner sustainable consumption [7,8] by activating idle resources [9,10], improving resource allocation efficiency [11], and slowing down the resource cycle [12,13] with the support of Internet technology [14,15]. Meanwhile, some studies emphasize that it notably blurs the boundary between production and consumption, avoids excessive production, reduces waste [16,17], and promotes

resource-conserving production and environmentally friendly development [18]. In addition, as a remarkably resilient global phenomenon, the SE has also been shown to promote social equity and inclusion through more accessible products and services [19,20]. To be short, the SE, increasingly integrating cleaner production and sustainable consumption [21–23], offers an effective way to balance the multiple interests of the present, future, people, planet, and prosperity [24], and it has been regarded as a potential path to promote SD in conceptual discourse and practical experience [25].

Those positive effects mentioned above were verified in theory and in the early practices of car and accommodation sharing [26,27]. Additionally, the "low participation cost" attribute attached to its core concept of the separation of ownership and use rights has brought mass corporate and individual participants [28,29]. However, while the SE has penetrated the domestic economy's industries through diverse organizational forms and business models, there has been a profound influence from and growing confusion about its sustainability contribution [30,31]. It remains a complicated and cross-dimensional exercise to evaluate the functionalities of the re-commercialization of already-owned assets, which aims to drive substantial progress toward more sustainable production and consumption patterns [11,32]. In this regard, some studies hold that "a paradox of openness and distinction" exists between boosting the sharing practices and keeping their commitments to fairness [33]. Particularly, when the utilitarian motive replaces the previously altruistic one increasingly, the SE will gradually turn back to the traditional model and become pseudo-sharing, losing the positive effects once promised [34]. In addition, opponents insist that the SE is not conducive to improving product and service quality and will reduce the welfare of consumers [35]. Simultaneously, the spillover of "tragedy of the commons" in the SE also harms public property and collective interests [27,36]. When the SE is purely regarded as an economic opportunity by the regime actors continually, coupling with the highly free development dominated by the sharing companies, it leads to a neoliberal nightmare of extreme capitalist exploitation of natural and social resources that is ultimately unhelpful to SD [37,38].

It is evident that massive controversies are emerging in the sustainability impact of the SE. The output of the SE presents various possibilities in different regions, industries, and development backgrounds, profoundly affecting cognition, attitude, and behavior. Dialectical materialism suggests we seek unity in opposition. Therefore, it is meaningful and urgent to conduct a systematic and comprehensive review of the sustainable impacts of the SE to promote a deeper understanding of those debates [31,39]. Only a scientific consensus on the SE can promote sustainable transformation. Any extreme viewpoint of one-sided emphasis on its positive or negative effects is not conducive to fostering strengths and circumventing weaknesses in practices while pursuing sustainability.

Over the past decade, some scholars have also realized the significance of reviewing the impact of the SE. Their review works are backed by abundant empirical evidence and case studies. However, inevitably, those contributions from discrete industries and fields also restrain the cross-industry applicability of current reviews. Additionally, under the triple bottom line analysis framework, their works often investigate economic, social, and environmental implications in isolation, complicating the comprehensive evaluation [40,41]. In brief, the existing papers are mainly devoted to clarifying the conceptual evolution of the SE, including definition dilemma discussion [42], knowledge structure sorting [43], business model comparisons [44,45], research clustering, and induction [46]. This study divides these influential contributions into two categories by sector—the review of the SE's effect in the broad sense or at an industry level—and summarizes the representative works in Table 1. From the perspective of system theory, it is still deficient in reviewing the impact of the SE. An in-depth, dialectical, and systematic review is imperative for deepening the cognition, including identifying contradictions between effects [47] and cause tracing of the disputes.

Table 1. Representative review studies in recent years.

Research Fields		Software	Data Characteristics			Main Contributions
			Period	Database	Works	
Broad sense	Broader SE		2010–2020		20	Complement the empirical results of emerging and developing economies [8]
	Broader SE					Consider more comprehensive, complex, and multi-level sustainable impacts [47]
	Broader SE	HistCite	2015–2020	WoS	425	The existing empirical studies have not put forward conclusive evidence to confirm sustainability claims [42]
Industria-level	Mobility Accommodation	VOSviewer	2010–2020.05	WoS	74	Identify the relationships between the SE, sustainability, and SDGs in mobility and accommodation [19]
	Accommodation Transportation	ATLAS.ti	1978–2018.04	WoS Scopus	219	Consider the economic, social, and environmental impacts of the SE in the accommodation and transportation sectors [28]
	Tourism Hospitality	BigExcel-GephiLeximancer4.0	2010–2015	EBSCO Host Science Direct Google Scholar	66 + 10	Discusses the SE impact on destinations, tourism services, and tourists from the perspective of micro-meso-macroevolutionary economics [48]
	Hospitality Tourism	BibExcel VOSviewer	1982–2018 (2010–2019)	WoS Scopus	189	Review the knowledge structure [43] form five research clusters, including the influence on society, economy, negative impacts, etc.
	Sharing mobility					Compare the influence differences of four modes, including economic profit, carbon dioxide emission, waiting time, travel time, comfort and convenience, etc. [44]
	Collaborative fashion consumption	ATLAS.ti	Before October 2016	Proquest WoS (Social Sciences Citation)	33	Discuss the sustainability of CFC from the perspective of environmental impact [49]

Given this gap, this study attempts to transcend the general literature reviews, which merely enumerate and present empirical evidence of the impact of the SE in the existing research. Quite the opposite, we hope to construct and promote a comprehensive and scientific understanding of the SE and its effects by conducting a multi-scale comparative analysis of the discrete impact studies on the economic, environmental, and social dimensions. More specifically, under the direction of our research objectives, the research questions are layered into the following four levels:

Q1. What methods and theories are used to carry out the existing research on the impact of the SE? What conclusions do they draw?

Q2. What variables are used to evaluate the outcomes on the economy, environment, and society? Are the selected variables and indicators consistent with each other?

Q3. Which dimensions of influences are vehemently debated? What are the concerns about the controversies?

Q4. The retrospective analysis and general discussion of the deep reasons for debates.

In this study, Section 2 states the data collection and analysis method. Section 3 mainly includes the discoveries of the attitude distribution after data sorting, the sorting of controversial views, and the preliminary attribution analysis of the controversies (mainly for Q1, Q2, and Q3). The discussion part further traces the underlying causes of the debates and proposes a more purpose-oriented and comprehensive evaluation framework (mainly aimed at Q4). Finally, the fifth section outlines the research conclusions and suggests future research.

2. Materials and Methods

2.1. Date Collection

This study concerns both quantitative and qualitative analyses assessing the SE's impact, whether they derive from primary or secondary data. First, before the data search, we extracted three keywords according to our concerns, namely "sharing economy", "sustainability", and "impacts". Simultaneously, considering the author's preference in writing, we also adopted three frequently used synonyms of "impact" to conduct four independent Boolean searches. Secondly, as an old concept revitalized by technological progress, the SE has no unified opinion on its connotation and extension, making scholars favor rationalizing the aforementioned semantic confusion [40,50]. By mapping those contributions, this term is commonly adopted interchangeably with other concepts to varying degrees, such as circular economy, gig economy, platform economy, lease economy, usage-based accessing, product–service system, pay per use, collaborative consumption, peer-to-peer, etc. [41,51–56]. Thus, we chose subject retrieval to defeat the influence of semantic confusion, including a comprehensive search of the title, abstract, author, keyword, and keyword addition. This method is well suited for hotly debated academic concepts represented by the SE, as it can take in more potentially relevant research by blurring key concepts. Thirdly, concerning the scientific nature and completeness of the data, we adhered to the primary criteria during the investigation: only published (including online published) journal articles (excluding review works and gray literature) in the Core collection of Web of Science were acknowledged as valid data. Considering that the SE, as an emerging phenomenon, has conspicuous time boundaries and signals entering scientific research observation, and its knowledge structure is constantly updating and upgrading [42], we consequently did not artificially limit the publication time to cover more relevant works in the analysis, and the last data collection and update were due on 15 June 2021.

The main refining process consisted of a preliminary review based on keywords and abstracts and a further review rooted in content. During the initial review, those works containing the replaceable phrases mentioned above were temporarily withheld to identify the impact of semantic confusion on SE evaluation. Furthermore, we should not ignore that fuzzy topic searching inevitably led to many contributions that deviated from our topic but were still included in the results judged by the algorithm. It was also unavoidable to further filter the research with weak relevance through manual means. Thus,

during the further review grounded on text, we excluded the studies that did not settle upon specific sharing activities, admitting that they were the SE's potential penetration areas, such as those that discussed knowledge or policy sharing, optimization design of freight systems, sustainable solutions to retail logistics, ICT applications, supply chain management, enterprise sustainable development, or industrial symbiosis. Throughout the refinement, we invited two researchers with reading backgrounds on the SE to work independently to eliminate duplications and implement the two-stage review to ensure that the retained data were firmly relevant to the topic. Fortunately, they maintained good consistency in the results of data processing (Wang = 194, Zeng = 197). More details about the collection and cleaning process are abstracted in Table 2.

Table 2. Summary of data acquisition procedure.

	Data Acquisition Procedure	Amount
Search conditions	1. 1_{st} **Boolean retrieval of the themes "sharing economy", "impacts", and "sustainability"**	399
	2_{nd} **Boolean retrieval of the themes "sharing economy", "influences", and "sustainability"**	121
	3_{rd} **Boolean retrieval of the themes "sharing economy", "effects", and "sustainability"**	194
	4_{th} **Boolean retrieval of the themes "sharing economy", "implications", and "sustainability"**	167
Refining criteria	2. **Take written in English non-review, non-gray literature as primary refining conditions**	803
	3. **Merge four separate Boolean search series and eliminate duplicate articles**	565
	4. **Initial review of titles, keywords, and abstracts** (1) Retain the studies of sharing activities consistent with the characteristics of the SE, even though the term "sharing economy" does not appear directly in these works or their authors do not define it as such (2) Exclude the articles examining the Shared Socioeconomic Pathways (SSPs), which are irrelevant to our topic	269
	5. **Further review the full text of the works singly** (1) Exclude the works with abstracts available only without the entire text (in PDF format) (2) Exclude the contributions that may be penetration areas for the SE but do not involve discussion on particular activities in their issues (3) Exclude the articles that only mention the benefits of the SE in their conclusions and recommendations	192

We obtained 192 pieces of work closely relevant to our topic, including qualitative and quantitative works. Moreover, throughout the refining, we found it to be a universal phenomenon to survey business models and discuss their impact in the same article, making it necessary to conduct non-exclusive classification by subject and content to target the studies on these effects (shown in Table 3). Hence, rooted in textual content, NVivo12 Plus helped us narrow the dataset to 84 pieces of impact research on the sharing economy, among which 45 were empirical studies supported by objective data.

Table 3. Results of non-exclusive classification (in NVivo).

Codes Name	Description	Files	References
Concepts	What is the SE	30	56
Drives and obstacles	What causes savage growth in the SE	66	100
Mechanisms and optimizations	How the SE operates and how to advance it	79	107
Impacts	What does the SE bring	84	119

2.2. Abduction Analysis

Grounded theory is a bottom-up approach to integrating emerging theories from qualitative data or text which is continually used in rigorous literature reviewing [57]. It guides the systematic coding work, including the open coding of extracting words and paragraphs in a text, the axial coding of combing the relations between the sample sets formed as mentioned earlier, and the selective coding of the core categories' identification in text analysis [58]. NVivo, which is qualitative analysis software for textual data founded on grounded theory [59], highlights supporting the abduction analysis, which creatively deduces new reasonable implicit assumptions and traces root causes entrenched in massive amounts of evidence [60]. Under the instruction of Schurz's classification standard on the abductive pattern, the three dimensions—background, factual evidence, and cognition mechanisms—are not independent of each other in analyzing the same phenomenon [61]. Instead, the ability to capture proof tightly depends on the cognitive level. The distinguished background makes external evidence contrasting, leading to consistent conjectures but inconsistent conclusions. Consequently, we were committed to thoroughly observing the various combinations of each conclusion in terms of theoretical basis, hypothesis, scientific method, evidence, cognitive mechanism, and occurrence background. In this way, we could interpret the conclusion more accurately, speculate one more reasonable conclusion, and find a more general and coherent common cause under known laws.

In scientific studies, the frequency of positive or negative assessment and the degree of attitudinal differences co-constitute a comprehensive evaluation for an emerging phenomenon. In general, the quantitative analysis focuses on deducing the relationship between the constituent elements and quantity, while the qualitative one is adept in grasping attributes and characteristics [62]. Consequently, given the differences in the conclusion itself and the explanatory power, this paper carries out a thorough and accurate decomposition of each conclusion supported by both methods. Overall, we implemented our analysis under the guidance of the abductive analysis framework visually presented in Figure 1. In the first move, we distilled, restructured, and tabulated the conclusion points of the impact of the economic, social, and environmental dimensions on 45 papers by distinguishing the positive, negative, and conditional attitudes. Next, rooted in the text content, we deconstructed each conclusion into the cognitive mechanism, supporting evidence, and verification path according to the "criteria for deconstruction" and sorted out dissenting arguments to further enrich the chart's content. These preliminary efforts provided a solid basis for in-depth retrospective analysis. In the following, we contrast the research background, methods, variable selection, and data type of the divergent attitudes from the economic, social, and environmental dimensions to ascertain the potential cause for conflicting conclusions. Incidentally, we also accepted the emission of new descriptions with explanations during the axial and selective coding processes. Finally, this paper endeavors to propose a guiding framework (including partial indicators) for future research on the impact of the SE to promote a more standard research approach and readability and comparability conclusions.
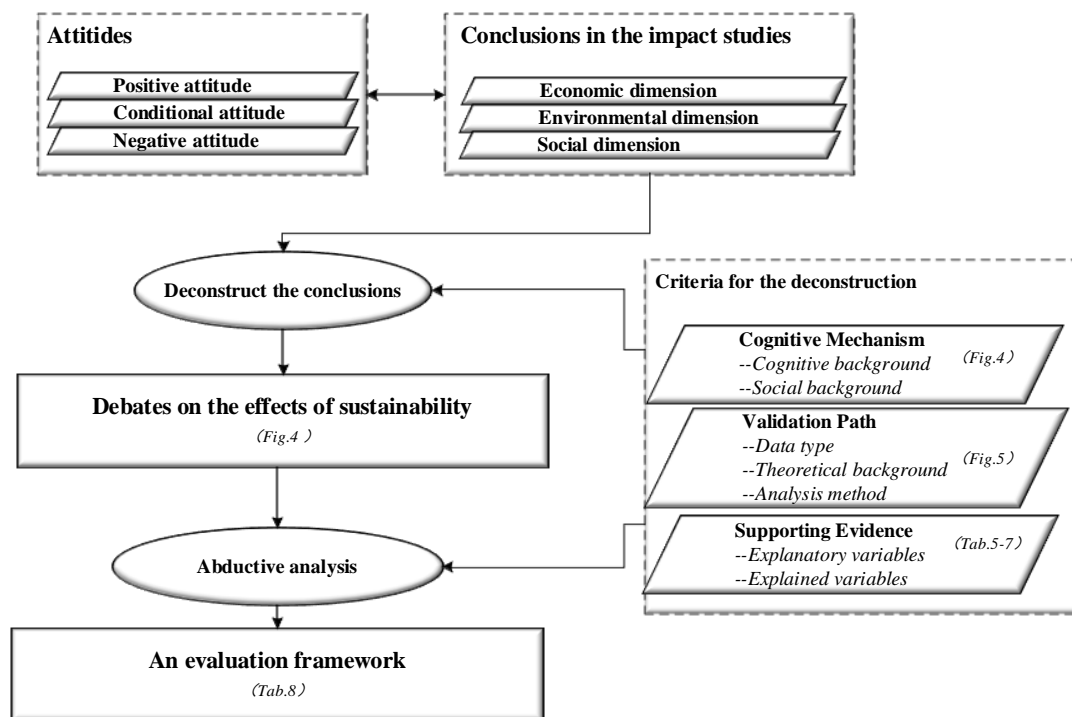
Figure 1. The framework of data processing and abductive analysis.

3. Results

3.1. The Data Distribution

3.1.1. Distribution of Knowledge Structure

When importing Excel files into NVivo, the respondents (the files' rows) would be stored as unique cases, where closed-ended questions were created as case attributes, while open-ended questions were designed as nodes. Table 3 shows the details of four case sets and one case classification obtained after the non-exclusive classification of 192 pieces of literature. Those sets supported the matrix query of publication quantity and publication year for four topics, thus helping to capture the phenomena's knowledge structure evolutionary trend over time.

As shown in Figure 2, the publication number for the four themes fluctuated significantly in 2019, revealing that the SE was suffering attitude and cognitive changes, owing to the rationalization of the public's expectations or the dampness of people's enthusiasm with the actual results. The tendency of Line C (short for the theme "concepts") indicates that there was still no consensus on "What is the SE?" Especially after 2018, the research on the connotation and extension set off a boom again, confirming the existence of a "definition dilemma" for the SE. Lack of consensus on definitions partly implies the inevitability of the debate over the impact of the SE, since clear research boundaries are a prerequisite for consistent and coherent conclusions, and the trend of the remaining three lines followed the evolution law of the knowledge structure of a scientific concept. In addition, the publications number in Lines D (short for "drives and obstacles") and M (short for "mechanisms and optimizations") show the rising interest in the drivers and barriers driving the swift growth of the SE. A similar upward trend for Lines D, M, and I (short for "impacts") also illustrate that researchers believed the motivation to participate and the operation mechanism were associated with the sustainability of the SE.
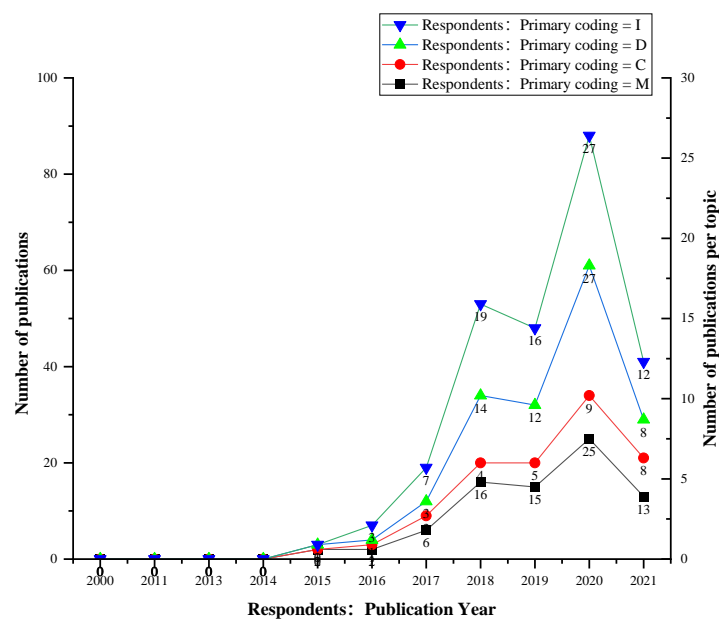
Figure 2. The matrix query of the number of publications and publication years for four topics.

In the content review, we coded every respondent's research object and industry to generate a collection named "Sharing content or industry". A visual word cloud map (Figure 3) and word frequency table (Table 4) were obtained by querying the word frequency of the foregoing sample set. Regrettably, NVivo merely supports rendering the results via querying the frequency of a single word and its synonyms rather than a phrase. Consequently, this study reshuffled the query results by reserving the highest frequency word in an expression to eliminate the interference caused by splitting the terms into multiple high-frequency words. It also can be observed that the existing scientific discussions on the SE almost covered the whole process of the economic cycle, including production (resources and capital), consumption (goods and services), and distribution (P2P and platform). Moreover, there was a high frequency of discussion on mobility, accommodation, tourism, food, clothing, logistics, and household appliances, reflecting the industry diversity of the SE.

Figure 3. The word cloud of "*Sharing content or industry*".

Table 4. The concise table of word frequency.

Vocabulary	Count	Vocabulary	Count	Vocabulary	Count	Vocabulary	Count
sharing	128	Airbnb	14	mobility	13	food	10
economy	52	accommodation	11	car	7	clothing	8
service	12	rental	5	vehicle	6	OLIO	3
consumption	10	tourism	5	taxi	5	laundry	3
production	9	hospitality	4	Uber	5	logistics	3
platform	8	Fairbnb	1	transportation	5	second	3
goods	7			Mo-bike	4	box	2
P2P	4			electric	3	Borrowmydoggy	1
resource	4			ride sharing	3	cow	1
capacity	3			Didi	2	Facebook	1
				Ofo	2	work	1
				Car2go	1		

3.1.2. Distribution of Attitudes in Three Dimensions

As presented in Figure 4, there have been extensive explorations on the effects of the SE on sustainable development among all three dimensions: economy, environment, and society. From the first column of Figure 4, the results on society display the most apparent attitudinal opposition, while positive attitudes dominated the research conclusions on the economy and environment. From the second column, there is a significant proportion supporting the positive effects. Still, a considerable number of studies confirmed their negative and conditional outputs. Notably, there were 11 articles (45 in total) that concurrently expressed two opposite attitudes toward the same dimension in their conclusions. This paper divided the current works into sectors according to the industry connection and shared content (see Tables A1 and A2 in Appendix A for a detailed list and their abbreviations). Our statistics show that the studies of *accommodation sharing and tourism* (11) and *mobility sharing* (16) occupied three out of five sectors in total. Only seven industries had more than two studies supporting our attitude comparison, as shown by the top seven from the bottom up in the third column. Additionally, only seven sectors were probed comprehensively, since not every industry affects all dimensions simultaneously in their hypothesis. As exposed in the rightmost column, developed countries and regions were chief contributors to the existing research. They led the influence studies on society, the environment of the emerging industries, and comprehensive studies on mainstream industries. In comparison, the emerging economies represented by China were lagging in industry diversity and literature volume. (The numbers in brackets refer to the document statistics counted in this study.)

3.2. The Impacts and Controversies Presented in the Data

This study employed the conclusions originating from rigorous derivation and argument rather than the speculative or unsubstantiated descriptions of the pros and cons in each study. The data deconstruction was strictly grounded on the fragments that contained the background, variables, methods, and data acquisition. Furthermore, we teased out five debates and traced their underlying causes by categorizing the attitudes on different dimensional effects and comparing their formation and distribution differences. In addition, the coded variables in the grounded analysis were also the primary data sources that constituted the evaluation framework of the SE, in line with sustainability. Incidentally, this paper does not cite all the original works corresponding to the data but rather the most influential ones among the similar works.
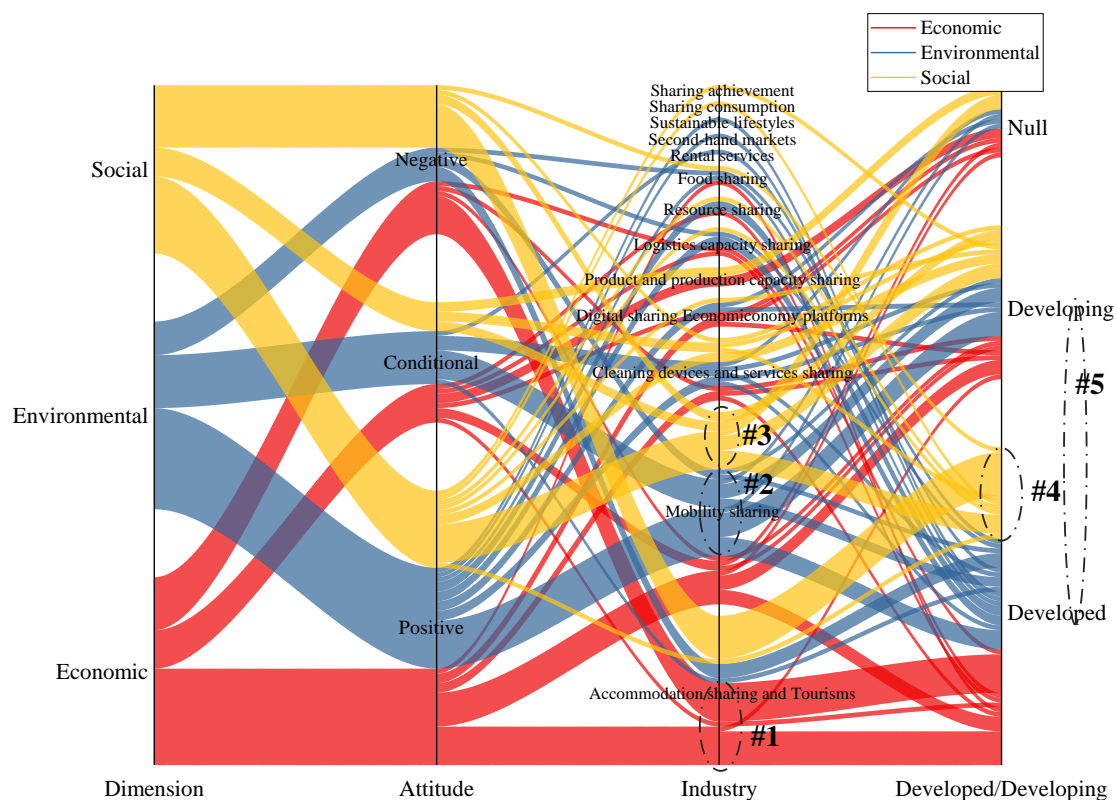
Figure 4. The parallel set chart for the distribution of attitudes and debates.

3.2.1. The Effects on the Economy and Their Debate

When combining Figure 5 and Table 5, the impact research on the economy consisted of qualitative (5) and quantitative (21) studies on 8 industries. Although their methods and data types were relatively scattered, we could still capture specific correlations between the method selection and data types. Generally speaking, the primary data were more likely to support qualitative analysis, while statistical panel data on social and economic indicators were mainly used for quantitative analysis. By abstracting the cognitive context, those impact studies of the economic dimension maintained consistency in the assumption of free-market competition and the research objectives of exploring the relationship between the dynamic supply–demand evolution caused by the SE and the economic quantity and quality output at the micro, medium, and macro levels. Throughout Table 5, given the singleness of the input and the multi-hierarchy nature of the output, it is evident that the selection of explanatory variables showed a higher commonality compared with the explained variables.

Regarding the correspondence between attitudes and industries, the positive attitudes dominated *accommodation sharing and tourism* and *mobility sharing*. Secondly, although the negative and conditional attitudes shared a similar proportion, they differed in industry composition. The former flowed to a single industry (A&T), while the latter was dispersed. As a result, the intense debate on the economic dimension emerged in *accommodation sharing and tourism* (marked #1 in Figure 5). Furthermore, developed countries and regions contributed mainly to debate #1 from the regional perspective. Thirdly, excluding *accommodation sharing and tourism* and *mobility sharing*, the positive effects of the remaining industries were barely supported by existing works, as seen from the shaded part in Table 5. More specifically, the positive views centered primarily on personal income growth at the micro level, and the attitude on economic impacts beyond the individual benefits seemed more controversial (marked in blue in Table 5).
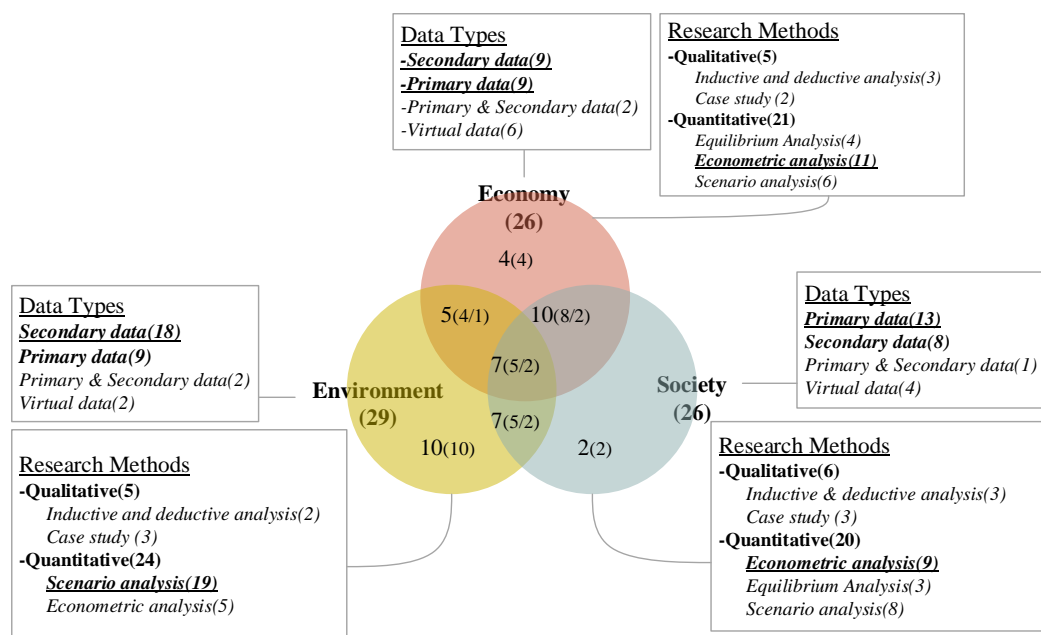
Figure 5. The collation chart of the validation paths of different dimensional effects. Note: The figures refer to corresponding statistics counted in this study; the numbers before and after the slash correspond to the statistics for quantitative and qualitative analysis, respectively; and the color blocks identify cross-dimensional research combinations.

Table 5. The supporting evidence of the impact study on the economy in different industries.

Industry	Attitude	Explanatory Variables	Explained Variables
A&T (10)	Pos (7)	Demand and consumption behavior (6) The number of accommodations (4) Heterogeneity of service providers (1)	Income (4): rental, per capita, and owner income Tax potential (1) Industrial economic returns (2) Service quality (1)
	Con (1)	The density of accommodation supply (1)	Profitability (1)
	Neg (7)	Demand and consumption behavior (4) The quantity of housing supply (3) Travel Stress Index (2)	Living cost (5): rent, house price, and Consumer Price Index Replacement on hospitality industry (1) Long- and short-term real estate market supply (3) The economic value of cities as tourism products (1)
MS (8)	Pos (6)	Demand and consumption behavior (4) Quantity and structure of supply (3) Business model and operation (1)	Income (1): personal income and financing opportunities Expenditure (1): low-cost travel scheme Economic efficiency (4): Investment structure (2): green finance and payback period Consumption structure (2): green consumption and consumption reduction Production structure (2): productivity (gain), aggregation effect, and demand response efficiency

Table 5. *Cont.*

Industry	Attitude	Explanatory Variables	Explained Variables
	Con (2)	Demand and consumption behavior (1) Business model and operation (1)	**Consumption structure (2):** new car registration, ownership rate, and vehicle utilization rate
	Neg (1)	Business model and operation (1)	Contradiction with traditional taxi parade fleet (1)
CD&SS (2)	Pos (2)	Business model and operation (2)	**Income (1):** personal income **Consumption structure (1):** green consumption and sustainable consumption pattern
	Neg (1)	Business model and operation (1)	Expenditure (1): commuting costs
DSEP (2)	Pos (2)	Demand and consumption behavior (1) Structure of supply (1)	**Economic efficiency (1):** achievement of budget, organizational financial, and investment objectives
	Con (1)	Demand and consumption behavior (1)	**Production structure (1):** meet demand with less products
P&PCS (2)	Con (2)	Quantity and structure of supply (2)	**Economic efficiency (2):** market share and corporate profits
LCS (1)	Neg (1)	Quantity and structure of supply (1)	**Economic efficiency (1):** operating costs
	Con (1)	Quantity and structure of supply (1)	**Economic efficiency (1):** financial benefit
RS1 (1)	Con (1)	Demand and consumption behavior (1)	**Consumption structure (1):** demand reduction and economic opportunity
FS (1)	Pos (1)	Demand and consumption behavior (1)	**Expenditure (1):** economic savings

3.2.2. The Effects on the Environment and Their Debate

As demonstrated in Table 6 and Figure 5, the influence analyses on the environment incorporated the qualitative (5) and quantitative (24) contributions for 10 industries. Compared with the other two, the works from the environmental dimension embodied the best empirical and quantitative thinking, and they mostly followed the path of seeking the optimal production and consumption scheme by horizontally comparing the differences in ecological output in multiple scenarios. Given this, bottom-up life cycle assessment, top-down input-output modeling, simulation modeling, and other scenario analysis methods were more prevalent, which aimed at precisely quantifying and managing the influences of the whole process from production to consumption [63]. In addition, due to the standard, transparent, and detailed data requirement, those existing works needed to rely heavily on authoritative statistical data [64] and mature LCA and I/O databases [65–67], facilitating unified explained variables. Still, we must also perceive the apparent heterogeneity of explanatory variables resulting from the diversity of industry and practice. Thirdly, in terms of critical points in primary data collection, environmental research pays particular attention to collecting the changes in respondents' consuming behaviors. In contrast, the economic and social analyses are concerned more with the motivation and attitude of rgw participants, sharing organizations, and governments.

Table 6. The supporting evidence of impact studies on the environment in different industries.

Industry	Attitude	Explanatory Variables	Explained Variables
MS (13)	Pos (8)	**Demand and consumption behavior (6):** frequency (induced travel) and changes in travel patterns (mode switching and travel distance) **Quantity and structure of supply (2):** production, utilization, and scale **Business model and operation (5): bike sharing** (FFBS, POS, or SBBS), **vehicle sharing** (ride hailing and carpooling), **electric vehicle sharing**, before and after use, base station, **operation** (rebalancing), and coordination of urban transportation	**Resource conservation and consumption (3):** fossil fuels, metal resources, and resource utilization efficiency **Emissions (5):** GHG of vehicles, GHG of infrastructure, GWP, and air pollution **Environmental and infrastructure efficiency (4):** utilization of urban infrastructure and public space and urban connectivity
	Con (5)	**Demand and consumption behavior (4):** utilization, scale (induced travel), and changes in travel patterns (mode switching) **Business model and operation (2):** life cycle (production, operation, and recycling)	**Resource conservation and consumption (1):** consumption in vehicle production **Emissions (3):** GHG threshold, GHG, and Haze **Environmental and infrastructure efficiency (1):** urban habitability
	Neg (2)	**Business model and operation (2): SBBS** operation (logistics induced by rebalancing) and **vehicle sharing** (ride hailing and deadheading)	**Resource conservation and consumption (1):** fossil fuels **Emissions (1):** GHG
CD&SS (4)	Pos (2)	**Business model and operation (1):** three laundry modes **Demand and consumption behavior (1):** consumption patterns, consumer behavior (frequency and temperature), and travel demand (induced consumption)	**Resource conservation and consumption (2):** water, detergents, electricity, and plastics
	Con (2)	**Demand and consumption behavior (2):** consumption patterns (single or compound) and consumer behavior (frequency, quantity, and duration) **Quantity and structure of supply (1):** production avoiding, depreciation, and maintenance	**Emissions (2):** GHG **Resource conservation and consumption (1):** gasoline
A&T (3)	Neg (2)	**Demand and consumption behavior (2):** increased demand and over-tourism	**Resource conservation and consumption (1):** products waste **Emissions (2):** noise **Environmental and infrastructure efficiency (2):** urban habitability and the spatial distribution of industries
	Con (1)	**Demand and consumption behavior (1):** additional consumption (extra income)	**Emissions (1):** Carbon footprint
LCS (3)	Pos (2)	**Demand and consumption behavior (1):** reuse or buying **and** logistics induced by product sharing **Business model and operation (1):** parking space (public space) sharing **Quantity and structure of supply (1):** production and new product procurement	**Resource conservation and consumption (1):** gasoline **Emissions (2):** GHG **Environmental and infrastructure efficiency (1):** idle parking space utilization rate and traffic performance
	Neg (1)	**Demand and consumption behavior (1):** induced consumption (VKT)	**Emissions (1):** GHG

Table 6. *Cont.*

Industry	Attitude	Explanatory Variables	Explained Variables
RS1 (2)	Pos (2)	**Demand and consumption behavior (2):** utilization, scale, and sharing by individuals or enterprises **Quantity and structure of supply (1):** production, utilization, and depreciation	**Resource conservation and consumption (2):** product reuse rate and waste reducing
DSEP (2)	Pos (2)	**Demand and consumption behavior (2):** product needs, platform usage, and resource utilization	**Resource conservation and consumption (2):** resource and energy consumption **Emissions (1):** construction waste **Environmental and infrastructure efficiency (1):** environmental accident rate
FS (1)	Pos (1)	**Demand and consumption behavior (1):** food recovery rate (reduce waste and increase transportation needs)	**Resource conservation and consumption (1):** Resource efficiency and resource waste **Emissions (1):** GHG
	Neg (1)	**Demand and consumption behavior (1):** rebound consumption (economic saving)	**Emissions (1):** GHG
RS2 (1)	Con (1)	**Demand and consumption behavior (1):** utilization and travel induced by trading	**Emissions (1):** GWP
SHM (1)	Pos (1)	**Demand and consumption behavior (1):** exchange or discard (lower transaction costs)	**Emissions (1):** solid waste **Resource conservation and consumption (1):** resource efficiency
SL (1)	Pos (1)	**Demand and consumption behavior (1):** consumption reduction, green consumption, and service life extension	**Resource conservation and consumption (1):** water saving and resource saving **Emissions (1):** GHG

Notes: The blue words display the specific forms of rebound effect and additional consumption.

As shown by the shaded area of Table 6, there was an overwhelming quantitative superiority in the studies which took an optimistic opinion of the impact on the environmental dimension. In terms of attitudes in different industries, *mobility sharing* and the emerging industries were more positive than the rest. Among the rest, the findings for *accommodation sharing and tourism* unanimously asserted that over-tourism and induced consumption impose burdens on emissions, environmental efficiency, and resource consumption. Altogether, compared with the opposing and vacillating attitudes of the other dimensions, the viewpoints on ecological size had the most explicit and unified behavior. There was a considerably large proportion of neutral attitudes in *mobility sharing* due to differences in the threshold settings and the dynamics change of the results during constant development. Thus, the non-consensus for the effect on the environment was presented in *mobility sharing* (marked #2 in Figure 4).

3.2.3. The Effects on Society and Their Debates

According to Table 7 and Figure 5, the influence discussions on society comprised qualitative (6) and quantitative (20) studies of 10 industries. They principally surveyed the attitudes of the stakeholders via interviews, questionnaires, and field surveys and evaluated the impact of sharing activities on social awareness, social equity, and urban livability from the value perspective. Thus, the works on social impact displayed the highest frequency of primary data use among the three dimensions. In addition to the influence of a data nature, the diversity of industries and the interest balance of multilateral platforms also increased the difficulty of variable selection, engendering the lack of commonness in both explanatory and explained variables. Yet, as we counted, only two papers dealt solely with social impact, while the rest usually discussed this in conjunction with the other dimensions, sharing the methods and data types. Methodologically, their conclusions were

inevitably frail in terms of robustness and scalability due to adopting a qualitative and subjective standard to analyze the calculated results of the economic and environmental indicators. Correspondingly, the impact of the social dimension turned out to be the most hotly debated one.

Table 7. The supporting evidence of impact study on society in different industries.

Industry	Attitude	Explanatory Variables	Explained Variables
MS (9)	Pos (7)	**Business model (3):** new jobs, multiple modes of travel, and investment attraction **Policy (2):** policy orientation and policy incentives (VAMO) **Demand and consumption behavior (2):** time-saving and low-cost travel solutions **Supply (1):** response to travel demand	**Social awareness (3):** green consumption, sharing, and environmental protection; consciousness **Social equity and inclusion (3):** fair transportation, public transport coverage, and employment and income opportunities **Urban habitability (4):** land use structure, industrial spatial layout, spatial utilization and coherence, urban connectivity, and travel convenience
	Con (2)	**Business model and operation (2):** BS network design, costs of ownership, and the commission rate	**Urban habitability (1):** time loss, convenience **Social equity and inclusion (1):** consumer surplus and social welfare
	Neg (2)	**Business model and operation (2):** cash payments (Uber) and encouragement for self-driving	**Social equity and inclusion (2):** precarious conditions of employment, intersectoral conflict, violence, and social interaction
A&T (8)	Pos (1)	**Service supply (1):** service coverage	**Social equity and inclusion (1):** quality of service
	Neg (8)	**Demand and consumption behavior (3):** tourist quantity, accommodation requirement, rent, commodity price, seasonal demand, and dependency on a short-term lease **Quantity and structure of supply (3):** time, space, density, and long- and short-term leases **Business model and operation (1):** Airbnb-like housing (commercial operation) **Background (2):** urban size and socioeconomic and economic condition	**Social equity and inclusion (6):** income gap, revenue opportunity, fair service, social conflict, sense of security, and gentrification (population crowding out and living cost) **Urban habitability (2):** crowding (space, traffic, and parking) and infrastructure distribution and utilization
CD&SS (3)	Pos (2)	**Business model and operation (1):** SweepSouth and practitioner's attitude **Quantity of supply (1):** labor time (female)	**Social equity and inclusion (2):** employment and income opportunities
	Con (1)	**Business model and operation (1):** LM modes	**Social awareness (1):** consumption behavior (washing and baking) and demand (frequency)
	Neg (1)	**Business model and operation (1):** SweepSouth and practitioner's attitude	**Social equity and inclusion (1):** precarious employment conditions
P&PCS (2)	Con (2)	**Business model and operation (2):** pricing, channel, and product quality strategy	**Social equity and inclusion (2):** consumer surplus and social welfare.

Table 7. *Cont.*

Industry	Attitude	Explanatory Variables	Explained Variables
LCS (1)	Pos (1)	**Supply (1):** parking sharing (public)	**Urban habitability (1):** quality of urban life and traffic performance (crowding)
RS1 (1)	Pos (1)	**Business model and operation (1):** self-reflection and advocating haring	**Social awareness (1):** the community of sharing culture
DSEP (1)	Pos (1)	**Demand and consumption behavior (1):** usage of the digital platform and practice	**Social equity and inclusion (1):** meeting the needs of multiple stakeholders
FS (1)	Neg (1)	**Background (1):** user characteristics (education and income level)	**Social equity and inclusion (1):** food crisis and group discrimination
SC (1)	Pos (1)	**Demand and consumption behavior (1)**	**Social awareness (1):** altruistic value
SA (1)	Pos (1)	**Demand and consumption behavior (1)**	**Social awareness (1):** social entrepreneurial willingness

As shown in Table 7, the notable attitude conflict appeared among industries rather than within sectors, such as attitudinal differences between *accommodation sharing and tourism* and *mobility sharing*. On the contrary, their social impacts on the same sector reached a high consensus. To be more precise, except for *mobility sharing, cleaning devices and service sharing*, and *accommodation sharing and tourism*, the attitudes of the rest basically formed a consensus within the industry. In comparison, the coexistence of advantages and disadvantages in the three sectors mentioned brought them both supporters and opponents, which was particularly true in *mobility sharing*. In addition, considering the social background, the emerging economies were more likely to suffer from the coexistence of new employment opportunities and precarious employment conditions, thus exhibiting a more dialectical attitude than developed countries and regions. To summarize, the contradictions for society appeared in (1) the sectoral differences of the developed countries and regions (#4 in Figure 4), (2) the social dimension debate in *mobility sharing* (#3 in Figure 4), and (3) the difference in the development environment in *mobility sharing* (#5 in Figure 4).

3.3. The Abductive Analysis of the Impacts and Controversies

3.3.1. The Impact Analysis on the Economic Dimension

In a nutshell, debate #1 could be dissected at two levels—whose economic interests and what kinds of economic interests—and then traced back to differences in the empirical paths (theoretical background) and supporting evidence (explained variables). It can be concluded that the divergent selection of output variables was the leading cause of attitudinal opposition when evaluating the economic impact of A&C, as the choice was strictly limited by the macro or micro perspectives.

More generally, the empirical difficulty of research on economic impact increases with expanding the range of discussed groups and the research layers. First, when talking about different groups, there are four studies that argue that accommodation sharing and tourism provide a new income stream for the participants holding vacant houses by re-valuing and cashing the empty rooms. However, they concurrently affirm that over-tourism and Airbnb-like accommodation are gentrifying sensitive groups, such as non-participants who are permanent residents of tourist destinations, through the supply of housing markets and commodity prices [68]. Second, in discussing the economic benefits of different industries, some studies claim that low-cost and localized travel programs increase the financial benefits of tourism by inducing demand and stimulating consumption [69]. Still, on an opposite note, some others proved that the new consuming habit of relying on short-term rentals to replace traditional hotels also caused economic losses to hospitality [26]. It is

challenging to judge the direction of the ultimate economic benefits when there are gain offsets between different groups or industries.

Theoretically, all three players in the SE directly benefit from the positive and undisputed economic opportunities created by sharing. According to temporary access of the use rights, the users can obtain products and services at a lower cost and risk without paying for ownership, while the owners can monetize the use value of idle goods and services (productivity) they owned to increase their income. Furthermore, sharing platforms can match supply and demand more efficiently through technological advances and charge commissions for completed transactions, and those direct economic benefits of different beneficiaries have been statistically and empirically verified in existing studies [70,71].

However, in reality, there are both expected (participants) and some unexpected communities (non-participants) whose interests are involved in the externalities of sharing activities when markets allocate resources. More specifically, as individuals, firms, and governments seek to maximize their utility, their new production and consumption decisions trigger dynamic supply and demand changes, which have complicated the effects on both participants and non-participants and made them hard to predict. Surrounded by free competition, interest conflicts among different groups are inevitable. When pursuing market equilibrium, their interest game may be disordered, repetitive, and nonlinear. Accordingly, the impact of the sharing economy on the economy may be multi-order, oscillating back and forth between positive and negative directions or spiraling upward [72] in different stages, which heavily rely on two pairs of apparent and prominent contradictions:

(1) Whether the quantity increase in economic benefits of direct beneficiaries can bridge the financial loss of non-participants;
(2) Whether the more complex production and consumption scenarios resulting from induced consumption optimize the economic structure and conform to sustainable development.

3.3.2. The Impact Analysis of the Environmental Dimension

In debate #2, by observing the explanatory variables in existing studies, we caught that the results for the environment tightly depended on the experimental design and research boundaries, and the accurate and plentiful details in the scenario simulations had an exogenous effect on the conclusions. Their controversy could be attributed to the differences in cognitive mechanisms (social background) and supporting evidence (explained variables). Fortunately, several studies considered those exogenous causes and were committed to advocating placing the assessment in a more standardized yet comprehensive reference system, such as referring to a more similar functional unit design in LCA [73]. Still, overall, our statistical results reveal that the current works hardly followed and implemented those recommendations.

Furthermore, the complexity of the decisions, the diversity of business practices, and the social-economic background co-constituted the contextualization of sharing practices, leading to the endogenous difference in conclusions on the environmental dimension. First, the transformation of consumption patterns varied with utility, business practices, and preferences; in other words, the complexity of decision making stemmed from the dynamic interaction between the supply–demand level and the participants' preferences. In the case of bike sharing, the emission-reduction potential depended on whether they replaced the car, public transport, or walking, which were associated with consumer preferences and the transport facilities arrangement [74]. The varying levels of demand for ownership versus use rights stimulated a revolution in the production and consumption sectors, ultimately engendering different resource consumption and emissions levels. Secondly, the business model details were diverse. Taking the operation of vehicle sharing as an example, such subtle particulars among online ride hailing, carpooling, and car sharing will also induce differences in vehicle mileage, ultimately affecting resource consumption and emissions. Thirdly, different countries and regions provide differentiated environments for the development of the SE while implementing inconsistent evaluation criteria for environmental output. For example, a recent published work successfully verified that the differences

in population density and per capita car ownership between Beijing and Toronto lead to more taxi hailing, congestion, and worse environmental impacts in China [75]. Similar to the economic dimension, the first-order effects on the environment of sharing activities are often positive, such as reducing waste and improving product utilization rates, directly contributing to resource conservation and emission reduction, while the conclusions turn ambiguous when considering the situational nature inherent in sharing practices. More precisely, a scientific measurement of environmental impacts requires accurate grasping of critical factors which regulate the outcomes (e.g., pattern shifts and induced consumption), and there are two studies that confirmed and measured the existence of a threshold, leading the conclusions to reverse when breached [23,76]. Radically, the debates on the environmental dimension are summarized as whether and to what extent the positive outcomes related to resource-saving and emissions are offset by the negative impacts of additional consumption and emissions induced by the rebound effect in the whole life cycle of various activities.

3.3.3. The Impact Analysis on the Social Dimension

The reach of the SE spans various industries, making industry diversity apparent, and there is a reason-result relationship between the industry diversity and lack of consensus on definitions across sectors, which on the one hand leads to contrasting modes of interaction between sharing activities and traditional national economic sectors. Although unified under "sharing", *accommodation sharing and tourism* and *mobility sharing* link different business logic and practices. To be precise, as the former is closer to realizing the right use of stock resources, this supplements the original real estate market and forms social pressure for the natives, comparing their initial living conditions. Meanwhile, the latter tends to evolve toward the product-service systems (pay per use) based on incremental resources, optimizing transportation performance, and driving more convenient urban connectivity [77]. In debate #4, the lack of consistency on whether to be based on existing idle resources triggered different social impact outputs of their business practices, ultimately resulting in diametrically opposed attitudes in developed countries and regions toward the two industries.

On the other hand, sharing activities within a sector are carried out in diversified forms and constantly closely interact with mainstream economic activities, making the impact assessment of social dimensions deeply troubled by their externalities and complexity. In addition, the absolute social impact depends on the varied but complex details of operations when everyone is committed to pursuing its interests. For instance, in bicycle sharing, most studies hold that regulating the layout of docking stations can affect participants' travel time and efficiency and ultimately influence all residents' mobility and livability [78]. As another opposite example, Airbnb's temporal and spatial distribution characteristics have been verified to trigger a wealth accumulation pattern akin to the Piketty phenomenon [79], meaning income discrimination and a widening income gap rather than their commitment to raising incomes and equality. Coincidentally, in debate #3, the bidirectional effects on society caused by commercial details were more easily observed in mobility sharing cases in emerging economies than in developed countries and regions.

More profoundly, the diversity of sharing activities also brings a wide range of affected audiences, involving both participants and non-participants, whose benefits are generally opposed. Whatever actions they take to pursue their legitimate interests may produce spillover effects, either positive or negative [80,81]. Specifically, on one side, many shared resources are physically exclusive, such as houses, cars, time, public and infrastructure. Additionally, through the progression of Internet technology, sharing practices promote more transactions and connections with strangers, simultaneously causing discrimination against those who cannot keep up with technological advances. However, few studies have realized and discussed such skill discrimination derived from technological progress being detrimental to equity commitment [82]. Whether physical exclusivity or technical barriers,

there are both beneficiaries and losers, signifying the group perspective these papers hold affects the findings.

Additionally, the SE promises to empower participants by providing flexible employment, more accessible goods and services, diverse income channels, and a more connected and equitable society. However, it is evident that emerging and developed economies do not share the same desire for their social commitments. In this way, they hold a divergence of attitudes on the social dimension in *mobility sharing* (#3). Throughout debate #5, positive results were supported by studies on both developed and developing economies, while adverse effects were a concern of and confirmed by only the latter. Just as rising employment and unstable employment conditions are more common and easier to co-exist in emerging economies [83], fundamentally, emerging economies are more likely to confront high levels of unemployment and inequality, creating a desire to pursue development and social stability. The demand theory can explain their more sensitive but tolerant behavior toward social inequality caused by sharing activities. As a result, the disunity of attitudes can be attributed to differences in the social backgrounds associated with developmental conditions and the expectations for the SE. In conclusion, three impact debates (#3, #4, and #5) observed in the social dimension revealed distinct causes and could ultimately be traced back to differences in the cognitive mechanism (cognitive background and social background) and empirical path (theoretical knowledge).

4. Discussion

Under the guidance of the retrospective analysis framework, we finally sorted out the corresponding relationships among the five debates and the cognitive mechanism, validation path, and supporting evidence and accomplished the preliminary attribution analysis. However, this study did not stop there. Instead, we proceeded to a more general discussion of those corresponding relationships to find the underlying, fundamental, and explanatory causes. To make these endeavors more visible, we captured the key links and plotted them in Figure 6. In addition, we also put forward a goal-oriented and comprehensive evaluation framework inspired by the SDGs (Table 8), guiding the orderly and effective development of future research, reducing disputes, and promoting consensus.
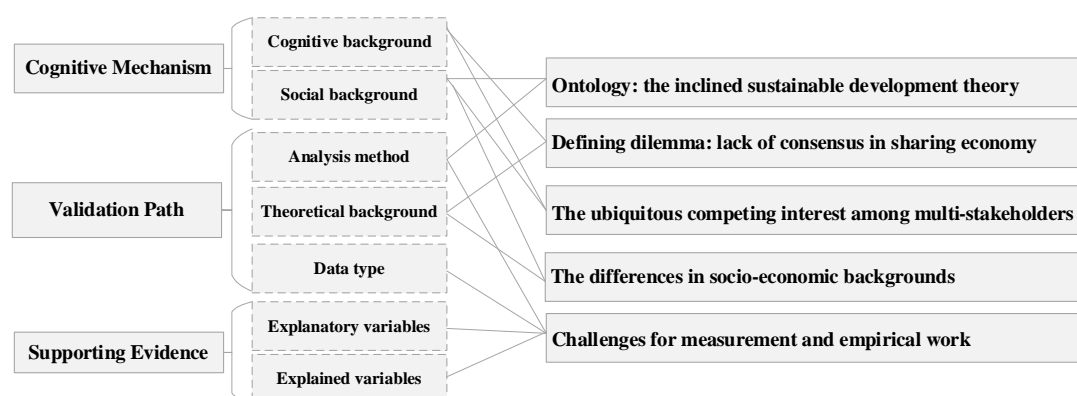
Figure 6. Mapping the deconstruction framework to the underlying causes.

Table 8. The assessment framework and indicators (excerpt).

Dimensions	Horizon Layer	SDGs Subgoal Layer	Criterion Layer and Commitments	Indicator Layer
Economic prosperity (Ec)	Micro-level	Goal 8: Decent Work and Economic Growth	Disposable income(real)	**Income** (rental, wage, other income, and personal savings) **Expenditure** (goods and services expenditure and indirect costs)
	Meso-level	Goal 9: Industry, Innovation, and Infrastructure	Profitability and corporate profit	**ROI, productivity, market share, and corporate reputation**
	Macro-level	Goal 8: Decent Work and Economic Growth	Quantitative growth	**GDP, GNP, etc.; Industrial scale; Revenue; Savings**
		Goal 12: Responsible Consumption and Production	Structure optimization	**Investment structure and efficiency, industrial structure, employment rate, and saving rate**
Environmental protection (En)	Resource consumption	Goal 7: Affordable and Clean Energy Goal 12: Responsible Consumption and Production	Quantitative growth	**Mineral resources, non-renewable energy, water, electric power, and manufactured goods**
			Resource or energy structure	**Resource or energy utilization and rate of technical progress**
	Emissions and environmental pollution	Goal 13: Climate Action	Emissions targets	**Greenhouse gas indicators** (GHG, GWP, etc.) and **solid waste** (construction waste and household waste)
		Goal 11: Sustainable Cities and Communities Goal 6: Clean Water and Sanitation	Environmental pollution index	**Contamination by chemical agents** (detergent) **Harmful emissions** (gas or haze, noise, color, light, and water)
	Environmental bearing capacity	Goal 11: Sustainable Cities and Communities	Land use (industry level)	
			Spatial planning (effectiveness)	**Infrastructure construction and coverage (rate)**
Ensuring well-being (So)	Fairness	Goal 1: No Poverty Goal 5: Gender Equality Goal 10: Reduced Inequalities Goal 11: Sustainable Cities and Communities	Equity of income	**The income gap and the gender gap**
			Equity of product and service	
			Equity of employment	**Unemployment rate**
			Equity of infrastructure and space	**Utilization and idling of infrastructure**
	Openness	Goal 11: Sustainable Cities and Communities Goal 17: Partnerships	Social connectedness	**Altruistic awareness and environmental awareness**
			Social interaction	**Group consciousness**
	Accessibility	Goal 2: Zero Hunger Goal 10: Reduced Inequalities	Convenience	**Accessibility of products and services**
			Non-discrimination	**Group discrimination** (skills, age, income, and region)

4.1. General Discussion

4.1.1. Ontology: The Inclined Sustainable Development Theory

The openness and multi-agents of SD conduce contrasting opinions on the normative question of "What must be guaranteed for everyone living in the present or the future?" This study finds these countries spontaneously split into two different schools of development theory when pursuing development suitable for their circumstances, namely favoring environmental protection or economic growth, and held distinct concerns about what promises the SE should deliver. It is revealed that the cognitive mechanism of diverse subjects was not unified, including cognitive and social backgrounds. More specifically, they implemented different interest balance schemes in practice and organized action with various production and consumption structures, making the SE present multiple forms. They also inspected the SE output from their discrepant cravings and chose different empirical approaches, especially analysis methods. It is self-evident to harvest different conclusions when examining the SE's economic gain, environmental benefits, and social welfare, namely when consulting the two standards of "complete reduction" and "optimization" of production and consumption. In short, different countries hold differentiated economic, social, and environmental commitments under discrepant ontological frameworks. The evaluation of the same sharing activity could not reach a consensus due to uneven criteria.

4.1.2. Defining Dilemma: Lack of Consensus in the Sharing Economy

We found that the confusion about the definition of the SE was spontaneous, being deeply affected by the cognitive background and theoretical background. As an old concept rejuvenated in the Information Age, it has an inherent contradiction between the connotation and extension of historical inheritance and new development. ICT helps optimize their participation modes and efficiency to match transactions in a larger space and shorter time. Meanwhile, it promotes industry diversity by interacting with traditional industries in various emerging forms. However, in essence, technological advances still cannot constrain the motivation to participate. Therefore, the definition of the SE in existing studies remains situational. In dealing with this confusing academic concept, scholars tend to make their descriptions compatible with their topics rather than a universal, generalizable standard by using different terms to make synonymous substitutions with the SE, impeding the clarification of definitions.

Moreover, unclarified cognitive and theoretical background issues raise the difficulty for existing empirical studies to select cases and supporting evidence, as we cannot obtain a coherent answer from an impact assessment of an incoherent entity. Theoretically, when there is no agreement on the research content and object, it is not easy to maintain a consistent research design, logic, and hypotheses, limiting the conclusion's interpretation and extension. Specifically, the diversity of business logic and practices has led to discrete discussion objects, being unable to converge to a clear scope. Worse, while the meaning and boundary of the SE are increasingly blurring with the disunity of the defined standard, many pseudo-sharing activities cannot be identified in time, being hidden away and denigrating its reputation. Despite some scholars having realized that a consensus on the SE is essential for estimating and forecasting its size, importance, and impact, it is regrettable that the "definition dilemma" still hinders research progress. To conclude, the definition dilemma makes it difficult to accurately capture "what the SE is" or even give a consistent answer about whether a specific activity belongs to the SE, and thus debate becomes inevitable.

4.1.3. The Ubiquitous Competing Interests among Multiple Stakeholders

The deficiencies of the cognitive mechanism trigger inadequate understanding and non-effective coordination of the widespread contradiction of interests exposed in practices, further aggravating these debates. The reverse logic of market entrance and physical and digital exclusivity generate opposing interests of varying degrees among multiple

stakeholders in the SE. Thus, the interests of multiple stakeholders are not equal to the integrated benefits of various groups, nor could a single group indicate their direction. Concretely, technological progress supports the penetration of sharing activities into the industry in reverse market mode. Throughout the process, the participants who are less affected by externalities or higher-order effects "vote with their feet" to provide legitimacy to the rapid development of the platform, resulting in the interests of broader groups being passively involved in and eroded by the savage growth of the SE. That aside, most shared objects are physically exclusive. Still, we found that micro participants often failed to accurately and globally identify the insecurity caused by such exclusivity in free competition. Cost minimization theory guides them to maximize their utility, including cost, benefit, social interaction, and convenience. Their irrational decisions to deal with changes may induce the enterprises to engage in unfair competition for market share in terms of price, product or service quality, process, etc., undoubtedly intensifying the contradiction between sharing and traditional operation activities. Secondly, when freed from ownership constraints, consumers tend to show worse use behaviors, which generates conflict between users and owners. Thirdly, digital exclusivity refers to convenience barriers formed by technological changes, and the adaptive capacity to those advances determines whether participants are empowered or disempowered in a revolution. Fourth, we also found that the government had no choice but to take counter-actions to cope with the changes exposed by the SE as it grew to defend the interests of non-participants and the public, which has often been proven to lag. In conclusion, the opposition and competing interests among different groups are ubiquitous and increasingly intensified. The failure to accurately recognize and grasp these laws makes the conclusion discussing the interests of a single group inconsistent with those of other studies.

4.1.4. The Differences in Socioeconomic Backgrounds

The effectiveness of an impact assessment hinges on the balance between capturing the details of development conditions closely related to economics, politics, and humanity and the universality of the conclusions. However, there has been a lack of multi-angle comparative studies on how the SE has evolved and its diversity and complexity across different economic, social, and geographical environments. We observed that developed countries contributed more to the existing research and led the exploration and practice of new industries, revealing that the cognitive background plays a central supporting role in the externalization evidence. The varying development statuses of various countries and regions bring discrepant drivers and obstacles to the SE. First, compared with emerging economies, developed countries and regions have better economic, social, and technological contexts conducive to the birth and spread of the SE. Similarly, compared with rural or suburban areas, the SE in urban areas shows more efficiency advantages in terms of the impacts on the environment and society due to their concentrated populations, diversified and shared resources, and differentiated needs. Still, the current studies do not profoundly discuss the output differences caused by such background differences. They tend to be too deeply rooted in the native conditions to miss the disturbance deriving from the diversity of participants, organizational forms, urban surroundings, and shared objects. As a result, the research conclusions on the same sharing mode are too weak to be extensible in different geographical areas. To summarize, the economic and social context may fundamentally affect the business model architecture of the SE and its output. However, the existing evaluations lack comparative investigation based on the differentiated socioeconomic background. Hence, it is not easy to reach a general and accurate consensus on its impact as influenced by the irregular and situational evolution of the SE.

4.1.5. Challenges for Measurement and Empirical Work

This study also finds that the measuring and empirical work of the SE's impact still suffers from multiple challenges, such as those in the analytical methods, data acquisition, and theoretical background. First, the interdisciplinary and multi-dimensional nature of

SD makes it complicated to discuss the impact within its framework. We cannot reconcile the analysis depth and breadth simultaneously in research. Second, the diversity of sharing practices and business patterns challenges empirical research. In heterogeneous industries, there is an irreconcilable contradiction between maintaining the size and significance of the data and the feasibility of the empirical work. Quantitative data on its scope and scale can help evaluate the phenomenon's outputs. Still, it is not easy to summarize or compare the outcomes of different forms of sharing organizations and business models in practice. Current studies' selection of indicators and data sources reveals the technical and theoretical background gaps for feature capturing of the analyzed objects. The pragmatic approaches that most researchers take in defining and quantifying the SE, such as choosing more readily available indicators and designating industries and business models, result in distinct observations. Third, the SE's research also generally faces the challenge of data validity and acquisition. Macro-level quantitative data seems to be obtained conveniently but also be less targeted. Aside from the subjectivity of self-reported data, the acquisition of industry-level quantitative data is also limited by the legality and maturity of access to technologies such as web crawling. In addition, it is also a subjective, lengthy, cumbersome, and unstable process to collect qualitative data, including structured and semi-structured interviews with stakeholders, questionnaire surveys, and collation of corporate information and government reports. All three of the above methods influence the selection of research methods and the scheme design to a certain extent, ultimately affecting the explanatory power and extensibility of the conclusions.

4.2. An Impact Assessment Framework of the Sharing Economy Based on the SDGs

After further discussion, the urgency and necessity of proposing a goal-oriented, standardized, and globalized framework for assessing the effects of the SE have become evident. Only an assessment framework with a global perspective can make research results from different regions and industries more readable and comparable, ease current debates, and promote scientific consensus on the SE. This study first extracted the comprehensive and standardized research perspective (horizon layer), evaluation criteria (criterion layer), and specific indicators (indicator layer) applicable to different industries and regions by sorting out the axial relations among the explained variables of those deconstructed conclusions in Tables 5–7. Secondly, we firmly believe that the impact evaluation scheme referring to the SE's commitment in three dimensions could improve the pertinence, guiding significance and eliminating the trouble of the definition dilemma. In addition, further axial sorting also helped us seek out the commonalities and connect its commitments with the Sustainable Development Goals (SDGs).

The SDGs are designed to guide participants at different levels in each country to meet the multiple challenges of economic prosperity, environmental protection, and ensuring well-being to change the world. Specifically, the SDGs pursue economic prosperity that spans the national, industrial, and individual levels as well as responsibility now and in the long run. The impact assessment on the economy mapped to the SE should accurately assess stakeholders' economic benefits and losses at all three levels, including participants and non-participants, and these outcomes could be more responsible production and consumption options for quantitative growth or structural optimization, since the increase in quantity might be offset by prevailing antagonism and competition among the interests of different groups. Secondly, the SDGs call for supporting environmental protection in thought and action, including water, land, the climate, and energy. Assessment of the ecological impact of the SE should include reductions in resource consumption and absolute emissions and improvements in environmental carrying capacity. It is also essential to consider and accurately measure any factors that may mediate or offset the self-evident positive effects. Thirdly, the SDGs particularly emphasize securing well-being, which advocates for the reduction of inequities across various dimensions such as income, gender, products, and services. Given this, the social impacts of the SE should be evaluated based on whether it contributes to a more equitable, open, and accessible community, especially

taking into account the social benefits of multi-stage and broad audiences. In summary, by combining the sub-goals of SD with the assessment criteria of the SE, we could generalize an impact assessment framework of the SE in line with sustainability and attach some indicators (drawn in Table 8). Under the guides of this framework on evaluating the SE output from three dimensions, we could more accurately and comprehensively grasp the contribution of the SE to SD and how to optimize its development purposefully.

5. Conclusions

This study systematically reviewed the impact of the sharing economy under a sustainable development framework to deepen dialectical cognition based on 45 scientific papers in the WoS database. The main contributions lie in the following four parts: (1) reviewing the complex conclusions presented by current studies on the effects of the SE in three dimensions, (2) comparing and sorting out vital debates of the attitudes among those conclusions, (3) deconstructing the formation path of each conclusion from the cognitive background, empirical approach, and supporting evidence, as well as tracing back the potential causes of controversies, and (4) summarizing the indexes that have been adopted to evaluate those effects and proposing a guideline and framework inspired by the SDGs to evaluate the SE via combining the practical outputs and initial commitments.

Overall, this study found that the debates about the impact of the SE are absolutely fierce and will continue into the foreseeable future. Separately, those current impact research works on the economy fail to keep consistent in the verification path and supporting evidence due to the slanted theory of sustainable development, the opposition of interests, and the lack of consensus in the sharing economy. The discussions on the economic level are still afflicted by the multi-level and multi-subject nature, making the conclusions discrete, complex, and challenging to unify. As for the environmental effects, mature and consistent research methods and open databases guaranteed the strongest consensus, while there is still a tiny percentage of conclusions that have not reached an agreement, mainly due to the complexity of the cognitive mechanism and the empirical challenges caused by social background differences. Among the social dimension, the differences in cognitive mechanisms and verification paths as a consequence of the differences in socioeconomic background, the ubiquitous interest opposition, and lack of consensus all ultimately led the influence discussions on society to manifest the most contentious one across the three.

This study argues that we need to urgently establish more of a consensus on the sharing economy to resolve the definition dilemma and empirical challenge effectively and fundamentally, and the comparative analyses from multiple perspectives will help us develop more precise boundaries, identify the advantages and disadvantages, and better understand the drivers and obstacles of its development. Finally, this can further guide the sharing economy practices to better match public expectations and the initial sustainable commitment based on the scientific cognition. In addition, this article must recognize that many valuable and profound works outside of the WoS Core database were not included in this discussion.

Given those findings above, this study advocates for future research on the sharing economy in the context of sustainable development, which could be carried out and promoted as follows:

(1) Establishing a consensus on the sharing economy, including the definition, connotation, boundaries, the business logic it should follow, and standard practices;

(2) Promoting the comparative analysis between the sharing economy and similar business activities;

(3) Promoting the horizontal comparative study of the sharing economy between the developing and developed regions;

(4) Promoting the comparative study of the evolution of the same sharing practice in different economic, social, and geographical environments.

Moreover, there is an urgent need to build a data guarantee for scientific analysis, and governments and enterprises should advocate and establish an effective and targeted

accounting system for the outputs of the sharing economy to promote more transparent data sharing while ensuring data security.

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Appendix A

Table A1. The industry classification, counts of literature.

Industry	Counts	The Serial Number
Mobility sharing	16	5/8/13/17/18/19/21/23/24/26/27/28/36/39/43/45
Accommodation sharing and Tourism	11	1/2/3/20/21/31/32/35/40/41/44
Cleaning devices and services sharing	5	12/14/18/25/43
Digital sharing economy platforms	3	11/12/38
Logistics capacity sharing	3	4/6/29
Resource sharing	2	34/43
Product and production capacity sharing	2	7/9
Food sharing	1	33
Rental services	1	22
Second-hand markets	1	15
Sharing achievements	1	30
Sharing consumptions	1	16
Sustainable lifestyles	1	37

Table A2. A concise list of abbreviations in this article.

Abbreviated Form	Common Form
GHG	Greenhouse gas
GWP	Global warming potential
FFBS	Free-floating bike-sharing
POS	Privately-owned bikes
SBBS	Station-based bike-sharing
MS	Mobility sharing
A&T	Accommodation sharing and Tourisms
CD&SS	Cleaning devices and services sharing
DSEP	Digital sharing economy platforms
LCS	Logistics capacity sharing
RS1	Resource sharing

Table A2. *Cont.*

Abbreviated Form	Common Form
P&PCS	Product and production capacity sharing
FS	Food sharing
RS2	Rental services
SHM	Second-hand markets
SA	Sharing achievements
SC	Sharing consumptions
SL	Sustainable lifestyles

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