Research on Effect Reasoning on Enterprise Digital Transformation Performance with Big Data Analysis

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Abstract: Due to the various differences between modern enterprises and traditional enterprises, many scholars have noticed that the research results of traditional mature enterprises can not be fully applied to the relevant research of modern digital enterprises. Therefore, many new theories have emerged in the field of digital transformation research in recent decades. In the course of many years of development, there have been more studies on its definition, conception dimension and measurement. Although some scholars have realized that effect reasoning will play a role in the performance of enterprise digital transformation, there are relatively few empirical studies on the impact of effect reasoning on the performance of enterprise digital transformation. Digital transformation refers to the realization of significant technological change by enterprises through digital technology, and its essence is a process of continuous exploration. This study is carried out to reveal the impact of the effect reasoning on enterprises' digital transformation with big data analysis from a process perspective. The results show that the effect reasoning and failure learning improves enterprise digital transformation performance. Empirical learning theory is used for the research context. It is helpful to enrich and develop the theoretical research on management innovation, and understand and guide Chinese enterprises to realize digital transformation with big data analysis.

Keywords: Effect Reasoning, Failure to Learn, Digital Transformation

1. Introduction

With the rapid development of the digital economy, the transformation and upgrading of enterprises are required. More enterprises are transforming and upgrading themselves with digital technology, thus improving the efficiency of their production and operation and innovating their products and services. According to the report "White Paper on China's Digital Economy Development (2020)" released by the China Information and Communications Institute, the added value of China's digital economy has increased from 2.6 trillion yuan in 2005 to 35.8 trillion yuan in 2019, and the proportion of the digital economy in GDP has risen to 36.2%, further highlighting its position in the national economy. In April 2020, the National Development and Reform Commission, the central net letter issued by the "about promoting the wisdom of" has assigned "action to cultivate new economic development plan" and "encouraged all kinds of platform, the open source community, the third party institutions provide needed by the digital transformation for the micro enterprise's development tools and the public service". As a result, higher requirements are placed on senior management to encounter various problems when launching digital initiatives. Effective decision-making plays an important role in the success of digital transformation [5]. Effect reasoning is a process in which enterprises adjust and create results based on existing resources. As they are difficult to accurately predict the future environment, it is hard to achieve the established goals by reducing costs and increasing profits, and reasonably avoiding risks [11].

Most of the existing researches focus on the mechanism of effect reasoning on outcome variables, and few scholars pay attention to the influence of mediation. Therefore, this paper attempts to study the influence of mediating variables on

effect reasoning and enterprise digital transformation, and conducts research from both theoretical and practical aspects. Theoretically, compared with previous technological changes, there is a big difference, because digital transformation is not simply to digitize existing resources of enterprises, but more importantly to maximize the value created by digital resources. Therefore, various problems will be encountered in the process of digital transformation. It also comes with failure. From the perspective of practice, since digital transformation is emerging in recent years, it will be full of unknowns in the process. At the same time, the successful experience of transformation is very few, which requires enterprise managers to be prepared for failure in the face of high risk and highly uncertain digital environment, and constantly study and learn from it. Digital transformation itself is a process of continuous trial and error, and failure learning refers to the process in which an enterprise encounters failure in the process of digital transformation and acquires the knowledge needed for success and establishes new behavior patterns. Decision logic will also have an impact on failure learning, and may also play an important role in the digital transformation of enterprises. Therefore, it is suggested that failure learning may play an intermediary role in the model of this study. In addition, institutional environment refers to the division of formal and informal institutions on the basis of social and economic activities. The degree of change of these external environment is related to the predictability of the enterprise in the future. Accordingly, Sarasvathy argues that institutional circumstances may affect the effect of effect reasoning. In a constantly changing environment, it becomes more difficult for enterprises to predict the future development direction, so it is very necessary to study whether effect reasoning can have different impacts on enterprises' digital transformation through failure learning.

At present, many studies focus on the direct impact of the effect reasoning on outcome variables, but they ignore the role of the intermediary mechanism. Therefore, we explored the effect of the mediating variable of the relationship between the effect reasoning and enterprises' digital transformation performance with big data analysis. At the same time, research was conducted from both theoretical and practical levels. Unlike previous technological revolutions, the digital transformation of enterprises involves the digitalization of existing resources and the creation of value and income from digital resources [4]. The digital transformation of enterprises is a long process, and failure is also inevitable for many enterprises [12]. Thus, the process of digital transformation is not easy [9]. In the extremely uncertain digital situation, enterprises need to have the ability to persevere in failure [14]. Digital transformation of enterprises is a process of trial and error, while failure learning refers to the mode in which enterprises encounter failures in digital transformation and acquire knowledge and establish new behaviors [2]. Failure learning is often influenced by decision-making [5] and is likely to play an important role in promoting enterprise digital transformation.

Therefore, it is suggested that failure learning may play a mediating role in the relationship between the effect reasoning and the digital transformation. In an uncertain environment, the future of enterprises becomes unpredictable, and the practicability and effectiveness of the effect reasoning weaken. Therefore, whether the effect reasoning affects the performance of enterprises' digital transformation is a question.

Therefore, combining the trial and error of enterprise digital transformation, we took failure learning as a mediator variable to construct a theoretical model of the effect reasoning of the digital transformation. The followings were investigated in this study.

(1) How enterprises make reasonable strategic decisions to promote digital transformation performance with big data analysis in an uncertain environment.
(2) With learning from experience theory, how to solve the predicament of enterprise digital transformation development.
(3) Discussion on the impact of the effect reasoning on the digital transformation and the mediating role of failure learning for the success of enterprise digital transformation.

2. Theory and Hypothesise

2.1. Effect Reasoning and Digital Transformation

According to Sarasvathy, in today's complex and changing environment, the use of effect reasoning will make decisions more rational and help top managers to make decisions that are better for the future of the business. Through reviewing a large number of literatures, it is found that many scholars' studies have shown that experienced senior managers are more inclined to use effect reasoning as a decision-making logic than inexperienced senior managers, and experienced senior managers tend to produce better corporate performance than inexperienced senior managers.

Effect reasoning mainly focuses on the existing resources at hand and the means that can be used. This method-oriented thinking mode can remind senior managers of enterprises to pay more attention to and consider the effective utilization of their own conditions and resources, so as to improve the utilization rate of their own resources. At the same time, senior managers can reduce some projects with high expectations of losses through tolerable losses, and carefully designate strategic alliances with other enterprises, so as to obtain better resources. All these can help enterprises reduce various risks brought by the operation process. At the same time, it can also enhance the viability of enterprises in such a complex and changing environment. Senior managers use the decision logic of effect reasoning to actively develop and take advantage of various hidden opportunities around them subjectively. Because opportunities are reserved for people who are prepared, they must seize those opportunities proactively to help enterprises gain certain competitive advantages in this complex and changeable market environment. Only by

constantly improving the utilization rate of resources, reducing the survival risk of enterprises and seizing more opportunities, can the performance of enterprises be improved. Make the enterprise get better development. The bearable loss of effect reasoning itself requires senior managers to make decisions from the perspective of losses that the enterprise can and wants to bear, so as to bring better performance level to the enterprise. When thinking about the losses that the enterprise can bear, the top managers can keep the maximum risk of all the decisions made by the enterprise within the range of losses that the enterprise can bear, which to some extent can greatly reduce the possibility of the enterprise suffering unbearable losses due to investment failure, so as to constantly improve the enterprise to adapt to this complex and changeable environment. Improve your ability and chances of survival. In addition, when considering the losses that the enterprise can bear, the senior managers can actually protect the advantages of the enterprise that cannot be lost, and reduce the risks while ensuring the survival of the enterprise. While maintaining the unique advantages of the enterprise, the enterprise can maintain its unique competitive advantages. At the same time, the loss that an enterprise can bear, as the preferred principle of senior managers when making decisions, is the result of their long-term practice and experience, which can bring good performance to the enterprise and bring the development of the enterprise to a higher level.

The flexibility of the organization of effect reasoning mainly requires that the enterprise must always maintain a certain degree of flexibility, so as to ensure its own ability to deal with various risks that may occur in the future and some accidental accidents. Making it always maintain organizational flexibility enables enterprises to have the ability to adjust at any time according to organizational structure and resource requirements on a certain basis. This can not only help enterprises to quickly cope with the external complex and changing environment, but also greatly help enterprises to quickly identify and seize those occasional opportunities. Through high organizational flexibility, we can also analyze and develop those happenstance events, so as to proactively utilize all available resources and create infinite possibilities. If an enterprise keeps its organizational flexibility, it naturally has the ability to cope with various complex and changeable external environments, and at the same time, it has the ability to exploit new opportunities by taking advantage of various contingencies in the face of those occasional events. All these help senior managers to achieve better corporate performance by making decisions.

The prior commitment level of effect reasoning essentially requires senior managers to learn how to make good use of the prior commitment of their partners to help the enterprise run better. In a complex and changeable environment full of uncertainty, an individual usually has no way to obtain all the relevant information, so it can only rely on previous experience and personal knowledge to make a relatively rational decision with limited rationality. However, when making decisions, senior managers need to understand that their partners have promised that senior managers can make good use of their partners' own experience and knowledge, which can effectively help senior managers to obtain more valuable information so as to make their decisions more rational. To reduce those irrational decisions to the enterprise caused by unnecessary losses. At the same time, if the enterprise can make good use of the previous commitment of the partner, it means that senior managers can also use the resources owned by the partner, and the integration of these resources will form the enterprise's own competitiveness. By making use of the previous commitment of the enterprise's friends, customers, suppliers and other partners, it can not only help reduce the possibility of loss caused by decision-making errors, but also to a large extent improve the enterprise's adaptability to the complex and changing environment and its own survival ability, and at the same time help the enterprise to strengthen the favorable competitiveness. In order to improve enterprise performance.

Therefore, this study believes that the decision logic of effect reasoning has a positive impact on the digital transformation performance of enterprises. Many scholars have also concluded in their research that effect reasoning can well improve the performance of enterprise digital transformation. Christophe et al. conducted an empirical analysis on the vertical data of 625 enterprises and compared the operation situation of enterprises with the decision-making logic of the previous year. The results showed that enterprises using the decision-making logic of effect reasoning could achieve higher performance than those using the logic of causation reasoning. Read et al. studied the data in JBV journal, found the variables related to effect reasoning and enterprise performance, and conducted diversified analysis on them. The results also showed that effect reasoning can bring higher performance to enterprises.

Effect reasoning refers to decision-making that enterprises constantly explore with their resources in uncertain and inaccurate predictions [8]. The positive effects of the effect reasoning are evident in a digital environment of high uncertainty and complexity. First of all, the adaptability of enterprises using the effect reasoning is generally stronger than that of enterprises without using it. Enterprises correctly use digital transformation and improve the performance of digital transformation by constantly thinking and studying digital paths. Secondly, the digital capacity building of various industries in China is still at the initial stage, which is full of unknowns and few successful experiences [9]. Enterprises that uphold effect reasoning continue to explore to promote the digital transformation of enterprises. Finally, with the development of the digital economy, the boundaries of enterprises are becoming increasingly blurred [3]. Thus, the effect reasoning helps enterprises establish a good cooperative relationship with stakeholders to learn about enterprises' digital experience and promote their digital transformation. Thus the following hypothesis is proposed and tested.

H1: Effect reasoning positively affects the performance of enterprise digital transformation.

2.2. Mediation Role of Failed Learning

In the process of enterprise digital transformation, enterprises that follow the logic of effect decision advocate exploration and experiment, and realize digital transformation through unplanned failure learning. Specifically speaking: First, after experiencing failure, enterprises with effective decision logic can accept failure calmly and consider failure as an excellent opportunity to improve their digital capability. In such a fault-tolerant organizational atmosphere, members are more likely to learn from failure and improve their shortcomings, thus promoting the digital transformation of enterprises. Second, enterprises that adhere to the logic of effective decision making advocate opportunity exploration in failure experience, and allow bold trial and error within the range of tolerance, and are more inclined to accelerate the pace of digital transformation through failure learning. Third, failure learning is not only about learning from one's own failure experience, but also about learning from the failure experience of other enterprises. In the logic of effect decision making, a purposeful interactive relationship is established between enterprises and stakeholders. A good cooperative relationship with other enterprises is conducive to the exchange and sharing of failure experience among members of different organizations. Learning from the failure experience of other enterprises can effectively avoid similar mistakes and prevent them from happening in the future.

In the process of digital transformation, an enterprise fails to reach the goal set by prefetching, so the enterprise seeks the cause of failure and experience in this process, so as to obtain the knowledge not available in other places, and create a new behavior pattern, so as to achieve the previously preset goal of a continuous improvement and learning. According to the conclusions of previous scholars, effect reasoning can provide all-round guidance for the behavior of enterprises, and it is also an essential factor to trigger the thinking of individuals and organizations in enterprises. Therefore, this study points out that failure learning plays a mediating role in the relationship between effect reasoning and enterprise digital transformation performance. Enterprises that follow the principle of effect reasoning are expected to set the target based on the experience and knowledge gained from failure learning to properly avoid possible risks, so as to achieve high-quality digital transformation of enterprises. In the process of transformation, enterprises like to pursue exploration and experiment, specifically: First: After a failure, an enterprise that makes decisions based on the logic of effect decision making will look at the failure in an ideal way, gain opportunities from it, and make continuous improvements, thus promoting the digital transformation of the enterprise to develop in a better direction. Finally, failure learning not only refers to its own experience, but also can be learned from the experience of other enterprises. A positive interactive relationship has been established between the enterprise and its stakeholders, as well as a cooperative relationship with other enterprises, which can well help enterprises and organizations to constantly exchange and share experience, so

as to effectively avoid the same problem.

Different from previous technological changes, digital transformation requires a highly difficult organizational change accompanied by numerous innovations and explorations [6]. Therefore, failure learning plays an important role in this process. Combined with the research context, failure learning is defined as a learning process in which enterprises accumulate experience and acquire knowledge from their failures or those of other enterprises when the expected results of digital transformation are not achieved. The result helps establish new behavior patterns and achieve the set goals [2]. Therefore, it is believed that the effect reasoning guides the behavior and process of enterprises, which is also an important factor to trigger the learning and reflection of members of the organization [7]. Therefore, failure learning plays a mediating role in the relationship between the effect reasoning and digital transformation performance. Thus the following hypothesis is proposed and tested.

H2: Failure learning plays a mediating role in the relationship between effect reasoning and enterprise digital transformation performance big data analysis.

3. Study Design

3.1. Data Collection

We used a questionnaire survey to collect relevant data. Questionnaires were sent out to 300 correspondents questionnaires, and 209 valid questionnaires were returned. 93 males (44.5%) and 116 females (55.5%) were included. 94 employees were under 30 years old (45%), 72 between 31 and 40 years old, accounting (34.4%), and 43 over 40 years old (20.6%). The operating years since the establishment were mainly 11−20 years, accounting for 42.1%. 35.9% of the enterprises had 501−1000 employees, and 55% of them were private companies. The statistics of sample characteristics are shown in Table 1.

3.2. Table

In order to ensure the validity of the measurement results, we used domestic and foreign mature scales for reference. The questionnaire items are shown in Table 2. Before the formal survey, a pre-survey was conducted by enterprises, and the final questionnaire was obtained after modification and improvement according to the pre-survey results and sample feedback. A Likert 5-level scale was used in the final questionnaire: 1 indicating very inconsistent and 5 indicating very consistent.

Effect reasoning: The measurement of the effect reasoning is based on the scale developed by Chandler et al. [8], which has been widely used by scholars in the Chinese context [13]. Effect reasoning was measured in four dimensions: experiment, loss tolerance, flexibility, and previous commitment.

Digital transformation performance with big data analysis describes the degree of digitization of enterprises. Based on

the research of Chi et al. [10], we measured the digital transformation performance in three dimensions of business operation, business process, and value creation [15].

Failure learning was referred to in the research of Xiaoyu and Li [2]. We combined the situational characteristics of enterprises' digital transformation and the failure learning behavior scale in three dimensions.

Table 1. Sample characteristics statistics.

variable		PERC	AVE	SD
sex	Man	44.5	1.56	0.5
	Women	55.5		
age	20-30	45	2.76	0.77
	31-40	34.4		
	Over 40 years old	20.6		
record of formal schooling	Junior college below	16.3	2.48	0.94
	Junior college	34.9		
	Undergraduate course	33.5		
	Master's degree or above	15.3		
enterprise scale	Under 100 people	10.5	2.65	0.91
	101-500	34		
	501-1000	35.9		
	More than 1,000 people	19.6		
Enterprise income	1001-5000	49.8	3.65	0.72
	5001-10000	35.9		
	At least 10,000 +	14.4		
ownership property	State-owned	45	1.55	0.5
	Private enterprise	55		

The overall standardized reliability coefficient of effect inference is 0.965 (Table 2). The analysis result indicates that the overall reliability of the questionnaire is high.

Table 2. Variable reliability analysis results.

Dimensionality	Reliability	Number of terms
Effect reasoning	0.964	12
Digital transformation	0.887	3
Failure to learn	0.89	3
Scale as a whole	0.965	18

4. Empirical Analysis and the Results

The Kaiser-Meyer-Olkin (KMO) coefficient is 0.985. Therefore, the reliability of the questionnaire is good (Table 3).

Table 3. Results of the variable validity analysis.

Sample sufficient degree of Kaiser-Meyer-Olkin metric		0.983
Bartlett's sphericity test	Approximate chi square	3736.863
	df	153
	Sig.	0

All variables are significantly correlated at a 99% significance level (Table 4). The correlation coefficient between digital transformation and effect reasoning is 0.911, which is siginifically related.

Table 4. Correlation.

Variable	Correlation	Digital transformation	Effect reasoning	Failure to learn
Digital transformation	Pearson Correlation	1		
Effect reasoning	Pearson Correlation	0.911**	1	
Failure to learn	Pearson Correlation	0.876**	0.918**	1
**. Significant correlation was observed at the 0.01 level (bilateral).				

In this study, the stepwise regression analysis was adopted to verify the research hypothesis, and the model containing only control variables was taken as the benchmark model. On this basis, explanatory variables such as effect reasoning and failure learning were successively introduced to obtain multiple regression models with the results shown in Table 5.

Effect reasoning has a significant positive impact on enterprise digital transformation performance. That is, $\beta=0.91$, SIG <0.05, $R^2=0.83$ of model 1. According to the data in the table, $\beta=0.92$, SIG <0.05, $R^2=0.84$ of model 2, indicating that effect reasoning has a positive and significant impact on failure learning. The analysis results show that the impact of

the effect reasoning on the digital transformation and failure learning is significant. Therefore, failure learning plays an intermediary role between effect reasoning and enterprise digital transformation. Therefore, hypothesis 2 is verified.

Table 5. Regression analysis model.

Predictive variable	Model 1	Model 2
R^2	0.83	0.84
F	1015.77	1111.53
B	0.99	0.92
SE	0.48	0.47
β	0.91	0.92
t	31.87	33.34
sig.	0	0

5. Conclusion

5.1. Research Conclusion

In the period of rapid development of the digital economy, digital transformation is a major trend for the future development of enterprises. How to successfully realize the digital transformation of enterprises has been a long-term concern of academia and society [1]. The effect reasoning leads enterprises to move forward in the direction of digital transformation. Based on the empirical learning theory, the mechanism and boundary conditions were investigated, and the following conclusions were drawn.

(1) Effect reasoning has a positive impact on enterprise digital transformation performance big data analysis.
(2) Failure learning plays a mediating role in the relationship between the effect reasoning and enterprise digital transformation performance with big data analysis.

5.2. Theoretical Significance

First, the effect reasoning theory is extended to the situation of enterprise digital transformation. In the era of rapid development of digital technology, digital transformation has become a new opportunity for enterprise development. However, the current research on enterprise digitization is still in the initial stage. As the "leader" of an enterprise, how to make digital measures and promote enterprise digital transformation has become an issue for research. Based on the perspective of effect reasoning, we investigated the effect of effect decision on the performance of enterprise digital transformation and found the positive impact of decision logic. This conclusion not only broadens the application scope of effect reasoning but also enriches the related research in the field of enterprise digital transformation, which has important theoretical value.

Second, it reveals the mediating mechanism of failure learning between decision logic and enterprise digital transformation. It is found that most existing scholars focus on the field of entrepreneurial enterprises to explore the mechanism of the effect reasoning. However, scholars often ignore the existence of mediating variables when discussing the mechanism. This may account for the differences in the conclusions of previous studies. Since enterprise digital transformation is essentially a process of continuous exploration and trial and error, we propose and verify the mediating role of failure learning between the effect reasoning and enterprise digital transformation. This conclusion makes up for the deficiency of previous research. At the same time, the influence of the effect reasoning on enterprise digital transformation provides a new perspective for related research.

5.3. Practical Enlightenment

A failure scenario is necessary for the growth and development of an enterprise to provide valuable learning opportunities for the enterprise. Because of the "success bias" in practice, enterprises often ignore the value of learning from failure. To avoid failure and breaking the law or the crisis of failure, failure learning is required to restore confidence. If we understand the learning value of the failure, we objectively explain the failure scenario and regard the process of enterprise development as the management process of obstacles, setbacks, and failures. We even gain "big learning" by actively designing "small failures" to promote the sustainable and healthy growth of enterprises.

Enterprises need to choose corresponding countermeasures according to different stages of digital transformation. The results of this study show that effect reasoning helps to improve the performance of enterprises' digital transformation. Therefore, in practice, senior executives must be flexible rather than just stick to one attitude. In the process of digital transformation, senior executives of enterprises need to focus on the logic of the effective decision, emphasize experiment and risk taking based on established goals, and adjust the digital route of enterprises by learning while testing. It is required for enterprises to act quickly in the digital wave and avoid falling behind competitors.

5.4. Research Prospect

First of all, the sample data collected in this study are only subjective comments made by individuals through perception. Although the author has demonstrated that there is no serious deviation, there is still no way to completely avoid the influence. Future scholars can verify their hypotheses according to the tracking research method when conducting research, so as to solve the endogeneity problem.

Secondly, this paper takes senior managers as research objects and sends questionnaires to them to collect data. Therefore, cross-layer risks are likely to occur during data collection. Scholars can verify the proposed research hypothesis through cross-layer data in future studies.

Finally, in combination with the characteristics of enterprises in the process of digital transformation and upgrading, this paper proposes and verifies the mediating role of failure learning in the relationship between effect reasoning and enterprise digital transformation performance. Future studies may try to incorporate variables such as value co-creation and collaborative symbiosis culture into the

research model. Therefore, we can comprehensively study the mechanism and boundary conditions of effect reasoning on enterprise digital transformation performance.

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