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Key drivers of digital transformation in supply chain management: insights from enterprises in Vietnam's southeastern region

Phuong Nguyen Quynh
Binh Duong University, No 504 Binh Duong avenue, Hiep Thanh ward, Thu Dau Mot city, Binh Duong province, Vietnam, lam.nq@hutech.edu.vn, nqphuong.21900005@bdu.edu.vn
Doan Trang Do
Binh Duong University, No 504 Binh Duong Avenue, Hiep Thanh ward, Thu Dau Mot City, Binh Duong province, Vietnam, doantrang.bolt@bdu.edu.vn
Thu Hoa Ho Thi
International University - Vietnam National University Ho Chi Minh City, Quarter 6, Linh Trung Ward, Thu Duc City, Ho Chi Minh City, Vietnam, htthoa@hcmiu.edu.vn (corresponding author)

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Abstract: This study aims to evaluate the impact of digital transformation on logistics and supply chain management in the Southeastern region of Vietnam, focusing on material flows, information flows, financial flows, and human flows. The research examines key factors influencing the decision to implement digital transformation, including peer influence, organizational capabilities, conversion costs, advantages of digital technology, digital technology experience, adaptation to digital technology, usefulness, and ease of use. Data was analyzed using Cronbach's Alpha to assess reliability, with AVE (Average Variance Extracted) used to validate the model. The study reports high reliability, with Cronbach's Alpha coefficients ranging from 0.864 to 0.930. AVE values for observed variables range from 0.613 to 0.769, all exceeding the 0.5 threshold, indicating that the variables met the AVE analysis requirements. The results emphasize the significant role of digital transformation in optimizing logistics flows and supply chain management, providing enterprises with enhanced efficiency and competitiveness.

1 Introduction

The Southeast region is one of the most developed agricultural production areas in Vietnam, with small and medium-sized enterprises (SMEs) accounting for approximately 97% of the total number of businesses. This region is known for its dynamic economic activities, significantly contributing to national GDP and labor force. SMEs employ around 51% of the labor force and contribute over 40% of the country's GDP. These statistics highlight the critical importance of focusing on and supporting SMEs in their digital transformation journey, as such efforts could have a significant impact on the overall digital transformation process for businesses across Vietnam [1].

However, small and medium-sized enterprises (SMEs) in this region face numerous challenges in applying digital transformation to optimize material flows, information flows, financial flows, and human flows in supply chain management. With the rapid advancement of technology and a fast-evolving market, understanding the factors influencing the decision to adopt digital transformation in supply chain management is essential for building a sustainable development strategy. Promoting digital transformation among small and medium-sized enterprises (SMEs) is therefore not only vital for regional growth but also for the broader national economy [2].

According to data from the General Statistics Office and related organizations, prioritizing and supporting SMEs in digital transformation can have a profound effect on the overall transformation of businesses across Vietnam. Despite the potential benefits, many SMEs face significant obstacles. A survey by the Ministry of Information and Communications reveals that only about 20% of SMEs have the workforce with the necessary skills and expertise to access and implement digital solutions effectively. This limited human resource capacity poses a significant barrier to their ability to embrace digital transformation in logistics flows, including material, information, financial, and human flows [2].

In addition, a study by the World Bank highlights another critical challenge—financial constraints. Around 45% of SMEs in Vietnam lack sufficient capital to invest in the digital technology and infrastructure essential for managing material, information, and financial flows effectively. This financial limitation further hinders their ability to adopt and integrate new technologies into their operations. As a result, these SMEs are at a disadvantage in the increasingly competitive market, struggling to keep up with larger enterprises that have more resources for digitalization. The combination of a limited skilled workforce and insufficient capital not only reduces SME competitiveness but also hinders long-term development, making it harder for them to survive in an intensely competitive market. Addressing these challenges is crucial to ensuring that SMEs can fully participate in and benefit from the digital economy, which is essential for the sustainable growth of Vietnam's business sector [2].

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Research on digital transformation in supply chain management for enterprises in Vietnam, especially in the Southeast region, is essential to improving business efficiency and contributing positively to sustainable economic development. In the era of the digital economy, digital transformation is an unavoidable trend. This research will explore the factors influencing the decision to adopt digital transformation in supply chain management, focusing on optimizing material flows, information flows, financial flows, and human flows, while providing support solutions for SMEs in the Southeast region to enhance their efficiency and competitiveness in the market.

Given the urgent theoretical and practical needs, the author has chosen the topic "Key Drivers of Digital Transformation in Supply Chain Management: Insights from Enterprises in Vietnam's Southeastern Region". This study aims to provide a comprehensive overview of the digital transformation landscape in supply chain management and the current state of industry in the Southeastern region, while analyzing the factors influencing the decision to adopt digital transformation among businesses in this area.

2 Literature review

Currently, there is no comprehensive explanation of the origins and development of digital transformation in supply chain management for businesses. When studying this activity in the context of the Southeast Region, researchers often refer to various related theories to better understand the factors influencing the decision to adopt digital transformation. This paper will utilize specific theories based on the results of empirical studies and the applicability of these theories in the field of digital transformation in supply chain management, particularly focusing on businesses in the Southeast Region.

2.1 The Theory of Planned Behavior (TPB)

The Theory of Planned Behavior (TPB), proposed by Icek Ajzen, is a well-established psychological theory designed to explain human behavior, particularly in contexts such as adopting new technologies and determining the intentions behind specific actions. TPB is rooted in the idea that human behavior is not only a function of rational decision-making but also influenced by various psychological factors that shape an individual's intentions and their subsequent actions. According to Ajzen, one of the key components of TPB is perceived behavioral control, which plays a significant role in influencing whether a behavior will be carried out or not [3].

TPB has its origins in earlier theoretical frameworks that laid the groundwork for understanding behavior and intention. The theory evolved from initial assumptions made as far back as 1966 and incorporates elements from several foundational theories. For instance, Bandura's Social Cognitive Theory significantly influenced TPB by introducing concepts like self-efficacy, which focuses on an individual's belief in their ability to perform a task. Triandis' Subjective Culture Theory contributed by highlighting the role of cultural and social factors in shaping behavior, while Rosenstock's Health Belief Model provided insights into how individuals assess the benefits and barriers to certain actions [3].

Beyond these foundational theories, TPB also aligns with other psychological and behavioral theories, creating a comprehensive framework for understanding human behavior. Locke and Latham's Goal-Setting Theory is related to TPB in that it emphasizes the importance of setting clear goals as a precursor to intentional behavior. Fisher and Fisher's Information-Motivation-Behavioral Skills Model offers a perspective on how information and motivation contribute to the development of behavioral skills, which is closely aligned with TPB's focus on perceived behavioral control. Moreover, Technology Acceptance Model (TAM) parallels TPB in the realm of technology adoption, emphasizing how perceived ease of use and perceived usefulness shape individuals' attitudes towards technology and their subsequent intentions to use it [3].

Within the TPB framework, Ajzen defines behavioral control as the extent to which individuals have the necessary information, skills, and physical and mental capabilities to perform a specific behavior. This concept of behavioral control is crucial because it directly impacts an individual's ability to execute a behavior once the intention is formed. Perceived behavioral control, which is a new factor introduced in TPB, refers to the degree to which people believe they can successfully perform a behavior if they intend to do so. This concept is closely related to Bandura's theory of self-efficacy, which posits that individuals' belief in their ability to perform a task greatly influences their likelihood of actually performing it. Perceived behavioral control focuses specifically on the sense of control individuals feel they have over executed a behavior, considering both internal factors (such as skills and knowledge) and external factors (such as opportunities and obstacles) [3].

2.2 Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM), developed by Fred Davis, is one of the most widely cited and influential models in the field of information systems and information technology (ICT) research. TAM was specifically designed to predict and explain user behavior regarding the adoption and use of ICT by focusing on two primary factors: perceived usefulness (PU) and perceived ease of use (PEOU). These factors serve as the core determinants of how users form attitudes toward technology, which in turn influence their decision to accept or reject new technological systems [4,5].

TAM's simplicity and ease of application have contributed to its widespread adoption in various studies exploring technology acceptance across different contexts. This model has been particularly valuable in understanding the factors that drive individuals and organizations to

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embrace new technological solutions, making it an essential tool in ICT research [4,5].

TAM's contribution to understanding technology acceptance is significant because it highlights the importance of user perceptions in the adoption process. It suggests that for successful implementation of new technologies, organizations must not only ensure that the technology offers clear benefits but also make it as user-friendly as possible. By addressing both the perceived usefulness and ease of use, developers and organizations can increase the chances of positive user attitudes and, consequently, higher adoption rates [4,5].

TAM provides a robust framework for predicting and explaining user acceptance of ICT by focusing on the perceptions of usefulness and ease of use. Its application extends beyond the workplace, influencing how technologies are adopted in various fields, from education to healthcare, making it a cornerstone of research in technology adoption and user behavior [4,5].

2.3 Unified Theory of Acceptance and Use of Technology (UTAUT)

The Unified Theory of Acceptance and Use of Technology (UTAUT), developed by Venkatesh, is an extension and combination of several theories, including TRA, TAM, the Motivation Model, TPB, and the integration of TPB and TAM. UTAUT introduces new variables such as personal characteristics, situational variables, and organizational characteristics [6-8].

UTAUT explains users' behavioral intentions and actual behavior toward new technology through four main variables: performance expectancy, effort expectancy, social influence, and facilitating conditions. These factors play a crucial role in determining user acceptance and behavior toward technology. Moderating variables such as gender, age, experience, and voluntariness also influence the relationship between dependent and independent variables [6-8].

Despite its complexity, UTAUT's ability to integrate multiple factors provides a deeper understanding of the nuances that influence user acceptance, making it particularly valuable in diverse and dynamic environments. Its adaptability across various industries and settings continues to make UTAUT a go-to model for researchers seeking to explore and predict technology adoption behaviors comprehensively [6-8].

3 Methodology

Based on the research objectives, theoretical foundation, and previous studies to identify research gaps, the research focuses on exploring the impact of factors influencing the decision to adopt digital transformation by enterprises in the supply chain. Accordingly, the author inherits the models of TPB, TAM, and UTAUT, and based on the results of previous empirical studies, has identified eight research concepts used in the dissertation, including [9-11], (1) the impact of peer influence [11-13], (2) organizational capabilities [14-16], (3) conversion costs [17,18], (4) advantages of digital technology [19,20], (5) digital technology experience [21-23], (6) adaptation to digital technology [22-25], (7) usefulness [25,26], (8) ease of use [27], Policies and regulations, (10) Driving digital transformation and the decision to adopt digital transformation[28,29].

Based on previous studies, the author proposes the following hypotheses and research models:

H1: The impact of peer influence will positively impact the decision to apply digital transformation in supply chain management.

H2: Organizational capabilities will positively impact the decision to apply digital transformation in supply chain management.

H3: Conversion costs will positively impact the decision to apply digital transformation in supply chain management.

H4: Advantages of digital technology will positively impact the decision to apply digital transformation in supply chain management.

H5: Digital technology experience will positively impact the decision to apply digital transformation in supply chain management.

H6: Adaptation to digital technology will positively impact the decision to apply digital transformation in supply chain management.

H7: Usefulness will positively impact the decision to apply digital transformation in supply chain management.

H8: Ease of use will positively impact the decision to apply digital transformation in supply chain management.

H9: Policies and regulations will positively impact the decision to apply digital transformation in supply chain management.

H10: Driving digital transformation will positively impact the decision to apply digital transformation in supply chain management.

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Figure 1 Research model

4 Results and discussion

The assessment of convergent validity for latent variables is based on the indicators of outer loading coefficients and the Average Variance Extracted (AVE). According to Fornell and Larcker, the AVE value should be 0.5 or higher to meet the requirement, indicating that the latent variable can explain more than half of its variance on average. If the AVE is less than 0.5, the factor or latent variable is typically considered for removal from the research model [30].

Reliability of the measurement scale is evaluated using two key indicators: Composite Reliability (CR) and outer loading coefficients. To assess reliability, CR should be greater than 0.7 and outer loading should be greater than 0.4 for the model to be considered reliable [31].

The analysis results show that all factors meet the required conditions, with AVE values greater than 0.5 (ranging from 0.613 to 0.769), composite reliability greater than 0.7 (ranging from 0.864 to 0.930), and outer loading coefficients greater than 0.4 (ranging from 0.713 to 0.897). Thus, all factors satisfy the requirements for reliability and convergent validity.

According to Henseler, discriminant validity is the degree to which a concept of a specific latent variable differs from the concepts of other latent variables. The square root of the Average Variance Extracted (AVE) for each factor is greater than the correlation coefficients between the corresponding variables. This indicates that the concepts in the study achieve discriminant validity [32].

The analysis results show that all square roots of AVE have coefficients higher than 0.5 (ranging from 0.783 to 0.877), meeting the requirement. Within each factor, the square root of AVE has a higher value than the correlation coefficients of other factors in the same column. Therefore, all factors achieve discriminant validity.

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According to Hu, the SRMR (Standardized Root Mean Square Residual) index should be less than 0.08 or 0.1. Additionally, Henseler suggest that the SRMR is a Goodness of Fit index for the PLS-SEM model, which can be used to avoid parameter bias within the model. With an SRMR value of 0.077, which is less than 0.1, the research model is considered to be a good fit for the study area in the Southeast region of Vietnam.

To generalize the research findings to the entire population, it is essential to reassess the reliability of the model. The study employs the bootstrapping technique with a resampling size of 1000 observations (n = 1000), based on the initial sample size of 495 observations.

With a 95% confidence level for the bootstrapping analysis, the results indicate that the 2.5% to 97.5% percentile range does not contain any values greater than 1. This ensures the discriminant validity of the model, and the estimates within the model can be considered reliable [33].

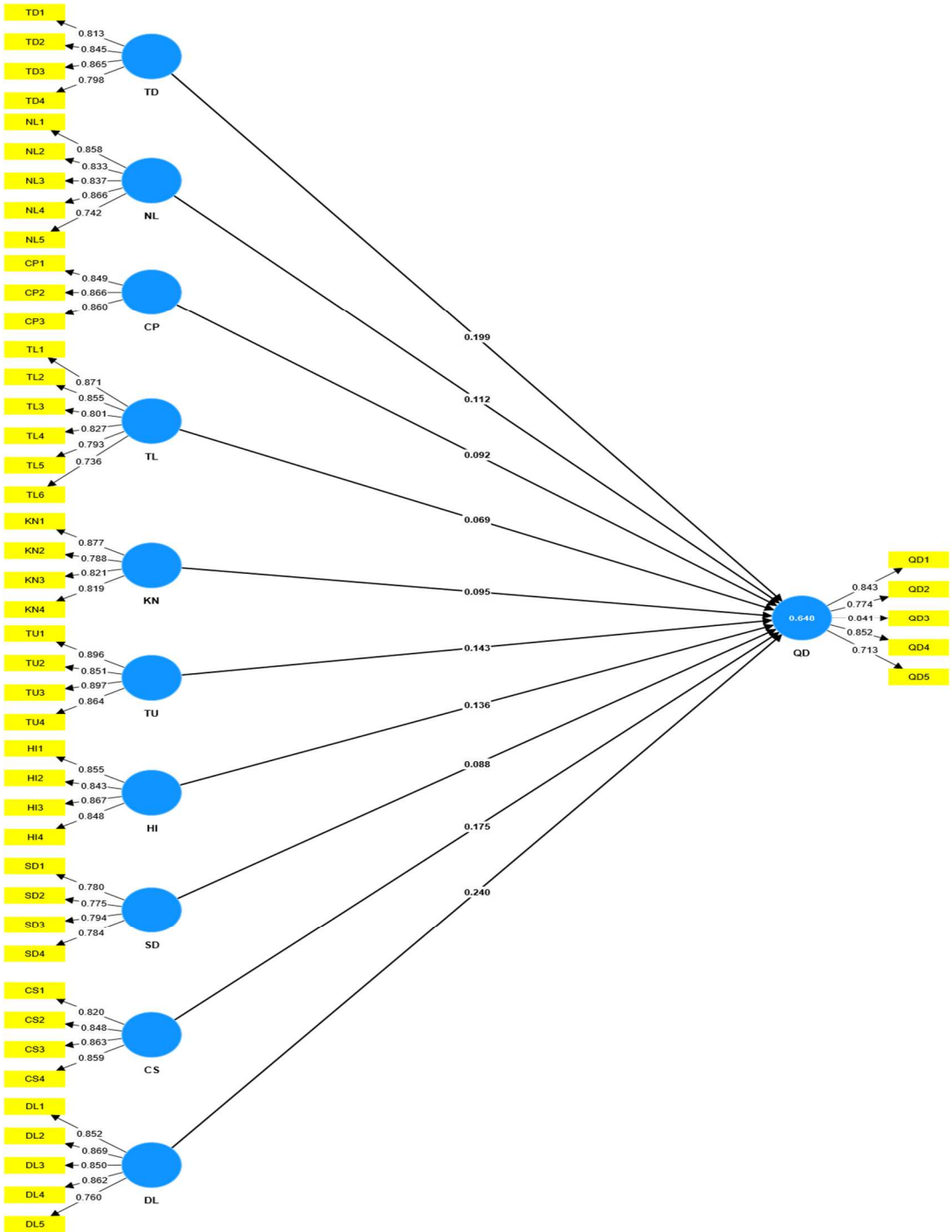

Figure 2 Standardized PLS-SEM results of the research model

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Table 1 PLS-SEM model estimation results

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values	Result
H1 -> QD	0.092	0.092	0.032	2.889	0.004	Accepted
H2 -> QD	0.175	0.174	0.028	6.218	0.000	Accepted
H3 -> QD	0.240	0.239	0.028	8.624	0.000	Accepted
H4 -> QD	0.136	0.136	0.037	3.642	0.000	Accepted
H5 -> QD	0.095	0.095	0.032	2.951	0.003	Accepted
H6 -> QD	0.112	0.113	0.033	3.409	0.001	Accepted
H7 -> QD	0.088	0.089	0.034	2.578	0.010	Accepted
H8 -> QD	0.199	0.200	0.033	6.038	0.000	Accepted
H9 -> QD	0.069	0.071	0.030	2.281	0.023	Accepted
H10 -> QD	0.143	0.143	0.037	3.905	0.000	Accepted

5 Conclusions

In summary, this study has developed an effective evaluation model to explore the factors influencing the decision to adopt digital transformation in supply chain management among enterprises in the Southeast region. The research confirms that several factors, including (1) the impact of peer influence, (2) organizational capabilities, (3) conversion costs, (4) advantages of digital technology, (5) digital technology experience, (6) adaptation to digital technology, (7) usefulness, (8) ease of use, (9) policies and regulations, and (10) driving digital transformation, significantly affect the attitude and decision of businesses to adopt digital transformation in supply chain management, particularly in optimizing material flows, information flows, financial flows, and human flows.

Many factors can directly impact the effectiveness of digital transformation in supply chain management, including the impact of peer influence (H1), organizational capabilities (H2), and conversion costs (H3). Support and collaboration from colleagues can create a synchronized work environment, facilitating a smoother transformation process. Organizational capability, encompassing management skills, technological proficiency, and innovation ability, also plays a crucial role in successfully implementing digital transformation strategies. Finally, switching costs, including investments in new technology and training expenses, must be carefully managed to ensure that they do not impose an excessive financial burden on the enterprise. Therefore, businesses must thoroughly evaluate these three factors before implementing digital transformation strategies to ensure effectiveness and success.

When digital transformation is effectively implemented, it brings significant benefits to supply chain management. These benefits include optimizing material flows, information flows, financial flows, and human flows, reducing operational costs, enhancing transparency and traceability, improving demand forecasting, optimizing inventory management, and increasing responsiveness to market changes. These advantages not only help businesses enhance their competitive edge but also increase the overall value of the supply chain. With successful digital transformation, businesses can achieve comprehensive improvements in operational performance, thereby increasing business efficiency.

Regular evaluation and continuous improvement are critical factors in maintaining and enhancing the effectiveness of the digital transformation process. Businesses need to establish key performance indicators (KPIs) to measure and monitor the effectiveness of each stage in managing material, information, financial, and human flows throughout the transformation process. This not only helps businesses promptly identify emerging issues but also allows them to adjust strategies to achieve the best possible outcomes. The effectiveness of digital transformation is not a destination but a continuous process that requires ongoing commitment and innovation from businesses. This ensures that companies not only maintain their competitive advantage but also continue to grow and adapt in an ever-changing business environment.

The advantages of digital technology (H4), the digital experience of personnel (H5), and the ability to adapt to digital technology (H6) are also crucial factors. The benefits of digital technology, such as modern features and integration capabilities, help businesses improve performance across activities from production to distribution, optimizing material, information, and financial flows. The digital experience of personnel is decisive, as employees with solid knowledge and skills in digital technology can effectively leverage new tools and solutions. The ability to adapt to digital technology is a key factor, as the quick adjustment of processes and working methods by businesses and staff to fit a digitalized environment helps maintain and enhance performance. Understanding and effectively managing these three factors will enable businesses to optimize performance during digital transformation.

Exploring, analyzing, and improving these factors will help enhance the effectiveness of digital transformation in enterprises. First, it shortens processing times and minimizes waste, thereby reducing operational costs. High

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performance also enables businesses to respond more quickly to market fluctuations, enhancing flexibility and competitiveness. Moreover, when performance is improved, businesses can better manage resources, optimize the flows of goods and services, and improve the quality of products and services delivered to customers. These benefits not only help businesses save time and costs but also contribute to increased customer satisfaction and the enhancement of brand value in the market.

The perceived usefulness of technology (H7) is a key factor, as employees will more readily accept and be willing to adopt technology if they perceive it to bring tangible benefits to their work and the organization. The more a technology demonstrates its value and improvement in job performance, the easier it will be accepted. The perceived ease of use of technology (H8) also plays an important role. If the technology is designed to be user-friendly, accessible, and easy to learn, employees will encounter fewer difficulties in using it, thereby enhancing the likelihood of acceptance and adoption of the new technology.

Policies and Regulations (H9) play a crucial role in promoting and shaping the digital transformation process in supply chain management for businesses. In the Southeast region, the development and enforcement of appropriate policies and regulations will create a favorable legal and business environment, enabling enterprises to easily access and apply digital technologies to their management processes, particularly in managing material, information, financial, and human flows. Clear policies and specific regulations provide guidance to businesses on the standards they must adhere to, as well as the opportunities and challenges associated with adopting new technologies. This not only helps businesses operate more efficiently but also protects their interests in an increasingly complex and competitive market.

Driving Digital Transformation (H10) is a key factor that motivates businesses to adopt new technologies in supply chain management, especially for enterprises in the Southeast region. This motivation stems from the need to improve operational efficiency, enhance competitiveness, and quickly respond to market changes. When the motivation is strong enough, businesses will have greater determination in implementing digital transformation strategies, ensuring that the process moves beyond just an idea and is effectively realized. Motivation also fosters internal consensus within the business, from leadership to employees, facilitating a smoother and more successful transformation process.

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