Digital Transformation as a Driver for Internationalisation: A Study of Malaysian SMEs in the Manufacturing Industry

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ABSTRACT

This research studies the effects of digital transformation (DT) and Small and Medium-sized Enterprises (SMEs) internationalisation on the Malaysian manufacturing industry. The application of advanced technologies facilitates Malaysian manufacturing SMEs to optimise their processes, enhance productivity, and become active players in the international markets. With digital devices and technologies, such companies have efficiently handled supply chains and engaged consumers, making it easier for them to enter new overseas markets. The overall sample size for this study was 402. A set of research instruments was developed bilingually for English and Bahasa Melayu respondents through a translation procedure. Data were gathered by email and Google Forms, and a random sample method was utilised. The Smart PLS version 4.0 data analysis allowed a thorough assessment of the complex links between DT and SME internationalisation. The significant results, measured by using recognised statistical standards, highlight their major impact on increasing the productivity and competitiveness of Malaysia's manufacturing industry. In conclusion, DT has undeniably proven to be a vital enabler of Malaysia's manufacturing industries' internationalisation. By embracing advanced technologies and innovative practices, these industries have significantly enhanced their productivity, responsiveness, and competitiveness, positioning themselves as formidable players in the dynamic and challenging international market landscape.

1. INTRODUCTION

Small and Medium-sized Enterprises (SMEs) play an important role in Malaysia's economy, notably in the manufacturing industry (Hashim, 2005; Mohamad et al., 2021). These enterprises contribute significantly to employment and growth of domestic product (GDP), concentrating on various items, from electronics to food (Moorthy et al., 2012; Chin & Lim, 2018). However, many SMEs need help in expanding their operations and competing worldwide. Malaysian SMEs must embrace digital transformation (DT) to prosper globally (Chelliah et al., 2010; Khaliq et al., 2011). Using digital technologies helps improve supply chain management, expedite processes, cut waste, and increase efficiency. Additionally, by utilising digital marketing and e-commerce, SMEs may reach a worldwide client base with minimal expenditures on physical infrastructure. Malaysian SME manufacturers must adopt DT to stay competitive in the global marketplace.

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These businesses promote innovation, make wise decisions, and seize new development possibilities using technology and data-driven strategies. This will secure their viability and success in an increasingly digital environment (Ulas, 2019; Teng et al., 2022).

SMEs can attain better flexibility and efficiency, optimise their production processes, establish value propositions for innovation ecosystems, and respond more quickly to the demands of their target markets. In addition, DT activities are necessary to sustain a company's position as a competitive player in the market and to be on the cutting edge of technological innovation (Queiroz et al., 2020). Understanding how digital technology might affect businesses' internationalisation processes, practices, and strategies is essential. With respect to this matter, Sustainable Development Goal 9 of the United Nations suggests, among other things, the development of resilient infrastructure (both regional and transborder), the enhancement of technological capacities, the expansion of Internet connectivity in the least developed nations, and the facilitation of entry and integration of small-scale industries and firms into global value chains. Furthermore, DT offers a viable avenue for SMEs to effectively explore prospects in international marketplaces, encompassing developed and emerging nations (Bertello et al., 2021).

Malaysian SMEs in the industrial sector encounter substantial obstacles in their DT. One of the key obstacles to implementing digital technologies is still limited access to resources, such as budgetary limitations and significant upfront investment costs (Azuar & Nehru, 2024). The move is made more difficult by inadequate digital infrastructure, which includes antiquated technology and restricted internet access (International Trade Administration, 2024). Furthermore, a significant barrier to successful DT is a lack of technical competence, typified by a dearth of digital skills and low levels of digital literacy among staff members (Ling et al., 2023). Adopting new solutions is also hampered by organisational resistance to change, fueled by cultural and attitudinal hurdles.

Additionally, due to fierce competition, SMEs must have sophisticated digital skills to stay competitive in global marketplaces (International Trade Administration, 2024). SMEs trying to expand internationally face additional challenges due to the intricacy of managing several legal frameworks and cultural disparities. There is limited empirical data on how Malaysian manufacturing SMEs use digital technologies for internationalisation, even though DT presents chances to improve operational efficiency, open up new markets, and stimulate creativity. More research is required to determine the key success factors, obstacles, and tactical methods for successful DT.

This study aims to identify the impact of DT on SMEs' internationalisation among Malaysian manufacturers and understand how embracing digital technologies can enhance their global competitiveness and operational efficiency in an increasingly interconnected market. By examining how adopting digital technologies influences these SMEs, the research aims to highlight how such transformations can improve their global competitiveness and operational efficiency. Understanding this relationship is crucial for Malaysian manufacturers to navigate international challenges effectively, capitalise on new opportunities, and enhance their overall performance on the global stage.

2. LITERATURE REVIEW

2.1 Digital Transformation (DT)

As the digital economy evolves rapidly, SMEs must transform their operations to remain more competitive and relevant. To achieve this goal, a company must fundamentally change its operations, integrate digital technology into every aspect of its operations, and deliver value to all stakeholders. A comprehensive understanding of DT requires understanding the five key areas

that drive this transformation (Team, 2023). Using the five domains of Rogers' book The Digital Transformation Playbook, there are a few examples of DT, such as customers, competition, innovation, value, and data (Rogers, 2016). Rogers (2016) proposed that businesses should reconsider their basic assumptions in five areas of strategy instead of changing technology.

- Customers: This sector needs to understand and address the needs of its clients to remain competitive. A great customer experience is an excellent way for SMEs to increase customer satisfaction and loyalty. By offering a great customer experience, organisations can boost customer satisfaction and loyalty, key factors in their long-term success. It is crucial for any company that seeks to compete in today's digital world to recognise and address each of these categories to succeed. SMEs can tap into new domains of development, promote innovation, and boost customer satisfaction by building a complete DT strategy that addresses each category (Rogers, 2016; Shaoshany, 2023).

- Competition: The second domain of DT concerns how firms collaborate and compete. In the past, these ideas were viewed as binary opposites: working with supply chain partners while competing with rival companies. This phenomenon, called 'disintermediation', occurs when a long-term business partner becomes our biggest rival after providing direct customer service. Asymmetries in competition, companies outside the industry that appear unrelated but offer value to their clients, and partnerships with direct competitors due to similar business models or external challenges are all features of the fluid industry boundaries we see today (Rogers, 2016; Mariano, 2019).

- Innovation: Innovation is often expensive, risky, or exclusive. SMEs rely on their managers to select the most viable solutions to build, test, and introduce them to the market because testing new ideas is difficult and expensive. Digital technology enables continuous testing and experimentation at previously unimaginable levels of complexity. Building a prototype costs only pennies, and user groups can quickly test the ideas. Constant learning and rapid iterations of products before and after the launch day are becoming common (Rogers, 2016; Doak, 2018).

- Value: Value from operations, the cornerstone of digital business, involves decreased costs and enhanced efficiency and speed. SMEs may produce this kind of value by designing modular components, producing digital components that can be reused, automating processes, and being more open and flexible. Almost every company may produce significant value from ecosystems by utilising partners` reach (to access additional clients) and variety (to expand their product and service offerings) (Rogers, 2016; Woerner et al., 2022).

- Data: Every contact in the digital world generates data, making it a key pillar in the digital revolution. This information helps to establish a baseline for transformation efforts and serves as a reliable benchmark for progress. Historically, numerous stakeholders have used this data for various reasons, including traditional analysis and report generation. SMEs embrace the potential for data to become key differentiators. Those who exploit their potential succeed. Models that support this process can be created using machine learning and powerful artificial intelligence (Rogers, 2016; Sharma, 2020).

DT brings significant potential and challenges for businesses across various sectors. It boosts engagement through personalised experiences for customers, but it may make it harder to retain trust and human connection (Rogers, 2016; Shaoshany, 2023). While it encourages agility and rapid product development, it may also result in pressure and resistance to change. The data domain allows valuable insights and better decision-making, but managing large datasets and ensuring compliance may be difficult (Rogers, 2016; Sharma, 2020). DT provides a competitive

edge and market expansion potential while also escalating the battle for continuous innovation (Rogers, 2016; Doak, 2018). Finally, while it has the potential to boost productivity and provide new revenue streams, evaluating and aligning these activities with business objectives requires more work.

2.2 Internationalisation

There are many mentions of the importance of 'the digital' in supporting the globalisation of production (Foster et al., 2018). Castellani et al. (2017) observe a natural affinity between globalisation and technological advancement, known as digitisation. Indeed, as relationships among agents leave ownership and territorial and social proximity circuits, and the distances to be managed increase, it becomes ever more useful for globalising firms to codify the knowledge to be used. Therefore, digitising cognitive processes is of considerable importance. Similarly, suppose a company transitions to digital practices. In that case, the scope of its strategic and operational alternatives expands, allowing it to capitalise better on the free replication and transfer of existing knowledge. Thus, digital and global transformations tend to overlap and reinforce one another, significantly changing the geography of innovation compared to the past' (Castellani et al., 2017).

With regard to the competitive posture of businesses of all kinds, the current wave of DT brought on by technical advancements connected to concepts such as big data analytics, 5G, the Internet of Things, and artificial intelligence presents both possibilities and challenges. Given the constrained financial and human resources and the specialised nature of their business models, these obstacles hold significant relevance for SMEs operating in global environments (Hervé et al., 2020). To survive and expand in the international marketplace, the latter must reconsider how they generate, collect, and provide value to their customers. Owing to the exponential growth and growing prevalence of emerging Internet-based technologies, business environments are becoming exceedingly dynamic and competitive. In this context, digitalisation places organisations under tremendous pressure to discern potential opportunities and threats and effectively adapt their offerings, structures, and procedures (Bouwman et al., 2019). Technological advancements, including but not limited to additive manufacturing, big data and analytics, the Internet of Things, and robots, fundamentally alter the landscape and methods by which organisations execute value-based transactions in domestic and international markets (Ojala et al., 2018).

3. RESEARCH METHODOLOGY

A quantitative survey was undertaken to meet the study goals. This approach was chosen because it can collect data from a larger sample size, allowing the discovery of patterns and trends linked to DT and internationalisation among Malaysian SMEs in the manufacturing industry. The survey instrument was created after a thorough literature assessment and adapted to collect critical characteristics on digital activities, perceived advantages, difficulties, and internationalisation outcomes.

3.1 Population and Sampling

Sekaran and Bougie (2013) defined a population as a collection of individual persons, things, or events of importance that researchers intend to explore at a given time. This study's population consists of SMEs and manufacturing companies in Malaysia. Regarding the sampling method, the study used probability sampling because this approach provides each population component an equal opportunity to be selected as a component of the sample. The population of this research includes all SMEs registered with the Companies Commission of Malaysia under various business types, such as sole proprietorships and partnerships. The sample consists of 402 Malaysian

manufacturing SMEs, categorised as 348 Bumiputera-owned sole proprietors (86.8%), 29 non-Bumiputera-owned sole proprietors (7.2%), and 24 partnerships (6%).

3.2 Measurement Items

A set of questionnaires was developed for data collection. The questionnaire was written in two versions, English and Bahasa Melayu. A back-to-back translation process was used to complete the questionnaires. A cover letter introducing the study's objectives was also prepared using questionnaires. A combination of intervals and analyses was produced on a nominal scale. These items were adapted from previous studies.

DT equips SMEs with the necessary tools and strategies to compete and thrive internationally, allowing them to adapt to changing market dynamics and customer expectations. For SMEs looking to internationalise, prioritising DT can significantly enhance their chances of success. The instruments used for DT indicators had three (3) items 1. organisation with new business platform, 2. digital technology was used for business operation, 3. the organisation's business operations are shifting to the use of digital technology) adapted from Fachrunnisa et al. (2020). The instruments used for internationalisation have four (4) items, namely, international branding (IntBranding), international marketing (IntMarketing), international products (IntProducts) and international training (IntTraining) and were adapted from Ruzzier et al. (2007). Respondents were asked to indicate their degree of agreement or disagreement with each statement on a five-point Likert scale ranging from strongly disagree to strongly agree.

3.3 Data Collection Method

The empirical analysis relies on primary data, namely a balanced sample of SMEs located in the Malaysian region. The data used in this study were collected during a broader survey on SMEs' internationalisation and DT in the Malaysian Region, specifically in the manufacturing sector. A structured questionnaire was submitted to a randomly stratified sample of Malaysian SMEs. In the data collection process, the researcher sent the questionnaires to the respondents through email and forms.

3.4 Data Analysis

Data analysis was performed using Statistical Package for Social Science (SPSS) 29.0 and Smart Partial Least Square Equation Modeling (PLS SEM) 4.0. Treatments for missing data, outlier detection, and cross-loading analyses were also performed. The initial stage of data analysis was a series of descriptive analyses. The Smart PLS software was used to answer the research questions. Several studies were conducted to assess construct validity. Convergent and discriminant validity were tested by examining the correlation matrix for all observed variables to identify the extent to which different measures of the same constructs are highly correlated compared to measures targeted at different constructs.

4. RESEARCH FINDINGS AND DISCUSSION

4.1 Measurement Model

The quality of the constructs in this study was assessed based on evaluation of the measurement model. The quality criteria assessment starts with the loadings and evaluation of the factor loadings, followed by establishing construct reliability and construct validity.

- Factor Loadings: Factor loading refers to 'the extent to which items in the correlation matrix correlate with a given principal component. Factor loadings can range from -1.0 to +1.0, with higher absolute values indicating a higher correlation of the item with the underlying factor (Pett et al., 2003). One item in the study had a factor loading below the recommended value of 0.60 (Hair et al., 2016). According to Pallant (2001) and Hair et al. (2016), an alpha Cronbach's value above 0.6 is considered high reliability and an acceptable index (Nunnally & Bernstein, 1994). Therefore, no indicators are deleted. The factor loadings are presented in Table 1.

Table 1 Factor Loadings

Item	Digital Transformation (DT)	Internationalisation
Digital Transformation (Item1)	0.865	
Digital Transformation (Item2)	0.909	
Digital Transformation (Item 3)	0.797	
IntBranding		0.958
IntMarketing		0.944
IntProducts		0.93
IntTraining		0.941

- Indicator Multicollinearity: Variance Inflation Factor (VIF) statistics were used to assess multicollinearity in the indicators (Fornell & Bookstein, 1982). According to Hair et al. (2016), multicollinearity is not a severe issue if the value of the VIF is below 5. Table 2 presents the VIF values for the indicators in this study and reveals that the VIF for each indicator is below the recommended threshold. However, these three factors have a high VIF value above 5. These factors were not deleted because they are reflective. When the factors have high VIFs, this indicates high correlations and supposedly high reliability.

Table 2 Multicollinearity Statistics (VIF) for Indicators

Item	VIF
Digital Transformation (Item 1)	1.986
Digital Transformation (Item 2)	2.279
Digital Transformation (Item 3)	1.616
IntBranding	6.627
IntMarketing	5.766
IntProducts	5.35
IntTraining	4.938

- Reliability Analysis: Mark (1996) states reliability is 'the extent to which a measurement instrument is both stable and consistent'. The essence of reliability is repeatability. If an instrument is administered repeatedly, the same results will be obtained. The two most commonly used methods for establishing reliability include Cronbach's alpha and Composite Reliability (CR). The results of both Cronbach's alpha and CR are presented in Table 3. Cronbach's alpha ranged from 0.8–0.9, whereas the CR statistics ranged from 0.8 to 0.9. Both reliability indicators have a reliability statistic over the required threshold of 0.70 (Hair et al., 2016). Hence, construct reliability was established.

Table 3 Cronbach Alpha and Composite Reliability

Item	Cronbach's Alpha	Composite Reliability
Digital Transformation	0.821	0.84
Internationalisation	0.959	0.983

- Construct Validity: Statistically, using PLS SEM, construct validity was established when convergent and discriminant validity were present.

Convergent validity is the degree to which multiple attempts to measure the same concept are in agreement. The idea is that two or more measures of the same thing should converge highly if they are valid measures of the concept (Bagozzi et al., 1991). When the AVE value is greater than or equal to the recommended construct value of 0.50, items converge to measure the underlying construct; hence, convergent validity is established (Fornell & Larcker, 1981). The convergent validity results based on the Average Variance Extracted (AVE) statistics in the current study show that the constructs have AVE values over 0.5. Thus, convergent validity was established. Table 4 presents the AVE values for each construct.

Table 4 Convergent Validity (AVE)

Item	Average Variance Extracted (AVE)
Digital Transformation	0.736
Internationalisation	0.89

Discriminant validity is the degree to which measures of different concepts are distinct. If two or more concepts are unique, then valid measures of each should not correlate too highly (Bagozzi et al., 1991).

According to the Fornell and Larcker (1981) criterion, discriminant validity is established when the square root of the AVE for a construct is greater than its correlation with all other constructs. In this study, the square root of AVE (in bold and italics) for a construct was greater than its correlation with the other constructs (Table 5). Hence, it provides strong support for the establishment of discriminant validity.

Table 5 Fornell and Larcker Criterion

Item	Digital Transformation	Internationalisation
Digital Transformation	**0.736**	
Internationalisation	0.215	**0.89**

4.2 Structural Model

After assessing the measurement model, the next step was to evaluate the structural path to determine the path coefficient (relationships among study constructs) and their statistical significance.

H_1 evaluates whether DT significantly and positively affects internationalisation. The results reveal that DT significantly impacts internationalisation (β = 0.197, t = 4.212, p = 0.000). Hence, H_1 is supported.

Table 6 Direct Relationship

Hypotheses	β	SE	t	p-value	Results
H1: DTr -> INT	0.197	0.047	4.212	0.000	Supported

Note: B= Beta Coefficient, SE= Standard Error, t= t-statistics, p= probability value *Relationships are significant at p<0.001, DT = Digital Transformation, INT = Internationalisation.

The significant and positive relationship between DT and internationalisation emphasises the growing importance of digital skills in today's global market. As businesses expand internationally, the ability to leverage digital tools and platforms becomes essential for navigating diverse markets, enhancing operational efficiency, and driving innovation (Wang et al., 2023). DT, therefore, plays a critical role in equipping firms with the capabilities necessary to compete and thrive in international markets. The findings underline the need for businesses to invest in DT as a strategic asset for global expansion.

It is revealed that DT matters in the internationalisation process of the Malaysian manufacturing sector, particularly for SMEs. Through automation, data analytics, and e-commerce platforms, digitalisation can help streamline manufacturing processes, cut costs, and produce better-quality products for Malaysian SMEs. With this technological edge, they can be more efficient with their operations and respond more quickly to global market needs. This includes SMEs that use digital marketing tools to directly access international consumers, passing the traditional obstacles to entry for neighbouring markets (Antonello et al., 2020; Olutimehin, 2024). Furthermore, the cloud-deployed solutions help in distant communications with global partners, which improves customer service and supply chain management. With DT at the core, these firms have armed themselves well against global trade intricacies that support their export story.

5. CONCLUSION

This study used Smart PLS version 4.0 to analyse the data and explore the connections between DT, SME internationalisation, and their impacts on the Malaysian manufacturing sector. The results reveal a clear message: DT is a powerful enabler for Malaysian manufacturers looking to compete globally. As SMEs adopt digital technologies, they become more productive, responsive, and competitive. This shift allows them to operate more efficiently and adapt swiftly to changing market demands. Ultimately, embracing DT is not just about keeping up with trends; it is about unlocking new opportunities for growth and success in the international marketplace. These findings have significant implications for policymakers and industry leaders. By providing support and resources for SMEs in their digital journeys, we can help them thrive in an increasingly interconnected world. This study highlights DT's critical role in shaping a vibrant and competitive manufacturing sector in Malaysia, paving the way for a brighter economic future.

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