Customer Participation in Digital Transformation, Value Co-Creation and Firm Performance: An Empirical Study in China Information Communication & Technology Industry

SUN, XIAOHAN

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By Sun Xiao Han

Principal Supervisor: Professor Kiran Jude Fernandes

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Abstract

The role of customer participation is an important area in service marketing research. Increasingly more enterprises encourage customers to participate in the service production and delivery processes, stimulate customers to share innovative ideas, and promote a greater role for customers through participation. Although some research has acknowledged the importance of customer participation in creating knowledge and value for enterprises, it has ignored the uncertainty and complexity that customer participation may bring. Most scholars study customer participation only in a broad sense without examining how to effectively manage customer participation. To address this existing research deficiency, this study uses service-oriented logic, digital transformation theory, value co-creation theory, and corporate performance theory to examine how enterprises can promote customer participation in the process of digital transformation, co-create corporate value with customers, improve and influence the company's digital transformation maturity, and thus promote the company's performance growth (including environmental, economic, and relationship performance). Specifically, this study makes the following major contributions:

1. Based on the behaviour of customers participating in digital transformation, customer participation is divided into four dimensions (information and knowledge exchange, business collaboration, co-leading, and cost-effectiveness) to understand the process of value co-creation, and to some extent, resolve the inconsistent views of customer participation in existing research. Most extant studies explore customer participation as a whole; such integrated research results in the loss of customer participation’s rich connotation and leads to differing opinions about the impact of customer participation.

2. Based on the theory of digital transformation and the theory of digital maturity model, this study primarily examines how to effectively guide and manage customers from the perspective of an operational management model and strategy.

The existing research on value co-creation largely focuses on how external environmental factors influence value co-creation among enterprises. These factors are difficult for enterprises to control and control.

3. This study focuses on the co-creation results of traditional enterprise customers and Internet enterprise customers in the process of digital transformation, analyses and compares the different concerns of traditional enterprise customers and Internet enterprise customers on the value co-creation process, and provides effective and positive aid for future strategic planning regarding these two types of customers.

The information communication technology industry in China is taken as this study's research object; five representative enterprises are selected. First, 10 traditional enterprise customers, Internet enterprise customers, and industry experts are interviewed in-depth, and the questionnaire is collected. Second, 506 matching questionnaires for traditional enterprise customers and Internet enterprise customers were collected.

Using structural equation modelling, this study examines the relationship between digital transformation and corporate value co-creation, as well as the intermediate role of digital maturity on digital transformation and corporate value co-creation. The empirical results support most of the assumptions, as follows:

1. Customer participation in digital transformation has a significantly positive impact on value co-creation (economic, innovation, and relationship value).

2. Value co-creation (economic, innovation, and relationship value) has a significantly positive impact on firm performance.

3. Digital transformation maturity has a significant moderating effect on the influence of value co-creation on firm performance.

4. Value co-creation has a mediating effect on the relationship between customer participation in digital transformation and firm performance.

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List of Abbreviations

1. ICT - Information & Communication Technology
2. CITC - Corrected Item Total Correlation
3. IKE - Information and Knowledge Exchange
4. BC – Business Collaboration
5. CL - Co-Leading
6. CE – Cost-Effectiveness
7. EV - Economic Value
8. IV - Innovation Value
9. RV- Relationship Value
10. DTM - Digital Transformation Maturity
11. EnP - Environmental Performance
12. EcP - Economic Performance
13. SP - Social Performance
14. KMO – Kaiser Meyer Olkin (Measure of Sampling Adequacy)
15. EBIT - Earnings Before Interest and Tax
16. IT – Information Technology
17. CT – Communication Technology
18. VC – Value Co-creation
19. eWOM – Electronic Word-Of-Mouth
20. IDC - International Data Corporation

21. SPD- Service Dominant Platform
22. CCCV - Customer Co-Creation Value
23. NPD – New Product Development
24. CPD - Customized Product Development
25. CFI - Comparative Fit Index
26. TLI - Tucker-Lewis Index
27. IFI - Incremental Fit Index
28. RMSE- Root Mean Squared Error

Declaration

I wish to clarify that this thesis is my own work. The data presented are original and were collected by me over a 12 month period between May 2018 and May 2019 in China's Information Commination Technology (ICT) industry from Fuzhou Ruijie Network Co., Ltd., Fujian Sanyuanda Communication Co., Ltd., Hangzhou Xinhua Third Co., Ltd., Zhejiang Fu Chunjiang Communication Group Co., Ltd. and Hangzhou Dongxin North Post Information Technology Co., Ltd, five companies. All the names of people and places are anonymised or changed in order to protect the identity of the participants. Appropriate recognition of any references has being indicated where necessary.

Statement of Copyright

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Chapter 1 - Introduction

1.1 Research Background

The digital economy is booming worldwide, and digital technology is rapidly changing. New information technology is penetrating all aspects of traditional industrial chains, as well as entire product life cycles. The use of information technology to transform the products and processes of traditional industries has become a common understanding of society as a whole, and has resulted in remarkable achievements.

The rapid digital wave is influencing all aspects of China's economy, society, and policy. The government's strong support for the digital economy has made it possible for the digital transformation to continue to play an important role in China's economy. The vast number of Internet users also constantly promotes the rapid and large-scale commercialization of China's digital business model. China is already one of the largest electricity supplier markets in the world and will become an important global force in mobile payments. Although digitalization of China's consumer end is at the forefront globally, the digitalized transformation of enterprises is relatively backward; some enterprises have not yet taken the first step towards digital transformation. These enterprises are not unaware that digital transformation is an important opportunity for them to adapt to the wave of technological development and seize the commanding heights of the digital economy, but lack a clear understanding of the path to digital transformation, which leads to the initial stage of digital capacity-building.

1.1.1 Digital Transformation and Application Diffusion Enable Realizing of Value Co-creation at a Historic Moment

With the rapid development of science, technology, and networks, many enterprises are paying increasingly more attention to satisfying customers’ unique

needs and maximizing their experiences. Digital transformation has become the main means for improving enterprises performance, as well as a source for competitive advantage； it has been referred to as the arrival of the new revolution era (Fitzgerald et al., 2014; Hess et al., 2016; Singh and Hess, 2017).

Customers want a more personalized experience when obtaining desired products and services. To keep abreast of this new 'need to keep in touch' customer, enterprises must adopt advanced technology to provide unparalleled customer experiences. Putting customers first is the centre of many corporate strategies.

To reduce costs, enterprises need to extend their existing applications to realize and welcome the arrival of the digital era. Leading concepts such as big data, new generation communication technology, and artificial intelligence have resulted in new blueprints for diverse industries. In many countries, digital transformation has become the only way for enterprises to realize sustainable management.

Digital transformation is the integration of information technology into all areas of an enterprise, radically changing how the way the enterprise operates and the value it provides to customers. Simply put, the purpose of digital transformation is to change how enterprises interact with customers to provide customers with excellent experiences while simultaneously improving company performance.

1.1.2 The Importance and Necessity of Value Co-Creation in Digital Transformation

Frequent interactions with customers and the exchange of professional knowledge and skills are important features of digital transformation. The process of digital transformation is usually regarded as an information technology and knowledge-intensive process. In many cases, it is difficult for enterprises to understand customers' individual needs. At the same time, it is often difficult for customers to express themselves to enterprises, as they use different languages to transfer knowledge. In the digital transformation process, it is indispensable for

customers to participate with enterprises in creating value because personal participation is a kind of social practice. In this process, tacit knowledge and explicit knowledge (Brown and Duguid, 2001) can be effectively transformed. Brown and Duguid, 2001 found out that practice can creates epistemic differences among the communities within a firm, and the firm's advantage over the market lies in dynamically coordinating the knowledge produced by these communities despite such differences, Enterprises can identify unexpressed needs and gather knowledge by observing customers.

Similarly, Lewis and Brown (2012) point out that service providers and customers can deeply interact in digital transformation, allowing providers to understand customers and meet their personalized needs. Enterprises specializing in providing overall solutions for digital transformation in the information communication technology industry (ICT) comprise the research background of this study. The ICT industry is a knowledge-intensive; interaction with customers and their perception of digital maturity play important roles in implementing and developing systems (Weitzel and Graen, 2010).

1.1.3 Enterprises and Customers Create Value Together in Practice Increasing Popularity and Importance

Many enterprises realize it is exceptionally difficult for a single party to have a long-term foothold in a market. With intensifying competition and the continuous opening of the market, increasingly more enterprises make use of their partners' knowledge to gain competitive advantage. For example, Xiaomi Technology develops extended innovation capabilities through fans; the company grew rapidly by cultivating a group of motivated fans and soliciting their opinions. They have built an online community to foster communal relationships with their fans, assigned different types of fans different roles, and organized internal operations around fans (Kuo et al., 2017). More enterprises are also aware of the importance of external partners, who can help them not only by providing external knowledge, but also by

participating in strengthening their recognition (Corsten et al., 2011; Noordhoff et al., 2011).

It has become more common and more important to encourage customer participation, which can bring new knowledge and promote enterprise innovation (Zhou et al., 2014). At the same time, it can help enterprises better meet their customers' needs and gain customer loyalty or dependence. Cooperation between customers and enterprises is becoming more common and necessary. For example, Huawei cooperates with customer enterprises (such as China Mobile) to develop chips, professional mobile phones, servers, and more, as well as to learn various technologies and become competitive.

1.1.4 Digital Transformation Brings New Growth to Enterprises and Becomes a Key Driver for Improving Firm Performance.

Digital transformation has brought new growth to enterprises, and has become a major objective. Value co-creation through digitalization can accrue in various ways, such as decreased costs, higher revenues, or the capture of new revenue streams. To secure the business model's profitability over time, it is important to establish an appropriate risk management system where financial gains more than match any negative consequences, such as high delivery costs.

Digital transformation can improve internal processes, enabling improved cost efficiency and leading to a positive effect on performance (Sjödin et al., 2016 & 2018). Other efficiency benefits can be achieved by capitalizing on product data flow to streamline the delivery process and stressing the requirements that relate to improved customer interaction (Cenamor et al., 2017). These efficiency advances are among the main drivers of digital business model development (Gauthier et al., 2018). When aiming for cost efficiency, it is also important to continuously review co-creation initiatives so the extra costs incurred from joint digitalization efforts are weighed in the balance (Müller et al., 2018; Zancul et al., 2016). However, the most significant costs come from product development and IT infrastructure, which

require very substantial upfront investment and continuous updating over time (Kiel et al., 2017).

1.2 Research Significance

1.2.1 Theoretical Significance

Research based on customer value co-creation theories studies the behaviour of traditional enterprise customers and Internet enterprise customers participating in digital transformation and the mechanism through which value co-creation impacts firm performance. This research is based on study of customer participation, value co-creation and firm performance using service-oriented logic. Based on the research content, this study's theoretical significance is mainly embodied in the following aspects:

1. **Theoretical Significance of Research on Behaviour Dimension Change in Traditional and Internet Enterprise Customers Participating in Digital Transition under Value Co-Creation**

The characteristics of digital transformation differ depending on the method of value creation. In the traditional method of value creation, enterprises are the only creators of value, while suppliers and customers are passive receivers of value. Enterprises dominate in the process of supplier and customer participation, and the participation behaviours of suppliers and customers are oriented around enterprise objectives and serve enterprise output. Under jointly creation of value, enterprises and customers, as equal value creators, jointly invest resources and through mutual interaction, create value for the other party as well as for themselves. In this method, supplier and customer participation changes from passive stylized behaviour to active participation. Under value co-creation, the characteristics of the participation behaviours of suppliers and customers differ from those of suppliers and customers in traditional services marketing. If suppliers and customers engage in the value creation system as manipulative resources rather than manipulated resources, their rights and scope in participation increase. Using the background of value co-creation, this study comprehensively examines the behaviour of traditional enterprises and

Internet enterprises that participate in digital transformation, and finds that the changes in the participation behaviours of traditional enterprise customers and Internet enterprise customers develop and supplement traditional customer participation theory.

2. The Theoretical Significance of Exploratory Research on Customers and Co-creating Customer Value Under the Background of Digital Transformation

Customer participation in value co-creation is a new research field that is still in the theoretical exploration stage. Theoretical and empirical studies are limited in number; consequently, there are few research results related to value co-creation. There are especially few studies on the value co-creation mechanism in the digital transformation process from the perspective of traditional and Internet enterprise customers. Payne (2008) proposes a conceptual model of value co-creation from the perspective of management, but this model does not reveal the internal mechanism of customer participation in value co-creation. At present, there are studies on the motivation for and influencing factors of customer participation in value co-creation (Meuter et al., 2005; Etgar, 2008; Hoyer et al., 2010), but not on customer participation in the process or the behaviour and results of value co-creation. Based on the theory of digital transformation, this study constructs a process model of value co-creation, conducts exploratory research on the process of customer value co-creation, and attempts to reveal the processes of customer resource input, customer-enterprise interaction, customer value co-creation output, enterprise value propositions, value co-creation systems, customer learning and enterprise learning and their effects on building the internal relationships of a customer value co-creation system. This exploratory research takes value co-creation as the research angle, enriches customer value theory and develops value co-creation theory.

3. Theoretical Significance of New Exploration on the Formation Mechanism of Firm Performance from the Perspective of Value Co-Creation

In marketing management theory, firm performance is a relatively mature concept. There are many mechanisms for firm performance improvement and growth, such as increasing the development of and investment in new products,

opening up new market users, and introducing new production and manufacturing equipment to improve productivity. From the perspective of value co-creation, customers participate in value co-creation, form personalized experiences in the process of interacting with enterprises, and jointly create customer value. The biggest difference between this process and customer value from the product perspective is that customer value is not created and delivered to customers by enterprises, but is acquired by customer experience. Customers participate in the process of customer value co-creation; that is, customer participation contributes to creating customer value. Customer value is the product of customer and enterprise co-creation. Therefore, under value co-creation, customer value under product-oriented logic is transformed into co-creation of customer value under service-oriented logic. Placing the influence of customer participation on customer satisfaction into the new context of value co-creation, taking customer value co-creation as the intermediate variable between the two relationships, and discussing the content and dimensions of customer value co-creation further develop research on the relationship between customer participation and customer satisfaction.

4. From the Perspective of Digital Transformation, the Theoretical Significance of Value Co-Creation for Forming Digital Transformation Maturity

The re-division of labour between people and machines in digital transformation generates new value creation points, which can stimulate innovation and change enterprise business models. By establishing a digital project platform for integrated design, procurement and construction, data accumulation, and interconnection, intelligent projects can be delivered to customers, helping them optimize operational and maintenance efficiency after the project is deployed, extending enterprise service value chains, and broadening revenue sources. Customer participation in digital transformation can create new value for enterprises. Our exploratory research regards digital transformation maturity as an influencing factor in studying the

relationship between value co-creation and company performance. To a certain extent, this has formed a new theoretical exploration for value co-creation and is helpful for developing theory.

1.2.2 Practical Significance

At present, most research on value co-creation focuses on the impact consumer participation in value co-creation has on enterprises, such as the impact of consumer participation in new product innovation and the speed at which new products enter the market (Fang, 2008), or study of consumer participation in value co-creation from the perspective of corporate strategy (Prahalad and Ramaswamy, 2004). This study considers the perspective of corporate customers. There are few studies on how value co-creation impacts corporate performance. Participation in value co-creation is a specific decision made by enterprise customers. These customers must have a mechanism for developing a decision-making process that can reflect their economic value, including environmental performance, economic performance, and social performance.

Under service-dominate logic, the value-generating process of 'manufacture, sales, and service' in the traditional industrial economy has been thoroughly subverted and transformed into 'listening, customizing, and creating value together' (Payne et al., 2008). This transformation requires enterprises to re-orient their roles and make adaptable adjustments to the change in their value-creation mode. The change in customer and enterprise roles means their cooperative behaviour and rules will be redefined; however, the change in customer participation behaviour will also bring about an adjustment in enterprise behaviour. The internal structure of the original value creation system will change, and the interaction interface between customer and enterprise subsystems will face new coupling. Therefore, an in-depth understanding of the mechanism through which cooperation and interaction impact corporate performance and environmental, economic, and social performance, the specific dimensions of co-creating customer value, and the impact and importance of these value dimensions on digital maturity are of great importance to enterprises. We already know the important influence of customer value on digital

transformation, but it is not clear how the internal structure of customer value co-creation (each dimension) plays a specific role in corporate performance and environmental, economic, and social performance; how the internal structure of customer value affects the evaluation of digital maturity; or the impact on corporate performance and co-creation in specific situations. The effect of customer value dimensions on this relationship may be strong or weak. Research on these issues is an important way to study customer value to provide in-depth guidance for enterprise digital strategy. It has practical guidance significance for enterprises in formulating their corresponding digital strategy and creating excellent customer value jointly with customers. At the same time, in the context of value creation, it is helpful for enterprises to clarify their role and position in value creation by analysing the internal relationships between customer participation in digital transformation, customer value creation, digital maturity, and company performance under certain circumstances. It is also helpful for enterprises to formulate a digital strategy, improve their digital marketing ability, and design, improve, and control their enterprises. Relevant customer participation contextual factors provide practical guidance.

1.2.3 Existing Problem in the Research

Existing research shows customer participation is influenced by various internal and external motivations, and most of them participate in exploration based on the transaction level in co-creation. At the same time, they play different roles. Customer participation may lead to more power transfer, which is not always beneficial for value creation (Chang et al., 2009; Yim et al., 2012). In addition, there are various external factors. The factors and relationships between enterprises will influence the effect of customer participation. However, from the enterprise level, research on how to effectively guide and manage customer participation is still relatively lacking. Finally, in cooperation with enterprises, customer participation is more desirable for customized products. Involving customers outside organizational boundaries can lead to additional costs for businesses (Bstieler and Hemmert, 2010). However, if the projects produced by customers can be spread out, efficiency and market

responsiveness can be improved, reducing future development costs, Specifically the existing problems in customer participation research are as follows:

1. Existing studies have paid attention to how customer practice affects the co-creation process, but there are inconsistent research results. For example, some studies have pointed out that when customers actually participate in the process, they not only provide knowledge related to their own needs, but also participate in enterprise innovation as co-producers (Fang, 2008). However, some studies have pointed out that customers are not enterprise employees, and their participation may lead to problems such as intellectual property rights and information disclosure, which are not conducive for the company as a whole. Coordination in collaboration (Sobrero and Roberts, 2001) and customer involvement can lead to transferring power to customers, giving them a larger voice, and bringing more uncertainty to the co-creation process (Chan et al., 2010). Other studies have pointed out that customer knowledge and skills are limited, and customer cannot effectively grasp the latest technological trends, which is also not conducive to developing new products or services (Alam, 2006).
2. Previous studies have pointed out that internal and external factors affect the process of customer participation, and most of these factors are difficult to control. Examples include relevant factors (such as ambiguity and environmental turbulence), relationship factors (such as the degree of customer network relationships) (Fang, 2008), project factors (such as the complexity and process dependence of the project process), and normative participation (Fang, 2008; Fang et al., 2008). If factors cannot be manipulated, it is difficult to provide effective guidance and suggestions for enterprises. Therefore, how to manage customer participation from the operational point of view becomes more urgent and important.
3. Existing studies have explored short-term and supplier performance, but neglected the value most pursued by customers. For example, previous researchers pay more attention to the speed of new product listing, product innovation, the market performance of new products, customer satisfaction, and

so on. These are short-term supplier values (Athaide and Zhang, 2011; Koufteros et al., 2005). Developing new products is a high-risk activity, and the failure rate is as high as 50% (Füller et al., 2009). New products co-exist with customers outside the enterprise boundary, and there are more uncertainties in production, so it is not enough to focus only on short-term corporate performance. When customers participate in developing new products, they engage not only at the transaction level, but also at the level of long-term relationships and common development to promote long-term interests.

4. Regarding who leads value co-creation, many scholars believe customers play a leading role in value co-creation and enterprises should play a supporting role. Prahalad and Ramaswamy, (2004) suggest this is only way to create value together. However, in practice, how to define the dominant role of consumers and the supportive role of enterprises are their real manifestations.
5. Driven by unique service and experience needs, customers actively participate in R&D, design, service, and other enterprise aspects, jointly creating value with the enterprise. Although this study proposes a theoretical basis for the mechanism of value co-creation from the perspectives of traditional and Internet enterprise customers involved in digital transformation, in the existing literature, research on the connotation, antecedent variables, and outcome variables of value co-creation remain at the theoretical level, lacking in-depth empirical research.
6. There have been empirical studies on value co-creation, mainly in service-oriented industries such as consumption and education, although some involve financial and software services. At present, there is no relevant empirical study on value co-creation that involves digital transformation service providers in the ICT industry. This study extends the scope of empirical research on value co-creation and provides new evidence for the theory.

1.3 Research Contents and Contributions

1.3.1 Research Contents

Based on the search review in subsection 1.2.3, we can summarize the main contents of this study as follows:

1. **Explores the Behavioural Dimension of Customer Participation in Digital Transition under Value Co-Creation**

Developments in science and technology have enabled customers to obtain more information at low cost than in the past. Customers have more rights in their relationships with enterprises and have changed from a 'passive audience' to 'active performance' (Prahalad and Ramaswamy, 2004). Consumers have become more active, creative, and motivated by participating. This change can be reflected in this study through the consumer participation behaviour dimension. Therefore, in the context of value co-creation, the consumer participation dimension should be different from that of consumers who are passive recipients of value under product-led logic. Based on the literature review and combining the characteristics of customer participation in digital transformation in the context of value co-creation, this research divides the customer participation dimensions using theory-driven and in-depth interviews, and verifies the dimensions quantitatively through survey data.

2. **Discusses the Dimensions of Value Co-Creation and Customer Value Co-Creation by Traditional and Internet Enterprises in the Process of Digital Transformation**

The behavioural basis of co-creating customer value is interaction and experience. For customers, the value co-created is essentially experience value (Prahalad and Ramaswamy, 2004). In the process of the interaction between customers and enterprises, customers jointly create personalized experiences and form unique customer value. At present, there are many customer value studies, but there is little research on co-creation of customer value, and even less on the causes and effects of co-creating customer value. This study examines how customers and enterprises jointly create customer value through interaction, the roles enterprises and customers play in the process of jointly creating value, and the value customers

create for themselves in the process of interacting with enterprises. Applying digital transformation theory, digital maturity theory, and benefit growth theory, this study constructs a model of customer participation in digital transformation. The process model of value co-creation based on existing customer value research is combined with in-depth customer interviews to explore the dimensions of value co-creation, and testing through empirical research.

3. **Explores the Influence Mechanism of Customer Participation in Digital Transformation on Enterprise Performance and Environmental, Economic, and Social Performance from the Perspective of Value Co-Creation**

Several research questions are addressed in this study. Under value co-creation, will customer participation in digital transformation bring new growth performance to enterprises? Through what type of transmission mechanism does customer participation in digital transformation affect firm performance, and environmental, economic, and social performance Can value co-creation become a bridge between customer participation in digital transformation and firm performance, as well as environmental, economic, and social performance? If these relationships exist, how do the internal dimensions of variables interact with each other for multi-dimensional customer participation and co-creation of customer value? What customer values do different dimensions of participation create? How does each dimension of jointly created customer value affect firm performance and environmental, economic, and social performance? Is the inherent logical relationship between the five variables of customer participation in digital transformation, value co-creation, firm performance and environmental, economic, and social performance established? These are the main problems to be solved in this study. This study takes the ICT industry as the research object, collects data through questionnaires, and uses quantitative analysis to test the hypotheses of the above problems and obtain the study's main conclusions.

4. **Discusses the Influence Mechanism between Digital Transformation Maturity and Firm Performance in Co-Creating Value and Aiding in the Success of Digital Transformation.**

In the process of digital transformation, digital transformation maturity is the basis for value creation between service providers and customers (Andreas Hein et

al., 2019). Enterprises play three roles in value co-creation: they provide a value proposition, create the environment and support for customers' interactive experiences, and interact with customers to help them achieve value co-creation (Prahalad and Ramaswamy, 2004). The most intuitive expression of customer-enterprise interaction is the interaction between customers and service providers. Service providers' support and concern for customer psychology and behaviour will affect customer experiences and value perception. In this study, digital maturity is introduced into the model as a variable that marks the interactive quality of digital transformation. The impact of digital transformation maturity on customer participation in digital transformation and the value co-creation relationship is investigated, and the moderating effect of digital maturity on co-creation of customer value and enterprise performance is empirically tested.

1.3.2 Research Method

1. Literature Review and Normative Research

Customer participation and co-creation of customer value are part of a relatively new research field. The domestic and international literature on the research variables of customer participation in digital transformation, co-creation of value, maturity of digital transformation, and firm performance has been carefully reviewed. This process helped identify the research trend and provided a theoretical basis for establishing the research framework and proposing the research hypotheses.

2. In-depth Interview Research Method

In the context of value co-creation, the dimension of customer participation in digital transformation is different from that in a traditional service industry. In addition to the support in the existing literature, further in-depth interviews are needed to discover the dimension of practical significance. At the same time, co-creation of customer value is a relatively new field, with little research or literature. The dimension of creating customer value also needs in-depth interviews to provide a basic foundation. At present, there is no unified scale for measuring

customer participation in digital transformation and value co-creation. Based on the characteristics of the industry studied, the scale used in this research is formed through in-depth interviews and references to existing literature. In-depth interviews are performed with three different groups: customers of traditional enterprises, customers of Internet enterprises, and experts. The in-depth interviews with traditional and Internet enterprises customers establish basic information about the current situation. The in-depth interviews with experts determine the logic and comprehensiveness of the research, and the scientific nature of the interview results is guaranteed from different angles.

3. Questionnaire Survey

This study's quantitative research is based on a questionnaire survey. The final questionnaire is developed through a preliminary design, interviews, a small sample prediction test, and questionnaire modification. Qualitative analysis is applied in each step to ensure scientific and objective measurement. After data is acquired through a large-scale survey, the theoretical hypothesis is improved using structural equation modelling, followed by an examination of the results. The software used for quantitative analysis is SPSS Statistics R23.0.0.0 and AMOS 24.0.0.

1.3.3 Research Contribution

Compared with existing research, the main contributions of this study include the following:

1. To better understand the process of customer participation in value creation, the degree of customer participation in digital transformation is divided into four dimensions: information and knowledge interaction, business cooperation, co-leadership, and cost efficiency. To a certain extent, this approach solves the problem of the inconsistent impact of customer participation found in existing studies. There are only a few empirical studies in the extant literature on customer participation, most of which regard customer participation as a whole. For example, Carson et al. (2012) point out that customer involvement makes it

difficult for enterprises to reach a consensus and hinders the performance of new product development, while Smets et al. (2013) find customer involvement in new product development provides enterprises with knowledge about customer demand and the market. On one hand, integrating participation into a dimension of research results in the loss of rich content and connotation regarding customer participation; on the other hand, it generates different opinions. This study explores the impact of customer participation on the process of cooperation from four dimensions: information and knowledge interaction, business cooperation, co-leadership, and cost efficiency.

2. To explore how to more effectively promote customer participation based on the viewpoint of digital transformation, this study introduces information and knowledge interaction, business cooperation, co-leadership, and cost efficiency between service providers and traditional and Internet enterprise customers into customer participation. It studies how to deal with information and knowledge needs, business cooperation needs, co-leadership needs, and cost effectiveness, which are better matched to maximize value creation and performance creation. This study primarily addresses how to effectively manage customers from the perspective of enterprise operability. Research on value creation has focused on the impact mechanism of external environmental contingency factors or the relationship in customer engagement (Noordhoff et al., 2011). These factors are difficult for enterprises to control and regulate. The interaction between information and knowledge, business cooperation, co-leadership, and cost efficiency considered in this study can allow enterprises to better regulate and manage these factors. Research on how to manage customer participation from an operational point of view is still quite limited (Coviello and Joseph, 2012; Hauser et al., 2006); this study makes an effective contribution to it.
3. This study primarily addresses long-term value for service providers and traditional and Internet enterprise customers. At the same time, based on the special industry of digital transformation service in the ICT industry, this research especially studies how to spread the interaction of enterprise information and knowledge, business collaboration, co-leadership, and cost-efficiency to other

customers or projects.

4. Using paired data, this study explores how to achieve the best cooperation between service providers and traditional and Internet business customers to promote performance on both sides. Most existing studies unilaterally focus on the perspective of either customers or suppliers, and there is no comparative study of customer segmentation in the industry.
5. The digital transformation maturity index is used in this study as a mediator between value co-creation and company performance to explore the impact of digital maturity on company performance in the process of digital transformation.

1.3.4 Thesis Structure

This research paper is divided into eight chapters; the specific contents of each chapter are as follows:

Chapter 1: Introduction. This chapter describes the study's research background, research significance, main research contents, research contributions, and innovations.

Chapter 2: Theoretical Background and Literature Review. This chapter reviews the relevant literature, including that on the main study variables, and determines the study's research direction and perspective.

Chapter 3: Research Framework and Theoretical Hypothesis. According to the theoretical basis found in previous research, the logical relationship between the main variables in this study is deduced, and the corresponding theoretical assumptions are proposed.

Chapter 4: Scale Development and Data Collection. Based on the study's hypothesis, a scale is compiled and formed to measure the research variables. Taking the ICT industry as the research context, data collection and collation, data analysis and discussion, and preliminary research results are completed.

Chapter 5: Digital Transformation of Traditional Enterprise Customer. Based on

the theoretical model, statistical software is used to analyse and collect the data of traditional enterprise customers, test the theoretical assumptions, and analyse and discuss the research results.

Chapter 6: Digital Transformation of Internet Enterprise Customer. Based on the theoretical model, statistical software is used to analyse the Internet enterprise data, test the theoretical hypotheses, and analyse and discuss the research results.

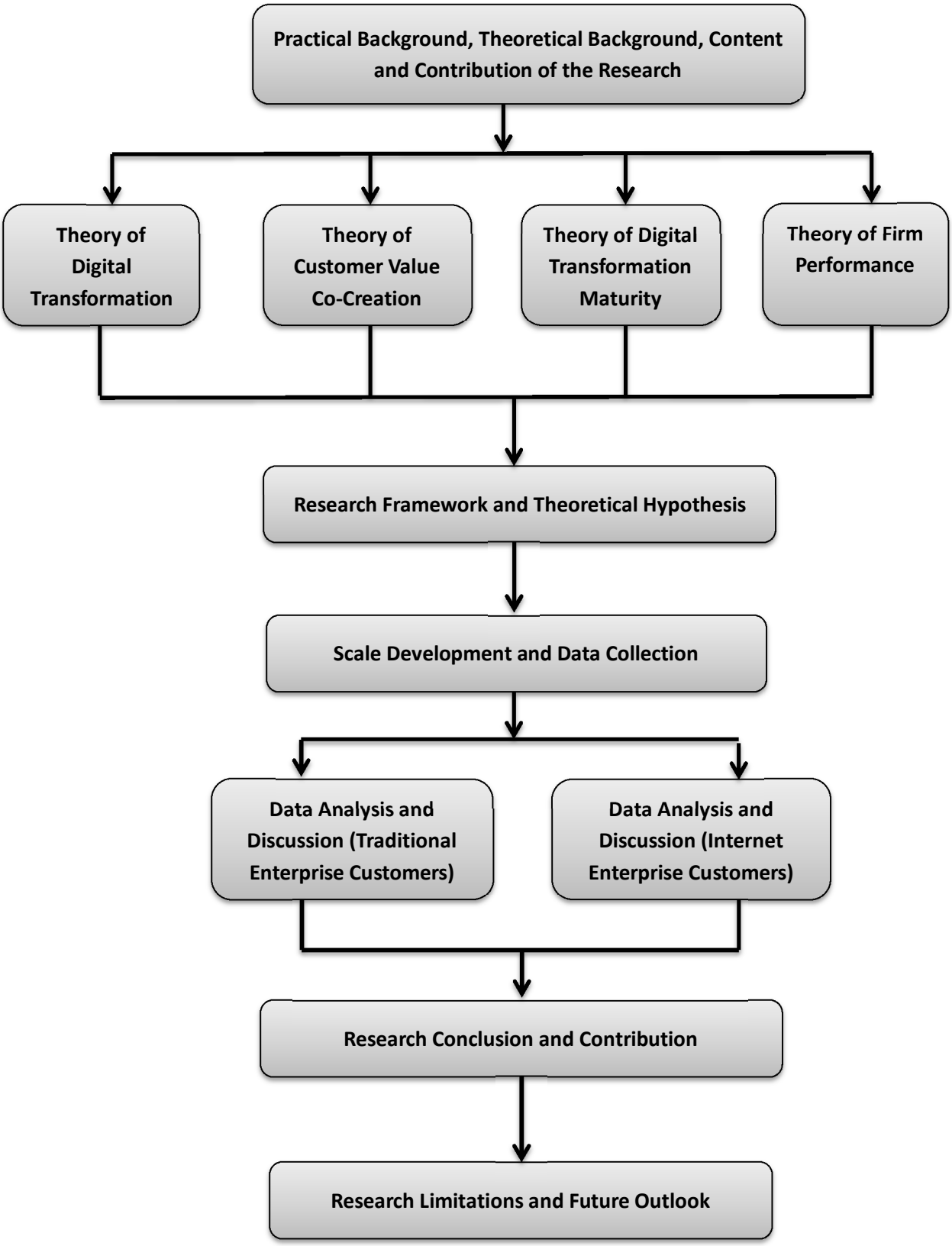
Chapter 7: Research Conclusions and Contributions. This chapter presents a comparative analysis of Chapters 5 and 6, summarizes the research conclusions, identifies the study's research contribution and the implications for business management practice, and summarizes the research results.

Chapter 8: Research Limitations and Future Prospects. This chapter presents an analysis of the study's shortcomings and future research directions.

1.3.5 Research Methodology and Technical Structure

The research methodology and technical structure of this study are shown in Figure 1.1. First, the relevant literature on digital transformation, value co-creation, digital transformation maturity, firm performance, and environmental, economic, and social performance is scrutinized and summarized. The content of the research is defined; qualitative analysis methods such as in-depth interviews are used to determine the dimensions of customer participation in digital transformation and value co-creation, a corresponding scale for quantitative empirical research is developed to verify the hypotheses proposed, and the corresponding theoretical explanation is offered. Finally, the research results are further analysed, and their application value and practical significance for enterprise management and company operational strategies are discussed.

Figure 1.1 Research Methodology and Technical Structure



1.4 Conclusion

This chapter introduces the study's practical and theoretical background, discusses the importance and urgency of digital transformation in current economic activities and its relevance to customer participation in value co-creation; briefly describes the specific contributions of the research in theory and practice, and points out the existing and urgent problems in research. The chapter also summarizes the research content, methods, contributions, structure, and technical route.

Chapter 2 - Theoretical Background and Literature Review

2.1 Digital Transformation Theory

Globally, business managers have begun to focus on digital transformation (Fitzgerald et al., 2014; Hess et al., 2016; Singh and Hess, 2017). The essence of digital transformation is realizing enterprise performance and competitiveness through a series of fundamental changes using digital technology-based and data-based product or service transformation, and process optimization and reconstruction (Hess et al., 2016).

2.1.1 Understanding Digitalization and Digital Transformation

First, two concepts need to be clarified: digitalization and digital transformation. Digitalization is a concept from the perspective of a chief information officer. Its main task is the realization of an information system and support of the business. Digital transformation is a concept from the perspective of a chief executive officer. Digital transformation does not concern the information system itself, but the understanding and design of the business, optimal design of new business processes, and adjustment of internal organizations to the business's development. Operations and processes are key to carrying out digital transformation.

Researchers' definitions of digital transformation can be roughly divided into three categories. The first category is the defining technology; Fitzgerald et al. (2014) and Nambisan et al. (2017) believe that technology can fundamentally improve the performance or coverage of enterprises. Pagani and Pardo (2017) indicate new digital technologies (social media, mobile, analytics, or embedded devices) can be used to achieve significant business improvements (such as enhancing the customer experience, simplifying operations, or creating new business models). Piccinini et al. (2015) suggest that a digital transformation strategy is a blueprint for supporting the

company's management of changes that arise from the integrating of digital technology and its operating it after the transformation. Digital transformation involves the use of digital technology to achieve significant business improvements, such as enhancing the customer experience or creating new business models; in other words, digital technology is used to fundamentally improve company performance.

The second category is related to organizational change. Rogers (2016) believes 'digital transformation is fundamentally not about technology, but about strategy', meaning senior leadership teams must find ways to capitalize on new and unexpected business model innovations that optimize customer needs and experiences. Berghaus and Back (2016) suggest number characterization transformation is a profound and accelerated transformation of business activities, processes, capabilities, and models, making full use of the changes and opportunities brought about by digital technology and its impact on society in a strategic and prioritized manner. Demirkan et al. (2015) argue that digital transformation includes digitization of sales and communication channels, which provides new ways of interacting with customers, and digitization of company products and services, replacing or increasing physical products. Digital transformation also describes how data-driven insights trigger tactical or strategic business changes and the introduction of digital business models that allow new ways to capture value. Barrett et al. (2015) argue that digital transformation focuses on the changes digital technology can bring to a company's business model, leading to changes in product or organizational structure or process automation. These changes can be observed in the growing demand for Internet-based media, leading to changes in the overall business model.

The third category is the combination of technological and organizational change. Horlacher et al. (2016) and Henriette and Boughzala (2015) argue that new digital technologies, such as social media, mobile analytics, or embedded devices, can be used to achieve significant business improvements, such as enhancing customer experiences, simplifying operations, or creating new business models.

Nwankpa and Roumani (2016) indicate changes are driven by and built based on digital technology. Within an enterprise, digital transformation is defined as organizational transformation to big data analysis and cloud, mobile, and social media platforms. Although organizations are constantly changing and developing to cope with the changing business environment, digital transformation is based on digital technology, which brings unique changes to business operations, business processes, and value creation. Andriole (2017) argues that digital transformation is not a software upgrade or supply chain improvement project, but a planned digital shock for a system that may be functioning reasonably. Digital transformation involves expanding the use of advanced IT, such as analysis, mobile computing, social media, or smart embedded devices, and improving the use of traditional technologies such as enterprise resource planning (ERP) to achieve significant business improvements.

Overall, we conclude digital transformation is a more complex type of technology-enabled business transformation, which needs to address the strategic roles of new digital technologies and capabilities for successful digital innovation in the digital world (Yoo et al., 2010). We define it as the process through which companies converge multiple new digital technologies, enhanced with ubiquitous connectivity, with the intention of reaching superior performance and a sustained competitive advantage by transforming multiple business dimensions, including the business model, customer experiences (comprising digitally enabled products and services), and operations (comprising processes and decision-making), and simultaneously impacting people (including skills, talent, and culture) and networks (including the entire value system).

2.1.2 Driving Factors of Digital Transformation

Digitalization requires using various technical means to collect data needed for an enterprise's daily operation and innovation, such as data from customer experiences with the use of products or services, market change data, and industry

trend data, forming panoramas of its daily operations, customers, products, market changes, and industry trends to improve its operational efficiency and create new business models. Berman (2012) believes enterprises can discover improvements in their operations and even develop new business models by digitalizing value data.

The essence of digital transformation is business remodelling (Rogers, 2016). The most important aspect of digital transformation is obtaining data through all business systems. Earley (2014) suggests using software tools and software technology empowers businesses to acquire innovative capabilities. As creators, people are key and need to ideologically recognize the need for and means of digital transformation. Successful digital transformation does not begin with technology, but with a customer-centric goal of thoroughly reforming the organization to realize transformation of productivity and business remodelling. Talent is the driving force in the digital journey to adjust the organizational structure and corporate culture to meet the needs of digital transformation.

Why must enterprises go down the digital transformation path? Given the influence of the macro-economic environment, competition in the same industry, and the operations of enterprises themselves, it is the inevitable choice for enterprises, rather than digitalizing for the sake of digitalization (Ward, 1987; Jelassi and Dutta, 1993; Yetton et al., 1994; Galliers, 1994; Raghunathan and Madey, 1999).

The first driving force of digital transformation is the emergence of economic challenges. In a highly globalized world, increased digital competition also creates common pressures, which is one of the reasons companies are accelerating their transformation (Westerman et al., 2011; Kohli and Johnson, 2011; Von Leipzig et al., 2017). With the digital economy's rapid development, we should also see the slowdown in the overall growth in the Chinese market, especially the current trend of protectionism against globalization. Enterprises face many challenges, such as market development, trade barriers, and core technology. Under the increasing pressure of the economic environment, enterprises should deal with the negative factors to achieve smooth operations and long-term growth. This drives them to consider improving their ability to cope with macro-difficulties through digital transformation.

(Loebbecke and Picot, 2015). Moreover, the long-term plan for China's economic and social development in its national sustainable development strategy requires enterprises to implement green energy savings, improve product structure, and achieve technological innovation on the supply side. Therefore, enterprises must rely on new technological means to meet the regulatory requirements with reasonable investments.

The second driving force of digital transformation is the intensification of market competition in the same industry. Emerging technologies play a key role as triggers of transformation. In particular, their growth rate (Chahal, 2016), market changes (Hess et al., 2016; Kohli and Johnson 2011), and industry disruption potential (Westerman et al., 2014; Fitzgerald et al., 2014) require companies to respond rapidly and assemble their digital resources. Enterprise managers have seen that market competition not only comes from enterprises in the same industry upgrading and innovating, but also from brand-new competitive pressure created by enterprises with Internet genes that enter the traditional enterprise market. In recent years, such cases have been numerous. The largest social platform directly affects the maturity of carriers and the huge amount of short message services (Lien and Cao, 2014), while the emergence of micro public banks represents the direct entry of Internet companies into the traditional financial industry market, and continues to attack cities in the field of small and micro loans (Zhou et al., 2015).

The third driving force behind digital transformation is the need for business operations (Andriole, 2017; Hess et al., 2016). From the point of view of an enterprise's own operations, because customer demand has changed significantly under the influence of the digital economy’s development, enterprises need to start by transforming and upgrading products and services, and think about how to ensure maximum satisfaction of customer demand and maximize the drive of operations to achieve an increase inefficiency (Kane et al., 2015; Andriole, 2017) and enterprise success. This success also lies in the construction of the digital ecosystem. In applying of digital technology, enterprises need to build an efficient platform to connect

upstream and downstream enterprises and partners; make the data flow between internal and external personnel more convenient; provide a low-cost, convenient resource pool for innovation practice; and provide rich and powerful data analysis support (Von Leipzig et al., 2017).

Observing the drivers found in the literature, we find there is an emergent need to respond to people's expectations, namely tech-savvy employees who want to work for digitally transformed organizations and tech-savvy customers who expect companies to keep pace with new technological trends to remain on the competitive landscape. More importantly, the emergence of small start-ups has disrupted existing businesses; these start-ups are known for the speed at which they acquire or even develop emerging technologies to gain competitive advantage, a key factor in increasing the importance of digital transformation plans.

2.1.3 Contents of Digital Transformation

Digital transformation encompasses the entire process of product design, intelligent manufacturing, and value-added service delivery, so it involves all aspects of enterprises. We believe from the perspective of top-level design, digital transformation should be carried out in these five dimensions:

1. Operations. The purpose of operations optimization is to improve enterprise decision-making efficiency, achieve rapid feedback from consumers, improve customer service experiences, and reasonably reduce operating costs (Singh and Hess, 2017; Fitzgerald et al., 2014). Because competition from an enterprise's view is changing from unilateral competition in technology and products to platform-based ecosystem competition, enterprises need to pay attention to the construction of resource aggregation and win-win cooperative ecosystems (Westerman et al., 2012; Westerman et al., 2014).

2. Customers. First, enterprises should consider further opening of business processes to customers as part of the digital transformation. For example, airlines not only provide customer convenience and improve customer experiences by

opening self-check-in machines, but also reduce the operating cost of counter services (Castillo-Mansano and Lourdes, 2013). Second, business can increase customer participation in optimizing and promoting products/services through Internet links. Because digitization realizes the direct connection between consumers and enterprises, feedback on consumer experiences and suggestions for exhibits and services can occur quickly, which speeds up the rhythm of product optimization and improvement. Xiaomi fan economic model is a classic case (Kuo et al., 2017). The community is the base for millions of fans, it only delineates potential product users, but also gathers consumers' suggestions for product design and improvement.

3. Teams. As the theme for implementing digital transformation, people need corresponding empowerment. The digital literacy of personnel will greatly influence the change process and become core competitiveness for enterprises (Westerman et al., 2014; Webb, 2013). Moreover, empowerment of personnel is not only for employees; it should also include the relevant personnel in the enterprise's ecosystem. The IT team will undertake critical tasks in the digital transformation of enterprises (Dhar and Sundararajan, 2007; Rau, 2007; Cagle, 2008). The enterprise architecture framework covers all levels from employment strategy to key infrastructure, and each level should be combined with digital transformation to carry out specific tasks.

4. Business Strategy. As the starting point of digital transformation, enterprise management needs a digital economic development opportunity to think and define business strategy. This involves formulating a business philosophy, business strategy, and product strategy, and defining a strategy for constructing a digital ecosystem. Management also needs to complete the transformation of digital leadership, update the enterprise's decision-making model, and make data a key factor in decision-making.

5. Business Process. Business processes will be optimized based on value flow, which not only can ensure delivery of maximum customer value, but also improve process execution efficiency and reasonably control enterprise operating costs (Achtenhagen, 2013). One trend in the digital age is business process openness. On

the one hand, business processes are open to upstream and downstream partners to build an ecosystem platform that supports sharing and innovation (Matt et al., 2014; Kaufman and Horton, 2015; Hess et al., 2016). On the other hand, business processes are open to customers (Berman, 2012; Daimler, 2017), allowing them to participate more in implementing of business processes, which not only improves customer experiences but also helps them quickly provide feedback on household opinions. Bank processes (Gaoshan, 2009), operator business openings, service acceptance, information inquiry, and so on have been greatly opened to customers, with remarkable results.

Based on the literature review, we believe high customer participation is a characteristic of digital transformation, a diversified industry with customer participation in value creation. In China, the ICT industry is the industry most widely involved in digital transformation.

2.1.4 The Challenge of Digital Transformation from Enterprises

More and more enterprises have begun to compete in digital transformation. Unfortunately, while some enterprises have successfully transformed, many have failed (Barlindhaug, 2007). These failures are the result of incorrectly understanding digital transformation. Digital transformation is a long-term journey, and there are many challenges in the process:

1. The challenge of cognitive dislocation. First, there is a lack of management vision and long-term strategy. Second, IT departments and business departments have different perspectives on digital transformation (Matt et al., 2014). For example, IT departments may pay more attention to controlling the cost of digital transformation, the convenience of system upgrades, data security, and other issues, while business departments pay more attention to agile, rapid intelligence to promote sales, enhance user experiences, and improve productivity.
2. Challenges of unclear stages. Many enterprises do not know the stage of their digital transformation, so it is difficult for them to take the lead in the market.

International Data Corporation (IDC) sees digital transformation as five stages: single-point experiment, partial promotion, extended replication, operational management, optimization, and innovation (Xiaohui, 2015).

3. Challenges of organizational structure. Some organizations are still doing new things using their old structure, which makes it difficult to innovate and integrate resources. Other enterprises have a new structure but continue to do old things. For example, some have established digital components, but the thought processes and actions are still very traditional; thus the new structure has not played its proper role. Digital transformation is not a departmental matter, but a business transformation that requires ICT technical support. Therefore, collaboration between departments and efficient external collaboration is necessary (Von Leipzig et al., 2017).
4. Challenges of performance evaluation. Many organizations have their own key performance indicators (KPIs), but they are relatively traditional, such as performance growth, profit increase, cost reduction, and customer satisfaction. In the process of transformation, enterprises must develop new KPIs (Kaufman and Horton, 2015). The design of a new KPI can help meet the current core performance evaluation while accelerating the transformation and is the key to the challenge.
5. The challenge of underbudgeting. Project budgets often become a problematic. With no budget or one below the industry average, it may not be possible to choose good products and services or find suitable partners, or problems may result when changing management and follow-up services. Others focus on short-term tactics rather than long-term strategies (Matt et al., 2014; Hess et al., 2016); the lack of a budget makes it difficult for enterprises to have a long-term strategy. Fully considering and preparing a budget plan suitable for their enterprise is an extremely critical factor in the transformation.

Based on this literature review, we believe the challenge of digital transformation is the key driving force for enterprises when considering value co-creation with customers.

2.2 Value Co-Creation Theory

As a new approach to creating value, value co-creation is attracting the attention of academia. The theory has impacted the traditional value production mode, marketing concept, enterprise strategy, and even consumer behaviour research. As one of the basic tenets of service-oriented logic (Vargo and Lusch, 2004a), value co-creation is becoming the next frontier issue for enterprises in gaining competitiveness (Prahalad and Ramaswamy, 2004).

2.2.1 Formation of Value Co-Creation Theory

Co-creation of value is a relatively new concept. Although it has attracted widespread attention in academic circles for nearly 10 years, research on value co-creation is still in the theoretical exploration stage.

The idea of co-creating value has been suggested by several scholars in different fields (Gronroos, 1997). Normann and Ramirez (1994) point out that consumers are active contributors to value creation. In 1994, Normann and Ramirez launched a discussion on value creation and proposed a new concept, value co-production, which is based on the traditional concept of value creation. In this concept, the two parties cooperating both participate in value creation and re-creation. Ramirez compares the traditional value creation mode to the value co-production mode. In management and marketing systems, there are two branches of systematic and explicit proposals for creating a value perspective. One branch is a series of articles and a monograph by Prahalad and Ramaswamy (2004) on co-operating with consumers to create a unique value, which vividly discusses the theory of value co-creation. Another branch is that proposed by Vargo and Lusch (2004a) of service dominant logic; one of its core ideas is consumers as co-creators of value. So far, the theory of value co-creation has attracted broad attention from the academic community. Increasingly more scholars have studied the new challenges faced by marketing, the strategic adjustment of enterprises, and the change in consumer

behaviour under value co-creation.

2.2.1.1 The Value Co-Creation Theory Proposed by Prahalad and Ramaswamy

From the perspective of enterprise competition, Prahalad and Ramaswamy (2000, 2004) reveal that the role changes for enterprises and consumers in the new environment will bring about a change in business philosophy and business models. Creating value with consumers should become the strategic orientation of enterprises to build new strategic capital and shape new enterprise capabilities. The authors' basic views on value co-creation are summarized in the following.

1. **Co-Creation Experience is the Basis of Value Co-Creation between Consumers and Enterprises**

Prahalad and Ramaswamy (2000, 2004) start with the case of value creation practice between enterprises and consumers and clearly point out that the essence of value creation is creating consumer experience value together. Consumer experience is a continuous process, and value creation runs throughout the experience process. Individual consumers have become the core and decisive factor in jointly creating experiences. The strategic focus of enterprises has shifted from providing products and services to creating innovative experience environments for consumers. Enterprises no longer sell experience to consumers, but provide usable scenarios so that consumers can create their own unique experiences. Prahalad and Ramaswamy (2000, 2004) develop the 'DART' model to ensure the effectiveness of value creation through dialogue, access, risk assessment, and transparency.

2. **The Interaction of Value Networks is the Way to Realize Value Co-Creation**

Prahalad and Ramaswamy (2004) argue that 'interaction is the place where value is created together', and that value creation is formed by heterogeneous interaction between consumers and enterprises at each node in the value network. The interaction process between enterprises and consumers not only helps enterprises obtain more in-depth information about consumers and their preferences, but can also help consumers complete the value creation process with

the support of service providers. Interaction exists in various forms in all links formed by value creation or experience, including the interaction between enterprises and consumers and the interaction between consumers and other enterprises in the value network to create experiences for common consumers. Therefore, the interaction of common value creation is the interaction of value networks. In the process of creating value, the focus of enterprise attention has shifted from the design of the production process and product quality management within enterprises to interactive quality between consumers and enterprises and an innovative interactive environment for creating unique consumer experiences.

In Prahalad and Ramaswamy's view, value co-creation is a process of cooperation between enterprises and consumers, for creating value. It is neither a means for producers to please consumers nor a process in which consumers create value for producers through their participation. Producers and consumers as counterparts work together, to co-create value for themselves and their customers. In value co-creation, the two parties create value through continuous dialogue and interaction. They actively and jointly construct personalized service experiences and define and solve problems. Value creation runs through the whole process of interaction between enterprises and consumers, as well as consumer experiences.

In short, Prahalad and Ramaswamy focus on joint creation of value from the perspective of experience. Co-creating value is the process of creating personalized consumer experiences in the interactions between enterprises and consumers. The core and essence of defining common value is experience value, and interaction is the way to achieve common value creation.

2.2.1.2 Co-Creating Value Theory under Service Dominant Logic Proposed by Vargo and Lusch

1. Service Dominant Logic

Vargo and Lusch (2004) propose service dominant logic in contrast to product dominant logic. Product dominant logic is derived from an industrial economy whose main activity is producing of material products, and service is only a ‘sub-optimal’

product dependent on the material products. Under product dominant logic, producers produce products, consumers consume products, and the value creation system seeks 'exchange value' operations around enterprises. Value is added to products and enterprises are value creators, while consumers are passive recipients of value. The roles and boundaries of producers and consumers are defined and clearly separated.

As shown in Table 2.1, the related research on service-oriented logic primarily consider the situational nature of service dominant logic, which emphasizes the active role of customers, the foundation of knowledge, and the importance and value of interaction.

Table 2.1 Relevant Research on Service Dominant Logic

Author	Conclusion
Vargo and Lusch (2004a)	Traditional marketing is based on the logic of product dominance, which is largely founded on the logical paradigm of tangible resources, value, and transaction relationships. In 2004, the authors proposed a new logic, service dominant logic, which connects intangible resources, values, and relationships. Compared with product dominant logic, the transaction unit of service-led logic is the service provider rather than the product, this makes a great contribution to practice and academia.
Vargo and Lusch (2004b)	This paper points out that the dominant logic is initially based on product marketing. The study focuses on the four characteristics of services (Intangibility, Heterogeneity, Inseparability and Perishability) are extensions to existing product dominant logic, and help provide effective strategic guidance for future practice.
Lusch and Vargo (2006)	The basic assumption of service dominant logic is achieved through open and collaborative efforts. The authors clarify five controversial issues in the logic of service leadership: why service dominant logic is advocated; the role of enterprises and customers in resource integration; the similarities and differences between value creation and value co-creation; the role of interaction in the creation and exchange of value; and the continuing need for refinement of an S-D logic friendly lexicon.
Vargo and Lusch (2008)	Value creation has always been the core of economic exchange. Traditional studies focus on the output and prices of enterprises, while the authors understand value creation from the perspective of service science and service dominant logic, especially emphasizing that service is the basic unit of exchange. Service

	exchange emphasizes the service system and integration of various resources. Service science is the service system in resource configuration and value co-creation. Value is reflected in certain situations, not in exchanges. This paper describes service science, points out the emphasis on service trade by increasing the mutual adaptability and existence of various resources (adaptability and survivability), and emphasizes the value of mutual benefit.
Vargo and Lusch (2011)	The business-to-business (B2B) exposition reflects product-led logic and the inadequacies of the 'producer' and 'consumer' divisions. In service-oriented logic, the transactions that economic and social entities participate in are based on services, and the participants are value creators. In a sense, this is B2B. More broadly, actors and actor to actor orientation are more dynamic, networked, and systematic in value creation. This paper expands service dominant logic and elaborates on the service ecosystem, which is system oriented.
Akaka, Vargo, and Lusch (2013)	Based on service dominant logic, this paper regards service as the basic unit and proposes the perspective of a service ecosystem to discuss responsible international marketing. This paper also points out that value is the integration of various resources related to practice and systems. This view mainly promotes the potential value in a social context.
Gronroos and Helle (2010)	This article applies service dominant logic to production industry business relationships, and points out that if supplier and customer resources and capabilities can complement each other through a matching process, suppliers can better create value for customers, and customers can be fully involved in the progressive value creation process, shared value, and suppliers.
Gronroos and Voima (2013)	This paper points out the role and scope of customers or enterprises in value co-creation and the nature of value. Value is created by customers through use value, which is a function of interaction. This paper also points out that value creation can be achieved in a variety of ways, such as by customers or suppliers alone or in combination. Interaction provides opportunities for value creation.

2. Value Co-Creation under Service Dominant Logic

The second core point of service-dominant logic is that 'consumers are co-creators of value', which emphasizes the application of manipulative resources and holds that 'manipulative resources are the root of competitive advantage'. Manipulative resources are resources that act on other resources and produce

results (Vargo and Lusch, 2004b). Manipulative resources are often intangible, such as knowledge, skills, and intellectual capital. Under product-dominant logic, competition largely depends on the uniqueness and advantages of the manipulated resources. As the manipulated resources consumers invest in enterprise value creation systems. Under service-oriented logic, the competitive advantage source comes from manipulative resources, because they are the real creators of effects. Consumers, as manipulative resources, act on enterprises with their own knowledge and skills. Manipulating resources to create value is the basis of value creation.

With the subtle changes in the roles of enterprises and consumers, consumers gradually evolve from passive receivers of value to co-creators of value. The value created jointly under service-dominant logic is not 'exchange value', but 'value-in-use' obtained from consumers, which is an important prerequisite for jointly created value under service-dominant logic. In a value co-creation system, consumers, as resource integrators, use the resources provided by enterprises and their own resources to create value and solutions for themselves. For consumers, value is formed continuously and dynamically as they participate in value co-creation activities. Value is uniquely determined by the beneficiaries (Vargo and Lusch, 2008); at the same time, enterprises are committed to it. In the process of making the enterprise available to consumers and interacting with them to help jointly create value, enterprises make joint value creation convenient, and cooperatively and interactively create value with consumers. Therefore, under service-oriented logic, the process of value creation occurs when consumers use or consume products or services. The process of joint value creation includes an excellent value proposition provided by the enterprise and consumer value creation through consumed products or services (Payne et al., 2008).

3. Comparison of Two Theories of Value Co-Creation

By comparing the two theories of value co-creation value, we identify the differences between them.

1) Differences in research perspectives

Vargo and Lusch propose that value co-creation is based on the

macro-perspective of an economic development and evolution model. Service-oriented logic is an economic model, and value co-creation between enterprises and consumers is a representation of this economic model. Based on 'all economies are service economies', it is clear the change in the market relationship between enterprises and consumers and the value creation of two market players are the main body of the market change in the value creation relationship.

Prahalad and Ramaswamy's 'co-creation of value' is based on the micro-foundation of enterprise management and strategic design, and they examine this issue at the enterprise level. The new market conditions have changed the process of value creation, and joint value creation has become a new market development trend. The original purpose of Prahalad and Ramaswamy's study of value co-creation was to identify how to make adaptable changes in business strategies for the new market conditions. The two scholars discuss value co-creation from the perspective of management and competition, which provides a comprehensive perspective for enterprises to change their strategy to value co-creation, given the new economic environment.

2) Differences in Purpose of Value Co-Creation

Because of the different research backgrounds and perspectives, the two kinds of value co-creation have different connotations. Briefly, the essence of Prahalad and Ramaswamy's value co-creation is co-creation of experience value. They believe value is embedded in a personalized experience and that enterprises and consumers interact to create personalized experiences. Co-created personalized experiences can occur at any stage of the interaction between enterprises and consumers, including new product development, as well as design, production, consumption, and other stages.

Vargo and Lusch's concept of co-creating value, is aimed at a specific stage of value generation—the use and consumption stage. From their perspective, the value produced by co-creation refers to use value. Consumers make use of the resources provided by enterprises, as well as their own resources, and in the process of using

and consuming products or services and through their interaction with enterprises, uniquely determine value. It can be seen that, compared with Prahalad and Ramaswamy's concept of value co-creation, the value co-creation proposed by Vargo and Lusch is narrower in connotation and extension. Value co-creation is limited to the use and consumption of products and services and excludes other stages of value generation, although there are also cooperative value creation behaviours in these stages, as shown in Table 2.2.

Table 2.2 Comparison of Two Value Co-Creation Theories

	Vargo and Lusch's theory of value co-creation	Prahalad and Ramaswamy's value co-creation theory
Theoretical perspectives	Economic development and evolution	Business competition
Purpose for Value Co-creation	Narrow distinction	Generalized
Value Standpoint	Value co-creation is generated through consumer use and consumption	Creating value is related to experience and can be generated at any stage of value formation.
Value creation process	Producers create value propositions through market offerings; consumers continue to create value through use and consumption	Consumers and businesses create value through continuous dialogue and interaction
Value creator	Producer, consumer, collaborator network	Producer, consumer, cooperative enterprise
Value basis	Use value or context value	Creation of a joint experience
Enterprise role	Propose value proposition, create value, and provide service	Provide experience and interactive contexts to engage consumers in value creation
Consumer role	Value co-creator	Value co-creator Co-creating the core of the experience Active participant
Value realization	Value realization of co-creation value systems including producers, consumers, and partners	Pay attention to the value realization of all parties involved in creating value
The focus of enterprise	Provide value proposition Support consumer value	Focus on the quality of interaction between consumers and businesses

attention	creation	Focus on the environment of innovative experiences Focus on the experience network

(Source: Author Created Using Relevant Data)

2.2.2 Analysis of Conceptual Debate on Value Co-Creation

At present, value co-creation is still a vague concept; no unified or widely accepted concept exists. In theoretical research, there are differences in the understanding and definition of value co-creation. Similar concepts overlap, which makes the original vague concept even more obscure. Thus, it is necessary to clarify the concept of value co-creation.

2.2.2.1 Definition of Value Co-Creation

Throughout the relevant literature, there are both narrow and broad distinctions in the definition of value co-creation.

1. Narrow Distinction in Value Co-Creation

The narrow distinction in value co-creation is the concept of value co-creation under Lusch and Vargo's (2004) service-oriented logic. It refers specifically to the co-creation of use value occurring at the stage of product or service use and consumption, as discussed in section 2.2.1.2.

2. Broad Distinction in Value Co-Creation

The broad distinction in value co-creation holds that as long as the value creation process is composed of consumers and enterprises, value co-creation exists. Value here refers not only to creating value for enterprises, but also to creating value for customers. Sheth (2000) holds that value co-creation marketing refers to interaction and cooperation between marketers and customers in the process of design, production, and consumption of products or services. Doorn et al. (2010) hold that 'co-creation' refers to the cooperation between customers and enterprises in the process of value creation through common creativity, design, and other

independent actions and that co-creating value can be either conscious or unintentional. As long as consumers participate in customized experiences with enterprises, value creation occurs. Therefore, consumers' suggestions for improving service experience and helping service providers and other customers not only represent customer participation behaviour, but also customer value creation behaviour.

Grönroos's (2008) analysis of co-created value divides it into two situations: one is that consumers participate in enterprise value creation as a kind of resource and create value jointly with enterprises. This process takes place in the value production process, which is dominated and managed by enterprises, as the creators of value and consumers as co-creators of value. Gronroos calls it the 'co-creation of value formation process'. The other situation is where enterprises participate in the process and consumers use them as a resource and create value jointly with consumers. This process occurs in the area of consumption and use. Consumers develop value in the process of use and consumption or create their own value. Enterprises interact with consumers through their own actions and affect the consumer use and consumption process, thereby affecting the consumer's value creation process. The whole process of value creation is dominated by consumers. Consumers are the creators of value, while enterprises are the co-creators of value. This is referred to as 'co-creation in the process of value development'. Gronroos believes value co-creation development using service-oriented logic, essentially expands of the connotation of value co-creation under service-oriented logic. Vargo and Lusch's (2004) value co-creation refers to co-creation of 'use value' and extends to the co-creation of 'use value' in the fields of production and consumption. In this sense, value co-creation includes not only 'co-creation of the value formation process' in the field of production, but also 'co-creation of the value development process' in the field of consumption, which is value co-creation in a broad sense.

In addition, the form of value creation by customers and enterprises can also outline the extension of value creation in a broad sense. Payne et al. (2008) combine the value created by enterprises and customers into customer emotional

participation and self-service through advertising and promotional activities, customers themselves as part of the service experience provided by suppliers, and customers making use of the procedures provided by suppliers to make choices and design products jointly.

It can be seen that, in each link of the value chain or value generation, as long as there is cooperation between customers and enterprises, it can be called value co-creation in a broad sense. In fact, due to the intangibility of service and the identity of production and consumption, the characteristics of value creation in service industries become more and more obvious. The process of value creation includes not only enterprises and customers jointly creating enterprise value, but also joint creation of customer value. In this study, even in the context of value co-creation, we examine the mechanism of the interaction between co-creating customer value and co-creating service provider value in the process of digital transformation.

2.2.2.2 Co-Creation Value and Co-Production

Co-production and co-creation of value represent a pair of concepts that are very similar in meaning and easily confused. In some studies, co-production and co-creation of value are treated as interrelated concepts. In fact, there are both similarities and differences between them.

In 2004, when Vargo and Lusch first proposed the service-dominate logic reverse edition, they used co-production to describe value co-creation. By 2006, Vargo and Lusch replaced co-production with value creation, but retained the concept of co-production. They defined co-production as ‘customer participation in the creation of core providers, through sharing inventions, co-design and co-production’. In 2008, Vargo and Lusch (2008) further pointed out that co-production is the joint action of customers and enterprises, and customers create output services for enterprises; value co-creation represents a cooperative action. Co-creation activities create customers’ specific values. Value co-creation is neither a

standard or norm nor an optional behaviour, but requires customers to act as partners in participation. Concisely, co-production creates enterprise output, and value co-creation is determined by customers and creates benefits for customers. The latter is superior to the former (Vargo and Lusch, 2008).

It can be seen that the difference between co-production and value creation is that co-production represents the common behaviour of customers and enterprises, which serves the output of enterprises; however, value co-creation represents cooperation between equal subjects. The process of value co-creation not only creates value for enterprises, but also creates specific value for customers. Co-production internalizes or integrates the enterprise's foreign resources, such as customer resources, to improve the enterprise's output. Customer resources are only a means and method for enterprises to achieve their own goals, and customer participation is passive. Although customers can be compensated for participating, all participation activities are carried out under the guidance, design, and arrangement of enterprises, and customers simply participate in the activities. The right of choice is very limited and the participation initiative is controlled, so the idea of co-production is oriented towards and centred around on enterprises. Value co-creation first recognizes the equality of the main body of value co-creation, contributes to value creation, and also obtains corresponding value in value sharing. Value is formed in the interaction, and all parties invest resources for their own interests. At the same time, they invest resources in the interests of others, sharing guarantees, and ultimately getting what they want. Hilton (2008) argues that enterprises should carefully distinguish between tasks, co-production, and co-creation. Co-creation is related to the value acquired by consumers through use, consumption, or experience, while co-production is related to the specific tasks undertaken by consumers before or during use, consumption, or experience.

Although the two concepts are different, there is an inevitable connection between co-production and value co-creation. Lusch and Vargo believe that the two are nested, and co-production is a form of value co-creation. Especially in the service industry, the service production process is also a process of consumption; production

and consumption cannot be separated. From the perspective of consumers, co-production and value co-creation with enterprises are essentially the same process.

2.2.3 Research Status of Value Co-Creation

2.2.3.1 Factors Influencing Value Co-Creation by Customers

1. Macro-economic and Social Factors

Whether co-production or value co-creation reflects the increasingly prominent position and role of customers in the process of value creation, the change in customer roles and formation of the value co-creation model are closely related to the social and economic development stage. Jaakkola and Alexander (2014) hold that while value co-creation generally occurs in mature societies, it is rare in developing markets that are in early economic development stages. When their consumption centres around basic consumption to maintain, livelihood, people are concerned about mass production and consumption; when they obtain what they need to meet their basic needs at low cost, there is no consideration of customization, co-production, and value co-creation. As previously noted, the development of information technology; formation of a post-industrial consumption culture; and arrival of the experience economy have created the necessary social and economic environment for value co-creation. The marketing paradigm of value co-creation is the product of a certain stage of social and economic development. Customer participation in value co-creation is also an inevitable trend at a certain stage of social and economic development.

2. Customer Factors

Meuter et al. (2005) find that a clear understanding of tasks, customer competence, and motivation are the factors that influence customer co-production. Accordingly, Auh et al. (2007) suggest there are four pre-factors that influence customer co-production: communication between customers and managers, customer professionalism, emotional commitment, and perceived mutual fairness. Communication between customers and managers ensures customers clearly

understand the tasks to be accomplished, customer professionalism ensures customers have the ability to co-produce, and emotional commitment and perceived fairness are related to customer motivation to participate in co-production.

Customer professional ability and customer effectiveness affect the willingness and impact of customer participation in value co-creation. In the process of value co-creation, customers need to invest in resources and abilities, such as time, energy, knowledge, skills, abilities, and other 'manoeuvrable resources'. Customers' resources and abilities impact the effect and efficiency of value co-creation. Etgar (2008) states that in addition to technology-related capabilities, customers need to possess certain 'psychological skills' for value co-creation, such as the abilities to cooperate overcome the impact of cultural differences, encouragement of co-authors, and mutually learn rather than simply exchange. Pralahad and Ramaswamy (2004) also believe that mastering modern dialogue technology based on computer and information communication has an important impact on customer participation value creation.

3. Product Factor

Not all products are suitable for the value generation mode of co-creation, which is related to a specific product category. Etgar (2008) suggests product categories where there are large perceived differences in product attributes are suitable for joint creation of value by enterprises and customers. These differences in product attributes provide a broader space for customer creation and stimulate customers to create their own personalized experience. At the same time, Etgar (2008) describes brand power as also affecting customer value co-creation; for example, customers do not want to participate in value co-creation for well-known brands, because they do not want to destroy the brand charm of those brands. Chan (2010) suggests that in industries with obvious professional service characteristics, enterprises and consumers continuously communicate information, and products with strong interactions and a high degree of consumer participation are suitable for the value co-creation model.

4. Enterprise Factor

Customer perceptions and attitudes towards corporate behaviour influence their participation in co-production and cooperation. Grönroos (1997) believes that if customers perceive an enterprise has empathy or the ability to engage in transposition thinking, they will be more willing to co-produce with it. Lusch et al. (2006) also indicate that if customers trust in an enterprise, they will be more willing to participate in value creation activities.

Enterprise attitudes towards customers' cooperative behaviours and related measures will affect customer participation in the process of value co-creation. In a business to customer (B2C) environment, Hoyer et al. (2010) propose a model of a new product development process that includes customer involvement in value co-creation. In the model, the degree of customer involvement in value co-creation efforts is affected by three pre-variables: customer motivation; incentives, including incentives for enterprises to participate in value co-planning; and obstacles created by enterprises. Hoyer et al. (2010) suggest enterprises can stimulate customers to participate in value co-creation activities by increasing customer profits and reducing their co-creation costs. On the other hand, there are also some factors in enterprise operations that hinder value co-creation, such as company patent ownership, trade secrets, intellectual property rights produced through value co-creation, and value co-creation requirements. Protecting relative transparency between enterprises and customers and worrying about patents and business secrets may deter enterprises from co-creating value. At the same time, the ownership of intellectual property rights and distribution of benefits brought about by the cooperation between customers and enterprises is a more complex problem.

2.2.3.2 Research on the Construction of a Value Co-Creation Theory Model

Many scholars have constructed theoretical models of value creation by consumers and enterprises, trying to reveal the value creation process from different perspectives. Prahalad and Ramaswamy (2004) refine the essentials of value co-creation between enterprises and consumers from a practical point of view. Payne

(2008) describes the ways value creators create their own value and jointly create value using the process of value formation. Etgar (2008) describes the five stages of customer participation in co-production, while Hoyer (2010) analyses value co-creation in the new product development process, as well as the antecedents and consequences of value creation.

Prahalad and Ramaswamy (2004) propose the basic elements of value creation using the DART model: dialogue, access, risk assessment, and transparency. Prahalad and Ramaswamy suggest combining the four basic elements can stimulate enterprises to more fully regard consumers as co-creators of partners' profit value, form new and innovative business models, and realize value co-creation to gain competitive advantage in the new market environment. Dialogue refers to the tendency for businesses and consumers to be interactive, highly committed, and take action. Dialogue not only means enterprises listen to customer voices, but also includes understanding consumers' experience levels, and the emotional, social, and cultural backgrounds of consumer experiences. It also means solving problems equally and communicating and sharing knowledge. Access refers specifically to the experience consumers expect to acquire rather than product ownership. Prahalad and Ramaswamy suggest that in the traditional value creation model, enterprises and consumers both pay attention to the transfer of ownership, but in the value co-creation model, consumers can experience, but not necessarily have, ownership. Experience itself is also a product of value creation. Consumers focus on experience acquisition and accumulation in multiple interactions, not only in the transfer of product ownership, but also in expanding their business opportunities. Risk assessment is the consumer's assessment of possible losses. Under value co-creation, enterprises have been unable to unilaterally manage risks, some of which are transferred to consumers. As co-creators of value, consumers bear more responsibilities and risks in value creation. Therefore, consumers should evaluate their possible losses and the trade-off between benefits and risks. Transparency means consumers can obtain the information they want, weakening information asymmetry; enterprises cannot assume ownership of information and isolate

consumers. Cooperation between enterprises and consumers promotes the sharing and transparency of information, which reflects their mutual trust. Only through this transparency can enterprises and consumers interact effectively and co-create value.

As their research objects, Payne et al. (2008) select 18 enterprises from different industries that are engaged in B2B and B2C activities, such as tourism, energy, retail, financial services, logistics, telecommunications, and mobile phone enterprises, study how these enterprises jointly create value with their customers, and construct a conceptual model of customers and enterprises value co-creation. The model consists of three processes: customer value creation, enterprise value creation, and contacts.

Etgar (2008) proposes the 'description model of customer co-production process'. This model considers customer co-production a dynamic process. Customer participation in co-production is divided into five stages: pre-conditions, motivation for customer participation, cost-benefit analysis, actual customer participation behaviour, and the results of the co-production and the process. The results show the model offers a comprehensive and detailed description of customer participation in a joint production process. Etgar believes macroeconomic conditions and factors related to customers, products, and situations are the pre-factors that affect co-production. The common motivations for customer participation include economic, psychological, and social motivation. The cost savings and perceived risk reduction that customers desire from co-production is their economic motivation, while what consumers who participate in co-production want to obtain is their psychological motivation. The intrinsic value and external value of social driving are the new social connections and social network resources established by customers because of their participation in joint production.

The cost of participation in product behaviour involves both economic and non-economic costs. An example of an economic cost is the input of material resources during participation, while non-economic costs are mainly the psychological and social losses experienced in the joint production effort. These costs and benefits are compared and balanced to make decisions. Etgar also analyses

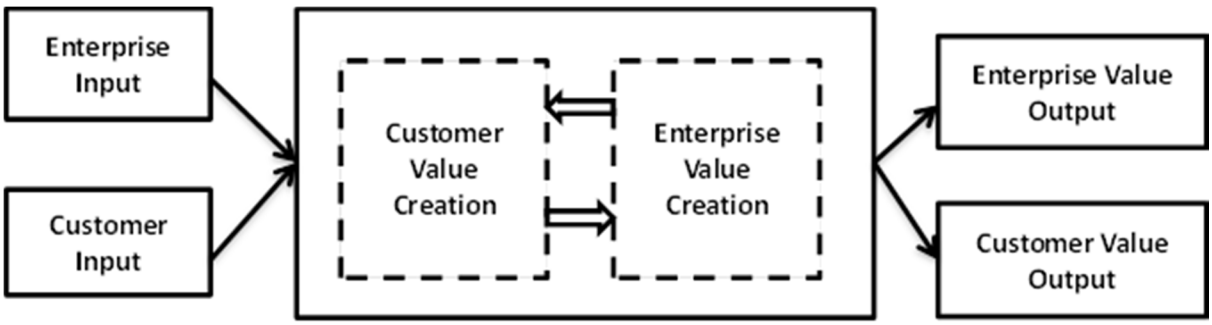
customer co-production behaviour in the different stages of conception, design, production, assembly, distribution, and consumption. Moreover, cost-benefit analysis used to determine whether co-production behaviour is worthwhile, and corresponding adjustments are made to behaviour.

Hoyer (2010) analyses the process of value co-creation in the context of consumer participation in new product development, and constructs a conceptual model of value co-creation. The model includes the motivation for consummers to participate in new product development, the link to and results of value co-creation, and the incentives and obstacles for enterprises in value co-creation. It is believed that economic, social, technological, and psychological factors determine consumption. Enterprises can stimulate consumer participation in the value co-creation process by increasing consumer interest and reducing their costs. At the same time, concerns about business secrets, intellectual capital sharing, information redundancy, and product infeasibility will have a negative effect on value co-creation.

2.2.4 Value Co-Creation Based on Producer Logic

Enterprises must achieve their own value objectives in the process of value co-creation. By putting various tangible and intangible resources into the value creation system, establishing value propositions according to consumers' value demands, and integrating the resources that consumers invest, they can achieve value creation through continuous interaction and cooperation with consumers.

Figure2.1 Value Co-Creation Process between Enterprises and Customers

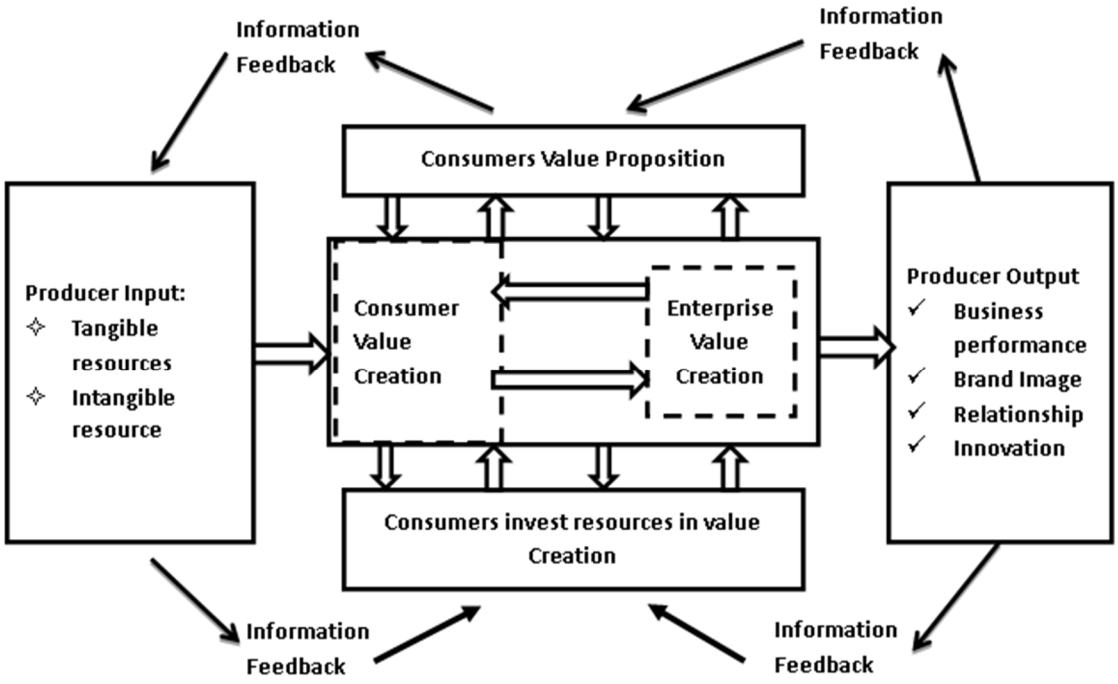


(Source: Arranged by relevant data)

As shown in the middle section of Figure 2.1, joint input of resources to create

value result in the value creation process to becoming a process of both consumers and enterprises (Cova and Salle, 2008). Ultimately, the output of the process is enterprise value, which is embodied in improving enterprise performance, shaping the brand, developing a close relationship with consumers, and improving the enterprise's ability to innovate (Fang, 2008). In a value co-creation system based on producer logic, there are two-way influencing relationships between consumer value appeal and the value co-creation core system and the value co-creation core system and resources invested by consumers for value co-creation. Each factor promotes and restricts the other, and together they form a value co-creation system. Hoyer et al. (2010) even state that consumer demand is a product of value co-creation. Using producer logic, consumers play three roles in value creation: expressing value demands in the value creation system, creating value through interaction with enterprises, and providing resources for the value creation system. As shown in Figure 2.2, value co-creation based on producer logic is an input-output process with the enterprise as the main contributor. Enterprises provide opportunities and conditions for creating value with consumers, pursue value co-creation efficiency, manage and evaluate the value co-creation process (Payne, 2008), and connect the various links of value co-creation through an information feedback process, making it a dynamic system.

Figure 2.2 Value Creation Process Model Based on Producer Logic



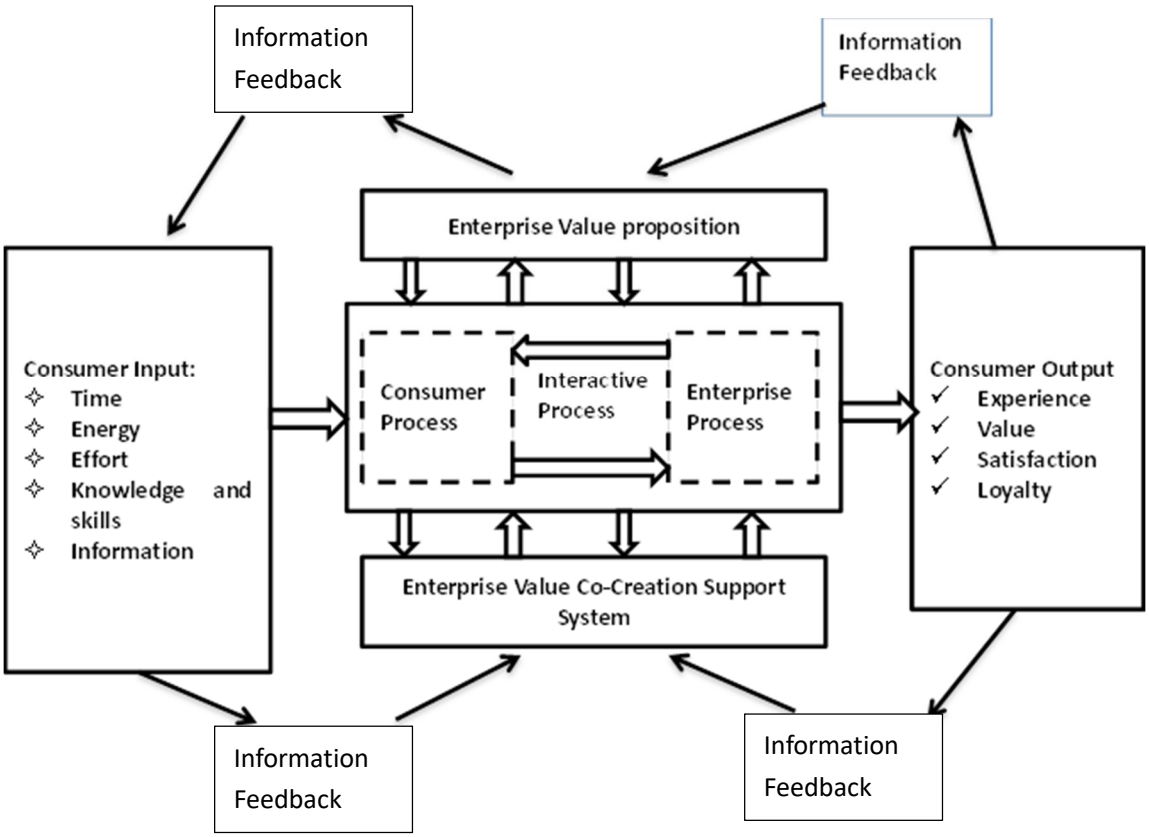
(Source: Arranged by relevant data)

At present, value co-creation research based on producer logic primarily focuses on the impact of value co-creation on the efficiency of enterprise management and the promotion and management of value co-creation. For example, Prahalad and Ramaswamy (2004) construct their 'DART' model, and suggest enterprises and consumers can be stimulated to jointly create value through dialogue, experience, risk assessment, and transparency, to ensure efficient value creation. Payne (2008) proposes a value creation concept based on service-led logic. The model is used to explore the process and approach of value creation systems and value creation between producers and consumers and to provide useful suggestions for enterprises in implementing value creation management. Based on a B2B market empirical study, Fang (2008) examines the impact of consumer participation in value creation on the degree of new product innovation and the speed of market introduction. Chan (2010) studies customer participation in value creation and the impact of customer and employee satisfaction on different values, and the concept of employee performance.

2.2.5 Value Co-Creation Based on Consumer Logic

According to service-led logic, the process of creating value for consumers involves using their own resources and the resources provided by enterprises to create value for themselves and provide solutions to problems (Gronroos, 2008). A value creation process based on consumer logic is also an investor-output process (Etgar, 2008; Ohern and Rindfleisch, 2009).

Figure 2.3 Value Co-Creation Process Model Based on Consumer Logic



(Source: Arranged by relevant data)

As shown in Figure 2.3, consumers as value co-creators put their time, energy, information, knowledge, and skills into the value co-creation system, and integrate theose resources with enterprise resources. The consumer and enterprise value creation processes are connected and integrated through interaction. Consumers and enterprises achieve value creation through continuous resource exchange, interaction, dialogue, and cooperation. Enterprises play three roles in the value

creation system: advocating value, creating value through interaction with consumers, and providing the value creation support system (Vargo and Lusch, 2004b; Prahalad and Ramaswamy, 2004; Cova and Salle, 2008). Specifically, enterprises establish value propositions according to consumer needs. After consumers accept these propositions, the enterprises form common value creation goals with the consumers and realize value creation with them through resource exchange and interaction. To ensure the smooth progress in value co-creation, enterprises must also provide a value co-creation support system, including infrastructure elements such as hardware, software, organizational structure, regulations, culture, and atmosphere, to help and support consumers in achieving value co-creation. In the value co-creation system based on consumer logic, there is a bidirectional relationship between the value proposition and value co-creation core system, and between the value co-creation core system and value co-creation support system provided by enterprises. The value co-creation information of consumers and enterprises gives timely feedback to the enterprise value proposition and value co-creation support system. Value co-creation between enterprises and consumers is also limited by the value proposition and value co-creation support system provided by enterprises. Through value co-creation and the process of cooperation and interaction, consumers can acquire different experiences, multi-dimensional customer value, and the resulting value output of customer satisfaction and customer loyalty.

Individual learning by consumers and enterprise organizational learning are important components of a value creation system (Payne, 2008). The process of value creation based on consumer logic forms multiple cycles through learning: consumers' personal learning and information feedback promote a closed cycle between consumer input and the value creation system; consumers constantly learn and accumulate experience in the process of value creation, and adjust their resource input and structure to get the best possible results. At the same time, enterprise organizational learning and information feedback also promote a closed cycle between the value creation system and consumer value output. Enterprises

continue to engage in organizational learning during the process of value creation, obtaining information from consumers and providing feedback on the effect of value creation and output information to the value creation support system and value creation core system to improve the efficiency of co-creating consumer value and the enterprise's own value. The two important links of organizational learning and consumers' personal learning can activate the entire value co-creation system and make value co-creation a dynamic process of sustainable development.

Value co-creation integrates enterprises and consumers, and promotes positive interaction, mutual learning, mutual influence, and mutual penetration (Gronroos, 2008). Both producer logic and consumer logic for value co-creation reflect the different understandings of the two value creators about the same value co-creation process, based on their respective perspectives. Either logic shows both enterprises and consumers participate in value creation as resource owners and contribute to value creation for themselves and their counterparts, which is the common ground of the two different logics.

By analysing the logic of these two different value co-creation process, we find the process model of value co-creation and value co-creation based on consumer logic better reflects the essential characteristics of value co-creation under service-dominant logic. As shown in Figure 2.3, value co-creation based on consumer logic highlights the status and role of consumers in value co-creation, reflecting the role of the relationship between consumers and enterprises in value co-creation. The continuous enterprises and consumers learning, in value co-creation makes value co-creation a dynamic development process. The process model of value co-creation based on consumer logic further shows the value output of value co-creation is the realization of consumer interests, and the realization of consumers' interests and values is the main motivation and prerequisite for consumer participation in value co-creation (Nambisan, 2009). Therefore, study of value co-creation based on consumer logic is not only conducive to promoting the ultimate realization of consumer participation in value co-creation, but is also conducive to clarifying the functions and roles of enterprises based on consumer logic to promote consumer

participation in value co-creation. However, influenced by the traditional value creation concept that 'enterprises are the main contributors to value creation', most existing value co-creation research is based on producer logic, while value co-creation research based on consumer logic is rare. Existing studies have not explored the process and mode of value creation between enterprises and consumers. Therefore, the value formation process, value generation mode, and value performance of enterprises and consumers in value co-creation are still unclear. In addition, existing research has not promoted construction of a value creation system at the level of strategic management. Based on consumer logic, value creation cannot be separated from establishing and managing enterprise value co-creation systems. Most existing studies are devoted to exploring the impact of value creation on business performance, but not from the perspective of strategic management. How should enterprises establish new value creation systems in the new value creation mode and how can strategic transformation be achieved? How can enterprises help consumers jointly create value? These studies have important practical significance for enterprises in building sustainable competitive advantage.

The value co-creation model of consumer logic also provides a new topic for future research.

1. Ways to Realize Value Co-Creation by Consumers and Enterprises

Generally speaking, value co-creation is a cooperative action of creating value in the interaction between consumers and enterprises. In existing research, consumers create value with enterprises mainly by participating in new product development, service innovation, and co-production. Therefore, this kind of value co-creation, based on producer logic, fits within the broad sense of value co-creation. Under service-oriented logic, value creation mainly focuses on 'use value' and consumer experience, which are closely related to consumers and thus, should be analysed based on consumer logic. Therefore, in the future, we should extensively study the value creation approaches based on use value and consumer experience. For example, besides the existing value creation approaches, consumers can also create value with producers through conscious or unconscious behaviours.

2. The Mechanism of Consumer Participation in Value Creation

Understanding the mechanism of consumer participation in value creation is the premise for enterprise management of consumer value creation. Research on the consumer value creation mechanism should include both motivation and process research. At present, some scholars (e.g. Meuter, 2005; Etgar, 2008; Hoyer, 2010) have begun to study the motivation and factors that influence consumer participation in value creation. For example, Etgar (2008) finds consumer participation in co-production is driven by economic, psychological, and social motivations. Some factors in the value co-creation process model based on consumer logic can also be used as content for research on the mechanism of consumer value co-creation. The input-output process of consumer value co-creation, the psychological and behavioural patterns of consumer participation in value co-creation, and the role of consumer learning methods and learning processes in value co-creation systems are all worth studying. Novani and Kijima (2012) take airline service selection as a typical case and discuss how to create new value through customer interaction. They also clarify the impact of different customer communication modes (social media and face-to-face) on the process of value co-creation.

3. Research on Strategies for Enterprises to Promote Co-Creation of Consumer Value

The basic idea of value co-creation requires enterprises to redefine the roles and relationships of the parties involved in value creation when designing their offerings. The method of co-creating consumer value and the relationship between consumers and enterprises are embodied in the internal management process, such as organization and process design, and a new value creation system is formed. In value creation, interaction with consumers and the consumption experience are two core issues. Prahalad et al. (2004) and Cova and Salle (2008) both believe improving the quality of interaction in consumer value creation and providing consumers with a unique experience support system are important strategies for promoting consumer value creation. In the future, we should focus on the interaction between enterprises and consumers, and empirically study the impact of different modes of interaction

and strategies on the output of consumer and enterprise value co-creation. In addition, future research should help enterprises solve practical problems, such as how to provide consumers with appropriate situations and conditions for creating unique experiences, how to enhance and improve the knowledge and skills of value-creating roles, and how to improve the quality of experiences.

4. **New Mechanism and Strategy of Service Platform Participation in Value Co-Creation**

Moving beyond value creation in individual companies, firms have integrated customers, partners, and stakeholders in mutual value co-creation processes. Examples are platforms such as Apple's App Store, where external developers use boundary resources provided on the platform to develop and share applications in an ecosystem. While value co-creation on B2C platforms is common practice, research on their B2B counterparts is still scarce.

Balajia and Royb (2017) propose that the interaction between customers and the Internet of Things (IoT) retail technology leads to value co-creation. The results show that ease of use, superior functionality, aesthetic appeal, and presence are key determinants of value co-creation for IoT retail technology. They also find value co-creation influences customers' continuance and word-of-mouth intentions. Using the concept of a service dominant platform (SDP) as a key contributor in a smart city's construction to explain how value can be co-created during the platform's formation and evolution, the study provides new insights by positively bridging the linkage between platform governance and service innovation and proposing an SDP as a clear sustainable strategy. Wei et al. (2019) explore how customer solution providers leverage digital platform architectures and particularly platform openness to exert control over complex organizational networks. Their findings show the features of product modules (core or peripheral), service modules (relationship intensity and customization), and knowledge modules (explicit, tacit, and codified) have differential influences on the level of platform openness. By managing the platform openness of different subsystems accordingly, solution providers can achieve different control benefits, including ensuring module quality, increasing

offering variety, reducing dependence on module providers, and facilitating resource sharing. Hein et al.（2017） analyse how B2B platforms utilize value co-creation practices. They have conduct a multiple case study in the context of emerging Internet of things (IoT) platforms, highlighting that B2B platforms follow three standardized value co-creation practices. The platform encourages the supply side through the integration of complementary assets, the demand-side through to ensuring platform readiness and connects both processes by servitization through application enablement. They have concluded by showing how platforms leverage different boundary resources in a process of standardization to develop a scalable infrastructure that explains how platforms enable value co-creation within their ecosystem. Xie et al. (2017） investigate the effects of co-creation of customer value on psychological ownership, customer-based brand equity, and electronic word-of –mouth in relation to short-video platforms. This study demonstrates that a well-designed co-creation value strategy is a potent reflection of a platform's customers and enhances co-creation of customer value for short-video platforms and transforms customers into intangible assets for electronic word-mouth.

2.3 Theory and Mechanism of Digital Transformation and Value Co-Creation

2.3.1 Digital Transformation and Value Co-Creation Theory

At present, many companies expect to realize the company's business transformation and development through the digital transformation of enterprises. Most can't keep up with the changes in the new digital era. Managers still lack a clear understanding and understanding of strategic planning and design in digital transformation work (Hess et al., 2016; Matt et al., 2014).

From an academic point of view, because there are a number of different research areas, such as social, industrial, economic, and personal digital transformation, digital transformation it is a fairly decentralized field. Recent work

related to digital business transformation has focused on the challenges, drivers, and failures of previous attempts. Although the literature has recognized the key role of professional strategy, it is still in its infancy and requires more in-depth work to provide a fully understanding of how transformation can be achieved (Kulatilaka and Venkatraman 2001; Yoo et al., 2010; Matt et al., 2014; Hess et al., 2016). Therefore, exploring the transformation of digital business from a strategic perspective should provide valuable insights and help leaders grasp the latest developments and potential strategic frameworks they are trying to build.

According to the description and discussion in the section 2.2 and 2.3, the value co-creation dimension describes what is offered to the customer in terms of the types of product and services offered by the company and customer. There are many ways digital transformation can create value customers through new technologies and more advanced service offerings.

1. **Digital transformation supports creating novel offering configurations enabled by digital technology.**

Digital transformation allows companies to either revise or extend their portfolio of products and services by incorporating IoT components or even combining different offerings with unique opportunities (Cenamor et al., 2017; Hasselblatt et al., 2018). The literature review shows, there are significant opportunities for configuring advanced services based on digital platforms (Cenamor et al., 2017). This provides a unique perspective on a business model of value co-creation by leveraging contributions from different roles in the ecosystem. Digital transformation can also play a complementary role in increasing value and reducing transaction costs, even when it is product/service smoothing or adaption rather than digitalization that is the main value driver (Gerpott and May, 2016; Laudien and Daxböck 2016). However, these novel offerings are by no means assured; firms can fall into a trap by employing digitalization solely as an attempt to sustain the market position of their existing products and services (Krotov, 2017; Luz Martín-Peña et al., 2018).

2. **Digital transformation is vital for firms to focus on understanding customer needs concerning digital solutions.**

Adding connected sensors and actuators to present offerings in an unsystematic manner does not necessarily lead to market success; evaluating market needs on an on-going basis is crucial (Gerpott and May, 2016). Several researchers highlight the importance of specifying and quantifying value creation to communicate the benefits of a particular business model to avoid offering functions that are not requested by and do not create any value for the target customer (Dijkman et al., 2015; Kiel et al., 2017; Metallo et al., 2018). Thus, firms would benefit from initially mapping out potential digital technology applications and the potential value benefits they can bring (Sjödin et al., 2018). Moreover, digital components are sometimes added without a clear understanding of customer needs and without a value proposition that is unique to the client (Gebauer et al., 2005).

3. Digital transformation enables co-creation of value through ecosystem orchestration or collaboration.

Existing literature generally upholds a positive view of digital transformation as a radical and disruptive innovation that possesses the potential to reshape competitiveness in industrial ecosystems. Studies show that approaching digital transformation with a more visionary and creative mind-set will lead to totally new business models that incorporate entirely novel functions where the digital component is the main value driver (Kiel et al., 2017; Metallo et al., 2018). In many cases, realization of digital value creation will occur beyond firm boundaries and across networks in the form of collaborative value co-creation.

In addition, firms may benefit from leveraging collaboration with innovative start-ups and small and medium sized enterprises that are more likely to adopt a pathfinder ethos when it comes with digitalization-based value creation (Loebbecke and Picot, 2015). Customers will invariably play a central role in this process because they will be integrated into the value-creation process such as through self-service or data sources (Laudien and Daxböck, 2016). An important criterion for value creation is that digital technology should not replace but rather complement human capabilities in the value-creation processes (Sjödin et al., 2018). This may be especially true in the case of advanced services where relational interaction with customers is important and over-reliance on digital systems to the detriment of

personal interaction can have negative effects on the value-creating potential of the new offering and how it is perceived.

4. Digital transformation enables creation of new value propositions.

Barrett et al. (2015) define digital transformation as enabling creation of new value propositions that increasingly rely on providing services. Organizations use digital technologies to transition from or augment the sales of physical products with the sales of services as an integral part of their value proposition of satisfying customer needs by offering innovative solutions as well as to gather data on their interactions with products and services (Porter and Heppelmann, 2014; Wulf et al., 2017). A prime example of creating a new value proposition using digital technologies is Netflix, whose business model was originally based on renting movies stored on physical media. Over the years, Netflix has moved away from this value proposition to become the first large-scale provider of video streaming services. More recently, they have leveraged data collected from the use of their streaming services to better understand the content viewers enjoy and how content is consumed to aid in producing their own content (Günther et al., 2017). Overall, the literature highlights the potential for digital technologies to generate disruptive innovations that can significantly alter existing value propositions (Huang et al., 2017).

5. Digital transformation also enables the redefinition of value networks.

Delmond et al. (2017) find that digital transformation also enables redefinition of value networks. Andal-Ancion et al. (2003) argue that a firm can use digital transformation to implement one of three main mediation strategies. In a disintermediation strategy, digital technologies bypass intermediaries and enable direct exchanges among participants in a value network, such as customers (Hansen and Sia, 2015). In a remediation strategy, the couplings between participants of a value network are reinforced as digital transformation enables close collaboration and coordination among participants, for example, by using a platform to coordinate exchanges within a supply chain (Klötzer and Pflaum, 2017). In network-based mediation, complex relationships among multiple stakeholders with potentially competing interests are created for the benefit of customers (Tan et al., 2015). Digital

transformations have also granted customers the ability to become co-creators of value (prosumers) within a value network (Lucas Jr. et al., 2013). For example, online communities (e.g. Oestreicher-Singer and Zalmanson, 2012) and social media (e.g. Kane, 2014) depend almost exclusively on the active contributions of users who have no obligation to use those technologies. Firms therefore have an imperative to incentivize customer engagement with digital transformation to drive co-creation of value (Saldanha et al., 2017; Yeow et al., 2017).

2.3.2 Digital Transformation and Value Co-Creation Mechanism

Digitally enabled business models will significantly change how value is delivered to the customer. These changes will occur both inside the company and within the company's external business ecosystem. Indeed digital transformation has a major impact on internal resources, capabilities, activities, and roles (Gorissen et al., 2016; Schallmo et al., 2017).

1. **Digital transformation helps develop and apply new capabilities through value co-creation.**

Rachinger et al. (2018) identify organizational capacity and employee competence as the major future challenges of digitalization. Digitalization capabilities for delivery of business model innovation can be developed in a stepwise way to ensure maturity progression (Parida et al., 2015). Key activities for building digital capabilities in manufacturing firms include investing in intelligent and connected information technology (IT) functionalities, building skills in advanced analysis of customer usage data at front-end units, and automating basic data analysis and support for service innovation (Cenamor et al., 2017). The development of information technology capabilities (Gauthier et al., 2018) is strongly correlated with internal employee capabilities (Dijkman et al., 2015; Metallo et al., 2018).

However, there will be a shortage of digital transformation qualified personnel; companies will be required to invest in educating and training of their employees to fit new job profiles and workplaces as well as to better integrate less qualified and elderly personnel (Müller et al., 2018; Zancul et al., 2016). To succeed with digital transformation, it will be necessary to establish a firm mentality and culture that

supports the transformation and actively searches for opportunities (Laudien and Daxböck 2016; Kiel et al., 2017).

2. **Digital transformation improves operational processes and activities for global delivery through value co-creation.**

To successfully deliver value from digitalization, companies must be able to develop scalable platforms that utilize modularity to achieve both efficiency and effectiveness in their offerings (Cenamor et al., 2017; Hasselblatt et al., 2018). Digital capabilities enable continuous improvement in routines related to information flow, integration of service activities, and centralized monitoring of service processes. Consequently, there will be fewer delays and more responsive customer service results, which is critical for service provision (Parida et al., 2015; Sjödin et al., 2016). For example, a warning signal (e.g. risk of breakdown) from customer usage data can immediately flow through the entire system and trigger the necessary changes in spare-parts levels and service staff scheduling and can even lead to automated re-routing of service plans (Reim et al., 2016, 2018).

3. **Digital transformation creates the need for revised roles and responsibilities in industrial ecosystems through value co-creation.**

There is wide consensus among researchers that a company's external business ecosystems will become much more important and significantly affect value delivery. This is because relationships become more intense, interdependent, and globally distributed (Parida et al., 2015; Ehret and Wirtz, 2017). The collection, storing, and sharing of data will require firms to become more collaborative, facilitating greater information transparency, inter-company connectivity, and joint data analysis (Hakanen et al., 2018). This need for intensified collaboration is of particular benefit to young firms because their future depends on partnerships that will be successful (Metallo et al., 2018). It may well become difficult for existing actors to maintain their powerful positions in supply chains when faced with other actors working in, for example, software development, data interpretation, and services, which have potentially stronger prospects for dominating the supply chain (Vendrell-Herrero et al., 2017). Therefore, every company needs to determine which partners and complementary actors will be needed to deliver value and how this partnership

should look (Kiel et al., 2017). Lenka et al. (2017) show how co-creation with customers is enabled by digital technology. This co-creation is highly challenging because it leads to role ambiguities between actors (e.g. unclear role descriptions). Therefore, different relational response strategies (e.g. role adaption) are required to cope with unclear expectations, responsibilities, and demands (Sjödin et al., 2016). Both vertical and horizontal industry partnerships will evolve and innovation centres and partnerships with public organizations will increase in importance with digitalization (Kotarba, 2018).

2.4 Digital Transformation and Firm Performance Theory

Value co-creation from digitalization can accrue in various ways, such as from decreased costs, higher revenues, or the capture of new revenue streams. To secure a business model's profitability over time, it is important to put in place an appropriate risk management system where the financial gains more than match any negative consequences, such as high delivery costs. The literature review shows it is evident that limited attention has been given to the value co-creation dimension of digitally enabled business models, even though discussions on costs and revenue are at the heart of digitalization.

Digital transformation can improve internal processes, enabling improved cost efficiency, and thus lead to a positive effect on performance (Sjödin et al., 2016, 2018). Other efficiency benefits can be achieved through a streamlined delivery process by capitalizing on product data flow and stressing the requirements related to improved customer interaction (Cenamor et al., 2017). These efficiency advances are among the main drivers of digital business model development (Gauthier et al., 2018). When aiming for cost efficiency, it is also important to continually review co-creation initiatives so extra costs incurred from joint digitalization efforts are weighed in the balance (Müller et al., 2018; Zancul et al., 2016). However, the largest costs come from product development and IT infrastructure, which require very substantial upfront investment and continuous updating over time (Kiel et al., 2017).

Enabled by digital technology, these new revenue models will open up more flexible and customized pricing that can be changed over time and in real time based

on operational data. These situations also give customers the opportunity to choose fixed prices, pay-per-use, or hybrid models, facilitating greater value creation through increased customization and shifts in responsibility (Zhou et al., 2015). Emerging technologies such as blockchain may have a particularly interesting role in changing the value-capture mechanisms by enabling increased transparency among multiple actors.

Digital transformation is also associated with increases in several dimensions of organizational performance, including innovativeness (Svahn et al., 2017), financial performance (Karimi and Walter, 2015), firm growth (Tumbas et al., 2015), and reputation (Kane, 2016) as well as competitive advantage (Neumeier et al., 2017). For example, under the freemium model, a firm can use online communities to increase users' sense of belonging and motivate them to purchase premium accounts (Oestreicher-Singer and Zalmanson, 2012). In the context of entrepreneurial firms where the growth rate is nonlinear, Tumbas et al. (2015) find that successful firms put up a 'digital façade' to enable connectivity with customers and business partners, while later using this façade as an instrument to foster relationships with other customers and suppliers. This and other examples (e.g. Setia et al., 2013) show how digital technologies can, through higher customer engagement and participation, foster higher firm profits. At a conceptual level, it has been proposed that digital technologies can support a firm's ability to sense the complexity of its environment and design a response that can help maximize its chances of survival through the adapting or redefining of its core activities (Tanriverdi and Lim, 2017).

2.5 Digital Maturity and Firm Performance Theory

In general, new digital technologies gain ground quickly and change the economic landscape. Innovations put forth by small, fast-moving innovative companies take over industries and reshape how business is conducted. Traditional companies, which are typically more inflexible, are faced with rapidly moving digital technologies that permeate industry standards. Digital innovations offer new opportunities; however, only a few companies capture the real benefits. The digital

innovation level and affinity of companies can be captured in a metric known as digital maturity.

Kane et al. (2016) argue that digital maturity in different organizations stems from common features. Specifically, they identify the following features that drive digital maturity. First, digitally advanced organizations have higher risk tolerance. They accept a certain level of risk that is logically attached to the implementing new technologies. Second, more digitally mature organizations are willing to experiment, which is closely linked to their higher risk tolerance. Rolling out new technology is cumbersome and might disrupt day-to-day business at first. Third, digitally maturing organizations invest heavily in recruiting talent and leaders with transformative visions. Those key employees help shape a digital culture in the organization. It is important that an organization's digital innovations, organizational culture, and employees be in sync.

Bughin et al. (2017) argue that a company's future success in a more digital environment can be partially derived early on in its transformation journey by analysing its digital intelligence. Digital intelligence is one of the key drivers in a successful digital transformation, in addition to clear digital vision and adequate technology improvements, as previously mentioned (Kane et al., 2015). Furthermore, Bughin et al. (2017) find digital intelligence is positively correlated with financial performance; a higher digital intelligence score has a positive impact on revenue, earnings before interest and taxes, and company growth after controlling for industry, company size, and location. Their results are statistically significant, and the correlation holds in various industries: business services, manufacturing, and high-tech. Moreover, they find (1) digital intelligence scores are the highest for digitally savvy firms and (2) the effect of each of the four dimensions (and their sub-dimensions) on digital intelligence is approximately the same, meaning the individual dimensions carry roughly equal weight. Interestingly, the individual scores in the four dimensions are very consistent with group ranking. In other words, digital leaders have higher scores across all dimensions compared to the average group and the same holds true for the average group and laggards.

Westerman et al.'s (2012) study sheds light on the relationship between digital maturity and financial performance. The study analyses 184 publicly traded companies to establish a connection between digital maturity and financial performance. In short, they find firms that have either high digital intensity or high transformation management intensity outperform firms that have neither high digital intensity nor high transformation management intensity. Subsequently, firms categorized as digitalized have the highest performance, leaving not only beginners behind but also firms that have only either high digital intensity or high transformation management intensity. The authors compare financial figures such as revenue generation, profitability, and market valuation. They find firms with either high digital intensity, high transformation management intensity, or both, derive more revenue from physical assets measured by fixed asset turnover and the revenue per employee multiple.

In a study conducted by Bughin et al. (2017), firms' digital intelligence is mapped on a 100-point scale. Subsequently, they categorize firms into three groups based on their digital intelligence scores: digital leaders (score of 41 and above), average firms (score between 25 and 40), and laggards (score below 25). In their study, the average firm achieves a score of 34. Their findings are as follows. First, firms in the top group, the digital leaders, are capable of repelling digital pressure and using digitalization to their advantage. Their scores are highly correlated with margin growth and revenue. Second, firms labelled as average neither profit nor experience negative growth. At around 60 percent of the sample, this group also represents the majority of companies. Bughin et al. (2017) stated these companies neither benefit from digitalization nor are they affected by digital disruption. Third, laggards underperform and are faced with shrinking revenue and negative growth profiles (Fitzgerald et al., 2014).

Moreover, Weill and Woerner (2015), in a recent study for the MIT Center for Information Systems Research, find firms with profound engagement in digital ecosystems outperform their industry peers. Numerically, companies with at least 50 percent of their revenue from a digital ecosystem outperform competitors by 32

percent in revenue growth and a 27 percent increase in profit margin.

Digital transformation is not affecting all industries at the same pace. On one hand, some industries were hit early due to growing digital competition. The music industry, for instance, adapted early to new digital concepts that emerged as new threats to traditional business strategies. On the other hand, some industries have yet to be affected by extensive digital transformation. Manufacturing, an industry that traditionally reacts slowly to new changes, is an example. Other industries such as the insurance or retail sectors are somewhat in the middle. Generally speaking, industries in tight regulatory environments, with risk-averse cultures, and complex organizational structures, suffer limitations with regard to advanced technological innovations (Westerman et al., 2011).

To summarize, the general understanding of digitalization's effect on firm performance is threefold. First, higher levels of digitalization normally benefit companies when it comes to profitability and impose a competitive edge across the board. Second, the speed of digitalization is uneven and thus, companies that are ahead of their peers reap disproportionate benefits. Third, for certain sectors, there is development towards a winner-take-all dynamic, which is a severe threat to companies that fall behind (Fitzgerald et al., 2013; Bughin et al., 2017).

2.6 Conclusion

This chapter introduces the background, digital maturity, and company performance of customer participation in value co-creation in the process of digital transformation, as well as the related theories of customer participation in value co-creation, including service dominant logic, digital transformation theory, and digital maturity theory. At the same time, it reviews some important related contents, such as an overview of customer participation. In addition, based on the importance of digital transformation, this chapter analyses the relevant connotations and research to better understand the process of customer participation in value co creation and digital transformation.

The review and carding of the relevant literature such as customer participation in digital transformation, customer value co-creation, and company performance show the previous research results provide a rich theoretical basis and reference for this study; at the same time, there is still room for in-depth research among the three areas, especially the general response to digital information technology. As the network social structure has gradually formed, the marketing environment has changed greatly, and the market roles of customers and enterprises have also changed; this provides a new social background and new research opportunity for customer participation in the digital transformation, co-creation of customer value, and research on company performance.

1. The relationship between customer participation in digital transformation and customer value creation is worth studying. The literature review indicates traditional research on customer participation focuses on the service industry, and then gradually spreads to the B2B market and the product development and innovation stage of tangible products. No matter which market, customer participation serves as an enterprise marketing strategy to achieve enterprise goals. These goals may be improving the enterprise's production efficiency, providing consumers with products or services more in line with their needs, improving the enterprise's innovation ability, or reducing service failures and the trial and error rate. Customers are regarded as 'part-time employees' or 'partial employees' and are incorporated into the enterprise's service production and traditional system. Most existing research focuses on the impact of customer participation on improving the corporate brand, customer satisfaction, customer loyalty, and so on. There are few studies on the actual benefits customer participation brings and whether it can really improve a company's performance, particularly in IT industries. Customer participation behaviour has a certain goal. As an important participant in service production and transmission, customers hope to receive benefits from participating. The customer value created in participation is also a concern of customers. These customer values are not only important influencing factors for customer attitude formation, but also the power source for customers to participate again. Customers are more active and

creative in participation activities, especially under the concept of co-creating value. The development of digital information technology and popularization of networks promote changes in customer participation modes and behaviour, which is particularly necessary for research on customer participation in the new market environment and research on customer value created by customers and enterprises through participation. It not only can offer insight into the influence of customer value composition and customer participation behaviour on customer value formation, but can also provide strategic guidance for enterprises to promote customer value creation.

2. Research on customer value creation is based on product dominant logic, and customer value creation under service dominant logic is worth examining. A basic premise of existing research on customer value is that enterprises use internal and external resources to create value for consumers, and consumers perceive the value created and delivered by enterprises in the service process. Customer value is created by enterprises playing the leading role, while consumers are passive receivers of value. In the value creation mode of product dominant logic, enterprises are committed to discovering how to provide consumers with more outstanding value than their competitors to gain competitive advantage, and consumers do not participate in the value creation system. However, in today's real market environment, the role of consumers has changed. Consumers seek to gain more initiative and control in the market, and actively participate in the process of value creation. They are changing from passive value recipients to active value creators. Under service-dominant logic, the value creation mode gradually moves to value co-creation.

3. The existing research on customer participation and customer value is insufficient in the area of interaction between customers and enterprises. The concept of customer participation itself connotes interaction between enterprises and consumers. The effect and benefits of customer participation are determined by the quality of the interaction between enterprises and consumers; in the context of high participation, the interaction between enterprises and consumers is particularly

important. However, in past research, consumers and enterprises have often been regarded as two separate subjects, and the interaction between enterprises and consumers is seldom reflected in customer participation research.

4. In the existing empirical research, customer value and customer participation are most often studied using single dimensional variables, revealing the causal logical relationship between them and other variables; there is little research on the relationship between the internal structures of variables. Customer value and customer participation are multidimensional variables with internal dimension structures. The existing literature shows the logical relationship among customer participation, customer value, and company performance as a single dimensional variable, but the logical relationships between the multidimensional structures of each variable are not clearly understood.

Chapter 3 - Research Framework and Theoretical Hypotheses

3.1 Research Framework

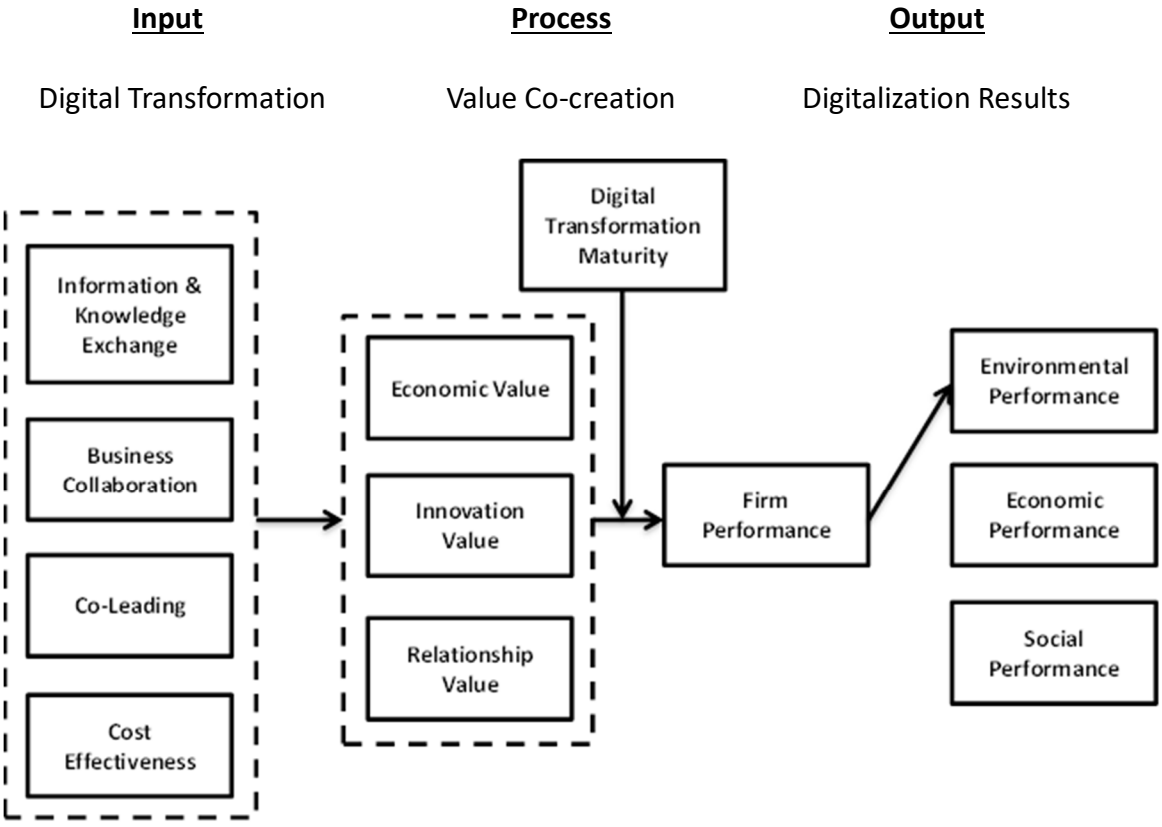
Value co-creation is a frontier research field. At present, the research on value co-creation is in a theoretical exploration period. A few empirical studies primarily focus on value co-creation from the perspectives of suppliers and enterprises, such as supplier co-production with enterprises, supplier participation in new product development, or customer participation in service innovation. There has been little study on the impact of joint value creation on enterprise performance in the context of digital transformation with traditional and internet enterprise customers as the main focus and ICT industry customers as the research object. With the rapid development of science and technology and the convenience brought by the Internet, there is an increasing number of customers who actively and creatively participate in value creation. Enterprises are also paying attention to customer value co-creation behaviour and seek to realize and create mutual interests with customers through interaction. Enterprises should be clearly understand that digital transformation can bring them many changes. Digital transformation should integrate their resources, check for gaps, pay attention to scientific and technological input, and use digital technology to achieve business innovation or optimize their business model. It also encourages business enterprises and platforms to integrate enterprise resources, such as infrastructure, human, data, organizational, and social resources in value creation to build a unified business service platform, achieve agile processes and decision-making paths, and support the rapid change and innovation in business applications.

Enterprises must understand why customers are willing to participate and interact with them: there must be interest and value demand motives behind their participation. Enterprises need to understand what value customers and enterprises

create for customers through participation activities. What impact do these values have on company performance? Only by revealing the 'black box' behind customer participation and value creation can enterprises construct the customer participation and value creation stage, propose a meaningful 'value proposition' to customers, and provide interactive situations and experience events to realize the 'value proposition', while consciously encouraging and guiding customers to effectively participate in joint value creation. In the process of value creation, efforts should be made to realize co-creation of customer value, and a strategic mode of value co-creation between enterprises and customers should be gradually formed.

This study explores the impact of customer participation in digital transformation on the co-creation of customer value and corporate performance from the perspective of business customers and platform users. The study's theoretical research model is shown in Figure 3.1.

Figure 3.1 Theoretical Research Model



The study's theoretical research model principally focus on input, process, and output and studies the continuous process in which digital transformation customers create value with enterprises through participation and interaction. Creating customer value is an important intermediary variable, which influences firm performance and environmental, economic, and social performance, and reveals that customers in the process of digital transformation participate in the internal mechanisms of environmental, economic, and social performance. In the theoretical model, digital transformation maturity is added as a variable that moderates the relationship between customer value and company performance in the process of digital transformation; it reflects the basis of value creation in that process and in the interaction between enterprises and customers. Process and interaction are characteristics of service (Grönroos, 2010). When companies provide services to customers, they interact with the customers and influence their processes. They learn from consumers, teach them new skills, and provide them with services that are richer than self-service.

Adjusting consumer preferences may exceed their expectations in various ways. The whole process is a service process aimed at creating customer value. Compared with customer self-service, this process provides more space and flexibility for service providers to influence consumers. The interaction between service providers and consumers in the process of consumption positively affects the consumption results and output. The two-way interaction between customers and service providers becomes the foundation for jointly creating value. In the model, interaction is not only reflected in customers' active participation behaviour, but also in service providers' support of customers' participation behaviour towards digital maturity. By measuring digital maturity, customers can be guided and promoted to actively participate in value creation. Therefore, customer-perceived digital maturity affects the relationship between co-creation of customer value and company performance. The theoretical model describes the internal logical relationship between customer participation behaviour and environmental, economic, and social performance in the process of digital transformation. The following primary relationships must be

verified.

1. Does the co-creation of customer value mediate the relationship between customer participation in digital transformation and firm performance on environmental effects?
2. Does the co-creation of customer value mediate the relationship between customer participation in digital transformation and firm performance on economic effects?
3. Does the co-creation of customer value mediate the relationship between customer participation in digital transformation and firm performance on social performance?
4. Does digital maturity moderate the relationship between co-creation of customer value and firm performance?
5. Is there an established logical relationship between customer participation in digital transformation, co-creation of customer value, and environmental, economic, and social performance?

Just like the previous literature review of research on customer participation in digital transformation, although there is no recognized standard definition of customer participation in digital transformation, there is a relatively consistent view of the connotation of customer participation in digital transformation. First, customer participation in digital transformation is the behaviour of customer involvement in enterprise service production and delivery. Second, customer participation in digital transformation is a process in which customers put certain resources into the production and transmission of services and use these resources to create value. Third, customer participation in digital transformation implies the process of value creation through cooperation between customers and enterprises.

Co-creation of value is a cutting-edge research field. At present, the research on co-creation of value is in the theoretical exploration phase. Some empirical studies also focus on co-creation of value from the perspective of enterprises, such as the

impact of co-production between customers and enterprises and customer participation in new product development or service innovation on business performance and enterprise innovation ability, but few focus on customers. The main line is studying the impact of customer participation in customer value co creation on company performance. In the new market environment and consumption culture, the phenomenon of active and creative customer participation in value co-creation is increasing. Enterprises also begin to pay attention to customer co-creation of value behaviour and seek to realize and create the interests of both sides in interactions with customers. It should be clear to enterprises that there must be interest and value appeal for customers to be willing to participate and interact with enterprises. Enterprises need to understand what value for customers that enterprises and customers create together in participation activities, and what impact these values have on forming their attitude and behaviour. Only the 'black box' behind customer behaviour is revealed. This allows enterprises to build a stage for customer participation and value co-creation, offer a meaningful 'value proposition' for customers, provide interactive scenarios and experience events to realize their 'value proposition', consciously encourage and guide customers to effectively participate in value co-creation, strive to realize co-creation of customer value in the process of value co-creation, and gradually form a strategic model of value creation by enterprises and customers.

This study explores the impact of customer participation on co-creation of customer value and company performance.

3.2 Definition of Concepts and Determination of Dimensions

This study's purpose is to explore the mechanism through which customer participation impacts the environmental, economic, and social performance of enterprises in the process of digital transformation from the perspective of value co-creation. Value co-creation is an important research setting. The change in the consumer's role plays a vital part in the process of transforming enterprise value

creation to value co-creation. The customer's active participation behaviour in value co-creation is different from that in traditional value creation.

3.2.1Definition of Customer Participation from the Perspective of Value Co-Creation in Digital Transformation

The previous literature review probes the research on customer participation, and although there is no accepted standard definition of customer participation, its connotation is still relatively consistent.

1. Customer participation is customer involvement behaviour in the production and delivery of enterprise services. Customer participation is initially related to service, which is mainly due to the indivisible characteristics of service production and consumption; that is, the process of service production is also the process of consumption. Customers participate in the process of service production to obtain better service.

2. Customer participation is a process in which customers invest certain resources in the production and delivery of services, and use these resources to create value. The process of participation is bound to be accompanied by investing resources, which is the bridge for customer participation in the enterprise service interface. These resources include tangible and intangible resources, such as knowledge, experience, effort, emotion, physical strength, and currency.

3. Customer participation implies the process of value creation through cooperation between customers and enterprises. Customers invest human resources in the process of service production and delivery and work with enterprise resources to create service results. The efficiency of resource integration and interaction depends on the degree of cooperation between customers and enterprises. Therefore, the final service result is decided by both enterprises and customers.

In the context of digital transformation, this study examines service industry customer participation in digital transformation from the perspective of commercial customers and platform customers. Using the concept of value co-creation and

referring to scholars' previous definitions of customer participation, this study defines customer participation as follows: 'In the process of service production and delivery, customers achieve specific goals and cooperate with enterprises'. In service interactions, resources are provided and cooperative efforts and actions are used to realize the process of value creation. This definition emphasizes the following points:

1. Customer participation is purposeful behaviour. The purpose of participation is related to the initiative for customer participation. The initiative for customer participation will be strengthened when customer participation can achieve customer goals or satisfy customer interests. Ennew and Binks (1999) believe participation should benefit both customers and service providers. Customer goals include access to customized services consistent with their preferences; more efficient, convenient, and high-quality services; better prices; reduced risk perception; and more diversified experiences.

2. Interaction between customers and enterprises. From the perspective of co-creating value, enterprises and consumers can participate and interact in the exchange of resources. The customer participation process is realized through mutual interaction between the two sides. The interactive characteristics of customer participation are obvious.

3. Cooperation between enterprises and consumers. Customer participation is a value creation process. Participation in value co-creation is equal participation among the subjects of value creation, and cooperation becomes the behavioural basis for customer participation. The purpose of customer participation is to realize value creation. This value co-creation is not accomplished by customers alone, but by their interaction and cooperation with enterprises.

3.2.2 Definition of the Dimension of Customer Participation in Digital Transition

1. The Dimension of Customer Participation in Existing Literature

Customer participation is a multi-dimensional behavioural concept. According to

the existing literature, scholars have produced abundant research results on this dimension, finding differences in its composition. On one hand, this is due to the different research perspectives and methods used by scholars; on the other hand, it is because customer participation behaviour has different patterns in different service industries and situations. With the development of modern science, technology, and information—especially the development of Internet technology and the digital economy—customer participation behaviour presents new forms and characteristics, and the composition of the customer participation dimension will change accordingly in a dynamic development process.

A review of the literature shows there are three ways of thinking about the division of the customer participation dimension. First, it can be divided according to the resource inputs in customer participation. Customer participation requires the investor's corresponding resources; thus, resource input has become an important measure of customer participation. The second approach is extracting and abstracting the behaviour in the customer participation process as the dimension of customer participation; this approach is widely accepted and applied, and the research results are relatively rich. For example, Kellogg, Youngdahl, and Bowen (1997) use 'critical event analysis' to determine the four forms of customer participation: pre-preparation, relationship building, information exchange, and interference. Ennew and Binks (1999) study the participation behaviour of British small businesses and their banks, revealing the relationships among participation, perceived service quality, satisfaction, and customer retention. Both customers and service providers participated in the study. Ennew and Binks (1999) suggest the concept of participation in general can be divided into three dimensions: information sharing, responsible behaviour, and interpersonal interaction. In a study of the impact of customer participation on customer satisfaction and employee performance in the process of value co-creation, Chan et al. (2010) divide the customer participation dimension into information sharing, providing suggestions, and participating in decision-making. Third, the resource input of customer participation is combined with customer participation behaviour to outline the dimensions of customer participation. For example, Hsieh, Yen, and Chin (2004) suggest customers participate in the process of service delivery in four ways: time,

effort, information supply, and co-manufacturing.

Overall, customer participation has become an important factor in market dynamics. Customers are changing from passive receivers to active creators (Prahalad and Ramaswamy, 2000), and have been carefully analysed by mainstream research on full customer participation. However, previous studies have pointed out that there are two sides to customer participation. On one hand, existing research is based on information provision, while on the other hand, it is from the perspective of information provision to customer participation. From the standpoints of relationship networks and knowledge transfer, this study explores whether customer participation produces various beneficial effects for enterprises, such as giving customers a better understanding of demand or market information or suppliers' need to master technical information (Bonner and Walker, 2004; Chang et al., 2009; Fang et al., 2008). Customer participation may provide external demand information for enterprises and promote product innovation (Bharadwaj al., 2012). Customer enterprise participation promotes relationship embeddedness and increases proprietary investment in relationships (Athaide and Klink, 2009; Athaide and Stump, 2003; Yli-Renko et al., 2008). Customer participation is also a social activity that promotes the transfer of tacit knowledge and overcomes the negative effect of causal ambiguity (Madhavan and Grover, 1998; Potter and Lawson, 2013). Finally, customer involvement enables suppliers to better understand customer personalized needs so they can effectively meet customer’s customized product needs (Verma et al., 2012; Smets et al., 2013).

On the contrary, some studies have pointed out that customer involvement may produce various negative effects; for example, enterprises may leak sensitive internal information and generate higher risks through in-depth cooperation with customers (Cheung et al., 2011). Customer involvement generates coordination problems and hinders the speed of product entrance to the market (Fang, 2008; Sobrero and Roberts, 2001); therefore, it is particularly urgent and necessary for enterprises to manage customer participation. However, the existing research neglects coordination and management of customer participation.

Table 3.1 Theoretical Research of Enterprise Customer Participation:

Author	Independent variable	Mediating Variable or Moderating Variable	Dependent variable	Research Content
Ramani & Kunar (2008)	(1) Customer concept (2) Interaction response capacity (3) Customer empowerment, (4) Customer value management	Mediating Variable: Customer relationship performance Moderating Variable: Customer contact and competitive intensity	Customer-based profit orientation	Customer orientation is beneficial for forming relationships and profit performance. Customer contact has a significant moderating effect on the relationship between interaction orientation and profit performance, but competition intensity has no moderating effect on the relationship between interaction orientation and relationship performance.
Koufteros, Vonderembse, and Jayaram (2005)	(1) Customer integration, (2) Supplier product integration (3) Supplier process integration	Moderating Variables: Uncertainty Ambiguity Strategic platform	Product innovation performance Quality performance Profit	Customer integration and supplier product integration promote product innovation, but have nothing to do with product quality. The empirical research shows that only ambiguity positively regulates the relationship between customer integration and new product innovation, but neither uncertainty nor strategic platforms play a moderating role.

Author	Independent variable	Mediating Variable or Moderating Variable	Dependent variable	Research Content
Homburg, Wieseke, Bornemann (2009)	Employee characteristics (customer orientation, cognitive empathy)	Mediating Variable: Knowledge of customer needs Moderating Variable: training in customer-oriented interactive behaviour and thinking in others' position.	Customer satisfaction and customer desire	Customer orientation promotes employee understanding of customer demand, which in turn promotes customer satisfaction and customer purchase desire. Training for employee customer-oriented interactive behaviour positively regulates the relationship between customer orientation, customer satisfaction, and purchase desire.
Joshi and Sharma (2004)	Organizational behaviour (resource/cross-functional team/dominant product/project characteristics)	Mediating Variable: Customer knowledge Moderating Variable: Integration of conflict resolution approaches and dominance of product project membership goals	Product performance	The authors develop a nomological network wherein they identify (1) the organizational actions that enable effective implementation of the customer knowledge development process, (2) the characteristics of new product development projects that moderate the effects of these actions, and (3) the outcomes that are generated by the process.

Author	Independent variable	Mediating Variable or Moderating Variable	Dependent variable	Research Content
Yli-Renko, Janakiraman (2008)	(1) Customer portfolio size (2) Income concentration (3) Relationship embedding	Moderating Variables: Customer portfolio size Income concentration	The number of new products developed	The results indicate the social interaction and network ties dimensions of social capital are indeed associated with greater knowledge acquisition, but the relationship quality dimension is negatively associated with knowledge acquisition.
Fang, Palmatier and Evans (2008)	Customer participation	Mediating Variables: Value co-creation drivers Value scale and customer share determinants Moderating Variable: Normative participation	The value customers get from new products	Customer participation promotes the new product development process and enterprise investment in new products, thus promoting formation and customer acquisition of new product value. Participation standardization positively regulates the relationship between segment participation and the drivers of new product development (new product development process and enterprise investment in new products).

Author	Independent variable	Mediating Variable or Moderating Variable	Dependent variable	Research Content
Fang (2008)	Customer participation (information provision and co-production)	Moderating Variable: Network relationship process complexity and process dependence of downstream customers	Product innovation and speed	The author differentiates two dimensions of customer participation: customer participation as an information resource (CPI) and customer participation as a co-developer (CPC) and explores the moderating effects of downstream customer network connectivity and new product development process interdependence and complexity matched.
Carson, Wu, and Moore (2012)	Top management team involvement, front end involvement (depth and breadth), creativity	Moderating Variables: Ambiguity Volatility	New product performance	Describes how ambiguity and volatility place different and conflicting demands on new product development processes. Suggests more ambiguous environments favour slower development processes based on larger data samples and interpretations whereas more volatile environments favour faster and more flexible development processes.

Author	Independent variable	Mediating Variable or Moderating Variable	Dependent variable	Research Content
Smets, Langerak, and Rijsdijk (2013)	Formal control (process and result control)	Mediating Variable: Customer participation (depth, information sharing)	Product performance (innovation of new products)	Studies show the customer's use of formal control significantly increases the level of customer participation in customized product development (CPD), and customer participation positively impacts new product performance. The customer use process and/or output control helps the customer believe more in the pursuit of CPD goals and successful product customization, thereby encouraging the customer to participate more actively in CPD.
Potter and Lawson (2013)	Exploring the effect of supplier involvement practices (supplier involvement orientation, relationship commitment, and involvement depth)	Causal ambiguity	Inter-organizational New Product Development (NPD) teams, and the subsequent impact on time to competitor imitation, new product advantage, and project performance.	Enterprise participation can weaken the causal ambiguity, which on the one hand enhances the difficulty of imitation, and on the other hand weakens the advantages of new products and enterprise project performance.

2. Dimensions of Customer Participation in Digital Transition

Customer participation in the digital transformation dimension of this research was developed based on previous research. At the same time, customer participation in digital transformation is placed in the context of the process of jointly creating value, adding some characteristics of customer participation value creation and increasing the reflection of customers. The new features of customer participation in digital transformation are divided into the following four dimensions: information and knowledge exchange, business collaboration, co-leading, and cost effectiveness.

1） Information and Knowledge Exchange

Information and knowledge exchange refer to the importance of customers providing pertinent information to co-create value and transfers the fundamental premise of 'operant resources' within the service dominant logic into concrete contributions (Vargo and Lusch, 2004, 2008). Other scholars emphasize the need for information management (Prahalad and Ramaswamy, 2004), noting the importance of finding a balance between information received and given between customer and provider (e.g. Nordin and Kowalkowski, 2010; Vargo and Lusch, 2004). Our variable focuses instead on active or passive information and knowledge exchange through the customer.

The exchange of information and knowledge between the customer and service provider is to ensure the exchange of services. In value co-creation activities, companies and customers need to maintain two-way, continuous, and dynamic information and knowledge exchange. Jaworski, Macinnis, and Kohli (2002) believe co-creation requires companies and customers to have an open dialogue in which they interact with each other; understanding each other's needs and abilities is conducive to value co-creation. Prahalad and Ramaswamy (2000) also indicate that 'dialogue' is one of the basic elements for achieving value creation between consumers and businesses. The exchange of information and knowledge emphasizes 'reciprocity', and enterprises and customers realize mutual understanding and learning through the two-way exchange of information and knowledge. Based on this, information and knowledge exchange is constructed as one of the dimensions of

customer participation, which means customers provide information such as service experience information and knowledge to service providers, and service providers provide service information and knowledge to customers (Yi and Gong 2013). This two-way exchange of information and knowledge reflects the equality and interactivity of customer and service exchange.

2） Business Collaboration

Business collaboration behaviour is a customer engagement dimension recognized by most scholars (Auh et al., 2007; Hsieh et al., 2004). Business cooperation behaviour is cooperation between the customer and service provider in the process of service production and delivery to obtain good service effect. The service characteristics determine that part of the content of service production and delivery must be completed by the customer and service provider. As co-creators of co-production and service value, the customer and service provider invest their own resources and share in the interaction. In completing value creation, customer cooperation behaviour is directly related to the efficiency of value creation and service quality.

3） Co-Leading

Co-leading occurs in the process of service production and delivery. The customer and service provider jointly decide the content and method of service provision, and reflect the new characteristics of customer participation from the perspective of jointly creating value. James (2001) believes customers are responsible for decision-making about service provision when participating in service provision. One characteristic of co-creating value is ‘common leadership’. Jaworski et al. (2002) argue that companies and customers work together to determine the areas of participation in the production and delivery of services. Athaide and Klink (2009) indicate that in co-production, customers are given more rights to co-produce with the company, and the boundaries between customers and businesses become blurred. Due to the change in customer roles in creating value, they are no longer passively involved in the process of enterprise value production. The initiative of customer participation is reflected in the choice and decision of a ‘digital

transformation plan' between customers and enterprises in service production and delivery. On the other hand, under value co-creation, enterprises gradually realize that customers hope to obtain greater choice, control, and decision-making power in service production and delivery, as well as psychological satisfaction, while obtaining service results that meet their preferences. Enterprises and service providers consciously and gradually hand over content that should be decided by the enterprise to customer decision-making, giving the customer greater rights. For example, enterprises may adopt the 'authorization strategy', giving consumers corresponding rights in the product or service production process to make them feel a sense of self-control, thus providing psychological satisfaction. The customer's increasing enthusiasm is combined with the company's authorization strategy, and the customer will show initiative and control over the process through participation behaviour. Therefore, in the context of jointly creating value, co-leading becomes an important behavioural aspect of participation.

4） Cost Effectiveness

In the process of digital transformation, enterprise users and platform users pay the most attention to cost-effectiveness. Digital transformation provides value by reducing enterprise costs, improving service efficiency, and effectively managing and controlling risks such as system and market risks, including in various internal enterprises. On the other hand, digital transformation can also change the way companies create value for their customers and provide new ways of delivering services to their customers. Cooper and Slagmulder (2004) state cost control is a structured way to coordinate enterprise activities in the supplier network to reduce the network's total cost.

3.2.3 Definition of the Dimension of Customer Value Co-Creation

1. Customer value from the perspective of value co-creation

In this study, co-creating customer value is an important variable that follows the relationship between customer participation in digital transformation, and

environmental, economic, and social performance in company performance. The basic assumption of traditional customer value is that value is created by the enterprise. The customer perceives value through cognition, emotion, and multi-sensory stimulation. In value generation, after the process of enterprise creation and customer perception, the enterprise is the creator of value, while the customer is the recipient. From the perspective of jointly creating value, just as companies and consumers jointly develop new products, forming customer value is also the result of mutual investment and interaction between the company and the customer. Customer value is neither the result of unilateral creation by the enterprise nor by the customer. The decision is made as a result of mutual creation. Overby and Lee (2006) develop the concept of 'extended value', arguing that value can be thought of as perceived value in the use of products and services, or as value created in the process of consumption. In fact, co-creating customer value is the unification of Oliver's two values. Auh et al. (2007) argue that co-production is an important way to increase customers' perceived value. This is because in co-production and value co-creation, value is created by both customers and companies, rather than just the company.

The customer's perception of value and the value creation process are mutually preconditions and conditions. The two are not linear, but a closed circle. Value is determined by phenomena and personality. For example, users of Xiaomi are not passive recipients of value. They create unique experiences and values for themselves in their own social situations and actively perceive that Xiaomi fans have become part of value formation. Creators can influence and even determine the time, place, and manner of value creation (Kuo et al., 2017). It can be seen that co-creating customer value emphasizes the process of forming customer value, rather than the value already generated. Perceived processes emphasize the role of customers in creating customer value, rather than unilaterally emphasizing the creation of customer value.

2. Dimension of customer value co-creation in digital transformation

As summarized in the section 2.2, the customer value dimension has provided

rich research results, but there is little research on co-creation of customer value. There are two main ways to measure customer value. The first is a comparison between customer income and loss. This measure is based on the income and loss that can be measured or perceived by customers and compared. However, this method is not applicable to the value of digitization but to services in the transformation process. Gains and losses for the experience of enterprise users and platform users are harder to measure and more difficult to compare. The second approach is to study the value classification obtained by enterprise and platform users in the service use process to measure the value customers receive from the service process. These values are based on the knowledge, experience, and perception of enterprise and platform users. The division of customer value in this study follows the second line of thinking.

In fact, enterprise users and platform users perform two basic processes when using services: information processing and experience (Payne et al., 2008). The information processing process is a rational cognitive process. Customers can obtain enough knowledge through information processing to evaluate the advantages and disadvantages of products or services. This kind of cognition is a rational process, and the resulting behaviour is directed and purpose-oriented. The experience process emphasizes the non-utility aspects of consumption emotions, situations, and symbols (Holbrook and Hirschman, 1982). The customer's value is not the result of consumption, but the process and experience of consumption. Holbrook (1998) defines customer value as an 'interactive, relative preference experience' that emphasizes the value of the consumer to the extreme. Experience-led behaviour is not necessarily governed by the purpose of the behaviour, but by the result of the experience. Therefore, it can be considered that there are two sources of customer value: the value from cognition and the value from experience. These two sources of value are united in the process of jointly creating value, as Cova and Salle (2008) put it, 'by co-creating functions and experiences, consumers also construct value for themselves'. Based on the two sources of the value of cognition and experience, this study uses a combination of literature and theory-driven in-depth interviews to

further explore co-creation of customer value.

From the perspective of the concept, co-creation of customer value falls under the larger concept of customer value. What needs to be determined is the customer value created by the customer and the enterprise. In this study, 10 enterprise customers with more than five years of digital transformation experience and senior executives in the company were selected for in-depth interviews. The method adopted was semi-structured interviews, with interview questions prepared in advance and the receipt of timely feedback. The questions were adjusted and questions were asked to dig deeper into the customer value created by the user during the participation process. For a summary of the participants in the in-depth interview, see table 3.2.

Table 3.2 Summary of in-depth interview participants

Position	Number of people	Gender	Aga	Education level	Industry work experience (in years)
Traditional business executives	2	Male	38	Bachelor	6
		Female	36	Master	7
Internet business executives	2	Male	34	Master	5
		Male	40	Bachelor	9
Traditional enterprise project manager	3	Male	35	Bachelor	6
		Female	28	Bachelor	6
		Male	32	Master	7
Internet Enterprise Project Manager	1	Male	37	Master	7
IT industry technical expert	2	Male	45	Doctorate	10
		Female	40	Doctorate	10

The results of the one-on-one semi-structured in-depth interviews are summarized to provide a comprehensive understanding of the functional, social,

intrinsic, and economic aspects of user engagement and service provider interaction value. Through a detailed understanding of the interview questions and constant questioning, we identified values that customers pay more attention to in the process of digital transformation. The contents of the in-depth interviews are shown in Table 3.3.

Table 3.3 Contents of In-depth Interviews

Interview content	Rationale of the problem	Summary of answer
Q1: Why is the company going digital? What can digital transformation bring to the enterprise?	Seeking to understand the background of digital transformation	Performance pressure Client needs Customer interaction to better understand customers Transformation of business models The digital economy is a big trend in the future, which can better grasp customer needs. Help customers succeed and improve customer performance Improve corporate innovation Change the relationships with customers and partners
Q2: How much do you know about the dimensions of digital transformation?	Seeking to understand the content of digital transformation	Information technology maturity The extent of application of IT technology Business cooperation and customer relationship improvement Sharing of information and expertise Building a commercial network system Digital leadership Cost-effective consideration Business model and business transformation
Q3: How do companies develop and implement their digital business transformation strategies?	Seek a strategic understanding of digital transformation and explore its content and processes	Leaders need to understand IT and business models to develop relevant implementation plans and steps Multi-party cooperation and win-win Full participation, allowing suppliers and customers to participate in the transformation of business and IT systems Create value with customers and

		partners Value transfer Value sharing Need to have performance indicators to ensure the success of the transformation

Through the three questions used in the in-depth interviews, the value actually obtained by customers in participation and interaction is obtained from both direct and indirect aspects. For the dimensions of customer value obtained in participation and the dimensions of customer value theory, refer to Babin et al. (1994), Chang et al. (2009), Sheth et al. (1991), and Rintamaki et al. (2006). The division of the value dimension and Chan's (2010) division of value co-creation with customers propose three dimensions that jointly create customer value: economic value, innovation value, and relationship value.

1） Economic Value

Economic value refers to the increase in service utility and cost reduction obtained by customers through participation behaviour; that is, customer participation allows customers to obtain higher quality, more personalized and professional services, reduce acquisition costs (Harrison, 2001), and reduce customer perceived costs. Economic value is inextricably and directly related to customer participation behaviour. Economic value is not a direct measure of the function and utility of the service itself to the customer, because the product or service should provide the customer with basic functions regardless of whether the customer participates. Economic value here measures the impact of customer participation on achieving service utility and the efficiency of implementation, rather than a categorical measurement of the specific utility value of the service.

2） Innovation Value

Value creation in the digital economy is particularly challenging, given the fact that rivals may easily replicate or substitute firms' resources or offerings (Amit and Zott, 2001). Driven by the Internet and technology advancement, many organisations have shifted their mind-set from simply being providers of products and services to

becoming facilitators of open innovation and collaboration for new ideas as well as innovation in the digital economy (Chesbrough, 2003; Fleming and Waguespack, 2005; Rayna and Striukova, 2015).

Within the marketing literature, several studies have found that customers as stakeholders have increasingly become co-creators of value (Vargo and Lusch, 2004) instead of simply being passive end recipients of service provision (Prahalad and Ramaswamy, 2004). They are also increasingly using social media to discuss ideas about products, services, or processes (Aral et al., 2013; Di Gangi et al., 2010), generating a wealth of user-generated contents in the process (Benthaus et al., 2016; Dong and Wu, 2015). This implies value from digital innovation is increasingly created through social media interactions between stakeholders within ecosystems. This view of value creation suggests dynamic interactions between firms and stakeholders (Tantalo and Priem, 2016; Wieland et al., 2017) rather than the firm simply creating value.

3） Relationship Value

Relationship value refers to the good interpersonal relationship formed by the interaction between the service provider and other consumers in co-creating customer value and the value formed by constructing a new social network. The interaction connects consumers to service providers (Ulaga and Eggert, 2010), and consumers to consumers, who communicate, cooperate, and help each other in interaction, forming a new network based on social interaction and social exchange. This process creates consumer-aware relationship benefits and values, which are based on the interaction. The more frequent the interaction between the two parties, the more input is allowed, the longer the relationship is maintained, and the greater the value of the relationship for the two parties.

3.2.4 Definition of the Dimension of Firm Performance

Firm performance is a measure of how well a firm is able to meet its goals and objectives compared to its primary competitors (Cao and Zhang 2011). In general, superior firm performance is characterized by profitability, growth, and market value (Cho and Pucik, 2005). As expected, much scholarly attention has been directed to

understanding the causal structure of firm performance and explaining the variations in performance among competing businesses (March and Sutton, 1997).

1） Environmental Performance

Environmental performance refers to the use of automation and how it affects productivity and service efficiency. When an enterprise improves its original operational processes, it needs to demonstrate that operational process improvements deliver the desired results. This means companies need to integrate many new metrics into their operational processes so that they can discover which operations are successful and reduce or terminate those that are not optimized.

Digital transformation requires companies to rethink how to do business, much like creating a start-up. Businesses should avoid thinking that what they are doing is what they should do in the future. Companies need to look at technologies like the IoT to see how these devices and the data they produce change the way business is done. Companies must also consider optimizing all business processes. Alexopoulos et al. (2011) find that improved environmental performance is a potential source of competitive advantage, leading to more efficient processes, improvements in productivity, and lower costs of compliance.

2） Economic Performance

Economic performance refers to the direct benefits and profits brought about by digital transformation. Digital transformation will affect many factors (Melville and Gurbaxani, 2004). Financial impact is the main goal of most enterprises when implementing digital transformation, but each enterprise has many different financial values for digital transformation. In some cases, these values may be indirect. For example, income improvement can be achieved by changing the way business is conducted; digital marketing may be an important part of this effort. Increased revenue can be achieved by increasing penetration into existing customers. It is also possible to increase market share through digital marketing.

As another example, profit can be increased by reducing costs or reducing investment in product components. Reducing inventory and shortening lead times results in reducing the financial investment in inventory. Costs can also be reduced by changing the working environment, improving performance, improving safety, and

reducing insurance costs. Improving the utilization of IoT devices and collecting information from these devices and sensors can help optimize business operations.

3） Social Performance

Digital transformation can improve social performance, leading to improving the relationship between enterprises and customers (Klemm, 2018). Digital transformation can improve customer experiences, reduce customer experience time, and increase customer experience satisfaction, including customers' ability to navigate the enterprise ecosystem. When customers are browsing corporate contact centres and websites, companies need to constantly improve their customer interactions and links, and new measurement methods are needed to evaluate customer experience satisfaction.

Customer behaviour changes depending on geography, age, education level, and past experience. The social performance of digital transformation can also ensure customer loyalty, provide a satisfying experience, and build the reputation of the company's own brand.

The goal of any customer engagement should not be just to get customers to buy products or services. Companies also want customers to ask for more information and seek advice, not just solve problems. Companies can observe whether the contact time at the contact centre is increasing, and at the same time, whether the interaction at the corporate contact centre is creating value.

3.3 Theoretical Hypotheses Development

3.3.1 The Relationship between Customer Participation in Digital Transformation and Value Co-Creation

As previously discussed, the process of including customers in value co-creation requires that they invest their own resources into the enterprise's value co-creation system. The enterprise provides an interactive platform for customers and forms a common goal of cooperation. Under this common goal, customers and enterprises co-create value through interaction. Value co-creation is the core concept of service

dominant logic, and is also the basic premise of customer participation.

The value created by customers as they participate will enhance their satisfaction. Cova and Dalli (2009) indicate that the deeper the production and delivery of customer engagement services, the more value and satisfaction customers perceive in the process. Harris et al. (2001) also suggest customer participation in research is an important way to enhance customer perceived value. Gentile et al. (2007) argue that customer experience and value perception come from the interaction between customers and products, companies, or organizations, and interaction indicates customers are rational, emotional, sensory, and physiological. Participation occurs at varying degrees of state of mind, and thus customer involvement and interaction with the business has an important impact on creating customer value. With increasing and deeper participation by customers, interaction between customers and service providers occurs more frequently. Customers experience the value creation process between themselves and enterprises from the two sources of cognition and experience. The process of motivating consumers to perceive value creation together with the most direct personal experience means customer participation has a direct impact on the co-creation of customer value.

Studies on motivating customer participation have shown that customers only participate in a process if they benefit from participation behaviour (Ennew and Binks, 1999). Research on cooperation also finds that before cooperating, all parties involved must measure and compare the economic and psychological benefits of cooperation, including transaction costs and risks (Smith, Carroll, and Ashford, 1995). Elsharnouby and Mahrous (2015) argue that in the process of service value co-creation, the purpose of high customer participation behaviour is to obtain higher perceived value. Customer participation affects the result of service creation. Therefore, the customer’s motive in the participation process is pursuit of value, hoping to benefit from participation behaviour, and gain as much as possible in the participation process. From the perspective of co-creation, the customer's pursuit of value is realized through the co-creation behaviour of both the enterprise and the

consumer. The customer can influence and promote co-creation of customer value through direct participation. On the whole, there is a positive relationship between customer participation and customer creation of value. The next step is to derive the hypotheses based on the perspective of the specific dimension of creating customer value.

1. Customer participation in digital transformation and economic value

When customers participate in digital transformation, they are actively involved in ensuring the quality of digital services, increasing the likelihood of successful service, and at the same time ensuring the realization of their own consumption goals. The digital transformation of customer participation in the service process can reduce the financial and performance risks brought about by the failure of digital services. Customer information sharing and cooperation behaviours also enable customers to directly input their own needs into the digital service system and make more choices, while working with service providers to create a higher level of customized services. Kellogg et al. (1997) argue that customer engagement in the service process can be seen as the customer's quality assurance behaviour to guarantee expected service outcomes. Bowden (2009) points out that customer engagement helps customers achieve multiple benefits, such as reduced risk, psychological satisfaction, and economic benefits; of these, perceived economic benefits are a major factor in determining customer participation. Etgar (2008) believes consumer participation in co-production is driven by economic interests through controlled production. In the process, customers can achieve cost savings and a reduction in perceived risk. Chan (2010) suggests customer engagement creates economic value in three ways: better service quality, customized service, and increased control. Parker and Alstyne (2000) indicate customers gain economic benefits such as price discounts, control over the service process, time-saving, and more diverse, personalized services by participating in the production and delivery of services. Therefore, the following hypothesis is proposed:

Hypothesis 1: Customer participation in digital transformation has a significantly positive impact on co-creation of economic value.

Hypothesis 1a: Information and knowledge exchange has a significantly positive impact on co-creation of economic value.

Hypothesis 1b: Business collaboration has a significantly positive impact on co-creation of economic value.

Hypothesis 1c: Co-leading has a significantly positive impact on co-creation of economic value.

Hypothesis 1d: Cost effectiveness has a significantly positive impact on co-creation of economic value.

2. Customer participation in digital transformation and innovation value

Under value co-creation, customers, as a manipulative resource, hope to acquire knowledge through participation and interaction. Payne (2008) indicates the process of creating value is a process of learning and innovating between the company and a customer. Customers participate in all aspects of service production and delivery through dialogue with service providers. This form of dialogue should be seen as an interactive process of mutual learning and innovation. On one hand, through cognitive experience in the process of value co-creation, customers acquire knowledge information exchange and experience, completing the learning process. They can then apply the knowledge acquired to value co-creation activities, creating and presenting new ideas for products and services. Customer innovation and value co-creation form a closed cycle, which impacts the future value creation behaviour of customers and service providers. On the other hand, enterprises obtain information and intellectual capital from customers in their interactive contact, prompting enterprises to engage in continuous development and improvement in the practice of creating opportunities and plans and executing them. Customer innovation and organizational innovation are integrated under the framework of value co-creation. Through innovative behaviour, they form two interdependent, interactive, and independent value creation systems. From the customer's point of view, his/her innovative behaviour and process is an important means of ensuring and enhancing collective value creation. The innovation process leads the customer participation value creation process into a continuous improvement process.

Etgar (2008) suggests that if consumers can acquire knowledge and skills in co-production to cope with new challenges and participate in product and service innovation, they will be more willing to participate in co-production. Hoyer (2010) thinks customer participation in the value co-creation process makes them eager to acquire knowledge about technology, products, or services, and gain the cognitive benefits of information and knowledge acquisition. Nambisan (2002) also points out in his research that customers can acquire new knowledge by participating in the service innovation process. Through their innovative needs or desire to know, they can apply their own inner ability to turn hidden fantasy into reality. This leads to the following hypothesis:

Hypothesis 2: Customer participation in digital transformation has a significantly positive impact on co-creation of innovation value.

Hypothesis 2a: Information and knowledge exchange has a significantly positive impact on co-creation of innovation value.

Hypothesis 2b: Business collaboration has a significantly positive impact on co-creation of innovation value.

Hypothesis 2c: Co-leading has a significantly positive impact on co-creation of innovation value

Hypothesis 2d: Cost effectiveness has a significantly positive impact on co-creation of innovation value.

3. Customer participation in digital transformation and relationship value

The relationship value in the process of digital transformation is the emotional relationship formed between the customer and service provider in the process of interaction. The theory of social exchange suggests that in social exchanges, people exchange not only the economic value of material, but also love, respect, approval, and emotion as the exchange of content in connecting business individuals. Ravald and Grönroos (1996) argue that when analysing the benefits of a product or service, relationship benefits should also be incorporated into customer value, stating that 'The perceived value of the customer is created and delivered as the relationship develops'. The relationship itself has an important impact on customer perceived

value, and customers pay attention to the relationship benefits formed by interactions with service providers. Price and Amould (1999) results show that in frequent service contact and interaction with service providers, customers and service providers conduct 'friend exchanges'; they become familiar with each other, creating intimacy between them. They establish a certain degree of business friendship, offering good interpersonal relationships and social support benefits to customers. Business friendship is often accompanied by customer loyalty, commitment, positive word of mouth, and other customer behaviours. John (2003) research also shows customer involvement can provide customers with psychological and emotional pleasures, including opportunities for self-expression, attention, status, self-identification, social harmony and a sense of belonging.

In value co-creation, the frequent interaction between customers and service providers leads to a close relationship. Vargo and Lusch (2004) argue that service provision and value co-creation mean transactions are relational. In this kind of relationship transaction, customers and employees can create value through their interactions and relationships. Friendly, fun-filled relationships increase customer value, which in turn increases company income and provides other benefits. Claycomb et al. (2001) argue that customer engagement promotes communication and relationship building between customers and employees. Research on healthcare by Foreyt and Poston (1998) and Street et al. (2003) shows gradual integration of patient and doctor values and preferences will improve the level of care, promote formation of better understanding, produce sincere and friendly interaction, and ultimately create value for the relationship. When customers and employees interact, each party creates value for the relationship (Fleming et al., 2005). Etgar (2008) studies consumer participation in co-production, and suggests co-production provides a platform for consumers and their partners to communicate and dialogue; participation in the behavioural network creates social connection value when participants have the same interests and hobbies. Sharing ideas, the joy of joint action, and joint production enable consumers to participate in actual and virtual co-production communication and social networks, and form good social

interactions and social relationships with value co-creators. Therefore, the following hypothesis is proposed:

Hypothesis 3: Customer participation in digital transformation has a significantly positive impact on co-creation of relationship value.

Hypothesis 3a: Information and knowledge exchange has a significantly positive impact on co-creation of relationship value.

Hypothesis 3b: Business collaboration has a significantly positive impact on co-creation of relationship value.

Hypothesis 3c: Co-leading has a significantly positive impact on co-creation of relationship value.

Hypothesis 3d: Cost effectiveness has a significantly positive impact on co-creation of relationship value.

3.3.2 The Relationship between Value Co-Creation and Firm Performance

1） Economic Value and Firm Performance

In the process of digital transformation, customer participation in the co-creating economic value can effectively improve the company's performance and introduce it to new business and service models. These changes can affect the company's environmental, economic, and relationship benefits. This leads to the following hypothesis:

Hypothesis 4: Economic value has a significantly positive impact on firm performance.

Hypothesis 4a: Economic value has a significantly positive impact on environmental performance.

Hypothesis 4b: Economic value has a significantly positive impact on economic performance.

Hypothesis 4c: Economic value has a significantly positive impact on social

performance.

2） Innovation Value and Firm Performance

In the process of digital transformation, customer participation in the co-creating innovation value can effectively improve the company's performance and introduce it to new business and service models These changes can impact the company's environmental, economic, and relationship benefits, suggesting the following hypothesis:

Hypothesis 5: Innovation value has a significantly positive impact on firm performance.

Hypothesis 5a: Innovation value has a significantly positive impact on environmental performance.

Hypothesis 5b: Innovation value has a significantly positive impact on economic performance

Hypothesis 5c: Innovation value has a significantly positive impact on social performance.

3） Relationship Value and Firm Performance

In the process of digital transformation, customer participation in co-creating economic value can effectively improve the company's performance, and introduce it to new business and service models. These alterations can change the company's environmental, economic, and relationship benefits. Therefore, the following hypothesis is proposed:

Hypothesis 6: Relationship value has a significantly positive impact on firm performance.

Hypothesis 6a: Relationship value has a significantly positive impact on environmental performance.

Hypothesis 6b: Relationship value has a significantly positive impact on economic performance.

Hypothesis 6c: Relationship value has a significantly positive impact on social performance.

3.3.3 The Relationship between Digital Transformation Maturity and Value Co-Creation and Firm Performance

Digital maturity is no longer a new concept in digital transformation. It occurs in the interaction between employees and customers and is often the key component in service exchange. Gottschalk (2009) develops a model of maturity levels for interoperability in digital government. The model includes five levels that can be applied by public organizations to identify their current level of maturity and future directions for improved interoperability. Mettler and Pinto (2018) find that although there are different ways to influence the perceived digital maturity of a hospital, the most promising way is to invest in hardware and software. They show investments in personnel development or enhancements in operations and maintenance services had no significant relationship with digital maturity. Digital maturity is an organizational asset that needs to be maintained and nurtured over time.

Aleem et al. (2016) present a digital game maturity model to evaluate the current development methodology in an organization. The framework of this model consists of assessment questionnaires, a performance scale, and a rating method. The main goal of the questionnaires is to collect information about current processes and practices. In general, this research contributes to formulating a comprehensive and unified strategy for game development of maturity evaluation. Two case studies were conducted, and their assessment results reported, demonstrating the maturity level of current development practices in two organizations. In this study, we add digital transformation maturity as an important interaction variable and include it in the theoretical model. Therefore, the following hypothesis is proposed:

Hypothesis 7: Digital transformation maturity has a significant moderating effect on the influence of value co-creation on firm performance.

Hypothesis 7a: Digital transformation maturity has a significant moderating effect on the influence of value co-creation on environmental performance.

Hypothesis 7b: Digital transformation maturity has a significant moderating

effect on the influence of value co-creation on economic performance.

Hypothesis 7c: Digital transformation maturity has a significant moderating effect on the influence of value co-creation on social performance.

3.3.4 The Relationship between Customer Participation in Digital Transformation and Value Co-Creation and Firm Performance

Digital transformation is a new way of thinking and doing things. A key characteristic of digital transformation is that it often changes the roles of providers, co-producers, and service customers and alters their patterns of interaction. Different organizations have different perspectives on the opportunities created by ICTs, but all are looking to improve efficiency and outcomes. This leads to the following hypothesis:

Hypothesis 8: Value co-creation has a mediating effect on the relationship between customer participation in digital transformation and firm performance.

Hypothesis 8a: Economic value has a mediating effect on the relationship between customer participation in digital transformation and firm performance.

Hypothesis 8b: Innovation value has a mediating effect on the relationship between customer participation in digital transformation and firm performance.

Hypothesis 8c: Relationship value has a mediating effect on the relationship between customer participation in digital transformation and firm performance.

3.4 Conclusion

Based on the theory of customer participation value co-creation, this chapter discusses the relevant dimensions of digital transformation, customer participation in value co-creation, and corporate performance; at the same time, according to these dimensions of analysis and discussion, it develops the theoretical assumptions, discusses how to effectively promote customer participation in value creation in the

process of digital transformation, and puts forward eight main hypotheses about the impact of customer participation in value creation on company performance.

Chapter 4 - Scale Development and Data Collection

To test the eight proposed hypotheses, this chapter first describes the sample selection, and then introduces the questionnaire measurements.

4.1 Selection of Research Industry and Sample Objects

4.1.1 Characteristics of Selected Industries

China's ICT industry was selected as the research object, with a focus on their traditional and internet enterprise customers. With the rapid development of technology, increasingly more customer companies emphasize a strategy of digital transformation. Introducing relevant software and digital management system platforms requires deep participation by customers. In China, ICT is a service provided to customers that is a combination and integration of IT (information technology) and CT (communications technology) services. The communications industry, electronic information industry, and Internet and media industry are all integrated within the scope of ICT. Fixed-line operators, such as China Telecom, provide one-stop ICT services for customers, including integration, outsourcing, professional knowledge, and software development services. In fact, ICT services not only provide enterprise customers with solutions for line construction and network architecture, but also reduce their burden in establishing applications, system upgrades, operation and maintenance, and security and reduce business operating costs, so they are affected by enterprise users.

The realistic basis of this research is that customers and enterprises co-create value. Therefore, in choosing the research industry, we must consider industries with characteristics of joint value creation. In fact, not every product is suitable for the joint formation of value models. Chan (2010) believes the characteristics of value co-creation are more obvious in professional services industries, such as medical care, financial services, and legal services. In these specialized service areas, customer participation is relatively high because it is necessary for them to actively participate

in the production and delivery of services. They can independently decide to use their own preferences to form services that meet their needs for individualization and individual satisfaction. The degree of service customization is also obvious. In addition, consumers and service providers in these industries demonstrate strong interactivity. Frequent contacts, timely information communication, and continuous communication between service providers and consumers are particularly important in professional services. There is a clear relationship of mutual trust and interdependence. The quality and effectiveness of services depend on the input and effort of all parties and are ultimately determined by the attitudes and actions of both parties. Thus, high level of participation, customization, frequency, trust, and interdependence are common features of the professional services industry (Auh, 2007).

Hubbert et al., (1995) divided the levels of customer participation in different services into low-, medium-, and high-level customer participation, and described the corresponding behaviours of customers at different participation levels. In a typical industry, customers with high participation levels participate by investing in various resources such as energy, time, emotion, commitment, information, and knowledge. Active participation behaviour results in personalized service, and customers and service providers are active in service production and consumption, interacting and jointly determining the service outcome. The characteristics of high-level customer participation are largely consistent with the characteristics of value co-creation; there are many commonalities between the two.

4.1.2 Determination of Research Industry and Sample Objects

In the current empirical research on value co-creation or co-production with consumers, the selected industries are largely concentrated in financial services, medical services, beauty salons, training, tourism, new product development, and software vending. Based on the industry characteristics of high levels of participation, customization, contact frequency, trust, and interdependence, customers in China's ICT industry were selected as the research objects. With the rapid development of technology, more customer companies emphasize the importance of an enterprise

digital transformation strategy. When customers introduce relevant software and digital management system platforms, they need strong customer participation. In China, ICT is a service provided to customers that is a combination and integration of IT (information technology) and CT (communication technology) services. The communications, electronic information, Internet, and media industries are all within the scope of ICT. Fixed-line operators such as China Telecom provide one-stop ICT services for customers, including integration, outsourcing, professional knowledge, and software development services. In fact, ICT services not only provide enterprise customers with solutions for line construction and network architecture, but also reduce the burden of establishing applications, system upgrades, operation, maintenance, and security and reduce business operating costs, so they are affected by enterprise users.

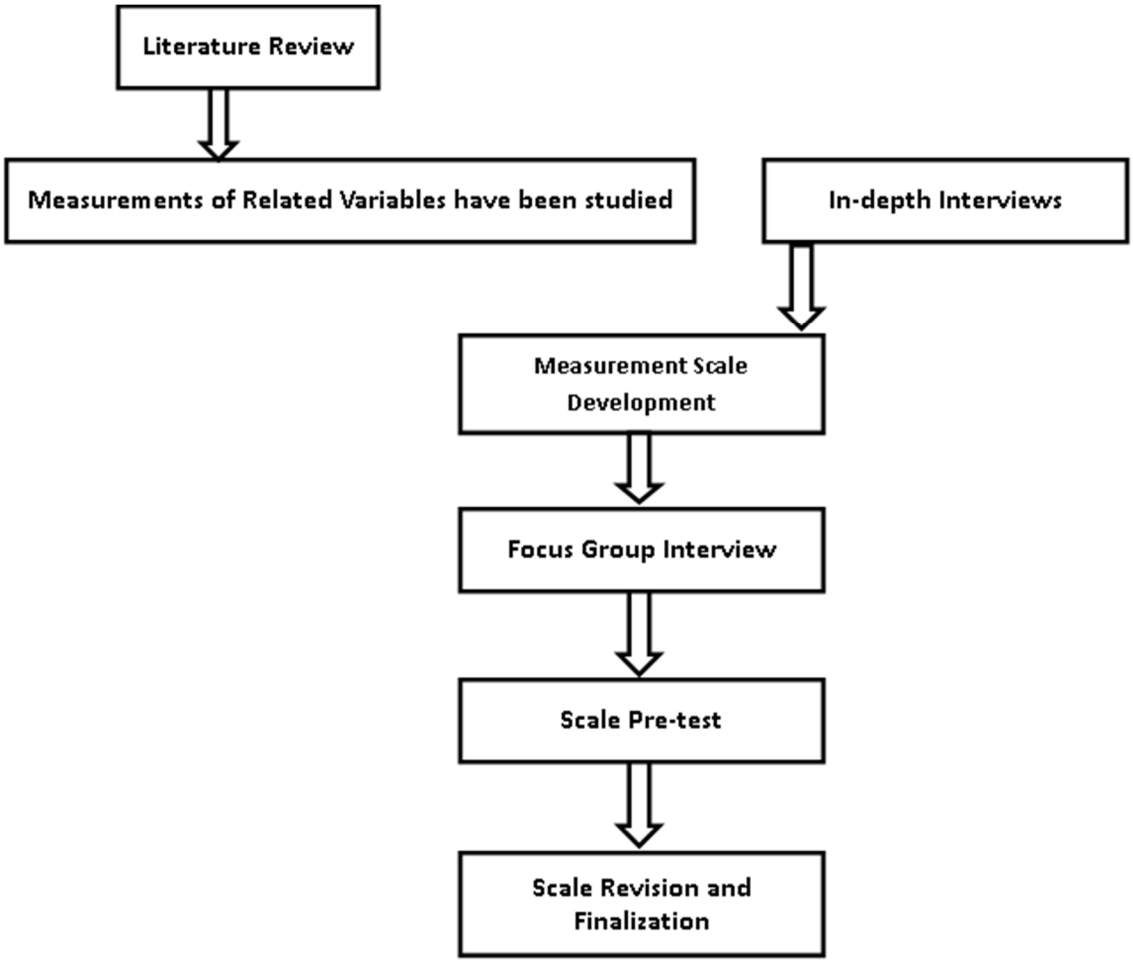
ICT is a promising sunrise industry, and its service customers are quite extensive, including media, finance and insurance, entertainment and leisure, retail trades, public utilities, healthcare, government affairs, education, high-end manufacturing, oil and gas, product manufacturing, chemical and pharmaceutical, agriculture, personal and local services, hotel services, construction, and other industries. For this study, we selected Fuzhou Ruijie Network Co., Ltd., Fujian Sanyuanda Communication Co., Ltd., Hangzhou Xinhua Third Co., Ltd., Zhejiang Fu Chunjiang Communication Group Co., Ltd., and Hangzhou Dongxin North Post Information Technology Co., Ltd., These companies divide their corporate customers into two types. The first type includes traditional enterprise customers who deliver services for basic product manufacturing, chemical and pharmaceutical manufacturing, and high-end manufacturing and hope to succeed in digital transformation to change existing business models and production efficiency. The second type includes Internet corporate customers who deliver services to media, finance and insurance, entertainment and leisure, retail trade, and personal and local services. These corporate customers already have Internet platforms and expect a digital transformation to improve existing business processes, innovation, and customer value. This study focuses on the participation and experience of these two types of customers in the process of digital transformation, and discusses the impact of digital transformation on corporate performance; thus, it has practical significance for

research on the entire ICT industry.

4.2 Design of Scale Measurement

The design of the scale in this study is based on a combination of theory and in-depth interviews. The research involves six main variables: customer participation in digital transformation, value co-creation, firm performance (environmental, economic, and social) and digital transformation maturity. Because measuring a single item cannot effectively capture the meaning of the variables, and it is difficult to meet the requirements of measurement reliability and validity, multi-measurement is used in every dimension of the six variables. The main research variables in this study all have existing scales. However, because of different research situations and emphases, the main purpose of scale development in this study is to combine the existing scales with this study's research context and refer to previous research results to design scales that are consistent with this study's context. Qualitative and quantitative analysis is conducted to ensure the reliability and validity of the scale and to ensure a more accurate measurement in this study's specific research situation. According to Churchill (1979) conclusion, the theoretical research framework construction is based on existing literature, which is the foundation for the measurement scale's design. For specific measurement items, we refer to scholars' existing research and then make appropriate adjustments according to the proposed research. Therefore, developing this study's scale follows the following steps. The dimensions and measurement items of the research variables are determined according to the existing literature and in-depth interviews. This ensures the measurement scale has a certain theoretical basis, and also ensures it is consistent with the actual research problem being studied. To ensure the validity of its content, the scale is finally determined using quantitative analysis, including reliability and validity analysis and exploratory factor analysis. The process of creating the scale is represented in figure 4.1.

Figure 4.1 Scale measurement development process



4.2.1 In-Depth Interviews

In-depth interviews are an important method used to form the scale. An in-depth interview is a one-on-one interview method. Interviewers prepare semi-structured interview outlines before the interview and have a thorough understanding of a specific issue. In the process of deepening the interview, they can gradually discover the respondents' behaviour and motivation. Although in-depth interviews are laborious, they can obtain real and reliable first-hand knowledge and reveal the essence behind the appearance. They are often used in exploratory qualitative research.

In addition to the existing literature, in-depth interviews are an important source for this study's measurement basis for customer participation in digital transformation and co-creation of customer value.

1. Interviewees

We selected the business executive/project manager/IT expert of five traditional corporate clients and the business executive/project executive manager /IT expert of five Internet corporate clients for in-depth interviews. The method adopted is semi-structured interviews; interview questions were prepared in advance, and timely adjusted, and questions were asked after receiving feedback. The in-depth interviews were conducted to understand the customer's actual participation in the digital transformation project experience and the company's results. The details of the in-depth interviewees can refer to chapter 3 on the table 3.2.

2. Interview Contents

The in-depth interview content is closely related to the research content, and the items are based on the problems involved in the research variables. Due to sufficient research on company performance and environmental, economic, and relationship performance, the measurement scale is also very mature. Thus, this different research situation does not require much change in the measurement of these three variables. The measurements are robust, so the in-depth interviews mainly focus on the three variables of customer participation in digital transformation, co-creation of customer value, and digital maturity. The specific content of the in-depth interviews is shown in table 4.1.

Table 4.1 Specific content of in-depth interviews

Research variable	Interview content
Customer participation in digital transformation	1. Please describe the specific process of implementing your digital transformation project.
	2. During the project implementation, what do you think are the activities in which you interacted with the digital transformation service provider?
	3. What impacts did the digital transformation service providers have on you?
	4. Did you have an impact on the digital transformation service provider's project? How did the project perform?
	5. What information and knowledge were exchanged between you and the digital transformation service provider?

	6. What do you need to do to ensure the best results after project implementation?
Value Co-Creation	1. Do you think the company's efficiency has improved after the digital transformation project? Is it helpful for the company's performance?
	2. What do you think you gained from the executing of the project or the interacting with the service provider? How do you feel? Why is that?
Digital Transformation Maturity	1. What do you think the service provider did to achieve the desired results of the project's implementation?
	2. Do you feel the company's digital maturity has improved? What are the specific aspects?

3. Interview Results

In the interviews, we conducted one-on-one in-depth conversations with the respondents around the research questions and interview outlines, and recorded the interview questions. Separate customers of five traditional enterprises (including two business executives and three project managers), three Internet enterprise customers (including two business executives and one project manager) and two IT industry technical experts were interviewed. The results of the interviews were organized and are summarized in table 4.2.

Table 4.2 Summary of in-depth interview results

Research variable	Summary of interview results
Customer participation in digital transformation	Inform the service provider about the company's current status and where the company can become more digitalized to improve its efficiency. The process and system have design problems, and the service provider will be notified as soon as possible. The service provider will inform the customer about the prohect's content, purpose, and requirements of the project. Training and verification will be first provided according to the service provider's requirements. Software testing and verification will guarantee performance.

	The service provider will try to arrange the project's scheduled goals and implementation time to ensure the project's effectiveness. The service provider will make the necessary adjustments to meet our individual needs according to our requirements. Service providers will help us consider how to reduce execution costs. The service provider will discuss with us the strategies, processes, and business objectives that are expected to be achieved after the project is implemented.
Value Co-Creation	Digital transformation can reduce our processes. Digital transformation is a trend; we already feel very efficient at work. When the project with the service provider is completed, there will be a sense of accomplishment. By participating in the project, we can solve some of the company’s existing problems. Establish a stable, continuous relationship with the service provider. Expected projects can bring new performance growth to the company and improve its efficiency. We got a lot of help from the service provider and the company’s strategy is clearer than before. Although the project is very difficult, the company's operating system is smoother than before.
Digital Transformation Maturity	I feel the company's digital transformation maturity has improved a lot. High digital transformation maturity can bring better environmental benefits and promote the company's economy. Digitalization improves the company's operations Digitalization can reduce many of our currently ineffective jobs. Compared with the previous company system, the current operation and management system is very large. This digital project is helpful to the company. I feel the company is more modern, the application of technology is more perfect, and the business connection is closer. The company's approval process, reporting process, and customer interaction process are on-line and can basically be operated without paper.

The in-depth interviews obtained first-hand information about customer participation in the project, the co-creation of customer value, and digital transformation maturity in the context of customer participation in digital transformation, which provided a basis for designing the measurement scale.

4.2.2 Preliminary Formation of Measurement Scale

A preliminary measurement scale was formed based on a large number of studies on measuring the research variables, combined with this study's in-depth interview results.

Bensaou and Anderson (1999) argue that the content validity of the variables in the theoretical model and their measurement can be ensured through expert interviews. The measurement scale was discussed with a doctoral tutor and two doctoral students, mainly regarding whether the measurement content of the scale was comprehensive: that is, whether the measurement item covers the entire content of the measured variable and its applicability. After modification, a preliminary scale was formed.

The overall scale consists of five parts. The first part obtains the basic respondents and company information, The second part includes customer participation in digital transformation measurement items. Respondents scored the measurement items one by one according to their experience and participation in the digital transformation project activities, and evaluated the participation behaviour of business users and platform users in value creation. The third part is comprised of value co-creation measurement items, which measure the customer value created by business and platform users and service providers. The fourth part includes digital transformation maturity measurement items, which evaluate the extent to which business users and platform users perceive service providers' influence on value co-creation. The fifth part is composed of firm performance measurement Items, which measure the impact of customer participation in digital transformation activities on company performance and environmental, economic,

and relationship benefits. The entire scale uses the Likert 7 point scale method, with 1 to 7 representing the seven semantic judgments of 'Strongly Disagree' to 'Strongly Agree'.

4.2.3 Pre-test

In order to ensure the investigation results of the scale, a pre-test was made before the formal investigation. The main purpose of the pre-test is to delete the measure affecting the reliability and validity of the scale by quantitative analysis of the scale to ensure the validity of the scale.

There are two main reasons for deleting measurement items. One indicator is the Cornbach's consistency coefficient **a**, and the Cronbach **a** coefficient indicates the internal consistency of the gauge measurements. In general, if there are more test items included in the scale, the higher the internal consistency coefficient a, the more the coefficient a will be smaller if one item is deleted. However, if an item is deleted, the coefficient a becomes larger, it indicates the behaviour or activity to be measured is not the same as the behaviour or activity to be measured by other test items of the scale. It may be considered to delete the item to improve the reliability of the measurement scales.

For reliability, another indicator is the Corrected Item Total Correlation (CITC). The Corrected Item Total Correlation indicates the degree of correlation between the test and other scale measures. According to Churchill (1979), if the Corrected Item Total Correlation is less than 0.5 (sometimes relaxed to 0.4) and the value increases after deletion, the test item should be deleted.

Churchill (1979) argues that before factor analysis, scale measurement should be refined to reduce the interference of unsuitable measures on factor analysis. In this study, the variation in Cronbach's **a** consistency coefficient and the CITC coefficient is used to refine each dimension of the variables.

4.2.3.1 Traditional Enterprise Customer Pre-Test

The pre-tested respondents were project managers/business executives/IT experts of traditional enterprise customers; 65 questionnaires were distributed. Of

those distributed, 57 questionnaires were retrieved, 50 of which were valid, resulting in an effective recovery rate of 76.9%.

1. Measurement of Customer Participation in Digital Transformation Items

Customer participation in digital transformation is a new multi-dimensional behaviour variable. Because of the different research situations and industries involved, there is no mature and unanimously accepted scale for customer participation in digital transformation. Claycomb et al. (2001) divided customer participation into three dimensions: attendance, information provision, and cooperative production, and developed nine item scales to measure customer participation. Jaakkola E and Taru Hakanen (2013) divide participants into three dimensions: actors, resources, and activities, and develop related measurement scales. Athaide and Zhang (2011) divide customer involvement in new product development into four dimensions: perceived customer knowledge, existing relationship history, product customization, and innovation discontinuity, and develop relevant test scales. Reinartz et al. (2018) adopt a value-creation perspective and analyse how digitization initiated the erosion of institutional retailing as the primary customer interface. They develop a framework that identifies five new sources of value creation and propose how these advances and transformations compete for customers.

Based on the measurement scales of Claycomb et al. (2001), Chan (2010), Jaakkola and Hakanen (2013), Athaide and Zhang (2011), and Reinartz, Wiegand, and Imschloss (2018), and the results of the in-depth interviews, customer participation in digital transformation is divided into the four dimensions of information and knowledge exchange, business collaboration, co-leading, and cost effectiveness, forming a preliminary measurement of customer participation in digital transformation. A reliability test of customer participation in digital transformation is carried out using predictive test data.

Table 4.3 Information and Knowledge Exchange (IKE) Reliability Analysis Summary

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
IKE1	0.823	0.824	0.916	0.879	0.756
IKE2	0.856	0.816	0.93		
IKE3	0.874	0.809	0.942		
IKE4	0.704	0.854	0.806		
IKE5(Deleted)	**0.304**	**0.926**	**0.405**		

It can be seen from table 4.3 shows the CITC value of IKE5 is 0.304, which is less than the critical value of 0.5, indicating the correlation between that item and other items is low; moreover, the factor loading of IKE5 is 0.405, which is lower than the critical value of 0.6. The Cronbach's alpha value if the IKE5 entry is removed increases to 0.926, indicating that if the IKE5 item is deleted, the overall information and knowledge exchange as measured by Cronbach's alpha will increase to 0.926, which is higher than the original value of 0.879. Based on the above analysis, we should consider deleting the test item IKE5.

Table 4.4 Information and Knowledge Exchange (IKE) Reliability Analysis Summary after Deleting Test Item IKE5

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
IKE1	0.874	0.887	0.937	0.926	0.807
IKE2	0.873	0.889	0.937		
IKE3	0.905	0.876	0.952		
IKE4	0.667	0.954	0.789		

Table 4.4 reports the summary of the reliability analysis results after deleting the IKE5 test item. After deleting IKE5, the Cronbach's alpha value increases from 0.879 to 0.926. Moreover, the KMO value also increases from 0.756 to 0.807, and the

factor loading of each test item is much higher than 0.6. Therefore, the IKE5 test item is deleted.

Table 4.5 Business Collaboration (BC) Reliability Analysis Summary

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
BC1	0.377	0.594	0.873	0.64	0.651
BC2	0.45	0.56	0.874		
BC3	0.618	0.478	0.807		
BC4(Deleted)	**0.342**	**0.611**	**0.089**		
BC5(Deleted)	**0.232**	**0.674**	**-0.033**		

Table 4.5 shows the CITC values of BC4 and BC5 are 0.342 and 0.232, respectively, both of which are less than the critical value of 0.5, indicating the correlation between those items and other items is low. The factor loadings of BC4 and BC5 are 0.089 and -0.033, which is lower than the critical value of 0.6.

Cronbach's alpha value if the BC5 item is deleted is 0.674, indicating if that test item is deleted, the entire business network as measured by Cronbach's alpha will increase to 0.674, which is higher than the original value of 0.64. Based on this analysis, we should consider deleting test items BC4 and BC5.

Table 4.6 Business Collaboration (BC) Reliability Analysis Summary after Deleting the Test Items

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
BC1	0.674	0.733	0.86	0.814	0.71
BC2	0.692	0.715	0.871		
BC3	0.627	0.782	0.829		

Table 4.6 summarizes the reliability analysis after deleting BC4 and BC5. The results show that after deleting BC4 and BC5, Cronbach's alpha increases from 0.64

to 0.814, and Cronbach's alpha value of deleting any other items is less than 0.814. Moreover, the KMO value increases from 0.651 to 0.71, and the factor loading of each test item is higher than 0.6. Therefore, BC4 and BC5 are deleted.

Table 4.7 Co-Leading (CL) Reliability Analysis Summary

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
CL1(Deleted)	**0.379**	**0.873**	**0.059**	0.843	0.748
CL2	0.646	0.813	0.451		
CL3	0.808	0.762	0.894		
CL4	0.781	0.772	0.896		
CL5	0.65	0.81	0.862		

Table 4.7 shows the CITC value of CL1 is 0.379, which is less than the critical value of 0.5, indicating the correlation between that item and other items is low. In addition, the factor loading of CL1 is 0.059, which is lower than the critical value of 0.6. Cronbach's alpha value if the CL1 entry is deleted is 0.873, indicating that if CL1 is deleted, the overall Cronbach's alpha for co-leading will increase to 0.873, which is higher than the original value of 0.843. Based on this analysis, we consider deleting test item CL1.

Table 4.8 Co-Leading (CL) Reliability Analysis Summary after Deleting the Test Item

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
CL2	0.564	0.895	0.912	0.873	0.778
CL3	0.863	0.779	0.722		
CL4	0.824	0.797	0.934		
CL5	0.683	0.855	0.82		

Table 4.8 summarizes the reliability analysis after deleting CL1. The results show that after CL1 is deleted, Cronbach's alpha increases from 0.843 to 0.873, and the KMO value also increases from 0.748 to 0.778. The factor loading is above 0.6.

Therefore, the CL1 test item is deleted.

Table 4.9 Cost Effectiveness (CE) Reliability Analysis Summary

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
CE1(Deleted)	**0.492**	**0.78**	**0.819**	0.794	0.583
CE2	0.659	0.726	0.921		
CE3	0.659	0.726	0.664		
CE4	0.628	0.737	0.304		
CE5(Deleted)	0.435	0.796	0.043		

As seen in table 4.9, the CITC values of CE1 and CE5 are 0.492 and 0.435, respectively; these are less than the critical value of 0.5, indicating the correlation between those items and other items is low. Cronbach's alpha value if CE5 is deleted is 0.796, indicating that if CE5 is deleted, cost effectiveness as measured by Cronbach's alpha will increase to 0.796, higher than the original 0.794. In addition, the factor loading of CE5 is 0.043, which is below the critical value of 0.6. Based on this analysis, we consider deleting test items CE1 and CE5.

Table 4.10 Cost Effectiveness (CE) Reliability Analysis Summary after Deleting the Test Items

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
CE2	0.635	0.734	0.842	0.799	0.673
CE3	0.726	0.635	0.893		
CE4	0.573	0.796	0.797		

Table 4.10 is a summary of the reliability analysis after deleting CE1 and CE5. After deleting these items, Cronbach's alpha increases from 0.794 to 0.799, and the Cronbach's alpha if any other items are deleted is less than 0.799. After deleting CE1 and CE5, the KMO value also increases from 0.583 to 0.673, and the factor loading of each test item is higher than 0.6. Therefore, CE1 and CE5 are deleted.

2. Measurement of Value Co-Creation items

This study divides jointly created customer value into three dimensions: economic, relationship, and innovation value. Each dimension is measured using previous research combined with the results of the in-depth interviews. The measurement of economic value mainly draws on Chan, Yim, and Lam's (2010) measurement of the co-creation of economic value. Measurement of relationship value mainly refers to the scales of Kollock (1999) and Wasko and Faraj (2000) and the value of innovation. Measurement of the new concept of shared value innovation and its building blocks is shown in the new concept of shared value, such as innovation in products, processes, services, business models, and organization. Management innovation also references De Silva, Howells, and Meyer (2018), Lokuge, Sedera, Grover, and Dongming (2019), Lages (2016), and Balka, Raasch, and Herstatt (2014).

Since the measurement items have different origins and the measurement items derived from the in-depth interviews are added, it is necessary to analyse the measurement reliability of co-creation of customer value and optimize the measurement items included in the scale.

Table 4.11 Economic Value (EV) Reliability Analysis Summary

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
EV1	0.446	0.607	0.853	0.668	0.574
EV2	0.484	0.587	0.906		
EV3	0.656	0.512	0.783		
EV4(Deleted)	**0.237**	**0.694**	**-0.024**		
EV5(Deleted)	**0.325**	**0.66**	**0.099**		

Table 4.11 shows the CITC values of EV4 and EV5 are 0.237 and 0.325. Respectively, in which is less than the critical value of 0.5, indicating the correlation

between those items and other items is low. The factor loadings are -0.024 and 0.099, respectively, both lower than the critical value of 0.6. Cronbach's alpha if the EV4 item is deleted increases to 0.694, indicating that if the EV4 test item is deleted, distribution value as a whole as measured by Cronbach's alpha will increase to 0.694, which is higher than the original 0.668.

Based on the above analysis, we consider deleting the measurement items EV4 and EV5.

Table 4.12 Economic Value (EV) Reliability Analysis Summary after Deleting the Test Items

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
EV1	0.64	0.761	0.836	0.81	0.674
EV2	0.748	0.647	0.901		
EV3	0.613	0.787	0.817		

Table 4.12 summarizes the reliability analysis after deleting EV4 and EV5. The results show that deleting EV4 and EV5 increases Cronbach's alpha from 0.668 to 0.81, and the Cronbach's alpha value of deleting any other items is less than 0.81. After deleting EV4 and EV5, the KMO value increases from 0.574 to 0.674, and each test item's factor loading is higher than 0.6. Therefore, EV4 and EV5 are deleted.

Table 4.13 Innovation Value (IV) Reliability Analysis Summary

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
IV1(Deleted)	**0.317**	**0.646**	**0.818**	0.653	0.575
IV2(Deleted)	**0.517**	**0.545**	**0.826**		
IV3	0.464	0.579	0.712		
IV4	0.428	0.591	0.14		
IV5	0.331	0.638	0.036		

As seen in table 4.13, the CITC values of IV1 to IV5 all have critical values of about 0.5, indicating that the correlation between the items after their addition is

low. We consider deleting the items by viewing the results in turn. Using this approach, it is best to delete items IV1 and IV2 in turn.

Table 4.14 Innovation Value (IV) Reliability Analysis Summary after Deleting the Test Items

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
IV3	0.432	0.663	0.591	0.723	0.640
IV4	0.560	0.336	0.867		
IV5	0.541	0.350	0.864		

Table 4.14 summarizes the reliability analysis after deleting IV1 and IV2. As shown in the table, after deleting IV1 and IV2, Cronbach's alpha increases from 0.653 to 0.723, and Cronbach's alpha after deleting any additional items is below 0.723. Therefore, IV1 and IV2 are deleted.

Table 4.15 Relationship Value (RV) Reliability Analysis Summary

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
RV1(Deleted)	**0.38**	**0.821**	**0.545**	0.798	0.559
RV2	0.653	0.74	0.799		
RV3	0.611	0.749	0.792		
RV4	0.695	0.721	0.84		
RV5	0.588	0.756	0.744		

Table 4.15 indicates the CITC value of RV1 is 0.38, which is less than the critical value of 0.5, indicating the correlation between that item and other items is low. Moreover, the factor loading of RV1 is 0.545, which is slightly lower than the critical value of 0.6. If RV1 is deleted, Cronbach's alpha is 0.821, indicating that if the RV1 test item is deleted; the entire relationship value as measured by Cronbach's alpha will increase to 0.821, which is higher than the original 0.798. Based on the above

analysis, we consider deleting test item RV1.

Table 4.16 Relationship Value (RV) Reliability Analysis Summary after Deleting the Test Item

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
RV2	0.609	0.791	0.785	0.821	0.585
RV3	0.676	0.759	0.833		
RV4	0.715	0.739	0.855		
RV5	0.583	0.802	0.754		

Table 4.16 is a summary of the reliability analysis after deleting RV1. After RV1 is deleted, Cronbach's alpha increases from 0.798 to 0.821, and Cronbach's alpha if any other items are deleted is less than 0.821. The KMO value also increases from 0.559 to 0.585, and the factor loading of each test item is higher than 0.6. Therefore, RV1 is deleted.

3. Measurement of Digital Transformation Maturity

The measurement of digital transformation maturity is based on the measurements of Balka, Raasch, and Herstatt (2014), Mettler and Pinto (2018), and Cerdeiral and Santos (2019), combined with the results of the in-depth interviews.

Table 4.17 Digital Transformation Maturity Measurement items (DTM) Reliability Analysis Summary

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
DTM1	0.593	0.815	0.916	0.834	0.713
DTM2	0.834	0.744	0.922		
DTM3	0.785	0.756	0.839		
DTM4	0.685	0.785	0.511		

DTM5(Deleted)	**0.311**	**0.876**	**-0.005**		

The results in Table 4.17 indicate the CITC value of DTM5 is 0.311, which is less than the critical value of 0.5, indicating the correlation between that item and other items is low. The factor loading of DTM5 is -0.005, which is lower than the critical value of 0.6. DTM5 has a Cronbach's alpha of 0.876, which indicates that if the item is deleted, the Cronbach's alpha of all digital transformation maturity measurement items will increase to 0.876, which is higher than the original 0.834. Based on the above analysis, we consider deleting test item DTM5.

Table 4.18 Digital Transformation Maturity Measurement items (DTM) Reliability Analysis Summary after Deleting the Test Item

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
DTM1	0.677	0.868	0.827	0.876	0.717
DTM2	0.893	0.782	0.947		
DTM3	0.808	0.812	0.902		
DTM4	0.587	0.895	0.753		

Table 4.18 is a summary of the reliability analysis after deleting DTM5. After deleting DTM5, Cronbach's alpha increases from 0.834 to 0.876, and the KMO value also increases from 0.713 to 0.717. The factor loading of each item is above 0.6. Therefore, the DTM5 test item is deleted.

4. Measurement of Firm Performance

The measurement of firm performance refers to the measurement tables of Cao and Zhang (2011), Cho and Pucik, (2005), March and Sutton, (1997), and Barbu and Militaru (2019), combined with the results of the in-depth interviews.

Table 4.19 Environmental Performance (ENP) Reliability Analysis Summary

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO

EnP1	0.541	0.619	0.805	0.713	0.589
EnP2	0.666	0.439	0.886		
EnP3	0.423	0.744	0.692		

As shown in Table 4.19, the CITC values of the three items are all around the critical value of 0.5, and the Cronbach's alpha of each item is not significantly improved. Therefore, none of the three items are deleted.

Table 4.20 Economic Performance (ECP) Reliability Analysis Summary

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
EcP1	0.294	0.733	0.611	0.647	0.465
EcP2	0.695	0.176	0.91		
EcP3	0.44	0.594	0.76		

Table 4.20 shows the Cronbach's alpha of each item is not significantly improved, so none of the three items are deleted.

Table 4.21 Social Performance (SP) Reliability Analysis Summary

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
SP1	0.374	0.755	0.674	0.685	0.539
SP2	0.695	0.359	0.902		
SP3	0.466	0.636	0.788		

As shown in Table 4.21, the CITC values of the three items are all around the critical value of 0.5, and the Cronbach's Alpha value of the three items is not significantly improved, so none of the three items are deleted.

4.2.3.2 Internet Enterprise Customer Pre-Test

The pre-tested respondents were project managers/business executives/IT

experts of traditional enterprise customers. There were 65 questionnaires distributed and 59 questionnaires were retrieved, of which 53 were valid, an effective recovery rate of 81.5%.

1. Measurement of Customer Participation in Digital Transformation Items

Table 4.22 Information and Knowledge Exchange (IKE) Reliability Analysis Summary

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
IKE1	0.686	0.799	0.928	0.842	0.752
IKE2	0.775	0.774	0.903		
IKE3	0.841	0.750	0.879		
IKE4	0.633	0.814	0.535		
IKE5(Deleted)	0.341	0.883	0.026		

Table 4.22 shows the CITC value of IKE5 is 0.341, which is less than the critical value of 0.5, indicating that the correlation between that item and other items is low. The factor loading of IKE5 is 0.026, which is lower than the critical value of 0.6. Cronbach's alpha value if the IKE5 entry is deleted increases to 0.883, indicating that if IKE5 is deleted, information and knowledge exchange as measured by Cronbach's alpha will increase to 0.883, which is higher than the original 0.842. Based on the above analysis, we consider deleting test item IKE5.

Table 4.23 Information and Knowledge Exchange (IKE) Reliability Analysis Summary after Deleting the Test Item

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
IKE1	0.753	0.848	0.876	0.883	0.760
IKE2	0.828	0.819	0.914		
IKE3	0.848	0.808	0.927		
IKE4	0.574	0.914	0.725		

Table 4.23 summarizes the reliability analysis if IKE5 is deleted. After deleting IKE5, Cronbach's alpha increases from 0.842 to 0.883. Moreover, the KMO value also increases from 0.752 to 0.760, and the factor loading of each test item is much higher than the critical value of 0.6. Therefore, IKE5 is deleted.

Table 4.24 Business Collaboration (BC) Reliability Analysis Summary

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
BC1	0.554	0.644	0.812	0.695	0.632
BC2	0.560	0.641	0.848		
BC3	0.624	0.568	0.803		
BC4(Deleted)	**0.424**	**0.616**	**0.290**		
BC5(Deleted)	**0.237**	**0.741**	**-0.070**		

As table 4.24 shows, the CITC values of BC4 and BC5 are 0.424 and 0.237, respectively, both less than the critical value of 0.5, indicating the correlation between those items and other items is low. The factor loadings of BC4 and BC5 are 0.290 and -0.070, respectively, both lower than the critical value of 0.6. Cronbach's alpha if the BC5 item is deleted is 0.741, indicating that if BC5 is deleted, the entire business collaboration as measured by Cronbach's Alpha value will increase to 0.741, higher than the original 0.695. Based on this analysis, we consider deleting test items BC4 and BC5.

Table 4.25 Business Collaboration (BC) Reliability Analysis Summary after Deleting the Test Items

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
BC1	0.595	0.717	0.820	0.776	0.700
BC2	0.609	0.701	0.829		
BC3	0.633	0.673	0.845		

Table 4.25 is a summary of the reliability analysis after deleting BC4 and BC5.

After deleting BC4 and BC5, Cronbach's alpha increases from 0.695 to 0.776, and the Cronbach's Alpha value if any other items are deleted is less than 0.776. After deleting BC4 and BC5, the KMO value also increases from 0.632 to 0.700, and the factor loading of each test item is higher than 0.6. Therefore, BC4 and BC5 are deleted.

Table 4.26 Co-Leading (CL) Reliability Analysis Summary

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
CL1	0.455	0.751	0.819	0.767	0.641
CL2	0.493	0.739	0.900		
CL3	0.698	0.665	0.845		
CL4	0.675	0.672	0.763		
CL5(Deleted)	**0.397**	**0.780**	**0.806**		

As Table 4.26 shows, the CITC value of CL5 is 0.379, which is less than the critical value of 0.5, indicating the correlation between that item and the other items is low. Cronbach's alpha if the CL5 item is deleted is 0.780, indicating that if CL5 is deleted, co-leading overall as measured by Cronbach's alpha will increase to 0.780, which is higher than the original 0.767. Based on this analysis, we consider deleting test item CL5.

Table 4.27 Co-Leading (CL) Reliability Analysis Summary after Deleting the Test Item

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
CL1	0.550	0.789	0.663	0.780	0.647
CL2	0.606	0.718	0.788		
CL3	0.629	0.702	0.809		
CL4	0.665	0.682	0.837		

The summary of the reliability analysis after deleting CL5 is shown in Table 4.27.

After CL5 is deleted, Cronbach's alpha increases from 0.843 to 0.873, and the KMO value increases from 0.748 to 0.778. Factor loadings are all above the critical value of 0.6. Therefore, CL1 is deleted.

Table 4.28 Cost Effectiveness (CE) Reliability Analysis Summary

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
CE1(Deleted)	**0.282**	**0.676**	**0.763**	0.664	0.611
CE2(Deleted)	**0.450**	**0.599**	**0.873**		
CE3	0.591	0.522	0.606		
CE4	0.507	0.572	0.851		
CE5	0.584	0.669	0.856		

The results in Table 4.28 show the CITC values of CE1 and CE2 are 0.282 and 0.450, both less than the critical value of 0.5, indicating the correlation between theses item and other items is low. Cronbach's alpha if CE1 is deleted increases to 0.676, indicating that if the CE1 test item is deleted, overall cost effectiveness as measured by Cronbach's alpha will increase to 0.676, which is higher than the original 0.664. Based on the above analysis, we consider deleting items CE1 and CE2.

Table 4.29 Cost Effectiveness (CE) Reliability Analysis Summary after Deleting the Test Items

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
CE3	0.538	0.699	0.729	0.693	0.605
CE4	0.634	0.443	0.870		
CE5	0.569	0.649	0.768		

Table 4.29 summarizes the reliability analysis after deleting CE1 and CE2. After deleting CE1 and CE2, Cronbach's alpha increases from 0.664 to 0.693, and Cronbach's alpha if any other items are deleted is less than 0.693. The factor loading of each test item is higher than the critical value of 0.6. Therefore, CE1 and CE2 are

deleted.

2. Measurement of Value Co-Creation items

Table 4.30 Economic Value (EV) Reliability Analysis Summary

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
EV1	0.569	0.720	0.872	0.748	0.706
EV2	0.549	0.693	0.856		
EV3	0.626	0.663	0.646		
EV4(Deleted)	**0.455**	**0.728**	**0.098**		
EV5(Deleted)	**0.483**	**0.715**	**0.160**		

Table 4.30 indicates the CITC values of EV4 and EV5 are is 0.455 and 0.483, respectively, both less than the critical value of 0.5, indicating the correlation between these items and other items is low. The factor loadings of EV4 and EV5 are 0.098 and 0.160, lower than the critical value of 0.6. Based on the above analysis, we consider deleting measurement items EV4 and EV5.

Table 4.31 Economic Value (EV) Reliability Analysis Summary after Deleting the Test Items

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
EV1	0.597	0.682	0.828	0.764	0.682
EV2	0.650	0.624	0.859		
EV3	0.544	0.740	0.787		

Table 4.31 is a summary of the reliability analysis after deleting EV4 and EV5. After deleting EV4 and EV5, Cronbach's alpha increases from 0.748 to 0.764, and the Cronbach's alpha value if any other items are deleted is less than 0.764. After removing EV4 and EV5, the factor loadings of each test item are higher than the critical value of 0.6. Therefore, EV4 and EV5 are deleted.

Table 4.32 Innovation Value (IV) Reliability Analysis Summary

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
IV1(Deleted)	**0.474**	**0.578**	**0.863**	0.660	0.491
IV2(Deleted)	**0.355**	**0.636**	**0.875**		
IV3	0.584	0.526	0.545		
IV4	0.503	0.657	0.796		
IV5	0.566	0.629	0.867		

Table 4.32 shows the CITC values of IV1 to IV5 are all near the critical value of about 0.5, indicating the correlation between the items after adding them is low. We consider deleting the items in turn. After viewing the results, the effect is best after deleting IV1 and IV2 in turn.

Table 4.33 Innovation Value (IV) Reliability Analysis Summary after Deleting the Test Items

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
IV3	0.536	0.643	0.737	0.672	0.644
IV4	0.571	0.596	0.772		
IV5	0.555	0.494	0.828		

Table 4.33 summarizes the reliability analysis after deleting IV1 and IV2. After deleting these items, Cronbach's alpha increases from 0.660 to 0.672; and if any of the remaining items are deleted, Cronbach's alpha is below 0.672. Therefore, IV1 and IV2 are deleted. After deleting IV1 and IV2, KMO also increases from 0.491 to 0.644, and the loadings of each factor are higher than the critical value of 0.6.

Table 4.34 Relationship Value (IV) Reliability Analysis Summary

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
RV1	0.707	0.761	0.593	0.761	0.698
RV2	0.544	0.808	0.710		
RV3	0.676	0.770	0.810		
RV4	0.729	0.755	0.852		
RV5(Deleted)	**0.439**	**0.833**	**0.836**		

As Table 4.34 shows, the CITC value of RV5 is 0.439, which is less than the critical value of 0.5, indicating the correlation between that item and other items is low. Cronbach's alpha if RV5 is deleted is 0.833, indicating that if BC5 is deleted, relationship value overall as measured by Cronbach's alpha will increase to 0.833, which is higher than the original 0.761. Based on the above analysis, we consider deleting test item RV5.

Table 4.35 Relationship Value (IV) Reliability Analysis Summary after Deleting the Test Item

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
RV1	0.597	0.781	0.599	0.833	0.755
RV2	0.557	0.705	0.772		
RV3	0.620	0.669	0.808		
RV4	0.673	0.638	0.853		

Table 4.35 is the reliability analysis summary after deleting RV5. After deleting RV5, Cronbach's alpha increases from 0.761 to 0.833, and the Cronbach's alpha value if any other items are deleted is less than 0.821. After RV5 is deleted, the KMO value also increases from 0.698 to 0.755. Therefore, RV5 is deleted.

3. Measurement of Digital Transformation Maturity

Table 4.36 Digital Transformation Maturity Measurement items (DTM) Reliability Analysis Summary

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
DTM1	0.617	0.775	0.787	0.815	0.748
DTM2	0.662	0.761	0.810		
DTM3	0.733	0.737	0.851		
DTM4	0.635	0.769	0.778		
DTM5	0.485	0.837	0.544		

As shown in Table 4.36, the CITC values of each test item are all around 0.5, and the Cronbach's Alpha value of each item is not significantly improved. Therefore, none of the five items are deleted.

4. Measurement of Firm Performance

Table 4.37 Environmental Performance (ENP) Reliability Analysis Summary

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
EnP1	0.542	0.657	0.667	0.630	0.547
EnP2	0.594	0.296	0.867		
EnP3	0.498	0.590	0.734		

Table 4.37 shows the CITC values of the three items are all around the critical value of 0.5, and Cronbach's alpha for each item is not significantly improved. Therefore, none of the three items are deleted.

Table 4.38 Economic Performance (ECP) Reliability Analysis Summary

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
EcP1	0.544	0.588	0.691	0.697	0.578
EcP2	0.511	0.652	0.630		
EcP3	0.450	0.676	0.699		

Table 4.38 indicates the Cronbach's alpha of each item is not significantly

improved, so none of the items are deleted.

Table 4.39 Social Performance (SP) Reliability Analysis Summary

Test Item	Corrected Item Total Correlation (CITC)	Scale Item Deleted Cronbach's Alpha	Factor Loading	Cronbach's Alpha	KMO
SP1	0.562	0.661	0.672	0.634	0.617
SP2	0.520	0.433	0.826		
SP3	0.561	0.512	0.789		

As Table 4.39 shows, the CITC values of the three items are all around the critical value of 0.5, and Cronbach's alpha for the three items is not significantly improved, therefore, none of the three items are deleted.

4.3 Questionnaire Distribution and Data Collection

4.3.1 Questionnaire Distribution and Recovery

To ensure the accuracy and logic of the data collection, based the pre-test results, two questionnaires were designed, one for traditional enterprise customers and another for Internet enterprise customers. The ICT industry was used as the research background. The traditional and Internet enterprise customers who were selected as respondents had project and execution management experience and actually participated in enterprise digital transformation. The formal investigation lasted for more than three months. We selected Fuzhou Star Network Ruijie Co., Ltd., Fujian Sanyuanda Communication Co., Ltd., and Hangzhou Xinhua Third Co., Ltd. in Hangzhou and Fuzhou. Zhejiang Fuchunjiang Communication Group Co., Ltd. and Hangzhou Dongxin Beiyou Information Technology Co., Ltd. completed most of the questionnaires during an on-site investigation and retention survey. The survey scope of the questionnaire covers Beijing, Hangzhou, Fuzhou, Shanghai, Xiamen, and Suzhou. Through friends and classmates who assisted in the investigation, there were two forms of network distribution and paper questionnaires in Nanjing and other

places. A total of 640 questionnaires (including online distribution) were distributed, 320 to traditional enterprise customers and 320 to Internet enterprise customers; 556 were recovered, including 272 traditional enterprise customers and 284 Internet enterprise customers. Among the recovered questionnaires, the regular filling out of the answers, only one answer for all the test items and the identical invalid questionnaires were eliminated. 506 valid questionnaires were actually recovered, including 251 traditional enterprise customers and 255 Internet enterprise customers. The effective recoveries were 79.05%, 78.43%, 79.68% respectively, The sample size was selected according to Bentler and Chou's (1997) recommendations for an SEM sample size, that is, 5 to 10 respondents per question.

4.3.2 Sample Statistical Features

Data were collected from 251 valid questionnaires of traditional corporate clients. The basic descriptive statistics of the respondents are shown in Table 4.40.

Table 4.40 Statistical Features of Traditional Enterprise Customers

Statistical Variable		Sample size	Proportion%
Gender	Male	213	84.86%
	Female	38	15.14%
Age	24 – 30	57	22.71%
	30 – 35	87	34.66%
	35 – 40	45	17.93%
	40 – 50	42	16.73%
	50 and above	20	7.97%
Education	Diploma and blow	51	20.32%
	Undergraduate	138	54.98%
	Postgraduate and above	66	26.29%
Position	Front Line Managers	57	22.71%
	Middle Level Manager	117	46.61%
	Senior Manager or Director	55	21.91%
	Chief Executive Officer	22	8.76%
Working Experience	0 – 5 years	60	23.90%
	5 – 10 years	125	49.80%
	10 – 15 years	55	21.91%
	15 and above years	11	4.38%

Data were also compiled from 255 Internet enterprise customers' valid questionnaires. The basic descriptive statistics of these respondents are shown in Table 4.41.

Table 4.41 Statistical Features of Internet Enterprise Customers

Statistical Variable		Sample size	Proportion%
Gender	Male	168	65.88%
	Female	87	34.12%
Age	24 – 30	108	42.35%
	30 – 35	89	34.90%
	35 – 40	41	16.08%
	40 – 50	15	5.88%
	50 and above	2	0.78%
Education	Diploma and blow	4	1.57%
	Undergraduate	142	55.69%
	Postgraduate and above	109	42.75%
Position	Front Line Managers	37	14.51%
	Middle Level Manager	123	48.24%
	Senior Manager or Director	64	25.10%
	Chief Executive Officer	31	12.16%
Working Experience	0 – 5 years	134	52.55%
	5 – 10 years	115	45.10%
	10 – 15 years	4	1.57%
	15 and above years	2	0.78%

According to the basic sample statistics, more male than female traditional Internet customers participated in digital transformation project. Age is largely concentrated around middle age and younger. There were 427 young and middle-aged respondents who participated in the digital transformation project, accounting for 84.38% of the total. Among Internet business customers, there were 238 young and middle-aged respondents, accounting for 94% of the total, also showing the younger characteristic of Internet companies. From the perspective of education level, 55.33% of the respondents in the sample have a bachelor's degree and 34.46% have a master's degree or above, while the proportion of Internet enterprise customers that have a postgraduate and above is as high as 42.75%. The characteristic of higher education in Internet companies is obvious. From the perspective of job distribution, middle level managers have the highest participation

in digital transformation projects, with the proportions of traditional and Internet enterprise customers reaching 46.61% and 48.24%, respectively. This shows enterprises attach great importance to digital transformation. In the distribution of working experience, the proportion of participants with 5-10 years of work experience in traditional enterprise customers and internet enterprise customers is 49.80% and 48.24%, respectively. Based on the sample's basic statistical information, the sample structure is reasonable and realistic.

4.4 Conclusion

This chapter introduces the characteristics of the research industry, how the research industry and sample objects were determined, and the design of the research scale adopts the method of combining theory and in-depth interviews. At the same time, to ensure the scale's survey effect, before the formal survey, a pre-test is done. Combined with the results of the pre-test, the questionnaire is distributed and the data are collected.

Chapter 5 - Digital Transformation of Traditional Enterprise Customer

5.1 Exploratory Factor Analysis

The purpose of exploratory factor analysis is to extract as few factors as possible to account for the largest possible variation. In the pre-test of the scale analysis in the fourth chapter, the project analysis of 50 samples used the CITC to delete scale items from the analysis. In the exploratory factor analysis, for the 251 traditional enterprise customer respondents, all the remaining scale items were included in the variable range of the factor analysis. The number of factors was limited, and exploratory factor analysis was performed using the maximum variation orthogonal axis method. Exploratory factor analysis was performed using SPSS Statistics R23.0.0.0.

The results show the KMO value is 0.654; the closer the KMO value is to 1, the more common the factors among the variables and the more suitable they are for the factor module. The more common standard, KMO, is 0.6 or more, indicating it is more suitable for factor analysis. The approximate chi-squared value of Barlett's spherical test is 3762.265, with degrees of freedom at 666, reaching a significant level ($P<0.000$). The Barlett spherical test shows there is a common factor between the overall correlation matrices, which is suitable for factor analysis. Exploratory factor analysis results show that the cumulative variance interpretation rate is 70.911%, and the effect is very good.

Table 5.1 Exploratory Factor Analysis Results

Rotating Component Matrix [a]											
	Component										
	1	2	3	4	5	6	7	8	9	10	11
IKE1	.839	.040	.106	.035	-.013	.034	.006	-.024	.056	.184	.023
IKE2	.880	.039	.019	.052	-.012	.148	-.076	.043	.037	.069	.-027
IKE3	.841	.087	.084	.092	.027	.035	-.021	.042	.020	.012	.083
IKE4	.574	.121	-.021	.072	.090	.093	.129	.119	-.018	-.054	.079
DTM1	.027	.737	-.091	.287	.059	-.010	-.004	.018	-.065	-.313	.007
DTM2	.077	.836	.040	.137	.006	.140	.035	-.039	.042	-.021	-.004
DTM3	.017	.792	-.021	-.021	-.008	-.053	.125	.007	-.003	.245	-.149
DTM4	.157	.696	-.054	-.105	-.005	.020	.067	.089	-.022	.303	.000
CL1	.020	.009	.616	.014	-.192	.089	.102	-.061	.157	-.060	-.220
CL2	-.037	-.086	.860	.066	-.042	.061	.005	.020	.083	.043	.064
CL3	.010	.007	.814	-.041	.039	-.006	-.114	.006	-.125	.053	.071
CL4	-.031	-.014	.600	-.062	.343	-.158	-.074	-.043	-.089	-.020	.221
RV1	.003	-.125	-.076	.595	.007	-.091	-.054	.534	.123	.189	-.099
RV2	.122	-.081	-.074	.760	-.005	-.113	.057	.133	.027	.217	-.078
RV3	.111	.144	.059	.826	-.002	.010	.083	-.003	.015	.073	.072
RV4	.027	.318	.050	.684	-.008	.052	.007	-.221	.024	-.118	.190
CE1	.002	-.006	.161	-.003	.817	-.116	.018	-.035	-.004	.001	.009

CE2	.042	-.027	-.027	-.017	.862	.090	-.017	.041	-.018	.040	-.018
CE3	.029	.085	-.161	.026	.749	.293	-.009	.046	-.073	-.009	-.068
EV1	.127	.025	-.151	.013	.303	.759	-.015	.037	.018	-.089	-.047
EV2	.076	.001	.029	-.044	.031	.888	.009	.002	.010	.023	.114
EV3	.095	.073	.140	-.056	-.076	.768	.031	-.084	.130	.127	-.018
BC1	.035	.132	-.001	.069	-.007	.004	.753	.118	.002	.019	-.042
BC2	.000	.046	-.051	-.022	-.051	-.052	.842	.039	-.036	.141	.040
BC3	-.042	-.002	-.017	.058	.040	.072	.803	.011	.092	-.047	.121
IV1	.002	-.005	.060	-.072	-.020	.703	-.045	.558	-.068	.023	.019
IV2	.079	.025	.013	-.030	-.049	-.045	.101	.863	-.020	-.026	.029
IV3	.082	.054	-.037	.039	.093	.030	.086	.888	.030	.009	.111
SP1	.025	-.007	.242	.035	.091	-.035	-.043	.038	.784	.040	-.067
SP2	.022	-.041	-.050	.086	-.091	.019	.048	.051	.871	.049	.145
SP3	.062	.024	.065	.000	.002	.115	.005	-.016	.811	-.121	-.035
EnP1	.184	.180	.017	.102	.043	.064	.027	-.016	-.135	.747	.022
EnP2	.013	.029	.024	.168	-.003	.014	.087	.042	.056	.733	.284
EnP3	.038	-.021	.716	-.065	.085	.054	-.047	.156	.071	.587	.164
EcP1	.012	-.111	.025	.064	.085	.212	.035	.022	.067	.126	.773
EcP2	.146	-.089	.082	.020	-.059	.083	.075	.049	-.120	.147	.784
EcP3	.017	-.041	.014	.074	-.003	-.025	.063	.077	.369	.121	.741

Table 5.1 shows the loading of each test item is above 0.55, indicating the test items are in good condition.

5.2 Reliability and Validity Analysis

5.2.1 Reliability Analysis

Reliability represents the reliability and stability of the scale. Its essence is the ratio of the variance of the true score to the variance of the observed score. Reliability refers to the characteristics of the test score or the results of the measurement, not to the measurement tool itself. After factor analysis, the reliability of the scale at all levels and the total scale should be further tested.

The main methods of reliability analysis are internal consistency reliability tests, retest reliability, duplicate reliability, and duplicate retest reliability. In this study, Cronbach's alpha, CITC, and the complex squared correlation coefficient (R^2) of the measurement items were used to test the reliability and internal consistency of the scale.

Table 5.2 Reliability Analysis of Internal Consistency of Measurement Scale

Dimension	Test Item	Corrected Item Total Correlation (CITC)	Complex Square Correlation Coefficient (R^2)	Scale Item Deleted Cronbach`s Alpha	Cronbach`s Alpha
Information and Knowledge Exchange	IKE1	0.728	0.595	0.83	0.868
	IKE2	0.853	0.640	0.778	
	IKE3	0.802	0.550	0.799	
	IKE4	0.521	0.335	0.906	
Business Collaboration	BC1	0.541	0.374	0.707	0.75
	BC2	0.617	0.398	0.62	
	BC3	0.574	0.330	0.67	
Co-Leading	CL1	0.57	0.371	0.711	0.771
	CL2	0.706	0.484	0.643	
	CL3	0.72	0.444	0.634	
	CL4	0.521	0.397	0.745	

Cost Effectiveness	CE1	0.571	0.352	0.799	0.8
	CE2	0.774	0.538	0.582	
	CE3	0.602	0.398	0.775	
Economic Value	EV1	0.63	0.380	0.805	0.821
	EV2	0.764	0.543	0.663	
	EV3	0.643	0.373	0.787	
Innovation Value	IV1	0.537	0.322	0.848	0.804
	IV2	0.751	0.501	0.627	
	IV3	0.676	0.471	0.706	
Relationship Value	RV1	0.477	0.341	0.747	0.761
	RV2	0.655	0.430	0.649	
	RV3	0.667	0.444	0.646	
	RV4	0.452	0.388	0.761	
Digital Transformation Maturity	DTM1	0.625	0.369	0.845	0.852
	DTM2	0.797	0.514	0.769	
	DTM3	0.767	0.483	0.78	
	DTM4	0.601	0.360	0.848	
Environmental Performance	EnP1	0.561	0.321	0.772	0.783
	EnP2	0.703	0.380	0.612	
	EnP3	0.610	0.397	0.721	
Economic Performance	EcP1	0.470	0.370	0.674	0.674
	EcP2	0.633	0.332	0.464	
	EcP3	0.476	0.317	0.679	
Social Performance	SP1	0.576	0.305	0.764	0.786
	SP2	0.712	0.377	0.616	
	SP3	0.594	0.323	0.744	

As seen in Table 5.2, the values of Cronbach`s alpha in each dimension of the scale ranged from 0.674 to 0.868, which indicating the internal consistency of the scale is good; the total correlation values of each item of the scale ranged from 0.452 to 0.853, mostly higher than 0.5. The complex squared correlation value is the decisive factor in multiple regression. The higher the complex squared correlation value, the higher the internal consistency between the test item and other items. The critical value of the complex squared correlation value of each item in the scale is greater than 0.3. From this point of view, the scale has good internal consistency. Based on the above analysis, the overall reliability of the measurement data is good.

5.2.2 Validity Analysis

In empirical research, validity measurement includes single-dimensionality, content validity, construct validity, and criterion-related validity. Construct validity can be divided into convergent validity and differential validity. Researchers often choose some of these indicators to illustrate scale validity. The single dimension, content validity, and construct validity indicators are selected in this study to illustrate.

Table 5.3 Single Dimension Test of Variables

Variable	Cumulative Interpretation Variance/%	KMO
Information and Knowledge Exchange	66.178	0.713
Business Collaboration	65.892	0.668
Co-Leading	80.175	0.643
Cost Effectiveness	69.449	0.633
Distribution Value	69.407	0.628
Innovation Value	67.738	0.640
Relationship Value	56.439	0.665
Digital Transformation Maturity	62.002	0.723
Environmental Performance	62,968	0.634
Economic Performance	62.098	0.650
Social Performance	66.457	0.684

As Table 5.3 shows, the cumulative interpretation variance is mostly above 60%, and the KMO values of each variable are above 0.5. The indicators show the variables are in good condition.

5.2.3 Confirmatory Factor Analysis Path Diagram

Standardized factor loading can be obtained through confirmatory factor analysis. Gerbing and Anderson (1988) consider that whether the standardized factor loading is significant can be used as an important index for judging convergent

validity. The higher the factor loading, the greater the number of components of the measured variables reflected in the measured items. Confirmatory factor analysis of the measurement scale data is conducted, and the factor loadings are obtained, as shown in Table 5.4. The path diagram of the confirmatory factor analysis is shown in Figure 5.1.

Figure 5.1 Confirmatory Factor Analysis Path Diagram

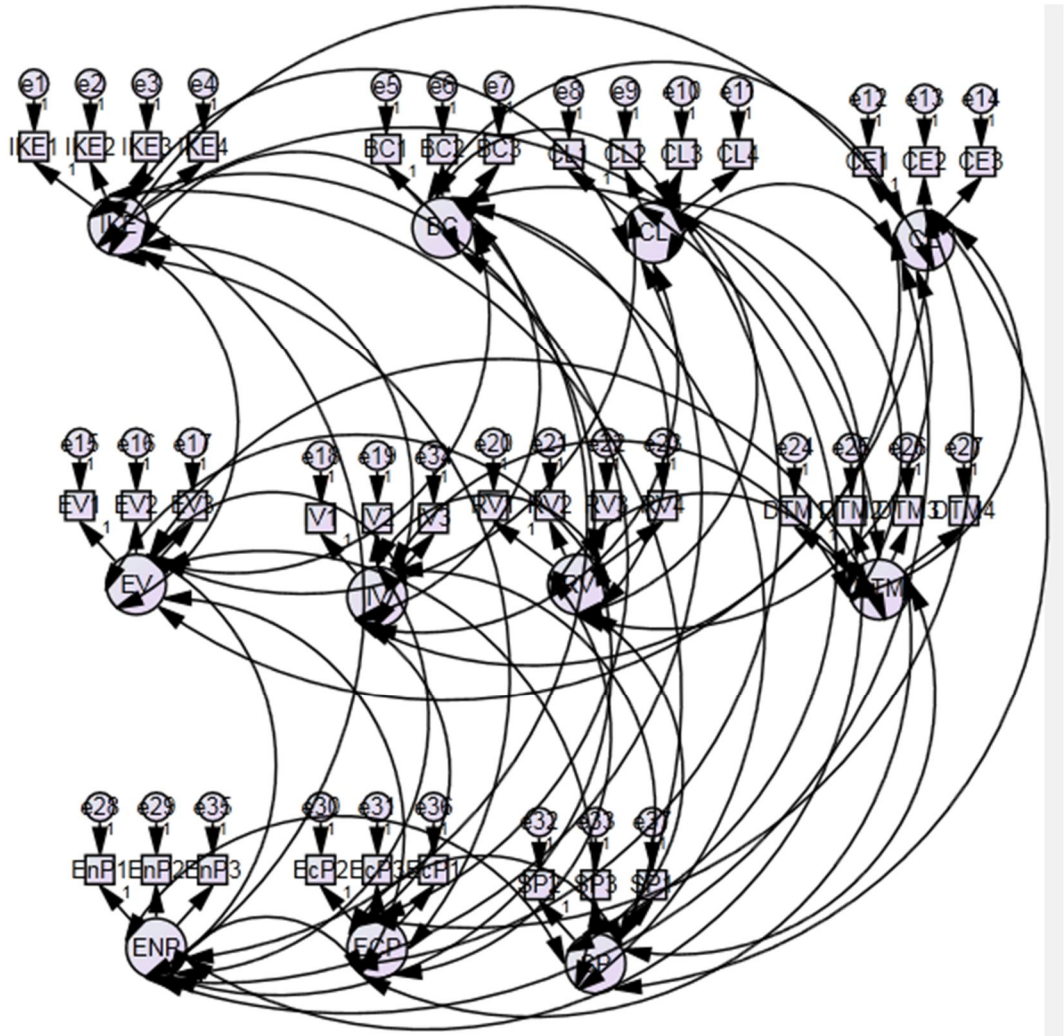


Table 5.4 Confirmatory Factor Analysis Estimated Result

	Factor load	Standardized factor load	Standard deviation	C.R.	Significance (P value)
IKE1<--IKE	1.000	0.807			
IKE2<--IKE	1.028	0.898***	0.071	14.466	0.000

IKE3<--IKE	0.893	0.751***	0.071	12.596	0.000
IKE4<--IKE	0.597	0.491***	0.077	7.700	0.000
BC1<--BC	1.000	0.614			
BC2<--BC	1.294	0.815***	0.169	7.656	0.000
BC3<--BC	1.149	0.676***	0.148	7.757	0.000
CE1<--CE	1.000	0.613			
CE2<--CE	1.657	0.963***	0.203	8.173	0.000
CE3<--CE	1.237	0.656***	0.140	8.850	0.000
CL1<--CL	1.000	0.490			
CL2<--CL	2.006	0.908***	0.296	6.777	0.000
CL3<--CL	1.398	0.675***	0.201	6.958	0.000
CL4<--CL	0.981	0.450***	0.179	5.489	0.000
EV1<--EV	1.000	0.655			
EV2<--EV	1.381	0.936***	0.152	9.108	0.000
EV3<--EV	0.897	0.649***	0.099	9.051	0.000
IV1<--IV	0.626	0.515***	0.085	7.390	0.000
IV2<--IV	1.000	0.834			
IV3<--IV	0.995	0.816***	0.108	9.227	0.000
RV1<--RV	1.000	0.582			
RV2<--RV	1.359	0.741***	0.172	7.886	0.000
RV3<--RV	1.321	0.774***	0.166	7.963	0.000
RV4<--RV	0.881	0.512***	0.140	6.278	0.000
DTM1<--DTM	1.000	0.635			
DTM2<--DTM	1.167	0.815***	0.124	9.391	0.000
DTM3<--DTM	1.121	0.755***	0.123	9.127	0.000
DTM4<--DTM	0.915	0.613***	0.116	4.893	0.000
EnP1<--EnP	1.000	0.484			
EnP2<--EnP	1.490	0.734***	0.224	6.638	0.000
EnP3<--EnP	1.495	0.760***	0.223	6.690	0.000
EcP1<--EcP	1.252	0.791***	0.146	8.606	0.000
EcP2<--EcP	1.000	0.638			
EcP3<--EcP	0.837	0.508***	0.128	6.562	0.000
SP1<--SP	0.908	0.686***	0.112	8.136	0.000
SP2<--SP	1.000	0.774			
SP3<--SP	0.894	0.656***	0.112	8.017	0.000

Note: * indicates the significance of the P value is less than 0.05, ** indicates the significance of the P value is less than 0.01, and *** indicates the significance of the P value is less than 0.001.

As shown in Table 5.4, the factor loadings of each item reached a significant level (P < 0.001), and the standardized factor loadings fell between 0.450 and 0.963, mostly in accordance with the interval standard of 0.50-0.95. The relative importance of the measured variables in each latent variable can be understood by the factor loading value. The higher the standardized factor loading, the greater the explained variation, which indicates the scale has good convergent validity.

Table 5.5 Degrees of Freedom and Chi-squared Value

Model	NPAR	CMIN	DF	Significance (P value)	CMIN/DF
Default model	129	1262.995	574	0.000	2.200
Saturated model	793	0.000	0		
Independence model	37	3969.675	666	0.000	5.960

From the perspective of the model's fitness index, Table 5.5 shows the chi-squared value CMIN is 1,262.995, the degrees of freedom DF are 574, and the chi-squared degrees of freedom ratio CMIN/DF is 2.220. A chi-squared degrees of freedom ratio of less than 1 indicates the model is overfitted and a value greater than 3 indicates the model is not well-suited, while ratios between 1 and 3 indicate that the model fits well. Other major model fit indicators also performed well, with a CFI (Comparative Fit Index) of 0.791, a TLI (Tucker-Lewis Index) of 0.758, and an IFI (Incremental Fit Index) of 0.797, all close to the critical value of 0.9, and RMSE (Root Mean Squared Error) of 0.069, close to 0.08. In general, if the RMSE value is above 0.1, the model has poor fit, while between 0.05 and 0.08 indicates the model has reasonable fit. Therefore, this model has good fit.

5.3 Data Analysis and Hypothesis Testing

This study uses AMOS 24.0.0. to process the data and examine the various assumptions of the theoretical model. According to the theoretical model diagram (Fig. 3.1), this study not only estimates the paths in the model to clarify the

relationships between the variables, but also tests the mediating effect of customer value and the adjustment effect of digital transformation maturity. In the model, the four dimensions (information and knowledge exchange, business collaboration, co-leading, and cost effectiveness) of customer participation in digital transformation are the model's exogenous variables. While there is a certain correlation between the four, it is an exogenous variable that does not affect the path analysis of the causal relationship within the model. Customer participation in digital transformation has an impact on firm performance and environmental, economic, and social performance through co-creation of customer value; as stated in the theoretical construction, the basis for value co-creation is the interaction and innovation between the customer and the enterprise. This study adds digital transformation maturity as a characteristic indicator of customer and enterprise interaction and innovation and adjusts the relationship between customer value and company performance. This is also a relationship that needs to be tested for theoretical verification.

5.3.1 Model Path Analysis and Discussion

1. The Relationship Between Digital Transformation and Value Co-Creation

Figure 5.2 Digital Transformation and Value Co-Creation Model Path Diagram and Parameter

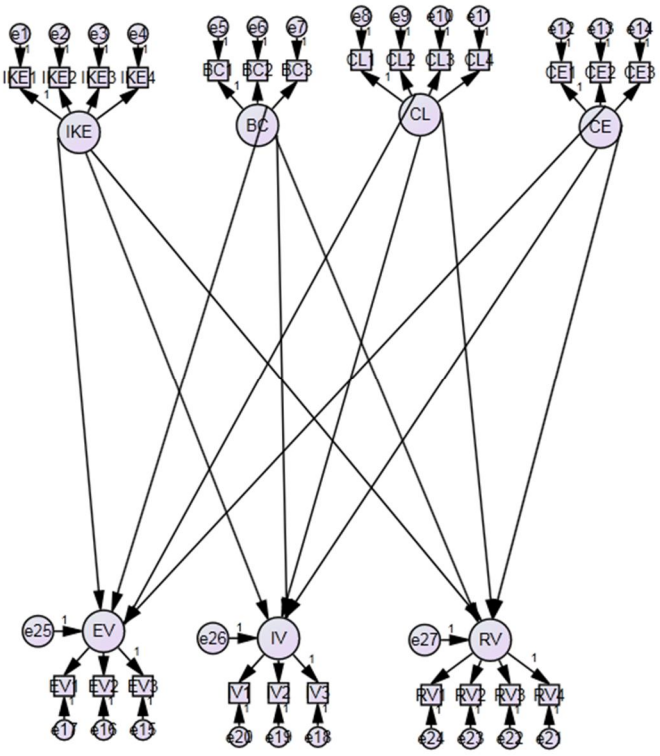


Table 5.6 Path Coefficients of Variables and Their Significance

Relationship Between Variables	Path Relationship	Estimated Coefficient	Standardized Coefficient	Standard Deviation	C.R.	Significance (P value)	Corresponding Assumption
IKE and value co-creation	IKE-->EV	0.165	0.204**	0.058	2.829	0.005	H1a
	IKE-->IV	0.136	0.136*	0.072	2.372	0.041	H2a
	IKE-->RV	0.134	0.218**	0.048	2,759	0.006	H3a
BC and value co-creation	BC-->EV	0.018	0.017	0.080	0.227	0.820	H1b
	BC-->IV	0.271	0.202*	0.108	2.507	0.012	H2b
	BC-->RV	0.111	0.135*	0.067	2.252	0.049	H3b
CL and value co-creation	CL-->EV	0.078	0.056	0.099	0.784	0.433	H1c
	CL-->IV	-0.022	-0.013	0.128	-0.169	0.866	H2c
	CL-->RV	0.023	0.022	0.081	0.288	0.773	H3c
CE and value co-creation	CE-->EV	0.160	0.152*	0.073	2.205	0.027	H1d
	CE-->IV	0.063	0.049	0.091	0.696	0.487	H2d
	CE-->RV	-0.014	-0.018	0.057	-0.250	0.803	H3d

Note: * means P value significance is less than 0.05, ** means P value significance is less than 0.01, and *** means P value significance is less than 0.001.

From the perspective of the overall model fit, the chi-squared value is CMIN=553.677, degrees of freedom are DF=240, and the chi-squared degrees of freedom ratio is CMIN/DF=2.307. When the chi-squared degrees of freedom ratio is between 1-3, the model fit is good. Other main indicators include CFI=0.847, TLI=0.824, and IFI=0.850, all at a level of about 0.9, and RMSEA=0.072, which is less than 0.08, indicating the model fit is good.

From the perspective of path relationships, IKE has a significantly positive relationship with EV, IV, and RV. BC has a significantly positive relationship with IV and RV, and CE has a significantly positive relationship with EV.

2. The Relationship between Value Co-Creation and Firm Performance

Figure 5.3 Value Co-Creation and Firm Performance Model Path Diagram and Parameter

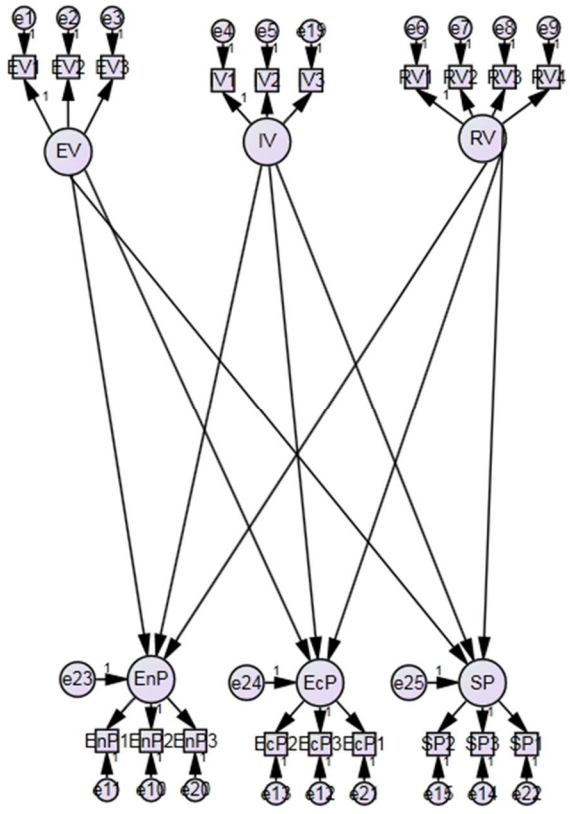


Table 5.7 Path Coefficients of Variables and Their Significance

Relationship Between	Path Relationship	Estimated Coefficient	Standardized Coefficient	Standard Deviation	C.R.	Significance (P value)	Corresponding Assumption

Variables							
EV and firm performance	EV-->EnP	0.140	0.129*	0.076	2.338	0.036	H4a
	EV-->EcP	0.149	0.183*	0.062	2.397	0.017	H4b
	EV-->SP	0.113	0.121	0.068	1.659	0.097	H4c
IV and firm performance	IV-->EnP	0.096	0.108	0.067	1.429	0.153	H5a
	IV-->EcP	0.130	0.196*	0.055	2.375	0.018	H5b
	IV-->SP	0.036	0.047	0.059	0.606	0.545	H5c
RV and firm performance	RV-->EnP	0.424	0.320***	0.113	3.770	0.000	H6a
	RV-->EcP	0.240	0.242**	0.088	2.733	0.006	H6b
	RV-->SP	0.221	0.193*	0.096	2.305	0.021	H6c

Note: * means P value significance is less than 0.05, ** means P value significance is less than 0.01, and *** means P value significance is less than 0.001.

From the overall fitness of the model, the chi-squared value CMIN = 406.11, the degrees of freedom DF = 143, and the chi-squared degrees of freedom ratio CMIN/DF = 2.84; a chi-squared degrees of freedom ratio between 1 and 3 indicates the model fit is good. Other main indicators include CFI = 0.837, TLI = 0.853, and IFI = 0.850, all at the level of about 0.9, and RMSEA = 0.07, which is less than 0.08, indicating the model fit is good.

From the path relationship, EV has a significantly positive relationship with EnP and EcP, IV has a significantly positive relationship with EcP, and RV has a significantly positive relationship with EnP, EcP, and SP.

5.3.2 Mediation Effect Analysis

The mediation effect can be expressed by the following regression equations:

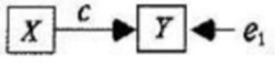
$$Y = cx + e_1 \quad (1)$$

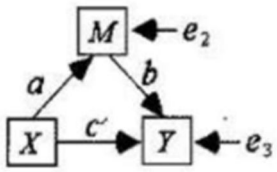
$$M = ax + e_2 \quad (2)$$

$$Y = c'x + bM + e_3 \quad (3)$$

Y is the dependent variable, X is the independent variable, and M is the mediating variable.

These three models and corresponding equations are shown as follows:





1. Test of Economic Value as a Mediating Variable

The first step is to test the formula: $Y = cx + e_1$ (1). That is, the significance of the regression coefficient between the dependent variable, firm performance, and the independent variable, digital transformation, is examined.

Table 5.8 Model Summary

Model	R	R Squared	Adjusted R Squared	Standard error of estimate	Change statistics				
					R squared change	F change	Degrees of freedom 1	Degrees of freedom 2	Significant F change
1	0.199	0.039	0.036	0.98204776	0.039	10.298	1	251	0.002

Table 5.9 Coefficients

Model	Unstandardized coefficient		Standardized coefficient	t	Significance (P value)
	B	Standard error	Beta		
(constant)	1.047E-15	0.062		0.000	1.000
Zscore: digital transformation	0.199	0.062	0.199	3.209	0.002

Table 5.9 shows the regression effect of formula (1) is significant; the zscore value is 0.199, with significance of p=0.002**. Regression testing can also be performed on equations (2) and (3).

The second step is to test the formula: $M = ax + e_2$ (2). That is, the significance of the regression coefficient between the mediating variable, economic value, and the independent variable, digital transformation, is tested.

Table 5.10 Model Summary

Model	R	R Squared	Adjusted R Squared	Standard error of	Change statistics				
					R squared	F change	Degrees of	Degrees of	Significant F

				estimate	change		freedom 1	freedom 2	change
1	0.234	0.055	0.051	0.97411730	0.055	14.569	1	251	0.000

Table 5.11 Coefficients

model	Unstandardized coefficient		Standardized coefficient	t	Significance (P value)
	B	Standard error	Beta		
(constant)	-3.030E-15	0.061		0.000	1.000
Zscore: digital transformation	0.234	0.061	0.234	3.817	0.000

As Table 5.11 shows, the regression effect of formula (2) is significant, with a value of 0.234 and significance of P < 0.000***.

The third step is to test the formula: $Y = c'x + bM + e_3$ (3). That is, the significance of the regression coefficient between the dependent variable, firm performance; the mediating variable; economic value; and the independent variable, digital transformation, is examined.

Table 5.12 Model Summary

Model	R	R Squared	Adjusted R Squared	Standard error of estimate	Change statistics				
					R squared change	F change	Degrees of freedom 1	Degrees of freedom 2	Significant F change
1	0.222	0.049	0.042	0.97893211	0.049	6.482	2	250	0.002

Table 5.13 Coefficients

Model	Unstandardized Coefficient		Standardized Coefficient	t	Significance (P value)
	B	Standard error	Beta		
(constant)	1.357E-15	0.062		0.000	1.000
Zscore: digital transformation	0.175	0.063	0.175	2.752	0.006
Zscore: economic value	0.102	0.063	0.102	1.613	0.108

Table 5.13 shows the regression effect of formula (3) is not significant; the b value is 0.102 with significance of p=0.108, which is not significant. The c' value is

0.175, with significance of p=0.006**, which is significant.

The above results show the mediating effect test results for economic value are not significant.

2. Test of Innovation Value as a Mediating Variable

The first step is to test the formula: $Y = cx + e_1$ (1). That is, the significance of the regression coefficient between the dependent variable, firm performance, and the independent variable, digital transformation, is examined.

Table 5.14 Model Summary

Model	R	R Squared	Adjusted R Squared	Standard error of estimate	Change statistics				
					R squared change	F change	Degrees of freedom 1	Degrees of freedom 2	Significant F change
1	0.199	0.039	0.036	0.98204776	0.039	10.298	1	251	0.002

Table 5.15 Coefficients

Model	Unstandardized coefficient		Standardized coefficient	t	Significance (P value)
	B	Standard error	Beta		
(constant)	1.047E-15	0.062		0.000	1.000
Zscore: digital transformation	0.199	0.062	0.199	3.209	0.002

As seen in Table 5.15, the regression effect of formula (1) is significant; the c value is 0.199 and significance is p=0.002**. Regression testing can also be performed on equations (2) and (3).

The second step is to test the formula: $M = ax + e_2$ (2). That is, the significance of the regression coefficient between the mediating variable, innovation value, and the independent variable, digital transformation, is examined.

Table 5.16 Model Summary

Model	R	R Squared	Adjusted R Squared	Standard error of estimate	Change statistics				
					R squared change	F change	Degrees of freedom 1	Degrees of freedom 2	Significant F change

1	0.128	0.016	0.013	0.99369518	0.016	4.208	1	251	0.041

Table 5.17 Coefficients

Model	Unstandardized coefficient		Standardized coefficient	t	Significance (P value)
	B	Standard error	Beta		
(constant)	-2.303E-15	0.062		0.000	1.000
Zscore: digital transformation	0.128	0.063	0.128	2.501	0.041

As shown in Table 5.17, the regression effect of formula (2) is significant; the a value is 0.128, with significance of p=0.041*.

The third step is to test the formula: $Y = c'x + bM + e_3$ (3). That is, the significance of the regression coefficient between the dependent variable, firm performance; the mediating variable, innovation value; and the independent variable, digital transformation, is tested.

Table 5.18 Model Summary

Model	R	R Squared	Adjusted R Squared	Standard error of estimate	Change statistics				
					R squared change	F change	Degrees of freedom 1	Degrees of freedom 2	Significant F change
1	0.233	0.054	0.047	0.97628283	0.054	7.196	2	250	0.001

Table 5.19 Coefficients

Model	Unstandardized Coefficient		Standardized coefficient	t	Significance (P value)
	B	Standard error	Beta		
(constant)	1.332E-15	0.061		0.000	1.000
Zscore: digital transformation	0.183	0.062	0.183	2.945	0.004
Zscore: innovation value	0.124	0.062	0.124	1.993	0.047

Table 5.19 shows the regression effect of formula (3) is significant; the b value is

0.124, with significance of p=0.047*, and the c' value is 0.183, with significance of p=0.004**.

The fourth step is to test the ratio of the mediating effect to the total effect and test how much of the variance of the dependent variable is explained by the mediating variable. The ratio of the mediating effect to total effect is: a*b/c=0.128*0.124/0.199=0.080. The amount of the dependent variable's variance explained by the mediating variable is the Sqrt(0.047-0.036)=10.49%. These results show a significant mediating effect on innovation value. The mediating effect ratio is 0.080. The mediating effect explains 10.49% of the variance of the dependent variable, firm performance.

3. Test of Relationship Value as a Mediating Variable

The first step is to test the formula: $Y = cx + e_1$ (1). That is, the significance of the regression coefficient between the dependent variable, firm performance, and the independent variable, digital transformation, is examined.

Table 5.20 Model Summary

Model	R	R Squared	Adjusted R Squared	Standard error of estimate	Change statistics				
					R squares change	F change	Degrees of freedom 1	Degrees of freedom 2	Significant F change
1	0.199	0.039	0.036	0.98204776	0.039	10.298	1	251	0.002

Table 5.21 Coefficients

Model	Unstandardized coefficient		Standardized coefficient	t	Significance (P value)
	B	Standard error	Beta		
(constant)	1.047E-15	0.062		0.000	1.000
Zscore: digital transformation	0.199	0.062	0.199	3.209	0.002

As seen in Table 5.21, the regression effect of formula (1) is significant; the c value is 0.199, with significance of p=0.002**. Regression testing can also be performed on equations (2) and (3).

The second step is to test the formula: $M = ax + e_2$ (2). That is, the significance

of the regression coefficient between the mediating variable, relationship value, and the independent variable, digital transformation. is examined.

Table 5.22 Model Summary

Model	R	R Squared	Adjusted R Squared	Standard error of estimate	Change statistics				
					R squared change	F change	Degrees of freedom 1	Degrees of freedom 2	Significant F change
1	0.131	0.017	0.013	0.99331384	0.017	4.404	1	251	0.037

Table 5.23 Coefficients

Model	Unstandardized coefficient		Standardized coefficient	t	Significance (P value)
	B	Standard error	Beta		
(constant)	-2.573E-15	0.062		0.000	1.000
Zscore: digital transformation	0.131	0.063	0.131	2.099	0.037

Table 5.23 shows the regression effect of formula (2) is significant; the a value is 0.131 and the significance is p=0.037*.

The third step is to test the formula: $Y = c^{'}x + bM + e_3$ (3). That is, the significance of the regression coefficient between the dependent variable, firm performance; the mediating variable, relationship value; and the independent variable, digital transformation, is examined.

Table 5.24 Model Summary

Model	R	R Squared	Adjusted R Squared	Standard error of estimate	Change statistics				
					R squared change	F change	Degrees of freedom 1	Degrees of freedom 2	Significant F change
1	0.301	0.090	0.083	0.95755913	0.090	12.417	2	250	0.000

Table 5.25 Coefficients

Model	Unstandardized coefficient		Standardized coefficient	t	Significance (P value)
	B	Standard error	Beta		
(constant)	1.633E-15	0.060		0.000	1.000
Zscore: digital transformation	0.169	0.061	0.169	2.771	0.006

Zscore: relationship value	0.228	0.061	0.228	3.742	0.000

As shown in Table 5.25, the regression effect of formula (3) is significant; the b value is 0.228, with significance of p = 0.000 ***, and the c' value is 0.169, with significance of p = 0.006**.

The fourth step is to test the ratio of the mediating effect to the total effect and the amount of the dependent variable's variance that is explained by the mediating variable. The ratio of the mediation effect to total effect is: a*b/c=0.131*0.228/0.199=0.150. The proportion of the dependent variable's variance explained by the mediating variable is Sqrt(0.083-0.036)=21.68%. There is a significant mediating effect on relationship value. The mediating effect ratio is 0.150, and the mediating effect explains the 21.68% of the variance of the dependent variable, firm performance.

5.3.3 Moderating Effect Analysis

If there is a relationship between two variables, but the relationship between them is affected by another variable, the third variable is called a moderating variable. In statistical analysis, the test of the moderating effect is primarily a test of whether the interaction effect between the moderating variable and the independent variable is significant. The specific steps are as follows:

The first step is to centralize the independent variable and the moderating variable to reduce the multiple collinearities among the variables. The second step is to construct the product term and use the product term of the centralized independent variable and the adjusting variable in a regression.

Table 5.26 Verify the Moderating Effect of DTM Between VC and EnP (H7a)

Model	Unstandardized coefficient		Standardized coefficient	t	Significance (P value)
	B	Standard error	Beta		
(constant)	8.421E-15	0.061		0.000	1.000
Zscore (value	0.250	0.062	0.250	4.042	0.000

co-creation) Zscore (digital transformation maturity)	0.071	0.062	0.071	1.143	0.254
(constant)	0.019	0.061		0.309	0.758
Zscore (value co-creation)	0.246	0.062	0.246	3.989	0.000
Zscore (digital transformation maturity)	0.066	0.062	0.066	1.072	0.285
Zscore (vc*dtm) Interaction term	-0.201	0.056	-0.201	-1.824	0.038

The results in Table 5.26 indicate the regression coefficient of the interaction term between the independent variable, value co-creation, and the moderating variable, digital transformation maturity, is -0.201, and the P value is 0.038*, indicating the result is significant. Digital transformation maturity has a significantly negative moderating effect on value co-creation and environmental performance.

Table 5.27 Verify the Moderating Effect of DTM Between VC and EcP (H7b)

Model	Unstandardized coefficient		Standardized coefficient	t	Significance (P value)
	B	Standard error	Beta		
(constant)	1.852E-15	0.061		0.000	1.000
Zscore (value co-creation)	0.237	0.062	0.237	3.797	0.000
Zscore (digital transformation maturity)	-0.134	0.062	-0.134	-2.145	0.033
(constant)	0.014	0.062		0.219	0.827
Zscore (value co-creation)	0.234	0.062	0.234	3.751	0.000
Zscore (digital transformation maturity)	-0.137	0.062	-0.137	-2.199	0.029
Zscore (vc*dtm) Interaction term	-0.073	0.056	-0.073	-1.294	0.197

As shown in Table 5.27, the regression coefficient of the interaction term between the independent variable and moderating variable is -0.073, and the P value is 0.197, which is not significant. Digital transformation maturity has no significant moderating effect on value co-creation and economic performance.

Table 5.28 Verify the Moderating Effect of DTM Between VC and SP (H7c)

Model	Unstandardized coefficient		Standardized coefficient	t	Significance (P value)
	B	Standard error	Beta		
(constant)	5.064E-15	0.062		0.000	1.000
Zscore (value co-creation)	0.196	0.063	0.196	3.099	0.002
Zscore (digital transformation maturity)	-0.073	0.063	-0.073	-1.164	0.246
(constant)	0.002	0.063		0.037	0.971
Zscore (value co-creation)	0.195	0.063	0.195	3.083	0.002
Zscore (digital transformation maturity)	-0.074	0.063	-0.074	-1.170	0.243
Zscore (vc*dtm) Interaction term	-0.012	0.057	-0.013	-0.216	0.829

Table 5.28 shows the regression coefficient of the interaction term between the independent variable and moderating variable is -0.012, and the P value is 0.829, which is not significant. Data transformation maturity has no significant moderating effect on value co-creation and social performance.

5.4 Conclusion

This chapter mainly analyses traditional enterprise customer data. Through the use of SPSS statistics R23.0.0.0, the data of the research objects are sorted out and analysed. Exploratory factor analysis, reliability and validity analysis, and validity tests

are performed. It is found that each condition is good, the measurement scale has good internal consistency, and the overall reliability of the data is good. Through the data processing, the hypothesis of the theoretical model is tested, and the path in the model is estimated to clarify the relationships between the variables. At the same time, the moderating effect of digital maturity in digital transformation and the intermediary effect of value co-creation are tested.

Generally speaking, digital maturity plays a regulating role in the process of customer participation in digital transformation. The degree of co-creation of customer participation in digital transformation and customer value and the impact on company performance depend on the intensity of digital maturity. In the case of high digital maturity, the probability of successful digital transformation is also higher.

Chapter 6 - Digital Transformation of Internet Enterprise Customer

6.1 Exploratory Factor Analysis

Exploratory factor analysis was performed on all data, and the results show the KMO value is 0.672. The closer the KMO value is to 1, the more common factors there are among the variables, and the more suitable the data are for factor modules. The more common standard, KMO reaches 0.6 or more, which is suitable for factor analysis. The approximate chi-squared value of Barlett's spherical test is 4426.659, with degrees of freedom of 703, reaching a significant level (P<0.000). The Barlett spherical test shows there is a common factor between the overall correlation matrices, which are suitable for factor analysis. Exploratory factor analysis results show the cumulative variance interpretation rate is 68.716%, and the effect is very good.

Table 6.1 Exploratory Factor Analysis Results

Rotating Component Matrix a											
	Component										
	1	2	3	4	5	6	7	8	9	10	11
DTM1	.676	-.068	.029	.135	.038	.133	.157	.106	-.093	.039	-.244
DTM2	.767	.011	.115	.080	.067	-.036	.123	.167	.047	.009	-.124
DTM3	.830	-.018	.018	.013	-.016	-.010	.047	-.014	-.013	.095	.019
DTM4	.779	.064	.140	.063	-.028	.059	-.085	-.258	.050	.110	.117
DTM5	.767	.090	.067	-.012	-.111	.093	-.026	-.055	.024	.071	.031
EnP1	.345	.558	.192	-.022	-.141	-.064	.280	-.108	.240	.124	.238
EnP2	.208	.677	.071	-.133	.048	-.011	.261	-.004	.172	.034	.078
EnP3	.063	.768	.086	-.055	-.083	.046	.123	.195	.215	.016	-.116
IKE1	.069	.204	.831	-.020	-.036	.007	.002	.057	.014	-.007	-.022
IKE2	.89	.115	.874	.026	.031	.110	.036	-.001	.089	-.057	.-094
IKE3	.112	.093	.841	.032	.078	.034	.071	-.025	.041	-.014	.016
IKE4	.094	-.058	.554	.031	.151	.138	.126	-.232	.178	.171	.040
CE1	.048	.005	.037	.775	.042	-.026	.006	-.083	-.024	.108	.128
CE2	.083	.040	.001	.845	-.044	.027	.072	-.034	.107	.007	-.146
CE3	.092	-.050	-.003	.838	-.067	.028	.032	.056	.221	-.027	-.079
SP1	-.026	.227	.041	-.033	.796	-.012	.083	.070	.076	.005	-.049
SP2	-.032	.007	.038	-.129	.826	-.024	.093	.003	.073	.029	-.070
SP3	.000	-.123	.103	.042	.726	.036	-.057	.235	.111	-.029	-.063

IV1	.087	.010	.028	-.098	.005	.688	-.071	.052	.077	.045	-.137
IV2	.005	.128	.081	-.022	-.054	.820	.089	-.043	-.088	.043	-.056
IV3	.095	.074	.133	.174	.063	.831	.110	-.066	-.011	.057	.160
RV1	-.003	.161	.000	-.016	-.032	.534	.561	-.170	-.001	-.056	.122
RV2	.004	.005	.007	.004	.153	.336	.748	-.032	-.046	-.108	.039
RV3	.025	.144	.090	.017	.019	-.076	.814	-.060	.015	.048	-.026
RV4	.186	.113	.093	.155	.050	-.055	.693	.199	-.059	.124	-.035
CL1	-.037	.035	-.073	-.019	.110	-.070	.019	.771	.093	.068	.091
CL2	.025	-.047	-.009	-.041	.081	-.014	-.018	.816	.033	.032	.199
CL3	-.110	.145	-.053	-.075	-.009	.024	.006	.554	.000	.002	.680
CL4	-.045	-.024	-.039	-.066	-.105	-.039	.023	.557	-.039	-.007	.842
EV1	-.030	.016	.067	.526	-.054	-.064	.087	-.026	.622	-.022	-.175
EV2	-.036	.134	.098	.228	.094	.041	-.066	-.058	.818	-.010	.057
EV3	.073	.068	.123	.004	.143	-.026	-.052	.236	.798	-.028	-.016
BC1	.078	-.053	.070	-.006	.023	.071	.171	-.128	.070	.752	.101
BC2	.173	.164	.002	-.001	-.076	-.015	-.056	.032	-.090	.809	-.064
BC3	.056	.096	-.051	.105	.101	.067	-.065	.229	.-.026	.779	-.041
EcP1	-.102	-.078	.104	.057	.134	.213	.074	-.018	-.025	.117	.714
EcP2	-.014	.127	.135	.061	.112	.058	-.047	-.063	-.043	.026	.703
EcP3	-.041	.147	-.022	.125	.602	.017	.085	-.159	-.169	.090	.580

As shown in Table 6.1, the loading of each item is above 0.55, and the condition of each item is good.

6.2 Reliability and Validity Analysis

6.2.1 Reliability Analysis

Table 6.2 Reliability Analysis of Internal Consistency of Measurement Scale

Dimension	Test Item	Corrected Item Total Correlation (CITC)	Complex squared correlation coefficient (R2)	Scale Item Deleted Cronbach`s Alpha	Cronbach`s Alpha
Information and Knowledge Exchange	IKE1	0.591	0.625	0.789	0.815
	IKE2	0.773	0.656	0.704	
	IKE3	0.746	0.550	0.715	
	IKE4	0.458	0.342	0.849	
Business Collaboration	BC1	0.448	0.323	0.685	0.698
	BC2	0.560	0.389	0.547	
	BC3	0.540	0.331	0.574	
Co-Leading	CL1	0.419	0.353	0.677	0.700
	CL2	0.551	0.431	0.594	
	CL3	0.571	0.469	0.583	
	CL4	0.408	0.347	0.684	
Cost Effectiveness	CE1	0.496	0.355	0.797	0.767
	CE2	0.672	0.553	0.608	
	CE3	0.642	0.496	0.638	
Economic Value	EV1	0.572	0.331	0.771	0.785
	EV2	0.717	0.499	0.609	
	EV3	0.594	0.361	0.741	
Innovation Value	IV1	0.509	0.328	0.803	0.776
	IV2	0.686	0.464	0.612	
	IV3	0.649	0.417	0.656	
Relationship Value	RV1	0.498	0.359	0.748	0.767
	RV2	0.661	0.419	0.660	
	RV3	0.625	0.383	0.681	
	RV4	0.493	0.319	0.751	
Digital Transformation Maturity	DTM1	0.545	0.447	0.810	0.644
	DTM2	0.672	0.529	0.773	
	DTM3	0.693	0.502	0.764	
	DTM4	0.624	0.492	0.785	
	DTM5	0.571	0.459	0.802	
Environmental	EnP1	0.491	0.322	0.759	0.698

Performance	EnP2	0.675	0.427	0.386	
	EnP3	0.497	0.339	0.627	
Economic Performance	EcP1	0.486	0.333	0.414	0.612
	EcP2	0.490	0.373	0.555	
	EcP3	0.488	0.330	0.560	
Social Performance	SP1	0.530	0.358	0.702	0.742
	SP2	0.602	0.398	0.618	
	SP3	0.572	0.368	0.652	

Table 6.2 show the values of Cronbach`s alpha in each dimension of the scale ranged from 0.612 to 0.815, which indicating the internal consistency of the scale is good; the total correlation values of each item of the scale ranged from 0.408 to 0.773, mostly higher than 0.5. The complex squared correlation value is the decisive factor in multiple regression. The higher the complex squared correlation value, the higher the internal consistency between the test item and other items. The critical value of the complex squared correlation value of each item in the scale is greater than 0.3. From this perspective, the scale has good internal consistency. Based on the above analysis, the overall reliability of the measurement data is good.

6.2.2 Validity Analysis

Table 6.3 Single Dimension Test of Variables

Variable	Cumulative interpretation variance /%	KMO
Information and Knowledge Exchange	65.530	0.684
Business Collaboration	64.147	0.647
Co-Leading	80.866	0.605
Cost Effectiveness	72.882	0.684
Economic Value	68.033	0.637
Innovation Value	66.636	0.643
Relationship Value	57.351	0.672
Digital Transformation Maturity Measurement items	61.255	0.790
Environmental Performance	63.879	0.616
Economic Performance	60.982	0.662
Social Performance	69.028	0.700

Table 6.3 shows the cumulative explanatory variance is more than 60%, and the KMO value of each variable is more than 0.5. Indicators show the single-dimensional character of each variable is good.

6.2.3 Confirmatory Factor Analysis Path Diagram

Figure 6.1 Confirmatory Factor Analysis Path Diagram

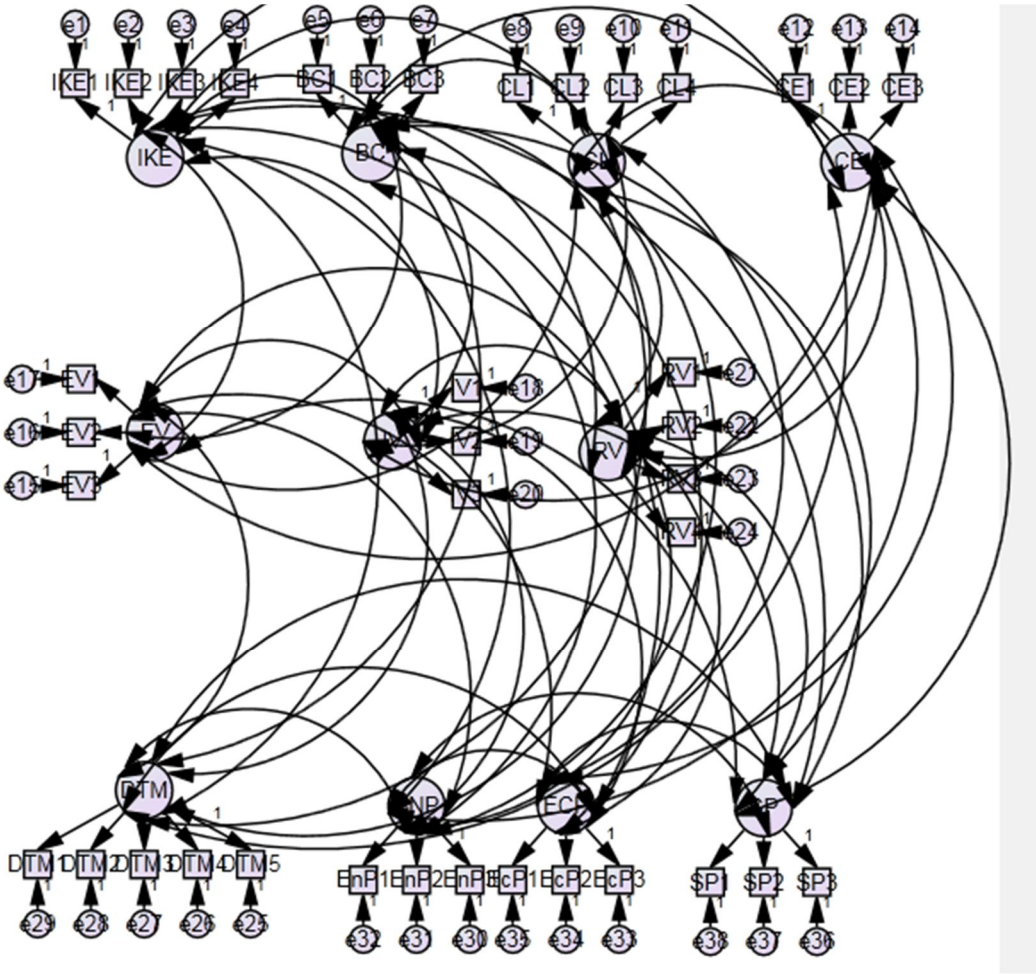


Table 6.4 Confirmatory Factor Analysis Estimated Results

	Factor loading	Standardized factor loading	Standard deviation	C.R.	Significance (P value)
IKE1<--IKE	1.000	0.811			
IKE2<--IKE	1.053	0.914***	0.071	14.928	0.000
IKE3<--IKE	0.855	0.734***	0.069	12.473	0.000
IKE4<--IKE	0.541	0.458***	0.075	7.194	0.000

BC1<--BC	1.000	0.531			
BC2<--BC	1.642	0.849***	0.244	6.741	0.000
BC3<--BC	1.425	0.667***	0.204	6.998	0.000
CE1<--CE	1.000	0.641			
CE2<--CE	1.426	0.847***	0.143	9.977	0.000
CE3<--CE	1.407	0.825***	0.141	9.955	0.000
CL1<--CL	1.000	0.678			
CL2<--CL	1.089	0.783***	0.133	8.158	0.000
CL3<--CL	0.921	0.624***	0.119	7.717	0.000
CL4<--CL	0.560	0.480***	0.110	5.070	0.000
EV1<--EV	1.129	0.690***	0.127	8.870	0.000
EV2<--EV	1.257	0.834***	0.134	9.372	0.000
EV3<--EV	1.000	0.669			
IV1<--IV	1.000	0.497			
IV2<--IV	1.559	0.774***	0.219	7.124	0.000
IV3<--IV	1.682	0.836***	0.237	7.106	0.000
RV1<--RV	1.000	0.717			
RV2<--RV	1.078	0.780***	0.113	9.534	0.000
RV3<--RV	0.886	0.602***	0.109	8.097	0.000
RV4<--RV	0.702	0.489***	0.105	6.709	0.000
DTM1<--DTM	0.831	0.635***	0.092	9.028	0.000
DTM2<--DTM	0.815	0.713***	0.081	10.035	0.000
DTM3<--DTM	0.981	0.788***	0.090	10.897	0.000
DTM4<--DTM	0.926	0.747***	0.089	10.445	0.000
DTM5<--DTM	1.000	0.704			
EnP1<--EnP	0.791	0.532***	0.108	7.330	0.000
EnP2<--EnP	1.197	0.825***	0.122	9.819	0.000
EnP3<--EnP	1.000	0.701			
EcP1<--EcP	1.136	0.730***	0.147	7.717	0.000
EcP2<--EcP	0.946	0.579***	0.139	6.811	0.000
EcP3<--EcP	1.000	0.598			
SP1<--SP	1.008	0.759***	0.112	8.996	0.000
SP2<--SP	1.010	0.742***	0.113	8.959	0.000
SP3<--SP	1.000	0.689			

Note: * means P value significance is less than 0.05, ** means P value significance is less than 0.01, and *** means P value significance is less than 0.001.

As shown in Table 6.4, the factor loading values of each test item reached a significant level ($P < 0.001$), and the standardized factor loading fell between

0.458-0.914, most of which met the range standard of 0.50-0.95. The relative importance of the measured variables in each latent variable can be understood by the factor loading values. The higher the standardized factor loading, the greater the explained variation, which indicates the scale has good convergent validity.

Table 6.5 Degrees of Freedom and Chi-squared Values

Model	NPAR	CMIN	DF	Significance (P value)	CMIN/DF
Default model	131	1567.250	610	0.000	2.569
Saturated model	741	0.000	0		
Independence model	38	4506.055	703	0.000	6.410

From the perspective of the model's fitness index, Table 6.5 shows the chi-squared value CMIN is 1567.250, the degrees of freedom DF are 610, and the chi-squared degrees of freedom ratio CMIN/DF is 2.569. A chi-squared degrees of freedom ratio of less than 1 indicates the model is overfitted, a value greater than 3 indicates the model is not well-suited, and values between 1 and 3 indicate the model fits well. Other major model fit indicators also performed well, with a CFI of 0.848, a TLI of 0.810, and an IFI of 0.854, all close to the critical value of 0.9 and RMSE of 0.079, which is close to 0.08. In general, if the RMSE value is above 0.1, it means the model has poor fit, while values between 0.05 and 0.08 indicate that the model has a reasonable fit. Therefore, this model has good fit.

6.3 Data Analysis and Hypotheses Testing

This study uses AMOS 24.0.0. to process the data and examine the various assumptions of the theoretical model.

6.3.1 Model Path Analysis and Discussion

1. The Relationship between Digital Transformation and Value Co-Creation

Figure 6.2 Digital Transformation and Value Co-Creation Model Path Diagram and

Parameter

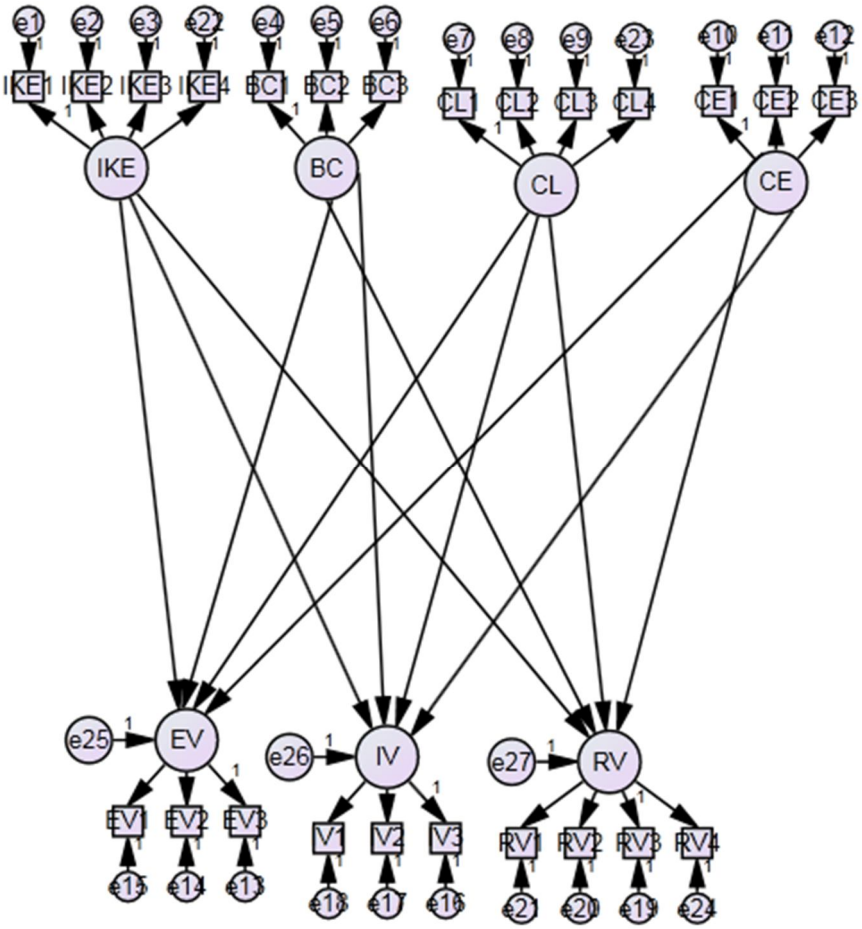


Table 6.6 Path Coefficients of Variables and Their Significance

Relationship between variables	Path relationship	Estimated coefficient	Standardized coefficient	Standard deviation	C.R.	Significance (P value)	Corresponding assumption
IKE and value co-creation	IKE-->EV	0.179	0.232**	0.054	3.288	0.001	H1a
	IKE-->IV	0.196	0.224**	0.065	2.997	0.003	H2a
	IKE-->RV	0.139	0.176*	0.060	2.305	0.021	H3a
BC and value co-creation	BC-->EV	-0.103	-0.082	0.092	-1.127	0.260	H1b
	BC-->IV	0.171	0.120	0.112	1.522	0.128	H2b
	BC-->RV	0.018	0.014	0.103	0.170	0.865	H3b
CL and value co-creation	CL-->EV	0.107	0.154*	0.069	2.551	0.021	H1c
	CL-->IV	-0.084	-0.079	0.083	-1.012	0.312	H2c
	CL-->RV	-0.018	-0.019	0.078	-0.231	0.817	H3c
CE and value co-creation	CE-->EV	0.430	0.437***	0.084	5.132	0.000	H1d
	CE-->IV	0.051	0.046	0.083	0.617	0.537	H2d
	CE-->RV	0.085	0.135*	0.078	3.090	0.046	H3d

Note: * indicates the significance of the P value is less than 0.05, ** indicates the significance of the P value is less than 0.01, and *** indicates the significance of the P value is less than 0.001.

From the perspective of the overall fit of the model, the chi-squared value is CMIN=674.914, degrees of freedom are DF=240, and the chi-squared degrees of freedom ratio is CMIN/DF=2.833. When the chi-squared degrees of freedom ratio is between 1-3, the model fit is good. Other main indicators include CFI=0.871, TLI=0.837, and IFI=0.875, all at a level of about 0.9 and RMSEA=0.071, less than 0.08, indicating the model fit is good.

From the perspective of path relationships, IKE has a significantly positive relationship with EV, IV, and RV. CL has a significantly positive relationship with EV, and CE has a significantly positive relationship with EV and RV.

2. The Relationship Between Value Co-Creation and Firm Performance

Figure 6.3 Value Co-Creation and Firm Performance Model Path Diagram and Parameter

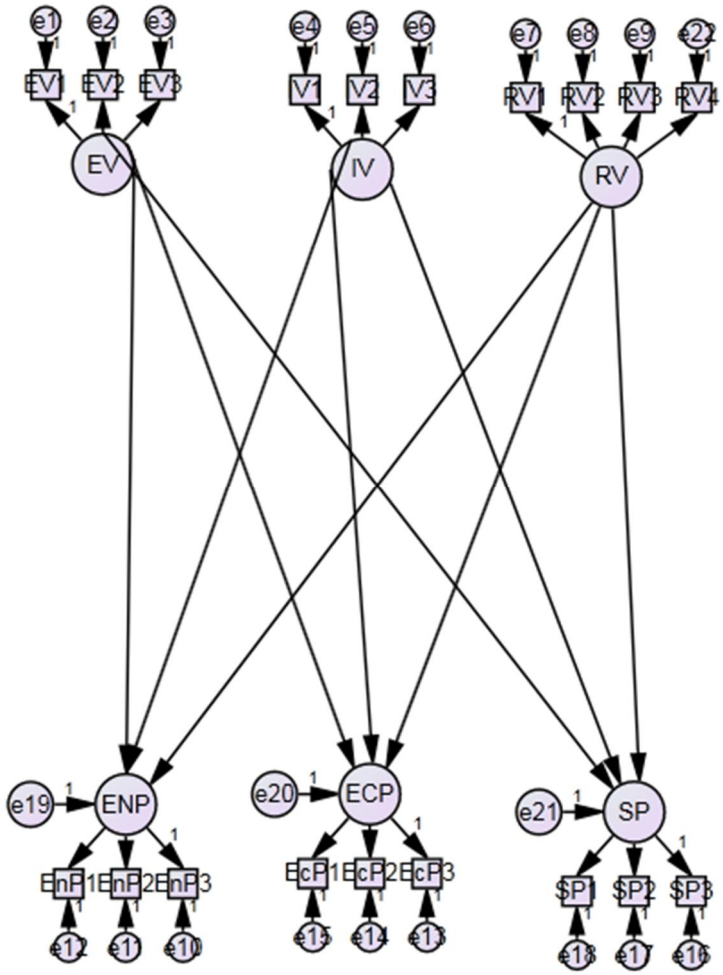


Table 6.7 Path Coefficients of Variables and Their Significance

Relationship between variables	Path relationship	Estimated coefficient	Standardized coefficient	Standard deviation	C.R.	Significance (P value)	Corresponding assumption
EV and firm performance	EV-->EnP	0.199	0.220**	0.067	2.950	0.003	H4a
	EV-->EcP	0.181	0.202*	0.073	2.492	0.013	H4b
	EV-->SP	0.186	0.162*	0.088	2.129	0.033	H4c
IV and firm performance	IV-->EnP	0.071	0.062	0.082	0.867	0.386	H5a
	IV-->EcP	0.196	0.173*	0.095	2.070	0.038	H5b
	IV-->SP	-0.045	-0.031	0.112	-0.403	0.687	H5c
RV and firm performance	RV-->EnP	0.449	0.419***	0.098	4.480	0.000	H6a
	RV-->EcP	0.367	0.354***	0.100	3.686	0.000	H6b
	RV-->SP	0.241	0.180**	0.110	2.190	0.029	H6c

Note: * indicates the significance of the P value is less than 0.05, ** indicates the significance of the P value is less than 0.01, and *** indicates the significance of the P value is less than 0.001.

From the perspective of the overall model fit, the chi-squared value is CMIN=406.566, degrees of freedom are DF=143, and the chi-squared degrees of freedom ratio is CMIN/DF=2.843. When the chi-squared degrees of freedom ratio is between 1-3, the model fit is good. Other main indicators include CFI=0.816, TLI=0.860, and IFI=0.821, all at a level of around 0.9 and RMSEA=0.07, less than 0.08, indicating the model fit is good.

From the perspective of path relationships, EV has a significantly positive relationship with EnP, EcP, and SP. IV has a significantly positive relationship with EcP. RV has a significantly positive relationship with EnP, EcP, and SP.

6.3.2 Mediation Effect Analysis

The mediating effect can be expressed by the following regression equations:

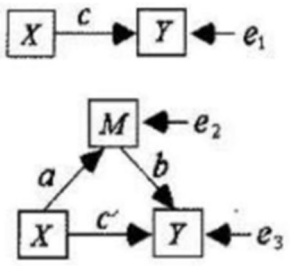
$$Y = cx + e_1 \quad (1)$$

$$M = ax + e_2 \quad (2)$$

$$Y = c'x + bM + e_3 \quad (3)$$

Y is the dependent variable, X is the independent variable and M is the mediating variable.

These three equation models and the corresponding equations are shown as follows:



1. Test of Economic Value as a Mediating Variable

The first step is to test the formula, $Y = cx + e_1$ (1). That is, the significance of the regression coefficient between the dependent variable, firm performance, and the independent variable, digital transformation, is examined.

Table 6.8 Model Summary

Model	R	R Squared	Adjusted R Squared	Standard error of estimate	Change statistics				
					R squared change	F change	Degrees of freedom 1	Degrees of freedom 2	Significant F change
1	0.280	0.078	0.075	0.96196576	0.078	21.321	1	251	0.000

Table 6.9 Coefficients

Model	Unstandardized coefficient		Standardized coefficient	t	Significance (P value)
	B	Standard error	Beta		
(constant)	3.14E-15	0.060		0.000	1.000
Zscore: digital transformation	0.280	0.061	0.280	4.617	0.000

As shown in Table 6.9, the regression effect of formula (1) is significant; the c value is 0.280, and significance is p=0.000***. Regression testing can also be performed on equations (2) and (3).

The second step is to test the formula: $M = ax + e_2$ (2). That is, the significance of the regression coefficient between the mediating variable, economic value, and the independent variable, digital transformation, is tested.

Table 6.10 Model Summary

Model	R	R Squared	Adjusted R Squared	Standard error of estimate	Change statistics				
					R squared change	F change	Degrees of freedom 1	Degrees of freedom 2	Significant F change
1	0.305	0.093	0.089	0.95432993	0.093	25.696	1	251	0.000

Table 6.11 Coefficients

Model	Unstandardized coefficient		Standardized coefficient	t	Significance (P value)
	B	Standard error	Beta		
(constant)	5.18E-15	0.060		0.000	1.000
Zscore: digital transformation	0.305	0.060	0.305	5.069	0.000

Table 6.11 shows the regression effect of formula (2) is significant; the a value is 0.305, with significance of p < 0.000 ***.

The third step is to test the formula: $Y = c'x + bM + e_3$ (3). That is, the significance of the regression coefficient between the dependent variable, firm performance; the intermediate variable, economic value; and the independent variable, digital transformation, is examined.

Table 6.12 Model Summary

Model	R	R Squared	Adjusted R Squared	Standard error of estimate	Change statistics				
					R squared change	F change	Degrees of freedom 1	Degrees of freedom 2	Significant F change
1	0.304	0.093	0.085	0.95632442	0.093	12.772	2	250	0.000

Table 6.13 Coefficient

Model	Unstandardized coefficient		Standardized coefficient	t	Significance (P value)
	B	Standard error	Beta		
(constant)	3.075E-15	0.060		0.000	1.000
Zscore: digital transformation	0.241	0.063	0.241	3.817	0.000
Zscore: economic value	0.126	0.063	0.126	1.992	0.047

Table 6.13 shows the regression effect of formula (3) is not significant; the b value is 0.126, with significance of p=0.047*. The c' value is 0.241, with significance of p=0.000***, and the result is significant.

The fourth step is to test the ratio of the mediating effect to the total effect and how much of the variance of the dependent variable is explained by the mediating variable. The ratio of the mediating effect to total effect is: a*b/c=0.305*0.126/0.280=0.137. The amount of the dependent variable's variance is explained by the mediating variable is Sqrt(0.085-0.075)=10%. There is a significant mediating effect of economic value, which accounts for 0.137. The mediating effect explains 10% of the variance of the dependent variable.

2. Test of Innovation Value as an Intermediate Variable

The first step is to test the formula $Y = cx + e_1$ (1). That is, the significance of the regression coefficient between the dependent variable, firm performance, and the independent variable, digital transformation, is examined.

Table 6.14 Model Summary

Model	R	R Squared	Adjusted R Squared	Standard error of estimate	Change statistics				
					R squared change	F change	Degrees of freedom 1	Degrees of freedom 2	Significant F change
1	0.280	0.078	0.075	0.96196576	0.078	21.321	1	251	0.000

Table 6.15 Coefficients

Model	Unstandardized coefficient		Standardized coefficient	t	Significance (P value)
	B	Standard error	Beta		
(constant)	3.14E-15	0.060		0.000	1.000
Zscore: digital transformation	0.280	0.061	0.280	4.617	0.000

As Table 6.15 shows, the regression effect of formula (1) is significant; the C value is 0.280, and its significance is p=0.000***. The regression tests of formulas (2) and (3) can be continued.

The second step is to test the formula $M = ax + e_2$ (2). That is, the significance of the regression coefficient between the mediating variable, induction value, and the independent variable, digital transformation, is examined.

Table 6.16 Model Summary

Model	R	R Squared	Adjusted R Squared	Standard error of estimate	Change statistics				
					R squared change	F change	Degrees of freedom 1	Degrees of freedom 2	Significant F change
1	0.149	0.022	0.018	0.99086375	0.022	5.669	1	251	0.018

Table 6.17 Coefficients

Model	Unstandardized coefficient		Standardized coefficient	t	Significance (P value)
	B	Standard error	Beta		
(constant)	-3.939E-15	0.062		0.000	1.000
Zscore: digital transformation	0.149	0.062	0.149	2.381	0.018

Table 6.17 shows the regression effect of formula (2) is significant, with a value of 0.149 and significance of p=0.018*.

The third step is to test the formula: $Y = c'x + bM + e_3$ (3). That is, the significance of the regression coefficient between the dependent variable, firm performance; the mediating variable, innovation value; and the independent variable, digital transformation, is tested.

Table 6.18 Model Summary

Model	R	R Squared	Adjusted R Squared	Standard error of estimate	Change statistics				
					R squared change	F change	Degrees of freedom 1	Degrees of freedom 2	Significant F change
1	0.302	0.091	0.084	0.9571401	0.091	12.537	2	250	0.000

Table 6.19 Coefficients

Model	Unstandardized coefficient		Standardized coefficient	t	Significance (P value)
	B	Standard error	Beta		
(constant)	3.592E-15	0.060		0.000	1.000
Zscore: digital transformation	0.263	0.061	0.263	4.310	0.000
Zscore: innovation value	0.115	0.061	0.115	1.881	0.061

As shown in Table 6.19, the regression effect of formula (3) is not significant; the b value is 0.115, and its significance is p=0.061, which is not significant. The c' value is 0.263, and its significance is p=0.000***. This result is significant.

The above results show the mediating effect of innovation value is not significant.

3. Test of Relationship Value as a Mediating Variable

The first step is to test the formula: $Y = cx + e_1$ (1). That is, the significance of the regression coefficient between the dependent variable, firm performance, and the independent variable, digital transformation, is examined.

Table 6.20 Model Summary

Model	R	R Squared	Adjusted R Squared	Standard error of estimate	Change statistics				
					R squared change	F change	Degrees of freedom 1	Degrees of freedom 2	Significant F change

1	0.280	0.078	0.075	0.96196576	0.078	21.321	1	251	0.000

Table 6.21 Coefficients

Model	Unstandardized coefficient		Standardized coefficient	t	Significance (P value)
	B	Standard error	Beta		
(constant)	3.14E-15	0.060		0.000	1.000
Zscore: digital transformation	0.280	0.061	0.280	4.617	0.000

As shown in Table 6.21, the regression effect of formula (1) is significant; the C value is 0.280 and its significance is p=0.000***. The regression tests of formulas (2) and (3) can be continued.

The second step is to test the formula: $M = ax + e_2$ (2). That is, the significance of the regression coefficient between the mediating variable, relationship value, and the independent variable, digital transformation, is examined.

Table 6.22 Model Summary

Model	R	R Squared	Adjusted R Squared	Standard error of estimate	Change statistics				
					R squared change	F change	Degrees of freedom 1	Degrees of freedom 2	Significant F change
1	0.164	0.027	0.023	0.98848219	0.027	6.907	1	251	0.009

Table 6.23 Coefficients

Model	Unstandardized coefficient		Standardized coefficient	t	Significance (P value)
	B	Standard error	Beta		
(constant)	1.673E-15	0.062		0.000	1.000
Zscore: digital transformation	0.164	0.062	0.164	2.628	0.009

Table 6.23 shows the regression effect of formula (2) is significant, with a value of 0.164 and significance of p=0.009**.

The third step is to test the formula: $Y = c'x + bM + e_3$ (3). That is, the significance of the regression coefficient between the dependent variable, firm performance; the mediating variable, relationship value; and the independent

variable, digital transformation, is examined.

Table 6.24 Model Summary

Model	R	R Squared	Adjusted R Squared	Standard error of estimate	Change statistics				
					R squared change	F change	Degrees of freedom 1	Degrees of freedom 2	Significant F change
1	0.383	0.146	0.140	0.92759148	0.146	21.439	2	250	0.000

Table 6.25 Coefficients

Model	Unstandardized coefficient		Standardized coefficient	t	Significance (P value)
	B	Standard error	Beta		
(constant)	2.697E-15	0.058		0.000	1.000
Zscore: digital transformation	0.237	0.059	0.237	3.993	0.000
Zscore: relationship value	0.265	0.059	0.265	4.466	0.000

As shown in Table 6.25, the regression effect of formula (3) is significant; the b value is 0.265, and its significance is P = 0.000***. The C' value is 0.237, with significance at P = 0.000***.

The fourth step is to test the ratio of the mediating effect to total effect and how much of the variance of the dependent variable is explained by the mediating variable. The ratio of the mediating effect to the total effect is a*b/c=0.164*0.265/0.280=0.155. The variance of dependent variable that is explained by the mediating variable is Sqrt (0.140-0.075) = 25.50%. There is a significant mediating effect in the relationship. The ratio of the mediating effect to the total effect is 0.155. The mediating effect explains 25.50% of the variance of firm performance.

6.3.3 Moderating Effect Analysis

In statistical analysis, the test of the regression effect is mainly to determine whether the interaction effect between the moderating variable and independent variable is significant. The specific steps are as follows.

The first step is to centralize the independent variable and moderating variable to reduce the multiple collinearities among the variables. The second step is to

construct the product term and include the product term of the centralized independent variable and adjusting variable in the regression.

Table 6.26 Verify the Moderating Effect of DTM Between VC and EnP (H7a)

Model	Unstandardized coefficient		Standardized coefficient	t	Significance (P value)
	B	Standard error	Beta		
(constant)	0.008	0.060		0.136	0.892
Zscore (value co-creation)	0.360	0.059	0.360	6.086	0.000
Zscore (digital transformation maturity)	-0.038	0.050	-0.045	-0.764	0.446
（constant）	0.005	0.059		0.078	0.938
Zscore (value co-creation)	0.323	0.059	0.323	5.438	0.000
Zscore (digital transformation maturity)	0.184	0.060	0.184	3.906	0.002
Zscore (vc*dtm) Exchange item	-0.022	0.050	-0.025	-0.434	0.665

Examining Table 6.26, we can see the regression coefficient of the interaction term between the independent variable, value co-creation, and the moderating variable, digital transformation maturity, is -0.022, and the P value is 0.665. The results are not significant, which shows digital transformation maturity has no significant moderating effect on value co-creation and environmental performance.

Table 6.27 Verify the Moderating Effect of DTM Between VC and EcP (H7b)

Model	Unstandardized coefficient		Standardized coefficient	t	Significance (P value)
	B	Standard error	Beta		
(constant)	-0.009	0.062		-0.143	0.886
Zscore (value co-creation)	0.262	0.061	0.262	4.270	0.000
Zscore (digital transformation maturity)	0.042	0.052	0.049	0.805	0.422
(constant)	-0.008	0.062		-0.127	0.899
Zscore (value co-creation)	0.272	0.063	0.272	4.342	0.000
Zscore (digital transformation maturity)	-0.051	0.063	-0.051	-0.809	0.420
Zscore (vc*dtm) Exchange item	0.237	0.053	0.237	4.011	0.028*

As Table 6.27 shows, the regression coefficients of the interaction terms between the independent variables and moderating variables are 0.237, and the P value is 0.028*. These results are significant, and show that digital transformation maturity has a significantly positive moderating effect on value co-creation and economic performance.

Table 6.28 Verify the Moderating Effect of DTM Between VC and SP (H7c)

Model	Unstandardized coefficient		Standardized coefficient	t	Significance (P value)
	B	Standard error	Beta		
(constant)	-0.003	0.063		-0.042	0.967
Zscore (value co-creation)	0.205	0.062	0.205	3.303	0.001
Zscore (digital transformation maturity)	0.012	0.053	0.015	0.236	0.814
（constant）	-0.001	0.063		-0.016	0.987
Zscore (value co-creation)	0.223	0.063	0.223	3.510	0.001
Zscore (digital transformation maturity)	-0.085	0.064	0.006	-1.337	0.183
Zscore (vc*dtm) Exchange item	0.005	0.053	-0.085	0.089	0.929

Table 6.28 shows the regression coefficient of the interaction term between the independent variables and moderating variables is 0.005, and the P value is 0.929. The results are not significant, showing digital transformation maturity has no significant moderating effect on value co-creation and social performance.

6.4 Conclusion

This chapter analyses the data of Internet enterprise customers, through the use of SPSS statistics R23.0.0.0. The results of analysing the data of the research object using exploratory factor analysis, reliability and validity analysis, and validity tests finds each condition is good, the measurement scale has good internal consistency, and the overall reliability of the data is good. Through the data processing, the hypotheses of the theoretical model are tested, and the path in the model is estimated to clarify the relationships between the variables. At the same time, the moderating effect of digital maturity in digital transformation and the intermediary effect of value co-creation are tested.

Generally speaking, digital maturity plays a regulating role in the process of customer participation in digital transformation. The degree of co-creation of customer participation in digital transformation and customer value and the impact on company performance depend on the intensity of digital maturity. In the case of

high digital maturity, the probability of successful digital transformation is also higher.

Chapter 7 - Research Conclusion and Contribution

7.1 Research Conclusion

This study explores the process of value co-creation by traditional and Internet enterprise customers through participation in digital transformation with service providers, which affects firm performance, as well as environmental, economic, and social performance. The theoretical hypotheses are empirically tested as follows.

1. Research hypotheses verification results for traditional enterprise customers

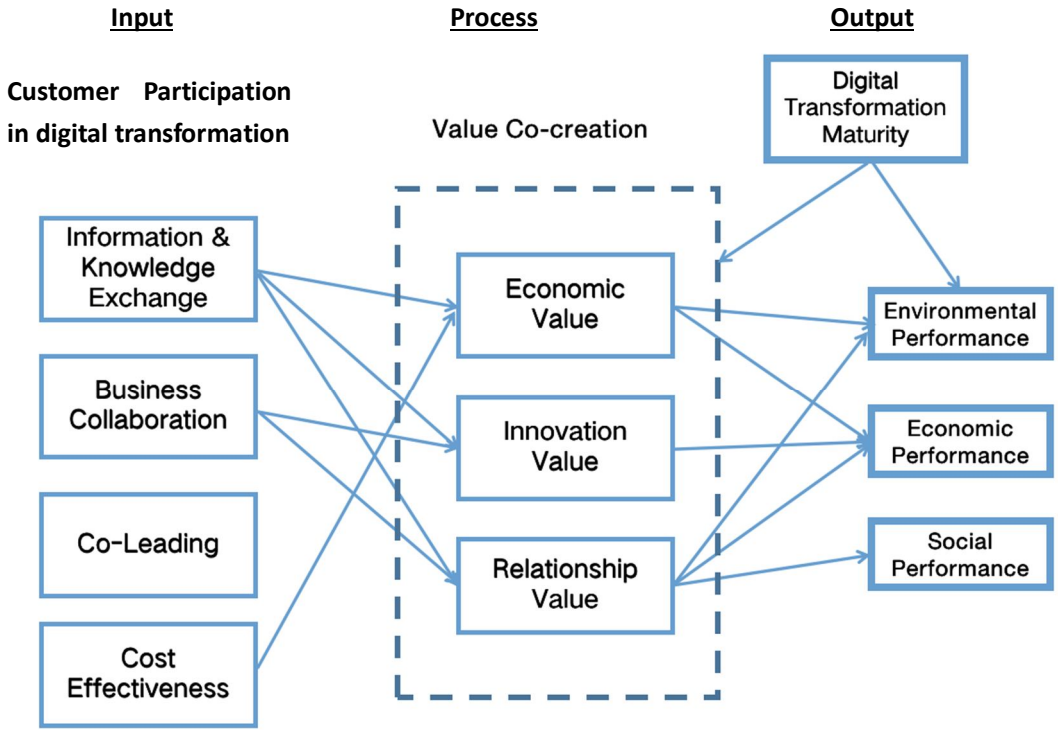
Table 7.1 summarizes the empirical test results of traditional enterprise customers, and Figure 7.1 presents the validated model relationships of traditional enterprise customers.

Table 7.1 Empirical Test Results of Traditional Enterprise Customers

Hypothesis	Hypotheses Development	Test Result
Customer participation in digital transformation has a significantly positive impact on co-creation of economic value.	H1a: Information Knowledge and Exchange has a significantly positive impact on co-creation of economic value.	Supported
	H1b: Business collaboration has a significantly positive impact on co-creation of economic value.	Not Supported
	H1c: Co-leading has a significantly positive impact on co-creation of economic value.	Not Supported
	H1d: Cost effectiveness has a significantly positive impact on co-creation of economic value.	Supported
Customer participation in digital transformation has a significantly positive impact on co-creation of innovation value.	H2a: Information knowledge and exchange has a significantly positive impact on co-creation of innovation value.	Supported
	H2b: Business collaboration has a significantly positive impact on co-creation of innovation value.	Supported
	H2c: Co-leading has a significantly positive impact on co-creation of innovation value.	Not Supported
	H2d: Cost effectiveness has a significantly positive impact on co-creation of innovation value.	Not Supported
Customer participation in digital transformation has	H3a: Information knowledge and exchange has a significantly positive impact on co-creation of relationship	Supported

a significantly positive impact on co-creation of relationship value.	value.	
	H3b: Business collaboration has a significantly positive impact on co-creation of relationship value.	Supported
	H3c: Co-leading has a significantly positive impact on co-creation of relationship value.	Not Supported
	H3d: Cost effectiveness has a significantly positive impact on co-creation of relationship value.	Not Supported
Economic value has a significantly positive impact on firm performance.	H4a: Economic value has a significantly positive impact on environmental performance.	Supported
	H4b: Economic value has a significantly positive impact on economic performance,	Supported
	H4c: Economic value has a significantly positive impact on social performance.	Not Supported
Innovation value has significantly positive impact on firm performance.	H5a: Innovation value has a significantly positive impact on environmental performance.	Not Supported
	H5b: Innovation value has a significantly positive impact on economic performance.	Supported
	H5c: Innovation value has a significantly positive impact on social performance.	Not Supported
Relationship value has significantly positive impact on firm performance.	H6a: Relationship value has a significantly positive impact on environmental performance.	Supported
	H6b: Relationship value has a significantly positive impact on economic performance.	Supported
	H6c: Relationship value has a significantly positive impact on social performance.	Supported
Digital transformation maturity has a significant moderating effect between the influence of value co-creation on firm performance.	H7a: Digital transformation maturity has a significant moderating effect between the influence of value co-creation on environmental performance.	Supported
	H7b: Digital transformation maturity has a significant moderating effect between the influence of value co-creation on economic performance.	Not Supported
	H7c: Digital transformation maturity has a significant moderating effect between the influence of value co-creation on social performance.	Not Supported
Value co-creation has a mediating effect between customer participation in digital transformation and firm performance.	H8a: Economic value has mediating effect between customer participation in digital transformation and firm performance.	Supported
	H8b: Innovation value has a mediating effect between customer participation in digital transformation and firm performance.	Supported
	H8c: Relationship value has a mediating effect between customer participation in digital transformation and firm performance.	Not Supported

Figure 7.1 Validated Model Relationships for Traditional Enterprise Customers



The results of verifying the overall theoretical model show most of the theoretical assumptions are verified. The logical relationships between traditional enterprise customers participating in digital transformation, value co-creation, and firm performance, including environmental, economic, and social performance, have been verified. Using theoretical deduction and empirical testing, the following conclusions are drawn.

1. From the perspective of value co-creation, traditional corporate customers that participate in the digital transformation of information and knowledge exchange have had a major impact on co-creation of customer value. Based on relevant theories and literature and through in-depth interviews with customers, the behavioural dimensions of traditional enterprise customers' participation in digital transformation under value co-creation are divided into information and knowledge exchange, business collaboration, co-leading, and cost effectiveness.

The empirical results show business collaboration has a significant impact on innovation and relationship value in co-creating customer value. Cost effectiveness has a significant impact only on economic value in co-creating customer value, while the impact on the other values is not significant. Therefore, they play a minor role in co-creating customer value. Co-leading does not have a significant impact on the other aspects of co-creating customer value, and does not play an effective role. This is strongly related to traditional enterprise customers' understanding of digital transformation. They regard digital transformation as a process of upgrading the company's IT technology rather than a process of business model and process transformation. The customers of traditional enterprises are in the process of digital transformation, and more emphasis is placed on project execution and project completion rates. Therefore, more attention is paid to the two dimensions of information and knowledge exchange and business collaboration. This is consistent with the findings of Claycomb et al. (2001) and Etgar (2008).

2. The relationship value created by traditional enterprise customers and enterprises has played a pivotal role in the impact on corporate performance, as well as environmental, economic, and social performance. This study divides co-creation of customer value into three dimensions: economic value, innovation value, and relationship value. The three dimensions of co-creating customer value have different effects on firm performance and environmental, economic, and social performance. The empirical results show relationship value has a significantly positive impact on firm performance and environmental, economic, and social performance. Economic value has a significantly positive impact on firm performance, as well as environmental and economic performance. Among these, relationship value has the greatest impact on firm performance and environmental, economic, and social performance.
3. Value co-creation has a partial mediating effect between traditional enterprise customers' participation in digital transformation and firm performance. Economic value and innovation value in value co-creation have a significant mediating effect between traditional enterprise customers' participation in digital transformation and firm performance. Therefore, co-creating customer value

plays an important mediating role between traditional corporate customers' participation in digital transformation and firm performance.

4. Digital transformation maturity has a positive moderating effect between value co-creation and firm performance and environmental performance. This study introduces digital transformation maturity as a variable that marks the quality of interaction between customers and service providers. In value co-creation, companies must not only provide value propositions, but also create interactions with customers to help them create value. Co-creation of customer value depends not only on the level of customer engagement, but also on the quality of the interaction between the business or service provider and the customer, and the process of value co-creation for the customer. Digital transformation maturity is introduced as a moderating variable in the model, which aims to study how the quality of interaction between customer participation in digital transformation and service providers moderates the relationship between customers and co-creation of customer value. The empirical results show digital maturity has a positive moderating effect between co-creating customer value and firm performance for environmental performance. However, it was not significant for economic and social performance. In general, digital transformation maturity has a positive moderating effect. When traditional enterprise customers perceive the digital transformation maturity of enterprises, the influence of value co-creation of customers participating in digital transformation is greater. This conclusion confirms the importance of interaction between service providers and customer value co-creation.

2．Research Hypothesis Verification Results for Internet Enterprise Customers

Table 7.2 summarizes the empirical test results for Internet enterprise customers, and Figure 7.2 presents the verified model relationships of Internet enterprise customers.

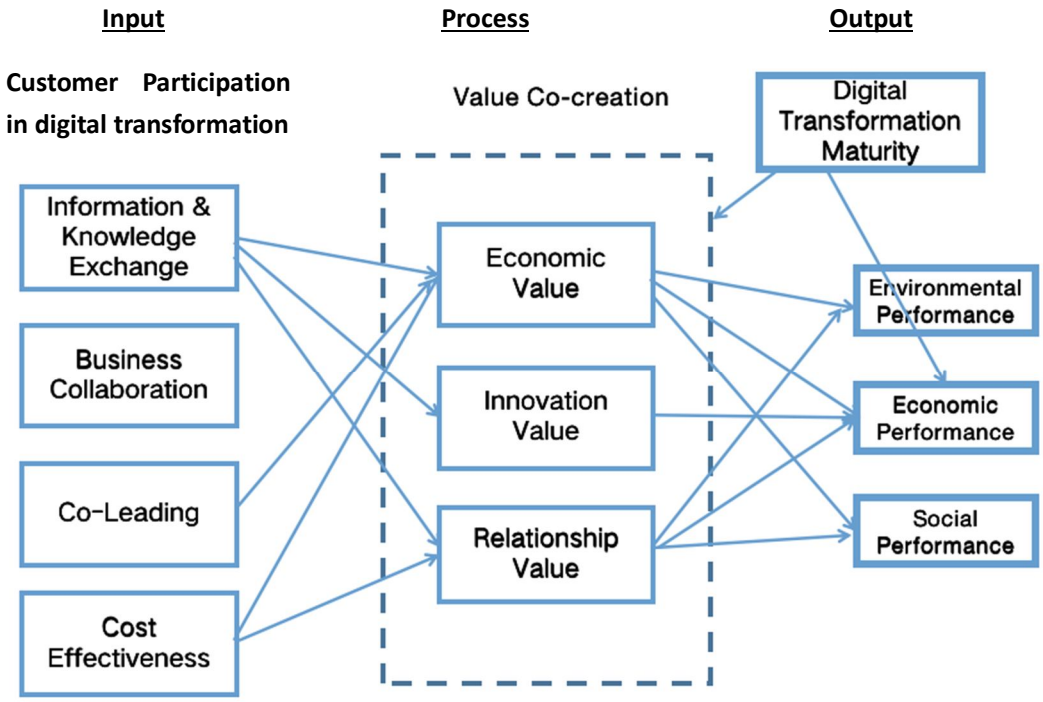
Table 7.2 Empirical Test Results of Internet Enterprise Customers

Hypothesis	Hypotheses Development	Test Result
Customer participation in digital transformation has a significantly positive impact	H1a: Information knowledge and exchange has a significantly positive impact on co-creation of economic value.	Supported
	H1b: Business collaboration has a significantly positive impact	Not

on co-creation of economic value.	on co-creation of economic value.	Supported
	H1c: Co-leading has a significantly positive impact on co-creation of economic value.	Supported
	H1d: Cost effectiveness has a significantly positive impact on co-creation of economic value.	Supported
Customer participation in digital transformation has a significantly positive impact on co-creation of innovation value.	H2a: Information knowledge and exchange has a significantly positive impact on co-creation of innovation value.	Supported
	H2b: Business collaboration has a significantly positive impact on co-creation of innovation value.	Not Supported
	H2c:Co-leading has a significantly positive impact on co-creation of innovation value.	Not Supported
	H2d: Cost effectiveness has a significantly positive impact on co-creation of innovation value.	Not Supported
Customer participation in digital transformation has a significantly positive impact on co-creation of relationship value.	H3a: Information knowledge and exchange has a significantly positive impact on co-creation of relationship value.	Supported
	H3b: Business collaboration has a significantly positive impact on co-creation of relationship value.	Not Supported
	H3c: Co-leading has a significantly positive impact on co-creation of relationship value.	Not Supported
	H3d: Cost effectiveness has a significantly positive impact on co-creation of relationship value.	Supported
Economic value has significantly positive impact on firm performance.	H4a: Economic value has a significantly positive impact on environmental performance.	Supported
	H4b: Economic value has a significantly positive impact on economic performance.	Supported
	H4c: Economic value has a significantly positive impact on social performance.	Supported
Innovation value has significantly positive impact on firm performance.	H5a: Innovation value has a significantly positive impact on environmental performance.	Not Supported
	H5b: Innovation value has a significantly positive impact on economic performance.	Supported
	H5c: Innovation value has a significantly positive impact on social performance.	Not Supported
Relationship value has significantly positive impact on firm performance.	H6a: Relationship value has a significantly positive impact on environmental performance.	Supported
	H6b: Relationship value has a significantly positive impact on economic performance.	Supported
	H6c: Relationship value has a significantly positive impact on social performance.	Supported
Digital transformation maturity has a significant moderating effect between the influence of value co-creation on firm	H7a: Digital transformation maturity has a significant moderating effect between the influence of value co-creation on environmental performance.	Not Supported
	H7b: Digital transformation maturity has a significant moderating effect between the influence of value co-creation	Supported

performance.	on economic performance.	
	H7c: Digital transformation maturity has a significant moderating effect between the influence of value co-creation on social performance.	Not Supported
Value co-creation has a mediating effect between customer participation in digital transformation and firm performance.	H8a: Economic value has a mediating effect between customer participation in digital transformation and firm performance.	Supported
	H8b: Innovation value has a mediating effect between customer participation in digital transformation and firm performance.	Not Supported
	H8c: Relationship value has a mediating effect between customer participation in digital transformation and firm performance.	Supported

Figure 7.2 Validated Model Relationships for Internet Enterprise Customers



The results of verifying the overall theoretical model show that most of the theoretical assumptions were verified. The logical relationship between Internet enterprise customers participating in digital transformation, value co-creation, and firm performance, as well as environmental, economic, and social performance was verified. Through theoretical deduction and empirical testing, the following conclusions are drawn.

1. From the perspective of co-creating value, participation by Internet corporate customers in digital transformation of the information and knowledge exchange has had a major impact on the creation of customer value. The empirical results show cost effectiveness has a significant impact on economic value and relationship value in jointly creating customer value. Co-leading has a significant impact only on economic value in co-creating customer value; the impact on other values is not significant, and therefore, it plays a minor role in Co-creation of customer value. Business collaboration does not have a significant impact on the other aspects of co-creating customer value, and does not play an effective role. This is strongly related to the degree of concern of Internet enterprise customers regarding digital transformation. They regard digital transformation as a process of enterprise business model transformation and process transformation. They use relatively mature business network systems and service providers to co-lead projects, co-make decisions, and collaborate. Therefore, more attention is paid to the behaviour and activities of the two dimensions of information and knowledge exchange and cost effectiveness.
2. The relationship value and economic value created by Internet enterprise customers and service providers play an important role in firm performance as well as environmental, economic, and social performance. The empirical results show that relationship value and economic value have a significantly positive impact on firm performance and also impact environmental, economic, and social performance. The value of innovation has a significantly positive impact only on firm performance and economic performance.
3. Co-creation of customer value has a partial mediating effect between the participation of Internet enterprise customers in digital transformation and firm performance, including environmental, economic, and social performance. Among these, co-creation of economic value and relationship value have a significant mediating effect between participation of Internet enterprise customers in digital transformation and firm performance. Therefore, co-creation of customer value plays an important mediating role between the participation of Internet enterprise customers in digital transformation and firm

performance.

4. Digital transformation maturity has a positive moderating effect on the co-creation of customer value, firm performance, and economic performance. Empirical results show digital transformation maturity has a positive moderating effect on co-creation of customer value, firm performance, and economic performance. However, firm performance in environmental and social performance is not significant. In general, there is a positive moderating effect of digital maturity. The higher the customer perception of an enterprise's digital maturity, the greater the impact of customer participation in digital transformation on co-creation of value. This conclusion confirms the importance of interaction between service providers and customers in value creation under co-creation.

7.2 Research Discussion

7.2.1 Consumers as Co-Creators of Value

S-D logic was not formerly projected as a novel concept rather as a 'counter model' to the goods-dominant logic of marketing. A few critics have stated that there is not anything innovative in the S-D logic concept. This might be right to a point, particularly in the perspective of certain features of business-to-business and relationship marketing. Certainly, S-D logic might still progress to accomplish the standing of adhesiveness warranting 'theory'. S-D logic can be established as the classic challenge to marketing convention by its claims like the communication of every business which is considered as the performance of the exchange standard. This is what the processor obtains from the service communication to assist others to utilise it using incorporation of reserves that are presented to others. Service logic's value-in-use viewpoint acknowledges that consumers and users are co-creators of their value, as long as they, as possessors, define actually what is of value. The research would intend to be a factor to the unbundling of this strongly composed value co-creation phrase. Primarily, co-creation is a method of empirical communication, recommending determined intention among service providers and

consumers, real or anticipated, similarly with every kind of inter-organisational links, in addition to among individuals and cohorts of individuals. In general, value creation is discerned only from the viewpoint of the innovating organisation.

Customer value co-creation is a course of action that involves a multi-stage process. Within the method, every single user has a various view in terms of its responsibility in the service delivery and all become involved it with unstable extents of contribution, exerting various categories of resources and intellectual, mental and social skills. In a service structure, unpredictably, high regard is persistently co-created and should be recognised as being employed, from the viewpoint of consumers. The recognition of value co-creation measurements is of major value for policymakers who could take on behaviours associated with every phase of the method and classify practical and logical tools intended at supporting the participation of customers. The value creation could be considered as the core principle and pivotal progression of financial exchange. A critical distinction between conventional methods of comprehending value creation and evolving ones for example service logic remains in the base of exchange. Both 'value-in-exchange' and 'value-in-use' refer to diverse and dissimilar modes of thinking regarding value and creation of value. While long-established models are based on the concept of value-in-exchange concentrating on the barter of operand reserves that have usually been signified as end goods, service logic is linked to the notion of value-in-use. SD logic cracks down on the pursuit of ostensible operant resources which stand for particular understanding and expertness that could perform on other reserves, both operand and operant, to build and generate value.

7.2.2 Service Logic and Co-Creation of Value

It is emphasised that 'the focal point is on value via the lens of the consumer' and value co-creation with consumers is input and the communicative, empirical, and relational nature form the base for describing service. Managers and executives should change from considering more about value as a little formed and market to considering just about value as something co-produced with the consumer and new value-creation associates. Companies should know just how to improve the practice

consumer value co-creation to make sure that the sheer quantity of value-in-use is accomplished. Thus, they are required to obtain imminent into a consumer's requirements, inclinations, desires, and demands. As consumers usually consider products and services as simply measures to preferred end status, companies should acknowledge the different aspires consumers long to achieve that is the ultimate objectives which are being struggled for. Service logic has inferences for every category of companies despite whether they are usually being defined as product or services firms. It might act as a theoretical stand for recognising consumer value dimensions and creating suitable approaches to meet with demands. Though the SD logic and service marketing background must measure as the standard, products-based conceptions and paradigms might yet be helpful in some circumstances. Several consumers might still concentrate on the product they purchase and certainly not on the way wherein it could be employed and generate value. In fact, in those specific states, emerging a marketplace contribution rooted in goods logic might more likely to be sufficient.

7.2.3 Purpose of Marketing Should be Service and not for Money

The concept of marketing is best recognised with regards to a service-for-service exchange, instead of barter and trade concerning or goods-for-profit. To be more precise, it is the behaviour originating from particular understanding and skills which individuals execute for themselves and other persons and the endeavour they desire accomplished for them, not the products that are infrequently employed in the spread of this service, which signify the resource of importance and therefore the objective of exchange. Following value is being co-created, more willingly than formed by one player and then served. In this manner, products are not being formed for their very own sake; to a certain extent, they provide services from which consumers and users recognise the value. Therefore, consumers recognise that value in the usage of the products. Also, by employing the products, consumers are engaged in apprehending the value, in such a way that value is being co-created. The concept of value co-created is one of the maxims of the service logic. In G-D logic, a company instils manufactured goods with value and sends it to a consumer, in such a

way that there is value in context or use. In service logic, there is value-in-use; the consumer, in fact, contributes to the generation of value by employing or entailed with the good or service which is developed by a company or supplier. In addition to this, the value which is formed is forever in the sense of the receiver. S-D Logic signifies that value is described by and as well co-created with the customer instead entrenched in output. The communication among the company, producer, or supplier and the customer then has important positions of dealings intrinsic in the value co-creation. Moreover, in such a correlation, there, in fact, might be more players than the manufacturer and customer, signifying that a system line is suitable within the S-D logic structure.

The prospective for co-creating value using communications is enormous. However, the hazards and problems that may well accompany them. Thus, the stakes of communicational value co-demolition must not be unnoticed. This is how the research has tried hard to emphasise that value co-creation is not just the only potential result of service systems' exchanges. Consequences and harmful externalities might take place for various reasons at the process stage. Therefore, before executing an approach on the basis of S-D logic, it is elemental to bear in mind where exactly how and eventually to what extent negative effect might take place. The current paper presents an initial point for more research on examining co-creation of the value from the customers' standpoint. Nevertheless, the research was carried out with detailed interviews. Depth discussions could not address a severely descriptive sample of persons of a population of involvement. Also, simply certain features of consumer co-creation value have been part of the investigation. Therefore, still more study is considered necessary.

The analysis of value for the customer and substantial performance implications for business relationships, due to the adoption of a service perspective on business, reveals some new avenues for understanding business-to-business firm performance. Values for customer creation and performance turn out to be intertwined.

7.2.4 Customer Participation in Digital Transformation and its Influence on Firm's Performance

The customer participation in digital transformation is dependent on factors of value co-creation such as economic values, innovation values and relationship values that contribute equally company in ensuring enhanced performance of an organisation. The co-creation value is considered to be an operational and creative practice, focused on the relationship between the organisation and the customers. It is initiated by an organisation to develop value for both customer and the organisation. Cooperation is the factor which can be attained only by the involvement of customers. It directly depends on the satisfaction of the customers in promoting the co-creation value of the company. The cooperative measure of an organisation in satisfying the demands of the customers is much needed for better maintenance of customer's contact. An organisation's readiness in altering the practices for the prime achievement of customer satisfaction will aid in the proper development of the company's performance. The implementation of required changes based on customer's comment will positively provoke the consumer's perception about the organisation.

Business Collaboration and co-leading involve a company not only in delivering knowledge, but also aids in attaining acquaintance. The employees should be trained in a better way to grasp positive annotations from experience gained by them. This increases the self-assurance of an organisation in facing customers. The effort of the entity in attaining connectivity with its customers through the offered service can lead to the stronger association of both, that directly impact the firm's co-creation value. The economic value can also be predicted based on the linking quality of an organisation exerted on to its customers. The relationship marketing and behavioural effects of an entity are primarily based on the relationship value. The relationship value aids in the creation of a positive impact on both customer's perception and progress of commercial activities of the firm. It seemed to be a component that brings out deeper effect on the contentment of assurance and persuasion. The Quality of the service offered guarantees healthier performance of the company. This

could be achieved through time-keeping delivery of services offered with definite clarifications. The company's success is dependent on the incessant enhancements with better service quality, which also aids to encounter the competitions of other firms. Proper support by the employees to the clients must be delivered on time with individual consideration, as service support offered by the company will sustenance the company's progress. But offering additional support by the workers devoid of necessity will deviate the time of the employees. When accurate service delivered with required resources, on-time can improvise the organisation's relationship value with the client. Proper improvisation of the services must be provided at a regular period to ensures excellence if the package offered. The status of an organisation is depicted by the way of interaction pursued by the employees to the customers in understanding their needs and expectations. The communication tactics followed by the employees possess a positive impact on the satisfaction of the customers through the delivery of required services. The inclination of an organisation towards extemporizing the way of interaction will increase the customer's contact with the company that directly has an emotional impact on the performance of an organisation.

7.2.5 Co-Creation Value is An Important Resource of Business

The co-creation value is an important resource of business and is a process through which the organisations gain from the customer's cooperation. It seemed to be an administrative resource that is effective and non-substitutable to form a competitive edge for the business. In this study the co-creation values are determined by the analysis of factors such as Information & Knowledge Exchange, Business cooperation, co-leading, and cost-effectiveness. The organisation should collaborate with the client through the implementation of newer ideas. This generates a better magnetism from the customer's side towards the services of the company. The positive approach of the organisation is working together with the client-side will exert a better association of the consumers over the company. An organisation should move forward in promoting better cooperative vicissitudes with the clienteles in ensuring service contentment among them. An initiative from the

organisation in endorsing errands to the consumers can aid in achieving loyalty from the consumer side. A company should exert its fullest cooperation in delivering valuable services to the clients even though the fault is not particularly on the company. Even the principles of the employees could be changed for the attainment of better success in the performance enhancement of the company. The readiness of an organisation and its employees in upholding required changes and managing of those for endorsing better services to the customers will aid in constructing novel ethics and innovative practices, which in turn positively influence the company's development. A business enterprise should always possess a welcoming approach to the requests of their clients. The positivity on a company's service among the consumers can be achieved based on the inclination of an organisation in accepting valuable suggestions and recommendations from the consumer side. The skill of knowledge is multiplied positively only when it is shared.

On sharing its acquaintance, an organisation can positively develop trust from its consumers. Feedback is reflected to be an important factor that decides the progress of a company. The enthusiasm of a business enterprise in accepting the feedback from the clientele will absolutely affect the association of the consumers on the offered service. Accomplishments of a firm in responding to the criticism obtained from the clients directly gain a conviction of the consumers on the service providers. Interpretation of consumer's attitude on the delivered service will assist the employees in providing effort on the formation and sharing of novel standards. Learning is not constricted to any factors. The employee's acceptance of acquaintance obtained from the experiences will not only make the employees knowledgeable but also increases self- confidence of an employee headed for achieving success. The advancement of an organisation depends on the association of its customers. Building relationships majorly influence the progress of the firm. The relationship is based on the trust factor exerted by the clients over the company. For better progress, an organisation should be eager in constructing a stronger relationship between its consumers. Maintaining transparency positively impact the trust factor. A company when provides a better depiction of its services, the attraction of the customers over the services offered will be amplified. Communication is the best part that ensures better association. Interaction by the

employees with the other contributors will aid in the better promotion of the services offered. The creation of value is based on the connection obtained by the employees with the customers. More intense and long-lasting relationships can be exerted between the consumer and the company when better communication is being practised.

7.3 Research Contribution

In general, this study explores the relationship between traditional enterprise customers and Internet enterprise customers participating in digital transformation, co-creating customer value, digital transformation maturity, firm performance, and environmental, economic, and social performance under co-creation of value. The internal mechanism of digital transformation in co-creating value is discussed in the context of the digital economy's rapid development, The main contributions of this research are as follows:

1. Based on the perspective of co-creating value, an exploratory study was conducted on the dimensions of customer participation in digital transformation and co-creation of customer value. Based on clarifying the new characteristics of customer participation in digital transformation and the transformation of customer roles, combined with in-depth interview results of traditional and Internet corporate customers and the support of existing literature, customer participation in digitization was redefined, transforming and creating the dimensions of customer value co-creation. Although this exploration is preliminary and may not be mature, under the transformation of the traditional value creation model to the common value creation model, this research on customer participation and value creation has practical and theoretical significance.
2. This study proposes a process model in which customers participate in digital transformation and jointly create customer value with enterprises. This model clearly describes the resource input, value co-creation, and value output process of customers' collective value creation. It can be used to understand the process of customer participation in digital transformation, the process of jointly creating

customer value, and the respective roles.

3. This study builds and confirms the internal formation mechanism between customers participating in digital transformation and firm performance, as well as environmental, economic, and social performance. By interacting with service providers to participate in digital transformation activities, customers co-create value, and then form a mechanism that impacts corporate performance and environmental, economic, and social performance. Co-creating value has a mediating effect. The direct and indirect paths for co-creating customer value and impacting firm performance and environmental, economic, and social performance have been validated.
4. The study of the sub-dimensions of the main variables reveals the inherent structural relationship between the variables and has practical significance for operational and marketing management practices. Research on the relationship between customer participation, value creation, firm performance, and environmental, economic, and social performance is not new, but research in the context of digital transformation and co-creating value and the relationship between the various variable dimensions is still rare. For marketing management practices, companies are more interested in understanding the operational implications of customer engagement behaviour that will create value and will have a significant impact on business performance and environmental, economic, and social performance.
5. Incorporating digital transformation maturity as an interactive factor for co-creating value, and testing the synergy between co-creation of customer value and firm performance and environmental, economic, and social performance, reflects the effectiveness of customers and service providers and confirms the importance of co-creation of customer value and firm performance.

7.4 Management Implication

This study's conclusions have certain management implications for enterprise operation management and marketing practices.

1. In high participation industries, the focus of a company's digital transformation

strategy should shift to digital transformation maturity, firm performance, and environmental, economic, and social performance as the core to co-create customer value with customers.

The research conclusions of this thesis show co-creating customer value plays an indispensable intermediary role in corporate performance and environmental, economic, and social performance in the process of digital transformation. Jointly creating customer value can activate a company's entire strategic profit chain. Only by realizing customer value can a high level of digital transformation maturity be reached and enterprise value realized. In particular, the relationship value and economic value of creating customers should be digitalized and focused on the transformation process. Therefore, co-creating customer value has become the top priority of high customer engagement enterprise digital transformation strategies. Enterprises need to shift from the traditional value creation model to co-creation of value with customers.

2. To realize the transformation of an enterprise's digital transformation strategy, they should establish an internal management mechanism that matches the customer's participation in creating value. The transformation of an enterprise from product dominant logic to customer dominant logic is a gradual and systematic process that requires the company to make changes in all aspects.

First, the company's business philosophy must be changed. Creating value with customers is one of the core components of service-led logic. Enterprises must fully realize that customers are no longer passive recipients, as in product dominant logic. They actively and creatively participate in their interests and through corporate interaction, become co-creators of value. Businesses are no longer the only providers of value, and business models that exclude customers from the value creation system are outdated and non-competitive. It is especially important to correctly understand the positioning and role of customers and enterprises in value creation under the value co-creation model. At the same time, enterprises need to transfer the concept of co-creation as a corporate culture to employees, so it can penetrate into enterprise management.

Second, enterprises need to adjust and change their internal management. Management of customer participation under value co-creation becomes more

complex, involving internal management, customer management, and interactive management between customers and enterprises. Therefore, enterprises need to expand and complicate the scope of management and make corresponding adjustments in organizational structure, process reengineering, and resource integration. At the same time, they must engage in building new enterprise capacity, including organizational learning and continuous improvement capabilities; educate and help customers improve their interactive skills; and improve the value of co-creation and customer value by matching enterprise organizational capabilities. Interaction under value co-creation is a dynamic process of mutual learning between consumers and enterprises. Enterprises need to capture, discover, absorb, and gain knowledge, experience, and inspiration from customers in the interactions and transform them into new opportunities for development and sources of continuous improvement. At the same time, enterprises should apply their own advantages and resources to manage and motivate customer behaviour in value co-creation and help and harmonize them, guiding customers to realize their own interests in value co-creation.

Finally, companies need to build a diverse Internet information technology communication platform to ensure customers participate in multiple channels. Internet information technology provides a broader platform for customer participation. Customers can participate in company’s operation through various means, including websites, blogs, forums, and social media, and propose product improvements, functional performance to be added in the future, product innovation concepts, methods of improving customer service and support, market expansion, new uses and applications of products, and new market segments.

3. Increase customer authorization and promote customer participation in co-decision-making, thus effectively promoting the company's digitalization process and enhancing firm performance and environmental, economic, and social performance.

With the development of information technology, intensifying competition, and transaction transparency, customers have more information and choices. Customers have won more ‘discourse power’ in their relationships with enterprises, and thus gained in trading activities. With more autonomy and greater influence on

enterprises, customers not only participate in different aspects of the enterprise value chain, but even participate in the enterprise's internal management. The expansion of customer engagement and the depth of participation require companies to grant more rights to customers. This study shows that under joint creation of value, information and knowledge exchange and cost effectiveness have an indirect impact on corporate performance and environmental, economic and social performance. Information and knowledge exchange and cost effectiveness indirectly lead to an increase in corporate performance. The foundation of information and knowledge exchange and cost effectiveness is empowering customers to feel a sense of control, competence, and influence in decision-making about service production and delivery, thereby becoming more involved rather than completing routine tasks. They perceive service providers as paying more attention to them, allowing them to experience the sense of participation and the resulting value of information and knowledge exchange and cost effectiveness.

4. Strengthen the training and authorization of service providers, improve the efficiency of interaction with customers, and guide customers to achieve value creation.

The results of this study show that digital maturity has a significantly positive moderating effect on co-creating customer value and firm performance, as well as environmental, economic, and social performance. Greater digital maturity aids in jointly creating customer value and corporate performance, and has a greater impact on environmental, economic, and social performance. Employees and service providers interact with customers in information, business collaboration, co-leading, and cost-effectiveness, and influence the value co-creation behaviours and activities of customers who participate in digital transformation. In interactions with customers, service providers need to recognize new ways to create value, clarify their role positioning and corresponding responsibilities, understand the roles and digital expectations of customers under common value creation, and guide customers to recognize their own value creation. The company's role is to encourage the active participation of customers and become the co-creator of value. Including customers increases the uncertainty of the value creation system. Creating value together requires employees to have flexibility, responsibility, and corresponding rights when

dealing with many uncertain situations. This requires companies to increase employee training and flexibility. The ability to handle a variety of situations, on the other hand, empowers employees to deal with issues that arise in consumer interactions in a timely manner. In short, co-creating value places greater demands on the professional ability and comprehensive quality of service providers. Enterprises need to increase investment and help employees improve their problem-solving skills and capabilities through employee training and organizational socialization for value co-creation.

7.5 Conclusion

This chapter introduces the research conclusion, research discussion, research contribution, and management implications. From the results of verifying the overall theoretical model, most of the theoretical assumptions were verified. The logical relationship among customer participation, co-creation of value and company performance in the process of digital transformation has been verified. Through theoretical deduction and empirical testing, this study explores the internal mechanism of customer participation in digital transformation, co-creation of value, digital maturity, and corporate performance formation under the background of co-creation of value.

Chapter 8 - Research Limitations and Future Prospects

8.1 Research Limitations

This thesis follows the theoretical research and empirical methods of scientific norms, but there are inevitably some limitations in the research; however, these also provide new opportunities to improve future research.

1. Diversification of research subjects

This research selects the ICT industry as the research background, and the research objects are traditional and Internet enterprise customer participation in digital transformation. The ICT industry is a high-participation, high-interaction, co-creation industry with obvious characteristics, In line with Chan (2010), Etgar (2008), the proposal to co-create value research industry. However, there have been some errors in the hypotheses test due to industry choices. As traditional enterprise customers are not sensitive to Co-leading, the assumption that Co-leading for customer value co-creation is not valid, Internet corporate customers are not sensitive to cost effectiveness for innovation value. Internet enterprises are typical knowledge-intensive enterprises. Strengthening scientific and technological innovation is the key to enhancing core competitiveness and maintaining competitive advantage and improving business performance. Continuously increasing R&D investment is an important manifestation of its efforts to increase scientific and technological innovation. In future research, a number of different industries can be selected as research objects to further verify the scientific nature of theoretical construction, and at the same time, comparative research can be performed between different industries.

2. Multi-dimensionality of the research object

The ICT industry was chosen as the research background for this study. Due to the multi-dimensionality and complexity of ICT industry customers, the choice of customers to participate in the digital transformation process can be referenced with fewer dimensions, which also leads to the research process. Some of the dimensions have been omitted, and newer business cooperation models such as benefit sharing,

fan economy, and innovation incentives were not been considered.

3. Complexity of research objects

The ICT industry was selected as the research background for this study and corporate customers in the ICT industry were also selected as the main research objects, involving industries such as media, finance and insurance, entertainment and leisure, retail trade, high-end manufacturing, basic product manufacturing, personal and local internet service, hotel service and others. Due to the limited number of samples collected, we have no analysis of the industry's characteristics and behaviour. It is hoped that the characteristics and behaviours of different industries can be more fully examined in subsequent research.

8.2 Future Prospects

In view of the research limitations noted, we consider improving the following aspects in future research.

1. In the study of the enterprise characteristics of customers and co-creation of customer value, customer participation has a certain degree of voluntariness. Customer participation is not only influenced by the organization's participation system, but also by the personality characteristics of enterprise customers, such as customer needs and initiative; the tendency for enterprise customer risk control; the influence of the social environment, specific market environment, and psychological environment; and the exertion of the personality traits of enterprise customers. In a facilitative environment, the personality traits of enterprise customers can be freely exerted, boosting their creativity and the expected effect of customer participation can be achieved. Therefore, changes in the business environment perceived by corporate customers may be an important reason for their participation. The personality traits of enterprise customers are not considered in this study. In future studies, this factor can be incorporated into the research framework to examine the interaction between customer personality characteristics and the enterprise's supportive environment on the impact of customer value co-creation.

2. There is still much room for research on the dimension of customer participation

from the perspective of value co-creation. This study is an exploratory study on customer participation from the perspective of co-creating value. From the empirical results, information sharing and cooperative behaviour better reflect the characteristics of customer participation in digital transformation under value co-creation, but the effect of the co-learning dimension lacks support among traditional enterprise customers. The effect of the business collaboration dimension lacks support among Internet enterprise customers, and the reason has been briefly analysed in the conclusion. In future research, we can first perform some qualitative analysis based on the actual participation behaviour of customers by, for example, using participation observation, interviews, and grounded theory to conduct a thorough analysis of customer participation behaviour, and extract the dimension of customer participation to more accurately reflect the characteristics of value co-creation.

3. Considering the factors of benefit sharing and fan communities as well as future research on co-creating customer value, this study follows Sheth et al.'s (1991) multi-dimensional structure of customer value, dividing all value created and experienced by customers in value co-creation into economic value, relational value, and innovative value according to differentiable categories, and does not divide the reasons for benefit sharing and fan communities into economic value, relational value, and innovative value. Considering the co-creation of customer value in future research, we can further study the factors of benefit sharing and the influence of fan communities in customer value co-creation, and consider them in research on customer value co-creation to expand the research methods and ideas of customer value co-creation.

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APPENDIX

Appendix 1 - Questionnaire for Traditional Enterprise

Distinguished ladies and gentlemen:

For the purpose of academic research, we need to understand the mechanism through which customer participation in digital transformation impacts customer value creation and corporate performance. Please take 10-30 minutes to answer the following questions one by one using your own experience. Your answers have a very important impact on this study. Please be patient and avoid missing questions. This questionnaire is anonymous. The information provided is for academic research only. Please feel free to reply, as every piece of advice you provide may lead us closer to the research results. Indeed, based on the rule of confidentiality, the information that you provide to us will not be disclosed to other companies or spread to any other person. Thank you very much for your support!

The enterprise digital transformation process involves a very high degree of customer participation. To ensure that customers are satisfied with the transformation effect, they must interact with service providers at various levels, participate in the digital transformation project, exchange project information, participate in cooperation, and establish effective relationships, achieving the best cost-effectiveness for the project. Please review the services provided by service providers or digital service platforms during your participation in digital transformation projects. Answer the following questions according to your real experience and ideas, and tick the most suitable numbers. There are no right or wrong answers.

Part 1: Profile of Respondent

a) What is your age:

   ☐ 24 – 30

- ☐ 30 – 35
- ☐ 35 – 40
- ☐ 40 –50
- ☐ 50 and above

b) What is your gender:

- ☐ Male
- ☐ Female

c) What is the highest level of education that you have completed?

- ☐ Diploma and blow
- ☐ Undergraduate
- ☐ Postgraduate and above

d) What is your position in the company?

- ☐ Front Line Managers
- ☐ Middle Level Manager
- ☐ Senior Manager or Director
- ☐ Chief Executive Officer

e) What is your total working experience?

- ☐ 0 – 5 years
- ☐ 5 – 10 years
- ☐ 10 – 15 years
- ☐ 15 and above years

For each of the following statements, please circle one response only to indicate the extent to which you either agree or disagree with the statement. Please use the following scale: Strongly Disagree: 1, Disagree: 2, Slightly Disagree: 3, Neither Agree nor disagree: 4, Slightly Agree: 5, Agree: 6, Strongly Agree: 7.

Part 2: Customer participation in digital transformation measurement items

Information and Knowledge Exchange (IKE)

IKE1: We have exchanged information and knowledge with service providers.	1	2	3	4	5	6	7
IKE2: We have regularly discussed support requirements with service providers.	1	2	3	4	5	6	7
IKE3: We have remained informed about the goals, potential, and strategies of service providers.	1	2	3	4	5	6	7
IKE4: We have responded more quickly to service providers.	1	2	3	4	5	6	7

Business Collaboration (BC)

BC1: We have better collaboration with the service provider.	1	2	3	4	5	6	7
BC2: We can be flexible in response to the service provider's requests.	1	2	3	4	5	6	7
BC3: We have co-operated extensively with the service provider.	1	2	3	4	5	6	7

Co-Leading (CL)

CL1: We have better project co-leading with the service provider.	1	2	3	4	5	6	7
CL2: We have open communication and training with the service provider.	1	2	3	4	5	6	7
CL3: We share learning and leading skills with the service provider.	1	2	3	4	5	6	7
CL4: We have continuous interaction during implementation with the service provider.	1	2	3	4	5	6	7
CL5: We think transition leadership is our main consideration factor.	1	2	3	4	5	6	7

Cost Effective (CE)

CE1: We have decreased more operational costs with the service provider.	1	2	3	4	5	6	7
CE2: We have decreased more managerial costs with the service	1	2	3	4	5	6	7

provider.							
CE3: We have reduced more marketing expenses with the service provider.	1	2	3	4	5	6	7

Part 3: Value Co-Creation Measurement items

Economic Value (EV)

EV1: Our participation helps lead the enterprise to superior economic advantages	1	2	3	4	5	6	7
EV2: Our participation helps lead the enterprise to accelerate the operational process	1	2	3	4	5	6	7
EV3: Our participation helps lead the enterprise to superior operational cost savings.	1	2	3	4	5	6	7

Innovation Value (IV)

IV1: Our participation helps motivate the enterprise to facilitate innovations	1	2	3	4	5	6	7
IV2: Our participation helps lead the enterprise to improve the competitiveness of business innovation.	1	2	3	4	5	6	7
IV3: Our participation helps empower the enterprise to make decisions that facilitate innovations.	1	2	3	4	5	6	7

Relationship Value (RV)

RV1: Our participation helps lead the enterprise to accelerate the relationship development process.	1	2	3	4	5	6	7
RV2: Our participation helps lead the enterprise to superior relationship benefits.	1	2	3	4	5	6	7
RV3: Our participation helps lead the enterprise to improve the competitiveness of business relationship.	1	2	3	4	5	6	7
RV4: Our participation helps enable the enterprise and digital	1	2	3	4	5	6	7

businesses to add relationship value through co-creation.							

Part 4: Digital Transformation Maturity Measurement items

DTM1: Our company has changed from paper-based to digital working styles.	1	2	3	4	5	6	7
DTM2: Our company embodies extensive data and process integration.	1	2	3	4	5	6	7
DTM3: Our company has an autonomous organization network.	1	2	3	4	5	6	7
DTM4: Our company has fused the physical and digital infrastructure components.	1	2	3	4	5	6	7

Part 5: Firm Performance Measurement Items

Environmental Performance (EnP)

EnP1: Our company uses various pollution reduction practices.	1	2	3	4	5	6	7
EnP2: Our company uses various practices to reduce use of energy, water, fuel, or other material resources.	1	2	3	4	5	6	7
EnP3: Our company uses various waste reduction practices.	1	2	3	4	5	6	7

Economic Performance (EcP)

EcP1: Our company places great emphasis on the quality of products, processes, and services.	1	2	3	4	5	6	7
EcP2: Our company uses various practices to reduce costs.	1	2	3	4	5	6	7
EcP3: It is important for the company that products and services are delivered on time.	1	2	3	4	5	6	7

Social Performance (SP)

SP1: Our company is concerned about the well-being, development, and satisfaction of employees.	1	2	3	4	5	6	7

SP2: Our company is concerned with developing supplier relationships.	1	2	3	4	5	6	7
SP3: Our company is concerned with developing customer relationships.	1	2	3	4	5	6	7

Thank you for your valuable time!

Appendix 2 - Questionnaire for Internet Enterprise

Distinguished ladies and gentlemen:

For the purpose of academic research, we need to understand the mechanism through which customer participation in digital transformation impacts customer value creation and corporate performance. Please take 10-30 minutes to answer the following questions one by one using your own experience and experience. Your answers have a very important impact on this study. Please be patient and avoid missing questions. This questionnaire is anonymous. The information provided is for academic research only. Please feel free to reply, every piece of your advice may lead us closer to the research results. Indeed, based on the rule of confidentiality, the information that you provide to us will not be disclosed to other companies or spread to any other person. Thank you very much for your support!

Enterprise digital transformation process involves a very high degree of customer participation. To ensure that customers are satisfied with the transformation effect, they must interact with service providers at various levels, participate in the digital transformation project, exchange project information, participate in cooperation, and establish effective relationships, achieving the project's best cost-effectiveness. Please review the services provided by service providers or digital service platforms during your participation in digital transformation projects. Answer the following questions according to your real experience and ideas, and tick the most suitable numbers. There are no right or wrong answers.

Part 1: Profile of Respondent

f) What is your age:

- ☐ 24 – 30
- ☐ 30 – 35
- ☐ 35 – 40
- ☐ 40 –50

- ☐ 50 and above

g) What is your gender:

- ☐ Male
- ☐ Female

h) What is the highest level of education that you have completed?

- ☐ Diploma and blow
- ☐ Undergraduate
- ☐ Postgraduate and above

i) What is your position in the company?

- ☐ Front Line Managers
- ☐ Middle Level Manager
- ☐ Senior Manager or Director
- ☐ Chief Executive Officer

j) What is your total working experience?

- ☐ 0 – 5 years
- ☐ 5 – 10 years
- ☐ 10 – 15 years
- ☐ 15 and above years

For each of the following statements, please circle only one response to indicate the extent to which you either agree or disagree with the statement. Please use the following scale: Strongly Disagree: 1, Disagree: 2, Slightly Disagree: 3, Neither Agree nor disagree: 4, Slightly Agree: 5, Agree: 6, Strongly Agree: 7.

Part 2: Customer participation in digital transformation measurement items

Information and Knowledge Exchange (IKE)

IKE1: We have exchanged information and knowledge with service providers.	1	2	3	4	5	6	7

IKE2: We have regularly discussed support requirements with service providers.	1	2	3	4	5	6	7
IKE3: We have remained informed about the goals, potential, and strategies of service providers	1	2	3	4	5	6	7
IKE4: We have responded more quickly to service providers.	1	2	3	4	5	6	7

Business Collaboration（BC）

BC1: We have better collaboration with the service provider.	1	2	3	4	5	6	7
BC2: We can flexible in responding to the service provider's requests.	1	2	3	4	5	6	7
BC3: We have co-operated extensively with the service provider.	1	2	3	4	5	6	7

Co-Leading (CL)

CL1: We have better project co-leading with the service provider.	1	2	3	4	5	6	7
CL2: We have open communication and training with the service provider.	1	2	3	4	5	6	7
CL3: We have shared learning and leading skills with the service provider.	1	2	3	4	5	6	7
CL4: We have continuous interaction with the service provider during implementation.	1	2	3	4	5	6	7

Cost Effective (CE)

CE1: We have decreased more managerial costs with the service provider.	1	2	3	4	5	6	7
CE2: We have reduced more marketing expenses with the service provider.	1	2	3	4	5	6	7
CE3: We have a high level of cost effectiveness with the service provider.	1	2	3	4	5	6	7

Part 3: Value Co-Creation Measurement items

Economic Value (EV)

EV1: Our participation helps lead the enterprise to superior economic advantages.	1	2	3	4	5	6	7
EV2: Our participation helps lead the enterprise to accelerate the operational process.	1	2	3	4	5	6	7
EV3: Our participation helps lead the enterprise to superior operational cost savings.	1	2	3	4	5	6	7

Innovation Value (IV)

IV1: Our participation helps motivate the enterprise to facilitate innovations.	1	2	3	4	5	6	7
IV2: Our participation helps lead the enterprise to improve the competitiveness of business innovation.	1	2	3	4	5	6	7
IV3: Our participation helps empower the enterprise to make decisions that facilitate innovations.	1	2	3	4	5	6	7

Relationship Value (RV)

RV1: Our participation helps lead the enterprise to superior relationship advantages.	1	2	3	4	5	6	7
RV2: Our participation helps lead the enterprise to accelerate the relationship development process.	1	2	3	4	5	6	7
RV3: Our participation helps lead the enterprise to superior relationship benefits.	1	2	3	4	5	6	7
RV4: Our participation helps lead the enterprise to improve the competitiveness of business relationships.	1	2	3	4	5	6	7

Part 4: Digital Transformation Maturity Measurement items

DTM1: Our company has changed from paper-based to digital working styles.	1	2	3	4	5	6	7
DTM2: Our company embodies extensive data and process integration.	1	2	3	4	5	6	7
DTM3: Our company has an autonomous organization network.	1	2	3	4	5	6	7
DTM4: Our company has fused physical and digital infrastructure components.	1	2	3	4	5	6	7
DTM5: Our company has high digital connectivity.	1	2	3	4	5	6	7

Part 5: Firm Performance Measurement Items

Environmental Performance (EnP)

EnP1: Our company uses various pollution reduction practices.	1	2	3	4	5	6	7
EnP2: Our company uses various practices to reduce use of energy, water, fuel, or other material resources.	1	2	3	4	5	6	7
EnP3: Our company uses various waste reduction practices.	1	2	3	4	5	6	7

Economic Performance (EcP)

EcP1: Our company places great emphasis on the quality of products, processes, and services.	1	2	3	4	5	6	7
EcP2: Our company uses various practices to reduce costs.	1	2	3	4	5	6	7
EcP3: It is important for the company that products and services are delivered on time.	1	2	3	4	5	6	7

Social Performance (SP)

SP1: Our company is concerned about the well-being, development, and satisfaction of employees.	1	2	3	4	5	6	7
SP2: Our company is concerned with developing supplier relationships.	1	2	3	4	5	6	7
SP3: Our company is concerned with developing customer	1	2	3	4	5	6	7

relationships.							

Thank you for your valuable time!