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Navigating Cultural Barriers: The Role of Socio-Technical Systems in Digital Transformation Readiness in SMEs

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Abstract

Digitalization in the industrial sector has become necessary for both the public and private sectors worldwide to adapt to the rapidly evolving digital landscape. This initiative is articulated in strategic plans designed to foster positive learning environments while minimizing adverse impacts on organizations. Although digital maturity has become an organization's top priority, enterprises still lack digital transformation consciousness and means. The interaction between technological transformation and cultural change highlights the necessity of addressing the resistance during the transition. Utilizing the socio-technical system theory, this study investigates the impact of organizational culture on the readiness for digital transformation in SME enterprises in Malaysia. The study comprises responses from 176 employees across various sectors of SMEs in Malaysia. A quantitative data analysis was conducted by employing the PLS method. The study found that technology, processes, customers, and partners positively impact the organization's digital transformation readiness (DTR). However, it was found that cultural factors within an organization act as a barrier to progress on the DTR. The present study provides insights by identifying critical factors in the digitalization process to enhance operations and business value to achieve sustainable development and improve quality of life through the digital economy.

Keywords:

Digital Transformation Readiness;
Organizational Culture;
Socio-Technical System Theory;
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1- Introduction

Digital transformation is the most critical civilization trend in today's society. It has become one of the most discussed topics in most countries, especially in industrial fields. This is due to the digital environment in which organizations operate being more fluid than ever and having the potential to lead, which means delivering quality in line with the organizations [1]. Therefore, adaptation has become a necessity. Organizations have adopted different digital transformation (DT) initiatives worldwide in the public and private sectors. These innovations contribute to operational improvement and business value that ultimately attain the goal of sustainable development through the development of a digital economy. Digital maturity (DM) is clearly stated in the strategy for implementing digital transformation processes (DTP) in all organizations [1].

The level of DM significantly influences the results of digital transformations across different industries. Companies with an advanced level of digital maturity stand a better chance of executing potential digital plans, leading to increased performance and a competitive edge [2]. The DM model gives organizations a systematic way to assess current capabilities and future needs, especially for SMEs struggling with the DTP [3]. Thus, measuring DM is critical to businesses ensuring they can effectively adjust to digital requirements [4]. Organizations can develop unique strategies for boosting digital transformation efforts by utilizing DM evaluations of factors such as strategy, personnel, and

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organizational culture. This can lead to the creation of innovative business models and improved customer experiences [4, 5]. Therefore, there is a need to perform digital maturity assessments for organizations that are undergoing digital transformation.

Examining the readiness for digital transition in Malaysia's industry by measuring its digital maturity level is supported by the goals outlined in the New Industrial Master Plan (NIMP) 2030 [6]. The priorities of the second enabler include developing and attracting skilled workers in line with Malaysia's national objective to improve the complexity of its economy and establish a dynamic digital nation [6]. The statistics on adoption and digital maturity also indicate a significant increase in digital adoption across various sectors. The adoption of digital technologies has risen from 78% to 85% during 2022 to 2023 [7]. This growth comes from heavier dependence on digital solutions for conducting business and engaging with customers. Similarly, the ongoing efforts to enhance digital capabilities also show an improvement. Data shows that 60% of businesses have reached an advanced level of digital maturity.

Evaluating digital maturity will provide insight into the existing abilities in different industries, revealing gaps in skills and education requirements. This will assist policymakers, and industrial leaders make resource distribution decisions, improving international competitiveness. Hence, a comprehensive study on DTR can help in efficiently planning its initiatives for digital transition, ensuring steady economic progress and competitiveness. While digital transformation's importance to productivity and growth is increasing, the understanding gap of how various technical and human elements contribute to readiness prevails.

Existing literature presents various challenges organizations face in the DTR, including resistance to change, insufficient digital skills, inadequate infrastructure, and inadequate coherent strategy [8, 9]. DT is observed as a comprehensive organizational change across multiple levels and units that adopts digital innovation. It reshapes business strategies, processes, and capabilities, which often encounter resistance. Digital strategy development is crucial to managing organizational changes and is central to this transformation [10]. Other studies also observed that a well-developed strategy is harmonized with technology adoption and is instrumental in accelerating digital transformation [11, 12]. However, Jones et al. [13] observed that 70% of organizational transformation initiatives fail, a large part because of the complexity of human behavior, and the strategy is less about the technology itself and more about changing how business is done in organizations [13]. This study emphasized that supportive organizational cultural characteristics such as innovation, market responsiveness, and collaboration significantly enhance the DTR of the organization. Similarly, several studies have observed that technology alone does not drive change [14, 15]. It requires an individual who recognizes its value and impact. Since DTR is a collaborative process, success depends on engagement, positive attitudes, and individual connections [14]. It is also highlighted that DT influences talent attraction, retention, and management, which underscores that effective talent management is vital for attaining high levels of digital maturity rather than depending solely on digitalization [15]. A pervasive mindset in organizational cultural settings that resists change can hinder the technological adoption processes. Similarly, rigid and hierarchical cultures are observed to impact digital transformation negatively [16]. A recent study observed that cultural traits like innovation and flexibility positively influence digital transformation, whereas a risk-averse culture negatively influences digital transformation [17]. Touijer & Elabjani [18] found that the role of digital technology is essential in enhancing internal processes and strategic competitiveness. This study advocates for customer-focused digital strategies and streamlined processes for greater efficiency. A thorough understanding of cultural dynamics that are aligned with technological advancement and human factors would present a more inclusive approach. This research is designed to explore the technological, strategic, and human factors influencing the DTR process, aiming to address the existing gaps in the literature. The study investigates how technology, strategy, process, culture, and external stakeholders such as customers and partners impact DTR among organizations in Klang Valley, Malaysia.

The paper is organized as follows: Section 2, the literature review, presents the theoretical background and detailed examination of existing studies on factors affecting digital transformation, followed by Section 3, the methodology of the study. Section 4 and Section 5 present the results and discussion of the study. Section 6 and Section 7 present contributions, limitations, and future research avenues. Finally, section 8 presents the conclusion of the study.

2- Literature Review

2-1- Theoretical Background

Ropohl's [19] Socio-Technical System theory provides a comprehensive framework that presents the organization system's interconnectedness of social and technical components. The theory states that each innovation transforms the human subsystem and changes socio-technical relationships. Hence, social changes through technological advancement bring generalization of value and behavior patterns. Since this relationship is reciprocal, the social components also impact technological development. Earlier works by Trist et al. [20] also conceptualize the interrelatedness of technical and social factors in organizational and operational settings. Thus, a philosophy of technology that operates in isolation must consider the social and economic implications. Studies on Industry 4.0 harness the sociotechnical and human-centric approach to address the impact of technological advancement on the workforce [21-23]. Studies found that technological advancement significantly impacts the social system, particularly human factors [22].

The present study is grounded on Ropohl's [19] Socio-Technical System Theory, which considers both the technical component including technology and processes, and the social component—namely customers and partners. In addition, this study scrutinizes the impact of organizational strategy and culture on DTR. This approach highlights the impact of technological and human factors in achieving DTR.

2-2- Digital Transformation and Digital Maturity

Digital transformation (DT) involves integrating digital technology into every dimension and activity of an organization. It brings structural changes in the operational methods, consequently altering customer value [24]. DT has increased significantly from the social and organizational perspective. However, digital transformation must be implemented correctly to avoid unfavorable outcomes. Many researchers emphasized the need for organizations to pay close attention to the DTP [25]. Nevertheless, the DT process involves multidisciplinary activities and requires experts in diverse domains. Hence, there is a need to support the operationalization of this transformation. The DT is represented by developing IT infrastructure branches that lack a data structure. It is possible to assist organizations in the DT at an operational level [26]. Overall, the context of using and adopting an organization's DT is required to create value in organizations [27]. Furthermore, organizations' strategies are increasingly incorporating strategic digital transformation. Due to the difficulties in implementing strategic digital transformation, organizations are becoming more conscious of the significance and function of this type of change in their operations and companies [28].

Digital maturity (DM) is an essential framework for organizations aiming to undergo improvements and growth [29]. It serves as a roadmap, providing managers with a clear strategy to enhance their digital readiness and achieve their objectives. DM signifies the readiness or completeness of system development. DM assessment within an organization provides a practical way to steer a successful digital transition. It is considered a comprehensive concept that can reach the highest level of maturity or reflect a managerial aspect [27]. Assessing the various dimensions of DM can facilitate technology implementation and adoption [30]. Existing research highlights various dimensions of DM that can substantially impact the readiness for DT. The present study analyzes five dimensions of digital maturity (DM) identified in the existing literature across various industries. These dimensions—culture, strategy, technology, process, and relationships with customers and partners are evaluated with an organization's readiness for DT [30, 31].

2-3- Development of Hypothesis

Strategy is considered a key driver of digital maturity. The existing literature emphasizes the significant role of strategy in a company's digital business Policies, which involves deliberate competitive actions aimed at providing digitally enabled businesses, processes, products, and services [12, 30, 32]. Digital strategy is an integrated method that organizations use to leverage digital technologies and revolutionize their business operations [33]. It is a coherent framework that guides an organization in utilizing digital technologies to create value and drive transformation across all business areas like products and services, rebuilding and customizing, digital distribution channels, cost efficiency, and a people-centric approach [33]. Research indicates that a well-defined strategy enhances readiness, drives successful implementation, and helps organizations adapt to evolving market dynamics and consumer expectations [34]. Successful digital strategies focus on innovation, agility, flexibility, and fostering a culture that empowers employees to innovate and adapt in a rapidly changing environment [35]. It ensures that the organization's digital prospects are logical, consistent, easy to understand, and integrated across the organization [25]. Moreover, it is important to align strategic goals with the organizational culture, as a supportive culture ensures that employees' values and behaviors align with digital transformation [18]. Thus, the hypothesis is developed:

H1: Strategy has a positive effect on the DTR of the organization.

Another dimension of digital maturity pertains to the diverse array of digital technologies companies integrate with their operations, processes, products, or services, and digital business development. DT includes the direct and indirect effects of applying digital technologies and techniques. In the organization, technology allows organizations to shift their efforts from the traditional to the modern approach [36]. It also paves the way for entirely new business models [30]. Indeed, digital technology is associated with a redistribution of work that must deliver opportunities to organizations and a potential redistribution of responsibility for organizations' outcomes [37]. The technology dimension identifies how technology is integrated into the current organization. Technology provides solutions in products, services, and digital communication. In addition, this dimension looks at exploring knowledge about new technologies to facilitate digital business advancement and ensure that connected digital technologies can collect data. Thus, the following hypothesis is developed:

H2: Technology has a positive effect on the DTR of the organization.

Another dimension focusing on DM includes current and newly established routines and processes created by the company to gather, analyze, and apply data across the business [30]. Businesses embarking on DT must develop strong data analysis skills and reshape their decision-making processes [30]. Adopting and assimilating big data analytics

necessitates comprehensive organizational structure, culture, and procedures transformations [30]. Digital transformation involves learning processes for digital natives through knowledge and technical skills. Though short and continuous, the process leads to delivering the parts that can be used to help employees perform and improve their knowledge [38]. The digital process becomes a key element of daily life that involves both people and the organization. By harnessing digital capabilities and technological advancements, it promotes business models, operational methods, and client interactions that yield substantial value [39]. The process depicts that the organization has competencies and systems that can analyze the data, and employees will have adequate familiarity with the organization's digital systems. Moreover, in DTR significant adjustments are needed in terms of workflow, roles, and duties. Fostering a culture that values flexibility and embraces change helps minimize resistance and ensures a smoother transition [40]. Hence, the following hypothesis is developed:

H3: Process has a positive effect on DTR.

Another important aspect involves the planned activities that engage stakeholders in digital business development throughout the value chain and business environment. Customers play a crucial role, as digital technologies empower them to jointly create value by designing and customizing products [30]. The organization engages with customers and partners digitally to gather data throughout the value chain for optimization and development. This dimension is crucial for evaluating the extent to which the initiative and concepts for new digital initiatives from customers and partners are recorded and impact the DTR. Thus, it is hypothesized that:

H4: Customers and partners have a positive effect on DTR.

2-4- Organizational Culture and DTR

Organizational culture (OC) can be seen as a collection of shared values, practices, and expectations that shape individuals' interactions in business and personal contexts [41-42]. The character of an organization, much like a person's nature, shapes how its workers handle issues [37]. Organizational culture varies between flexible and rigid and internal and external focus [43].

The framework of organizational culture has been examined from various perspectives. Existing research has examined how this culture might function within an organization and what elements might influence its development [42]. Kane et al. [12] emphasized the critical role of humans, OC, and the necessity of formal strategic planning in successful DT initiatives. Thus, a digital culture that encourages ongoing learning, significant change, and vital innovation is essential to DT [30]. Studies have shown that fostering an innovative culture, aligning strategic goals with digital transformation, and promoting digital awareness collectively create an environment for digital transformation [44].

Technology adoption is not solely based on the availability of the latest technology but also on the cultural readiness to accept and utilize these technologies. A progressive culture that welcomes new ideas, constant learning, and risk-taking can facilitate the technology transformation more smoothly [45]. Moreover, process optimization and reengineering efforts work best when the OC is inclined towards efficacy, teamwork, and adaptability [46]. An organization's culture strategically outlines its plans for digital evolution by steering strategic objectives and approving long-term digital projects. A supportive culture promotes coordination, ensuring digital transformation change efforts are integrated across the organization [42].

So, the readiness to transform digitally is not only about having the right technology, process, and strategy. It is about fostering a culture that approves changes and values innovation. Organizational culture is a catalyst that can either enhance or weaken this transformation [47]. Therefore, when employees trust the data derived from the digital system and support digital development, the management can support the growth of digital culture. Therefore, the present study investigates how the OC mediates the relationship between strategy, technology, process, and readiness for digital transformation. Hence, the following hypothesizes are developed

H5: Organizational culture has an effect on DTR.

H6: Strategy has a positive effect on the culture of the organization.

H7: Technology has a positive effect on the organizational culture

H8: Process has a positive effect on the culture of the organization

H9: Organization culture mediates the relationship between process and DTR

H10: Organization culture mediates the relationship between strategy and DTR

Figure 1 presents the research framework of the study.

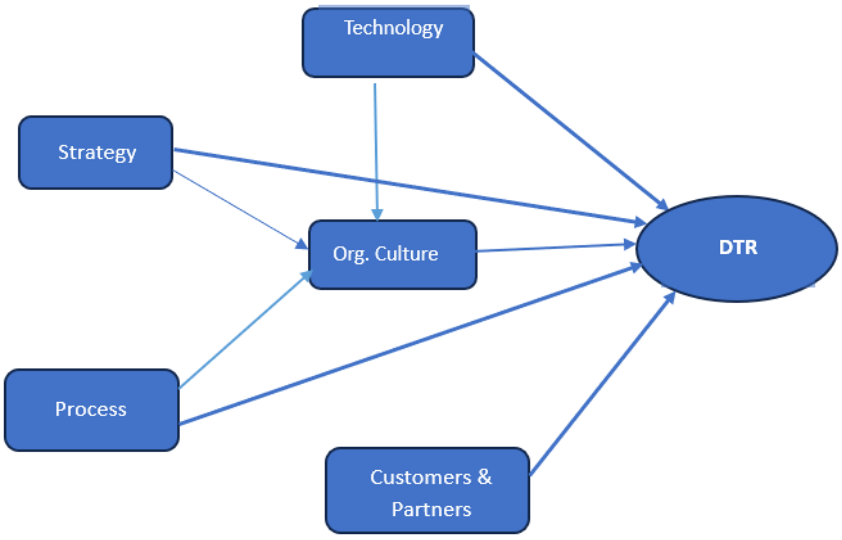

Figure 1. Research Framework of the study.

3- Research Methodology

3-1- Research Design and Data

The present study is based on quantitative analysis. It focuses on investigating the employees from the SMEs in different sectors in Klang Valley to test the hypotheses stating the direct and indirect relationship with DTR. The definition of SMEs differs across countries and organizations. Typically, SMEs operate with revenues, assets, or employee numbers below certain thresholds. The present study focuses explicitly on employee counts to identify SMEs. In Malaysia, SMEs are defined as businesses with a maximum of 200 full-time employees in the manufacturing sector and no more than 75 full-time employees in the service and other sectors [48]. The present study surveys employees working in different departments in organizations with diverse backgrounds. Online surveys via Google Forms were used for data collection through social media platforms like WhatsApp, Telegram, and Instagram between December 2023 to February 2024. Once the data is collected, it is sorted based on the number of full-time employees in each organization, ensuring that the sample represents SMEs as defined by Malaysian standards.

Outlining the intention and possible gains of the study. GPower Software was used to establish the ideal sample size, suggesting a sample group of 104 individuals. 250 questionnaires were distributed among the respondents. Out of 210 returned questionnaires, 176 were considered usable for further analysis. The response rate was 70.4%. The questionnaire was accompanied by an explanation letter outlining the study's intention and possible gains and mentioning that participation is voluntary. It was expressed with utmost clarity to those responding that the information they provided would be kept confidential and reserved exclusively for academic purposes.

The questionnaire was developed based on a review of existing relevant literature. A 5-point Likert scale (1 to 5, strongly disagree to strongly agree) was used to measure the respondent's awareness of the research issue. The questionnaire comprised statements about five distinct factors: strategy, culture, process, technology, customers, and partners. The dependent variable of the study was DTR. Rigorously tested research scales and questionnaires from Kane et al. [12] and the DTRA [49] were modified to measure these constructs. The questionnaire underwent a pretest with 20 employees to refine it and ensure the study's feasibility. Tables 1 and 2 illustrate respondents' demographic profiles, highlighting the diversity in sectors, departments represented, and years of experience.

3-2- Data Analysis Technique

The data analysis was performed using Smart PLS 4, a tool for PLS-SEM. This method suits complex models, especially with smaller sample sizes and exploratory contexts [50]. It involved several steps to ensure a detailed and rigorous data analysis by specifying the measurement and structural models, evaluating the model for reliability and validity, and assessing the model using path coefficients, R-squared values, effect sizes, and predictive relevance [50]. Moreover, existing studies recognize PLS-SEM as a suitable technique that has the potential to reveal new causal relationships [51]. A variance-based structural equation modeling, PLS-SEM, was employed to analyze the complex relationships among observed and latent variables. It is particularly helpful for exploratory research and theory development, as it does not require strict assumptions about data distribution and can handle small sample size [52]. This has made its widespread adoption in management research [52]. In the context of DTR, PLS-SEM has been instrumental in assessing how various factors interact and influence the organization's readiness for DT [52, 53]. Analyzing these relationships allows the organization to identify key factors and obstacles in successful digital transformation and develop targeted strategies to achieve DT goals.

Table 1. Respondents Profile in terms of Industry and Department

Sector	Frequency	Percent (%)	Department	Frequency	Percent (%)
Electronic	15	8.5%	Customer service	8	4.5%
Retail	3	1.7%	Broadcasting	10	5.7%
F&B	3	1.7%	Engineering	23	13.1%
Telecommunication	38	21.6%	Human resource	15	8.5%
Medical	9	5.1%	Marketing	28	15.9%
Service	18	10.2%	Medical	10	5.7%
Finance	15	8.5%	Operating	9	5.1%
Petroleum	12	6.8%	Purchasing	4	2.3%
Construction	56	31.8%	R&D	13	7.4%
Engineering	5	2.8%	Safety & Health	56	31.8%
Pest Control	2	1.1%			
Total	**176**	**100**	**Total**	**176**	**100**

Table 2. Work Experience of Respondents

	Frequency	Percent
Less than 5 years	49	27.8%
5 - 10 years	25	14.2%
10 - 15 years	42	23.9%
More than 15 years	60	34.1%
Total	176	100%

3-3- Addressing Survey Bias

The study employed Harman's single factor test, which explained 43.1% of the variance less than the 50% threshold—suggesting that common method bias is not a concern within the dataset. Furthermore, following the methodologies outlined by Aghazadeh et al. [51] and Kock [54], the model was assessed, revealing that the internal variance inflation factor was under 5. This further confirms that common method variance (CMV) is absent. Table 3 presents the VIF of the construct that measures the multicollinearity of the variables. Table 3 shows that the VIF value for all constructs is below 5.0, which ensures the absence of multicollinearity in the model.

Table 3. VIF

Constructs	VIF
Culture	1.408
	1.707
	1.488
Customer & Partner	2.025
	1.978
	1.784
Digital Transformation Readiness	1.549
	1.816
	1.381
	1.875
Process	1.424
	1.643
	1.344
Strategy	1.929
	1.908
	2.022
Technology	1.487
	2.063
	2.111
	1.789

4- Result

4-1- Measurement Model Analysis

Table 4 presents the factor loading, Cronbach Alpha, composite reliability, and AVE that measure the reliability and validity of the construct. Cronbach alpha and composite reliability (CR) measure the internal consistency of the construct. Cronbach Alpha estimate of inter-correlation of the observed indicators [50] and CR ensures that the indicators consistently reflect the construct they are intended to measure, thereby contributing to the overall reliability and validity of the model [55]. The Cronbach Alpha and CR values range from 0.745 to 0.836 and 0.843 to 0.901, respectively, which are well above the benchmark of 0.70. Therefore, it suggests sufficient convergence or internal consistency of the data [50].

Factor loading and AVE assess convergent validity. All of the loading values exceed the benchmark (0.7) except for one indicator (0.678) of DTR. However, since the AVE score is higher than 0.60, it is acceptable [46] (Ramayah et al., 2018). AVE reflects the variance explained [56]. AVE value higher than 0.50 ensures convergent validity [56, 57]. The AVE value ranges from 0.607 to 0.752, meaning all variables attain the threshold level and explain more than 60% of the variance of the respective indicators.

Table 4. Internal Consistency and Convergent Validity of the Constructs

Items	Mean	Std. Dev	Factor Loading	Cr alpha	CR	AVE
Org.Culture (OC)						
Q2C	4.273	0.765	0.792			
Q4C	3.966	1.065	0.850	0.745	0.855	0.663
Q5C	4.011	0.872	0.800			
Customer and Partners (CP)						
Q1CP	4.17	0.772	0.867			
Q2CP	4.136	0.726	0.861	0.831	0.899	0.747
Q3CP	4.131	0.798	0.865			
Process (P)						
Q1P	4.006	0.914	0.799			
Q2P	4.148	0.777	0.853	0.721	0.843	0.643
Q4P	4.153	0.815	0.749			
Strategy (S)						
Q1S	4.188	0.793	0.849			
Q2S	4.136	0.800	0.855	0.836	0.901	0.752
Q3S	4.119	0.861	0.896			
Technology (T)						
Q1T	4.051	0.841	0.702			
Q2T	4.193	0.672	0.873	0.827	0.885	0.659
Q3T	4.114	0.859	0.858			
Q4T	4.108	0.808	0.803			
Digital Tech Readiness (DTR)						
Q2DTR	4.062	0.762	0.762			
Q3DTR	4.176	0.76	0.828	0.783	0.86	0.607
Q4DTR	4.182	0.826	0.678			
Q5DTR	4.364	0.694	0.838			

The discriminant validity pertains to how the underlying constructs are distinct from one another. Fornel & Larcker criterion [56] and HTMT ratio are used to assess the discriminant validity. To establish discriminant validity according to Fornell-Larcker's criteria, the AVE for each construct should be higher than the correlations between that construct and any other construct in the model. In Table 5, we observe that all constructs satisfy this criterion for discriminant validity. For example, the square root of AVE of Culture (0.814) is greater than the correlations between Culture and other constructs (0.494; 0.109; 0.499; 0.463; 0.442).

Table 5. Fornell-Larckers Criteria

	Culture	Customer & Partner	Digital Transf. Readiness	Process	Strategy	Technology
OC	0.814					
Customer & Partner	0.404	0.864				
DTR	0.194	0.703	0.779			
Process	0.499	0.599	0.577	0.802		
Strategy	0.463	0.518	0.458	0.497	0.867	
Technology	0.442	0.73	0.641	0.655	0.445	0.812

Note: Diagonal values represent the square root of the AVE and the off-diagonals present the correlations which is smaller than the diagonal values.

Another alternative approach to assess the discriminant validity is the Heterotrait-Montrait (HTMT) ratio [58]. This ratio should be below 0.90 to reveal that the two constructs are not highly correlated [59]. In our study, all of the variables are below 0.90 (Table 6), hence the discriminant validity is established.

Table 6. HTMT Analysis

	Culture	Customer & Partner	Digital Transf. Readiness	Process	Strategy	Technology
OC						
Customer & Partner	0.515					
DTR	0.269	0.865				
Process	0.683	0.771	0.758			
Strategy	0.567	0.618	0.579	0.634		
Technology	0.552	0.883	0.774	0.844	0.525	

4-2-Structural Model Analysis

Table 7 presents the goodness of fit of the model. In the present study, the SRMR value of 0.086 is less than 0.10 which is considered a good fit [50].

Table 7. SRMR Report

	Saturated model	Estimated model
SRMR	0.086	0.086
Chi-square	827.88	827.803

To evaluate the structured model and the explanatory power of the DTR, the co-efficient was determined. The coefficient of determination score (R^2) measures the model's predictive accuracy. From Table 8, it is observed that 58.4% (adjusted R^2) of the variance of DTR is explained by the exogenous variables, which indicates a moderate level of predictive accuracy [56]. The predictive relevance or Q2 of the Path model indicates the predictive relevance of the exogenous for the endogenous variable [56]. In the current study, the Q2 values are 0.518 and 0.274, which are greater than 0, indicating large and medium predictive relevance, respectively [60].

Table 8. R^2 and Q^2

	R-square	R-square adjusted	Q^2predict
OC	0.322	0.31	0.274
DTR	0.596	0.584	0.518

Table 9 presents a summary of the results. Through the hypothesis test, the relationship between variables was tested. According to the result, culture (4.849; P<0.01), customer and partner (5.655; p<0.01), Process (3.09; p<0.01), and technology (3.077; p<0.01) were significant drivers of digital transformation readiness. In contrast, the direct influence of organizational strategy on DTR (1.768; p> 0.05) and technology on culture (1.266; p>0.05) was not statistically significant.

In addition, the present study used the bootstrapping indirect effect method to test the mediation effect (Table 9). The result shows that Process → Org. Culture → DTR (2.249; p<0.05) and Strategy → Org. Culture → DTR (2.431, p<0.05) was significant. However, Technology → Org. Culture → DTR was not statistically significant.

Table 9. Path coefficients and hypothesis testing

Relationship	Path coefficients	Standard deviation (STDEV)	T statistics and (P values)	Decision
Strategy → DTR	0.071	0.079	1.768 (0.077)	Rejected
Technology → DTR	0.189	0.074	3.077 (0.002)	Supported
Process → DTR	0.158	0.074	3.09 (0.002)	Supported
Customer & Partner → DTR	0.433	0.077	5.655 (0.000)	Supported
OC → DTR	-0.26	0.054	4.849 (0.000)	Supported
Process → OC	0.273	0.114	2.402 (0.016)	Supported
Strategy → OC	0.262	0.076	3.437 (0.001)	Supported
Technology → OC	0.146	0.116	1.266 (0.206)	Rejected

5- Discussion

The present study shows that organizational strategy does not directly influence DTR, implying that strategic initiatives may not sufficiently drive digital transformation readiness. This study evaluates strategy based on a clear and coherent digital business strategy, the efforts made to progress as a digital business, and the organization's ability to forecast and plan for future trends. This indicates that these strategic aspects were lacking when it came to DTR. A similar pattern was observed in the findings of Gouveia et al. [61], highlighting that the connection between strategic direction and DTR is not consistently straightforward. Strategy formulation alone may not be enough to facilitate organizational digital transformation effectively. Brink & Packmohr [62] observed that lack of strategic alignment negatively impacts SMEs' digital transformation success. However, according to Kane [12] and Hess et al. [11], a well-developed strategy in harmony with technology adoption plays a pivotal part in accelerating digital transformation. The biggest obstacle to DT was a lack of effective strategy disruption. The study found that digital maturity is significantly driven by digital strategy, which lies in its scope and objectives. It is observed that early-stage companies prioritize technology over strategy, leading to operational focus. However, maturing companies use technology to achieve strategic goals. Digital transformation is observed as a directive of digital strategy [12].

In addition, the present study observed a significant association between technology and DTR, supporting the notion that technological infrastructure facilitates digital transformation. This viewpoint differs from the conventional knowledge about how organizations should transition to new technologies [24]. According to Kraus et al. [24], a company's exclusive technology will not give a competitive edge in the long term. Kraus et al. [24] emphasize the critical need for integrating digital technologies with a firm's strategic orientations. Similarly, according to Nadkarni & Prügl [63], DT is not a technology-driven challenge; it necessitates a big cultural change within the organization.

Our study also finds that process has a significant positive effect on DTR, which implies that a well-defined process positively impacts the readiness for DT. This result conforms with the findings of Gouveia et al. [61] where it is observed that integrating digital technologies into well-defined business processes is essential for successful digital transformation. Nadkarni & Prügl [63] also emphasize adapting organizational processes to leverage digital technology efficiently.

Similarly, the effect of customer and partner on the DTR is positively statistically significant. This implies the critical role of social constructs in any organization's digital transformation. Existing literature observes that digital transformation enables organizations to integrate corporate social responsibility, highlighting the importance of customers and partners in achieving successful digital transformation [64]. The findings also align with the observation that focusing on customer needs and preferences in digital transformation design and implementation can create greater value [61]. The study emphasizes the importance of including outside stakeholders, such as customers and partners, early in the design process and maintaining different validation and team-building stages [61].

From the direct effect, it is observed that culture has a statistically significant and negative effect on DTR. The result indicates that certain cultural aspects may negatively impact an organization's ability to adapt to digital changes. In the present study, the organizational culture was measured by employees' perceptions of the organization's approaches to collaboration, employee engagement, innovation, and experimentation. On the other hand, process and strategy have positive and significant effects on the organization's culture. However, technology has no statistically significant impact on the culture of the organization.

5-1- Mediation Analysis

Table 10 presents the mediating effect of OC between the process, strategy, technology, and digital transformation readiness of the organization. The results indicate that while strategy does not directly affect DTR, it has a negative effect on DTR when mediated by culture. Statistically significant negative effects of strategy through culture advocate the existence of cultural barriers that impact an organization's ability to adapt to digital transformation. In the present study, organizational culture is measured by collaboration across teams, active engagement at work, and digital business initiatives, starting with small initiatives. These factors encourage teamwork, a high level of motivation, and commitment to growth, and allow for manageable and low-risk testing of new ideas to foster a culture of innovation. The negative impact of culture on Digital Transformation (DTR) suggests that if key aspects such as collaboration, active engagement, and digital business initiatives are not effectively implemented, or if there is a lack of active participation, or if these initiatives do not scale or integrate into broader business strategies, the digitalization process may be slowed down. The study by Reisberger et al. [42] also observed that a supportive culture of innovation and adoption can enhance the organization's digital transformation.

Table 10. Mediating Effect

Relationship	Path coefficients	Std. Dev	T statistics and (P value)	Decision
Strategy → OC → DTR	-0.068	0.028	2.431 (0.015)	Supported
Process → OC → DTR	-0.071	0.032	2.249 (0.025)	Supported
Technology → OC → DTR	-0.038	0.031	1.24 (0.215)	Rejected

These aspects of cultural barriers manifest in different ways in the daily operations of SMEs. Ineffective collaboration can lead to isolation, resulting in communication breakdowns and duplicated efforts. Since it is important to recognize and reward collaboration, if not managed properly, this can create a sense of competition rather than fostering cooperation. Similarly, lacking engagement often results in decreased motivation, reduced productivity, and resistance to new initiatives. This, in turn, can lead to higher turnover rates, disrupting continuity and undermining efforts toward digital transformation. Additionally, digital business initiatives often begin as small experiments. While starting with small-scale projects can be effective, it may limit the overall impact if these initiatives fail to scale or integrate into broader strategies. These results are consistent with existing studies on DT in SMEs that emphasized the importance of teamwork and collaboration [65, 66]; active engagement, and management of digital business initiatives [66] for effective transformation.

Similarly, the process indicates a statistically significant negative effect on DTR with culture as a mediator. This finding presents a significant insight, suggesting that while specific processes can directly improve digital readiness, cultural factors may challenge this enhancement. It underscores the complex nature of organizational culture and its potential to obstruct digital transformation, even in the presence of process improvements. Our findings are consistent with Velyako & Musa [67], who highlight that certain process-related factors can negatively affect DTR if the cultural issues are not properly managed. Overall, the current study emphasizes the complex nature of DTR, highlighting the crucial role of OC as a significant barrier to successful DT.

Certain cultural dimensions, such as rigid attitudes toward innovation and risk aversion, may inhibit an organization’s ability to embrace digital transformation initiatives fully. This aligns with research by Hartl & Hess [68], where organizational culture was shown to hinder change. Resistance to change, embedded within organizational culture, often manifests as reluctance toward collaborative efforts and limited experimentation, both of which are crucial for a successful transition in digital initiatives. For instance, resistance from employees who perceive digital transformation as threatening their roles or altering their work routines can lower morale, thereby slowing the rate of DTR [66]. Moreover, a lack of support for collaborative and flexible work practices may reduce alignment across teams, creating silos that limit the organization's ability to adapt to evolving digital demands. The implications run deep due to such negative cultural influence. For organizations whose cultures favor stability over innovation, the costs may increase, the implementation time may be longer, and competitiveness in a rapidly digitizing marketplace may decrease [69]. Leaders should invest in initiatives enhancing openness, developing skills for the digital frontier, and ensuring experimentation get rewarded until a culture that supports rather than hinders digital transformation readiness is cultivated.

5-2- Contribution

The present study utilizes socio-technical systems theory to understand DT. It integrates social and technical factors in digital transformation. It focuses on the impact of customers and partners in the DTP, showing how the social construct can drive or impact internal technological changes. Hence, this study confirms the socio-technical systems theory in

digital transformation readiness, which was developed to explain the reciprocal role of social constructs in technological innovation.

The study contributes to the existing literature by revealing that though technology positively impacts DT, strategy alone does not impact transformation readiness. It emphasizes a balanced approach that integrates both strategic and technological elements. The mediating role of organizational culture depicts that cultural factors partially mediate the effect of organizational process and strategy in the digital transformation journey. Hence, the present study will act as a pathway for the digital transformation organization to recognize the holistic approach to DTR. It focuses on the need for cultural change initiatives to promote transformation readiness. Moreover, it emphasizes prioritizing customers and partners in DTR to be competitive.

6- Conclusion

Digital transformation is the integration of digital technologies into all areas of a business, changing the fundamental ways of operation and delivering value to customers. DT involves continuous strategizing and learning, creating feedback loops that inform future strategies and advance the process. The present study aimed to explore the factors that impact DTR within SMEs in Malaysia. The PLS-SEM revealed that technology, process, and customers and partners positively influence DTR, while strategy proves ineffective in digitalization efforts. This implies the crucial role of social construct in DT, emphasizing the importance of incorporating customer needs and preferences in DT design and implementation to generate greater value. Moreover, the evidence emphasizes that the cultural factors within an organization act as a barrier to progress on the DTR. These results suggest that organizations must address their internal culture and resistance to realize the benefits of the DT move fully. Additionally, strategy formulation alone may not be enough to facilitate organizational digital transformation effectively, and it should be in harmony with technology adoption.

The theoretical contribution of the study is its confirmation of the socio-technical systems theory in DTR by focusing on the impact of customers and partners in DTP. It serves as a guide for organizations undergoing digital transformation to adopt a comprehensive approach to transformation readiness. This study emphasizes a balanced approach that integrates both strategic and technological elements. Additionally, it highlights the importance of cultural change initiatives and prioritizing customers and partners to remain competitive. Therefore, addressing cultural barriers is essential for organizations to navigate DT's complexities and successfully achieve sustainable growth.

6-1- Limitations and Future Research Avenues

The present study has certain limitations. The scope of the study is limited to the employees from different SME companies operating in Malaysia. The study's first limitation is its small sample size. This sample size may not adequately represent the diversity or variability within the broad population of Malaysian MSMEs. Consequently, a study focusing on key economic sectors such as manufacturing, construction, service, and agriculture would yield more generalizable results. Moreover, the data were collected through a cross-sectional study. A longitudinal study would be able to capture the dynamic nature of digital transformation.

While our current study focused on Malaysian SMEs' general cultural barriers and socio-technical systems, we recognize that industry-specific factors (e.g., manufacturing vs. service sectors) can significantly impact organizational culture and readiness for digital transformation. Future studies can investigate any industry-specific factors that may have an impact on the organizational culture and DTR. In addition, future studies can explore the critical factors in different stages of the DTP since organizations are expected to face various challenges in different phases of transformation. The study can be conducted on organizations that have already completed their digitalization journey. Future studies can explore in depth the cultural barriers that affect leadership, employee engagement, and change management practices. Moreover, exploring the role of emerging technologies like AI and IOT can be integrated into organizational culture.

7- Declarations

7-1- Author Contributions

Conceptualization, L.A. and A.S.; methodology, L.A. and N.A.; software, A.S.; validation, L.A. and A.S.; formal analysis, A.S. and L.A.; investigation, N.A.; resources, L.A.; data curation, N.A. and A.S.; writing—original draft preparation, N.A. and L.A; writing—review and editing, A.S.; visualization, A.S.; supervision, L.A.; project administration, L.A.; funding acquisition, L.A. All authors have read and agreed to the published version of the manuscript.

7-2- Data Availability Statement

The data presented in this study are available on request from the corresponding author.

7-3- Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

7-4- Institutional Review Board Statement

Not applicable.

7-5- Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

7-6- Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

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Appendix I: Instruments

Items
Culture
Collaboration across teams and divisions is recognized and rewarded as part of our culture and operating mode.
I am actively engaged at work, meaning I am enthusiastic about the work I do, committed to growing my skills, and dedicated to helping my Organization and colleagues succeed.
When my Organization implements digital business initiatives, they tend to start as mostly small experiments.
Customer and Partners
The outcome of digital business initiatives in my Organization is good for the internal and external stakeholders.
My Organization is actively implementing initiatives to increase agility in its response to rapidly changing markets.
My Organization uses different approaches to get sufficient talent to support our digital business strategy
Process
My Organization's management structure and practices (e.g., reporting relationships and decision-making processes) interfere with its ability to engage in digital business successfully.
My Organization values and encourages experiments and testing as a means of continuous Organizational learning.
My Organization provides its employees with the resources and/or opportunities to develop skills and opportunities to thrive in a digital business environment.
Strategy
My Organization has a clear and coherent digital business strategy.
My Organization put in effort to develop itself as a digital business.
My Organization has forecasting capability when developing its enterprise digital business strategy.
Technology
Digital technology is incorporated in the Organization in fundamentally new and different ways.
My Organization primarily drives digital business adoption and engagement internally by expecting employees to be motivated to embrace digital business opportunities.
My Organization effectively utilises the digital knowledge, skills, interests, and experience held by our employees.
My Organization utilizes digital technologies to improve processes, engage talent across the Organization, and drive new and value-generating business models.
Digital Tech Readiness
The technology implementations in my Organization have been successful.
My Organization evaluates and adopts new ways of working using different technologies.
My Organization provides training for employees' personal development.
My Organization responds well to change.