How Does Digital Traceability Impact the Innovation Behavior of Food Firms Based on the Marketing Perspective?

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Abstract. Marketing is the vital force behind business growth. Meanwhile, innovation serves as the fundamental safeguard for effective marketing strategies. And whether booming digital technology can foster and promote the innovative behavior of food enterprises has received extensive attention from a variety of societal sectors. Drawing upon the knowledge-based perspective and the theory of dynamic capability (DC), this study constructs an important emerging information technology, using knowledge management (KM) as the mediating variable and DC as the moderating variable. A theoretical model that examines the impact of digital traceability on fostering innovative behavior (IB), including creative product development, improvement in procedures, and novelty in administration within enterprises, can be outlined in this paper. Partial least squares structural equation modelling (PLS-SEM) with Smart PLS-SEM 4.0 software was used to analyze the questionnaire survey data from 372 food enterprises that have a certain foundation in digital traceability (DT) and are located in three demonstrative regions for the construction of traceability systems. The empirical results indicate the following: 1. DT significantly impacts the IB of food firms; 2. KM plays a mediator role between DT and IB; 3. DC regulates the moderate effect in the first half (DT-KM) and the second half (KM-IB).

Keywords: Digital traceability, Innovative behavior, Knowledge management, Dynamic capability, Marketing

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1 Introduction

With the formulation of national strategies such as the 14th Five-Year Plan of China and the Summary of Long-Term Objectives for 2035, the food industry is transforming towards efficient automation, digitalization and intelligence. Food firms attach great importance to innovative behavior (IB) [1]. Food firms apply an emerging information technology — digital traceability (DT), and build a traceability system through digital means like the Internet of Things, artificial intelligence, blockchain, and cloud computing [2],which can improve the original product development, business process, and management model, thereby influencing the generation of IB. Since 2018, the international technology giant IBM has successfully joined forces with well-known food firms such as Walmart, Kroger, McLean, Nestle, and Dole to bring innovation in business processes and management models by introducing blockchain traceability technology. However, more business managers maintain a skeptical attitude towards whether DT can promote IB or not [3]. Therefore, the study aims to if and how DC in the food industry might encourage or promote creative behaviour. Additionally, it tries to investigate the fundamental mechanisms and border circumstances that underlie how digital traceability encourages creative behaviour in businesses.

2 Theoretical Basis and hypothesis development

2.1 DT and IB

As a technical procedure, DT is used by businesses to set up a traceability system employing cutting-edge digital information technology[1].IB refers to developing new products and services, adopting new processes and processes, introducing new management models, and implementing new enterprise organisational forms to occupy an advantageous position in the competition. DT can facilitate innovative behavior[1]. As a result, the following hypotheses are put forth in this study:

H1: The DT has a positive effect on IB.

2.2 The mediating role of KM

Zhao [4] believes that KM is the process by which firms acquire, absorb external knowledge and transform and apply internal knowledge. The DT system is an investment based on knowledge and technological resources that provides a mechanism for the two-way interchange of communication and acquaintance between enterprises and their partners, which stimulates the creation of new products, processes and management concepts. In light of the argument previously presented, this study puts forth the hypotheses below:

H2: KM will mediate the relationship between DT and IB.

2.3 Moderating role of DC

Teece [5] believes that dynamic capability (DC) includes three dimensions: Sensing capability, Seizing capability, and Reconfiguring capability. DC can enable companies to innovate and adapt to changes in customers, competitors, markets and industries through the above three dimensions: high uncertainty, volatility and unpredictability. DC may also have a regulating process for DT-KM, and KM-IB. Therefore, this study proposes the following hypotheses:

H3a: DC positively moderates the relationship between the DT and KM.

H3b: DC positively moderates the relationship between the KM and IB.

In conclusion, Figure 1 depicts the research design used in this work.

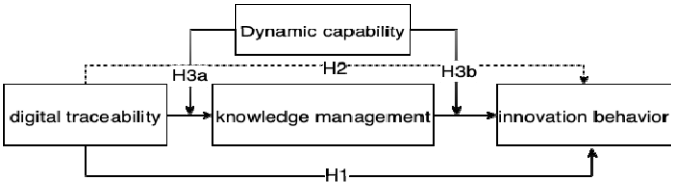

Fig. 1. Research Model

3 Research Design

3.1 Sample and Data Collection

"Study Group concerning Marketing Course Construction and Practice Based on OBE Concept" targets Shandong, Ningxia and Heilongjiang Province from February to June 2023, and 467 food firms distributed questionnaires and 401 questionnaires were collected. An overall of 372 acceptable questionnaires were gained after eliminating the missing ones, resulting in an effectual recovery ratio of 79.66% for the questionnaires. In the research sample, the average operating life of the surveyed firms was 12 years. Private firms accounted for the highest proportion, reaching 50%, followed by state-owned enterprises, representing 32.16%. Food manufacturing enterprises occupied 48.74%, wholesale enterprises accounted for 29.13%, and retail enterprises constituted 22.13% respectively.

3.2 Measurement Instruments

To certify the reliability and legitimacy level of the questionnaire, the mature scale was mainly used for measurement instruments. DT mainly refers to the scale of Cousins et al. [6]. KM involves Lane et al. [7] 6-item scale. DC relates to Wilden et al.,Wilden, Gudergan [8] 9-item scale. IB mainly refers to the scale of Gunday et al. [9] 9-item scale. The scales all use the Likert 7-level scale, where 1 is never considered, and 7 is successfully implemented. This study's scale reliability and validity were good (see Table 1). The presence of common method bias (CMB) was assessed depleting the test of Harman's one-factor before the hypothesised research model was

examined. The findings showed that a single component contributed 42.53% of the variance, which is less than the 50% cutoff point and excludes common method bias (CMB).

Table 1. Construct validity and reliability.

	Items	Loading	Alpha	CR	AVE		Items	Loading	Alpha	CR	AVE
KM	MK1	0.823	0.884	0.888	0.636	IB	IB1	0.809	0.932	0.935	0.649
	MK2	0.809					IB2	0.830			
	MK3	0.702					IB3	0.840			
	MK4	0.770					IB4	0.714			
	MK5	0.866					IB5	0.841			
	MK6	0.822					IB6	0.812			
DC	DC1	0.712	0.916	0.925	0.598		IB7	0.840			
	DC2	0.749					IB8	0.717			
	DC3	0.763					IB9	0.837			
	DC4	0.735				DT	DT1	0.864	0.856	0.860	0.778
	DC5	0.765					DT2	0.859			
	DC6	0.759					DT3	0.921			
	DC7	0.866									
	DC8	0.795									
	DC9	0.809									

Note (s): Alpha = Cronbach's Alpha, CR = Composite reliability, AVE = Average variance extracted.
Source: Authors' calculation.

4 Data analysis

Partial least squares structural equation modelling (PLS-SEM) was conducted in analysing cross-sectional data. The hypotheses of the model are analyzed using Smart PLS-SEM 4.0 software.

4.1 Measurement model

Convergent validity was established using four tests. Table 1 shows that the factor loading is more than the advised cutoff value of 0.50[10], falling within the values of 0.702 and 0.921.The Cronbach's alpha, ranging from 0.856~ 0.932, surpassed the acceptance level of 0.70 [10]. Table 1 displays that the consistency reliability (CR), ranging from 0.860~ 0.935, implies equivalence, internal steadiness, and the trustworthiness of all elements. The lowest AVE in Table 1 is 0.598~ 0.778, exceeding the maximum value of 0.50[10]. Researchers who find that two indicators must not be statistically similar are said to have found discriminant validity (DV). As Henseler et

al. The HTMT of all the structures is demonstrated less than 0.7 in Table 2 and the VIF value is less than 5, according to this study. [10]. The R2 values of BI and KM are 0.53 and 0.43, correspondingly, in Table 3, demonstrating the high predictive power of both constructs.

Table 2. Fornell−Larcker criterion and HTMT criterion

	DC	DT	IB	KM	VIF	HTMT	DC	DT	IB	KM	DC×KM
DC	**0.774**				1.108	DT	0.562				
DT	0.503	**0.882**			1.474	IB	0.544	0.693			
IB	0.515	0.620	**0.806**		1.465	KM	0.337	0.665	0.662		
KM	0.312	0.579	0.604	**0.797**	1.144	DC×KM	0.069	0.437	0.348	0.199	
						DC×DT	0.178	0.193	0.248	0.414	0.521

Note: Bold values appearing on the main slanting of the correlation matrix represent the square roots of the AVEscores. Correlations between the constructs are shown as off-diagonal items below the diagonal. Source: Authors' calculation.

4.2 Structural model

Using Smart PLS 4.0, the research model's hypotheses were tested. PLS-SEM was employed in this study, which incorporated a bootstrapping resampling method with 5000 subsamples. Fig. 2, Fig. 3, Fig. 4 and Table 3 depict the results of the hypothesis testing Supported. There was a positive relationship between DT and IB (β = 0.190, T=3.258, $p < 0.05$). KM as a mediator between DT and IB (β = 0.166, T=4.496, $p < 0.001$). DC as a moderator between DT and KM (β = 0.288, T=5.851, $p < 0.001$). DC as a moderator between KM and IB (β = 0.154, T=4.075, $p < 0.001$). Thus, H1, H2, H3a, and H3b were supported.

Thus, H1 was supported.

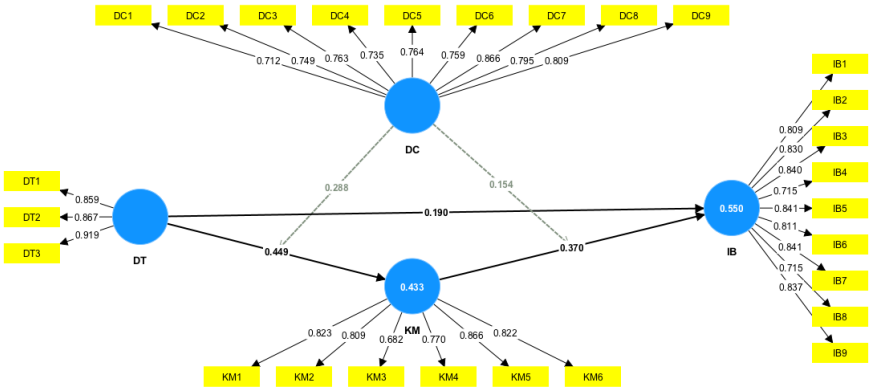

Fig. 2. Structural model.

Table 3. Outcome of significance analysis for the path coefficients in the structural model and predictive relevance of the model

Hypothesis	Structural Path	Coefficient	t-statistics	Results		R-square	R-square adjusted
Direct Effects					BI	0.534	0.530

H1	DT→IB	0.190**	3.258	Supported	KM	0.433	0.429
Mediating effects							
H2	DT→KM→IB	0.166***	4.496	Supported			
Moderating effects							
H3a	DC×DT→KM	0.288***	5.851	Supported			
H3b	DC×KM→IB	0.154***	4.075	Supported			

Note: * = p < 0.05, ** = p < 0.01, and *** = p < 0.001. Source: Authors' calculation.

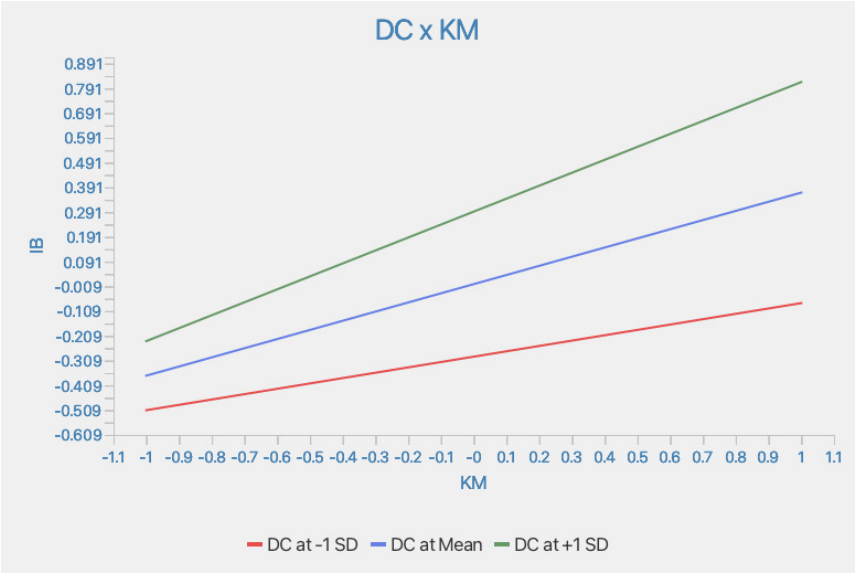

Fig. 3. The moderating role of DC between. DT and KM

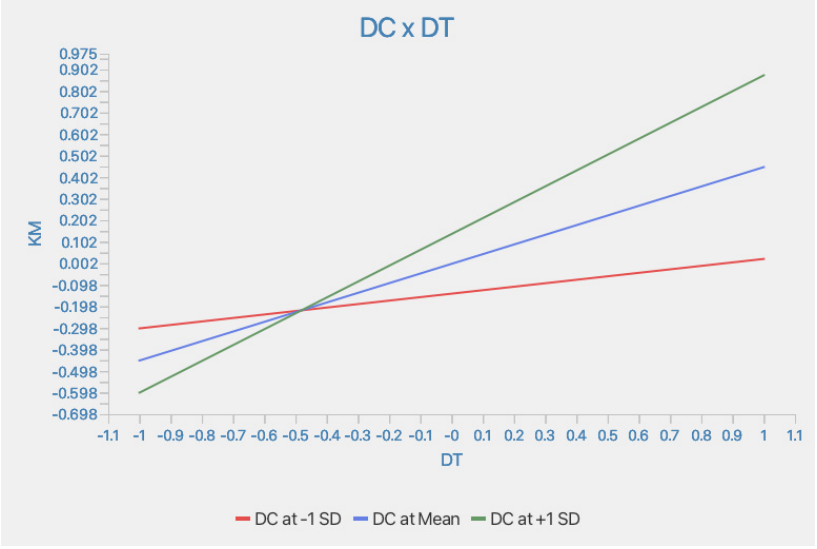

Fig. 4. The moderating effect of DC between. KM and IB

5 Conclusions

The empirical results show that: DT promotion in the food industry can encourage IB. Meanwhile, KM plays a role as a mediator in their interaction and contributes in some measure to the IB produced by DT in food operations. In addition, promoting DT in food businesses considerably enhances IB when confronted with increasing degrees of DC. Furthermore, DT use in the food industry can improve KM with its DC. Therefore, effective KM can encourage IB once it is established, especially in quickly changing external settings.

Besides, the theoretical contributions are made by this research: A moderated mediation model is built to investigate the link between DT and IB practices. The influence route of traceability practices on IB is shown through in-depth investigation of the link between DT and IB, expanding previous research findings and points of view. Additionally, building on an expanded knowledge-based perspective, which adds KM as a mediating factor, offering empirical support to explain the "black box" between DT and IB. Furthermore, food industry managers also need to recognize their own DC and adjust their strategies for DT and KM in a timely manner to promote broader IB.

Hence, management insights are offered by the study: Managers in the food sector need to be aware of how important it is to advance DT practices for KM and to encourage IB that can lead to advancements in management, process, and product innovations. Food firms should proactively use digital technologies based on a thorough assessment of existing traceability resources and capabilities in order to drive effective DT and support KM and innovation strategies. Managers of the food business should also prioritize KM as they use DC to encourage IB. Companies must develop and enhance their KM skills, viewing them as essential components of core competencies. Food firms may use DT methods to stimulate IB, integrate innovation resources, and further strengthen sustainable competitive advantage by using the mediating influence of KM. Additionally, food industry managers need to acknowledge their own DC and make timely adjustments to their strategies for DT and KM to facilitate a broader range of IB as well.

The existing constraints, however, still need to be addressed in future studies. Managers from middle to upper levels of the firms made up the study's participants. Future research should take the unique traits of each component as well as organizational procedures into account, choosing different survey participants depending on various variables. For instance, choosing information technology executives to offer perspectives on the operational condition of the business's traceability system.

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