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Construct Development of Digital Transformation Capability: Dynamic Capability Perspective

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Abstract: *Digital transformation necessitates the development of a robust capability, as well as the resolution of complex convergence issues between the digital system and the existing legacy systems within the transforming enterprise. This study seeks to expand upon the existing conceptualization of digital transformation capability by introducing a novel model grounded in dynamic capability theory. To explore the development of digital transformation capability construction, this study conducted a multi-phase empirical investigation involving organizations that have either already undergone or are currently in the midst of digital transformation. The empirical findings reveal that digital transformation capabilities are constructed from three primary dimensions: sensing, organizing, and restructuring. Furthermore, this study assessed the criterion validity of a reflective measurement model designed to describe digital transformation capability and its impact on well-established organizational performance metrics. The results confirm the validity of this model in capturing the essence of digital transformation capability and its significant influence on organizational performance. By providing a deeper understanding of the underlying mechanisms and dimensions of digital transformation capability, this study offers valuable insights for both academic researchers and practitioners seeking to navigate the digital transformation journey.*

Keywords: *Construct development; Digital transformation capability; Dynamic capability theory; Empirical test*

1. Introduction

To sustain and enhance organizational performance amid this rapidly evolving digital landscape, enterprises must proactively cultivate digital transformation capabilities [1]. Furthermore, as customer demands grow increasingly diverse, firms are compelled to reconfigure business resources and accelerate the development of such capabilities to maintain competitiveness [2], achieving effective digital transformation remains a formidable challenge. Enterprise digital transformation entails driving organizational change through digital tools and platforms, fostering innovation in products and services, and ultimately enhancing business performance to secure long-term competitive advantages [3]. Thus, organizations must perpetually adapt their business processes and models in response to technological and market shifts. This necessitates the development of robust digital transformation capability.

Given the theoretical and practical gaps in understanding digital transformation capability (DTC), this study seeks to advance prior conceptualizations by proposing a dynamic capability-based framework. The proposed model offers a comprehensive perspective for organizations to systematically develop DTC, thereby addressing the multifaceted challenges inherent in digital transformation. This study contributes to the digital management literature in two key ways: 1) By elucidating how organizations cultivate and deploy DTC to drive structural changes in business processes and models within digital environments. 2) Through the construction and validation of a psychometrically robust scale to operationalize DTC.

To achieve these contributions, the study pursues three specific objectives: 1) To establish a theoretically grounded definition of DTC and delineate its core constituent dimensions. 2) To formulate and empirically validate a parsimonious yet reliable measurement instrument for assessing DTC. 3) To examine the predictive validity of the proposed reflective measurement model by evaluating its relationship with organizational performance as a well-established outcome variable.

The subsequent section presents the theoretical foundation of DTC, supported by a systematic review

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of extant literature. Following this, we introduce the reflective measurement model and detail the methodological approach employed for scale validation, including research design and analytical procedures. The paper concludes with a discussion of key findings, theoretical and managerial implications, and avenues for future research.

2. Literature Review

2.1. Dynamic Capability Theory

The critical role of dynamic capabilities emerges from the growing complexity of value networks through which firms create and capture value. Dynamic capabilities enable enterprises to effectively navigate these challenges by facilitating strategic adaptation to environmental changes. Unlike traditional capabilities, dynamic capabilities specifically address how firms adapt to rapidly evolving conditions [4], making them particularly relevant for understanding the disruptive nature of digital transformation processes [5]. In this study, we employ dynamic capability theory as our conceptual framework to analyze the essential competencies that enterprises must cultivate during digital transformation.

2.2. Related Studies of Digital Transformation Capability

A prevalent issue in prior studies involves the conflation of dynamic capability with digital transformation capability, without adequately distinguishing these constructs from digital capability. This conceptual ambiguity has led to an imbalanced emphasis on digital capability while neglecting the essential supporting capabilities required for successful organizational transformation. Digital capability is the comprising agility and responsiveness, multi-channel communication, visualization, and governance - as drivers of digital business performance, particularly in e-commerce contexts [6]. However, this operationalization presents two significant limitations: first, e-commerce represents merely one facet of comprehensive digital transformation; second, measuring digital transformation capability solely through e-commerce indicators constitutes an oversimplification of this multidimensional construct. Digital capabilities influence stakeholders' adaptive capacities to integrate and reconfigure skills, resources, and functional competencies [7]. Nevertheless, their framework demonstrates conceptual inconsistency by conflating functional capabilities with integration and reconfiguration capabilities, suggesting a need for theoretical refinement.

3. Construct Development of Digital Transformation Capability

This study defines digital transformation capability as an organization's dynamic capacity to intensify digital technology deployment in response to evolving environmental demands, thereby enhancing value creation across products, services, and business models. Through systematic integration of dynamic capability theory and digital transformation literature, we conceptualize DTC as a multidimensional construct comprising three core dimensions: sensing, organizing, and restructuring. Specifically, the capability of sensing in the digital environment, organizing internal and external available resources, and reconstructing organizational structures are important dimensions of digital transformation capability.

This study conceptualizes digital transformation capability as a multidimensional, second-order construct with three reflective, first-order factors: sensing, organizing, and restructuring. As such, the model is a reflective one at the first-order, as three latent factors emerge, which are reflected upon their indicators. The reason for this level of the model being reflective is that each capability dimension is an underlying concept that has an effect on its indicators [8]. In other words, each latent (capability) factor determines its indicators and not vice versa [9]. Similarly, at the second-order, the three factors reflect the overall construct of digital transformation capability.

Subsequently, to examine the developmental trajectory of digital transformation capability, this study implemented a multi-phase empirical investigation targeting organizations at various stages of digital transformation. Three sequential survey phases were conducted, with the number of participating organizations increasing progressively. Specifically, Phase 1 involved 45 organizations, Phase 2 included 95 organizations, and Phase 3 encompassed 160 organizations. All methods followed applicable guidelines and obtained informed consent from all participants.

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3.1. Phase 1

1) Background

This study investigates organizational data at the enterprise level and cannot access information that can identify individual participants during or after data collection. The survey results revealed a diverse distribution of respondents across different management levels within the participating organizations. Specifically, the largest number of responses was received from senior managers, accounting for 21 individuals (46.7%). This was followed by executive-level respondents, including Chief Executive Officers (CEOs), Chief Marketing Officers (CMOs), Chief Financial Officers (CFOs), and Chief Information Officers (CIOs), who collectively contributed 17 responses (37.8%). The smallest number of responses was obtained from department managers, with 7 individuals participating (15.6%).

2) Measurement Model of Digital Transformation Capability

To assess the psychometric properties of the digital transformation capability scale, this study employed IBM SPSS Statistics software to conduct a series of analyses examining the unidimensionality, validity, and reliability of the three factors within the scale. The KMO value was found to be 0.854, and Bartlett's test was significant, indicating that the data were appropriate for factor analysis [10]. The extraction of the sum of squared loadings revealed three principal components, confirming that the three dimensions proposed in this study are the primary constructs underlying digital transformation capability. The cumulative percentage of explained variance (average variance extracted, AVE) was 66.89%, which exceeds the recommended threshold of 50% and is also higher than the maximum squared correlation between the three factors. This finding further supports the construct validity of the scale.

3) Data Analysis and Results

To further examine the relationships among these dimensions and validate the proposed model, we employed SmartPLS4 software for partial least squares structural equation modeling (PLS-SEM) analysis. As shown in Appendix 1, all item loadings exceeded the commonly accepted threshold of 0.7, indicating strong convergent validity. Additionally, the average variance extracted (AVE) values for each dimension surpassed the recommended threshold of 0.6, further confirming that the measurement items adequately captured the variance of their respective latent constructs. The composite reliability (CR) values for sensing, organizing, and reconstruction were all greater than 0.8, which is indicative of high internal consistency and reliability of the measurement scales. To verify the necessity and appropriateness of employing a higher-order model structure, we compared the first-order factors (sensing, organizing, and reconstruction) with the second-order factor representing the overarching digital transformation capability construct [11]. The results revealed that the second-order factor loadings were higher than those of the first-order factors.

To validate the research hypotheses of the structural model, we employed SmartPLS4 software for data analysis and utilized the bootstrap resampling method to estimate the path coefficients [12]. The variance inflation factors (VIFs) for all predictors were well below the conventional threshold of 5, indicating that multicollinearity is not a concern in this study [13]. The results of path analysis showed that digital transformation capability (path coefficient = 0.798, t value = 14.369) had a 99% statistical significance on organizational performance.

3.2. Phase 2

1) Background

This study conducted empirical research on Chinese A-share listed enterprises, and obtained high-quality responses from 95 enterprises through a questionnaire survey. The survey results showed that senior management had the highest number of responses, with 45 (47.5%), followed by executives with 31 (32.6%), and department managers had the lowest number of responses, with 19 (19.9%).

2) Measurement Model of DTC

The KMO and Bartlett's test value is 0.915, and percentage of explained variance (AVE) is 63.923%. The factor loadings are all above 0.5, and Cronbach’s alpha coefficients are all above 0.8: sensing (0.922), organizing (0.895) and restructuring (0.926).

3) Data Analysis and Results

All loadings are greater than 0.7, AVE values are greater than 0.5, CR values are greater than 0.8, and

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second-order factor loads are higher than first-order factor loads. All VIFs are far below 5, and there is no multicollinearity problem. The path analysis results indicate that digital transformation capability (path coefficient=0.790, t value=13.743) has a 99% statistical significance on organizational performance.

3.3. Phase 3

1) Background

This study conducted a questionnaire survey on digital transformation enterprises and received effective responses from 160 enterprises. The survey results showed that senior management had the highest number of responses, at 78 (48.8%), followed by executives at 51 (31.9%), and department managers had the lowest number of responses, at 31 (19.3%).

2) Measurement Model of DTC

The KMO and Bartlett's test value is 0.946, and percentage of explained variance (AVE) is 63.397%. The factor loadings are greater than 0.5 except for sen5 (0.412), sen6 (0.186), org4 (0.275), org6 (0.392), res4 (0.325), and res7 (0.266). Cronbach's alpha coefficients are all above 0.8: sensing (0.889), organizing (0.879) and restructuring (0.905).

3) Data Analysis and Results

The results of factor loadings comparison of first-order factors and second-order factors, AVE, CR, and Cronbach's Alpha values are shown in Appendix 1. All loadings are greater than 0.7, AVE values are greater than 0.6, CR values are greater than 0.8, and second-order factor loads are higher than first-order factor loads. This indicates that the data has good reliability and validity. All VIFs are less than 5, indicating that there are no multicollinearity problems. The digital transformation capability (path coefficient=0.740, t-value=14.157) has a 99% statistical significance on organizational performance.

3.4. Comparison of 3 Phases

The digital transformation capability structure proposed in this study demonstrates robust stability across the different phases. The dimensions of sensing, organizing, and restructuring consistently emerge as effective components of digital transformation capability, and their collective impact on organizational performance is positive. As the number of samples expanded across the three phases, the model structure gradually stabilized, reinforcing the validity of the proposed digital transformation capability dimensions. The comparison results of the three survey phases are shown in Table 1.

Table 1: The comparison results of the three survey phases.

Path Coefficient (Sampling)	Phase 1 (N = 45)	Phase 2 (N = 95)	Phase 3 (N = 160)
Digital Transformation Capability -> Sensing	O.905***	0.890***	0.884***
Digital Transformation Capability -> Organizing	0.931***	0.909***	0.914***
Digital Transformation Capability -> Restructuring	0.922***	0.904***	0.897***
Digital Transformation Capability -> Organizational Performance	0.798***	0.790***	0.740***
Organizational Performance R^2	0.637	0.625	0.547

4. Discussion

4.1. Implications

Compared to previous research, this study offers two significant academic contributions. Firstly, it advances the conceptualization of digital transformation capability by integrating the dynamic capability perspective and revealing its multidimensional reflective structure. This study propose that digital transformation capability is composed of three core structural dimensions: sensing, organizing, and restructuring. Secondly, this study provides empirical validation of the impact of digital transformation capability on organizational performance through a methodological approach of gradually increasing the sample size.

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Based on the preceding discussion, this study offers several important practical management implications for practitioners. Firstly, in terms of development strategy, enterprises must prioritize digital transformation based on their own resource situation. Secondly, enterprises need to continuously develop and strengthen their digital transformation capability. Under the condition of increasing investment in digital technology and management, enterprises should flexibly utilize existing resources and abilities, timely identify customer needs, insight into market trends, track the latest achievements in the field of technology, enhance their adaptability to environmental changes, adjust internal organizational structure and business processes, give departments corresponding decision-making power, and thereby improve organizational performance.

4.2. Limitations and Future Research

Due to the limitations of the research sample and scope, there are still some improvement points in this study: firstly, future research could incorporate environmental factors to explore how enterprises develop their digital transformation capabilities in diverse contexts. Secondly, future research could focus on the digital transformation of enterprises within specific industries to identify industry-specific challenges, opportunities, and best practices.

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Appendix 1: Items' Descriptive Statistics and Standardized Factor Loadings.

Dimension	Item	Mean			Standard Deviation			Loading			Variance		
		Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3
sen1	Monitor changes and trends in the marketplace.	4.16	3.99	3.88	0.928	0.973	0.9	0.723	0.68	0.761	0.862	0.947	0.81
sen2	Scan for opportunities and threats in the environment.	4.11	4.05	4.01	0.859	0.867	0.836	0.646	0.631	0.686	0.737	0.753	0.698
sen3	Identify inefficiencies in existing business processes.	3.8	3.77	3.83	0.944	0.962	0.953	0.769	0.715	0.7	0.891	0.925	0.908
sen4	Identify opportunities for organizational change based on market conditions.	4.11	4.42	4.36	0.775	0.662	0.704	0.768	0.653	0.688	0.601	0.438	0.495
sen5	Foresee a wide range of actionable options based on the surroundings.	3.91	4.01	4.09	0.973	0.805	0.819	0.528	0.779	0.412	0.946	0.649	0.672
sen6	Seek new opportunities for strategic uses of IT.	3.64	3.94	4	0.981	0.873	0.824	0.507	0.86	0.186	0.962	0.762	0.679
sen7	Determine the needs for a digital transformation strategy.	3.44	3.84	3.74	1.078	1.024	1.054	0.657	0.749	0.771	1.162	1.049	1.11
sen8	Formulate the digital transformation strategy.	3.98	4.34	4.23	0.753	0.694	0.729	0.645	0.651	0.689	0.568	0.481	0.531
org1	Align the digital transformation strategy with business goals and strategies.	3.73	3.81	3.79	0.986	0.789	0.827	0.776	0.661	0.703	0.973	0.623	0.684
org2	Try to allocate management resources for digital transformation.	3.84	3.84	3.86	0.824	0.903	0.86	0.682	0.79	0.755	0.68	0.815	0.74
org3	Implement active interactions between other functions such as manufacturing, marketing and services.	3.58	3.72	3.68	1.011	0.895	0.915	0.811	0.525	0.684	1.022	0.801	0.837
org4	Integrate internal resources and competency for digital transformation.	3.69	3.79	3.91	0.9	0.849	0.957	0.376	0.661	0.275	0.81	0.721	0.916
org5	Integrate external resources such as expert skills and knowledge for digital transformation.	3.84	4.07	4.1	0.976	0.878	0.841	0.512	0.69	0.392	0.953	0.771	0.707
org6	Combine internal and external resources for digital transformation.	3.69	3.89	3.84	0.973	0.869	0.91	0.648	0.579	0.596	0.946	0.755	0.829
org7	Emphasize the strategic role of the sourcing function for digital transformation.	3.98	3.92	3.78	0.783	0.907	0.852	0.567	0.516	0.602	0.613	0.823	0.725
org8	Prioritize digital transformation investments by the expected impact on business performance.	3.71	4.29	4.04	0.843	0.77	0.9	0.675	0.569	0.602	0.71	0.593	0.809
res1	Seek new ways to do something.	3.93	3.87	3.89	1.031	0.948	0.801	0.636	0.725	0.716	1.064	0.899	0.641
res2	Frequently try to innovate new products and services.	3.64	3.8	3.75	0.957	0.87	0.925	0.519	0.699	0.71	0.916	0.757	0.855
res3	Continually develop and produce new products or services.	3.73	3.95	3.89	0.963	0.938	0.952	0.657	0.783	0.763	0.927	0.88	0.906
res4	Try to maintain time to market with new products and services.	3.76	3.95	4.07	0.83	0.79	0.939	0.75	0.69	0.325	0.689	0.625	0.882
res5	Try to reconfigure the resources for new products and services.	3.98	4.08	4.05	0.783	0.694	0.716	0.502	0.646	0.643	0.613	0.482	0.513
res6	Try to apply knowledge resources to new products and services.	3.87	4	3.97	0.786	0.684	0.704	0.722	0.691	0.689	0.618	0.468	0.496
res7	Try to fit business processes into integrated resources.	3.87	4	3.95	0.869	0.812	0.845	0.459	0.687	0.266	0.755	0.66	0.714
res8	Cooperate with each other to solve conflicts.	4.13	4.28	4.19	0.919	0.834	0.872	0.685	0.749	0.723	0.845	0.695	0.761
res9	Facilitate a sustainable effort to implement a digital transformation strategy.	4.13	4.15	4.16	0.786	0.699	0.734	0.739	0.708	0.704	0.618	0.489	0.539

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Appendix 2: Factor Loadings Comparison of First-order Factors and Second-order Factors, AVE, CR, and Cronbach's Alpha Values.

Construct	Items	2nd Order Factor Loading			Construct	Items	1st Order Factor Loading			AVE			CR			Cronbach's Alpha		
		Phase 1	Phase 2	Phase 3			Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3
Sensing	sen1	0.837	0.819	0.814	Digital Transformation Capability	sen1	0.724	0.779	0.718	0.638	0.656	0.651	0.909	0.928	0.895	0.905	0.925	0.892
	sen2	0.799	0.829	0.834		sen2	0.681	0.753	0.664									
	sen3	0.848	0.804	0.810		sen3	0.731	0.798	0.789									
	sen4	0.765	0.771	0.798		sen4	0.635	0.736	0.740									
	sen5	0.824	0.895	-		sen5	0.829	0.699	-									
	sen6	-	0.831	-		sen6	-	0.784	-									
	sen7	0.804	0.786	0.838		sen7	0.779	0.652	0.707									
	sen8	0.707	0.737	0.743		sen8	0.649	0.675	0.714									
Organizing	org1	0.858	0.750	0.800		org1	0.753	0.646	0.648	0.761	0.579	0.625	0.939	0.897	0.880	0.937	0.896	0.879
	org2	0.935	0.842	0.859		org2	0.872	0.739	0.699									
	org3	0.873	0.737	0.786		org3	0.779	0.664	0.761									
	org4	-	0.726	-		org4	-	0.656	-									
	org5	0.863	0.740	0.731		org5	0.849	0.641	0.714									
	org6	-	0.799	-		org6	-	0.747	-									
	org7	0.855	0.746	0.796		org7	0.797	0.703	0.731									
	org8	0.848	0.742	0.765		org8	0.811	0.691	0.698									
Restructuring	res1	0.790	0.820	0.826		res1	0.749	0.743	0.723	0.607	0.637	0.642	0.909	0.932	0.909	0.907	0.928	0.907
	res2	0.813	0.827	0.830		res2	0.782	0.771	0.734									
	res3	0.770	0.847	0.837		res3	0.731	0.729	0.756									
	res4	0.778	0.823	-		res4	0.702	0.758	-									
	res5	0.765	0.757	0.758		res5	0.729	0.692	0.732									
	res6	0.795	0.815	0.808		res6	0.693	0.762	0.715									
	res7	-	0.750	-		res7	-	0.654	-									
	res8	0.795	0.701	0.750		res8	0.719	0.577	0.747									
	res9	0.722	0.831	0.796		res9	0.626	0.779	0.615									
Organizational Performance	op1	0.775	0.775	0.792	-	-	-			0.666	0.670	0.674	0.895	0.887	0.882	0.876	0.876	0.875
	op2	0.791	0.795	0.807	-	-	-											
	op3	0.843	0.852	0.880	-	-	-											
	op4	0.858	0.838	0.808	-	-	-											
	op5	0.812	0.812	0.815	-	-	-											