Technology Adoption among Small and Medium Enterprises in Malaysia: The Role of Organisational Resilience, Infrastructure Systems, Manufacturing Systems, and Data Transformation

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ABSTRACT

Technology adoption plays a critical role in enhancing the competitiveness and operational efficiency of small and medium enterprises (SMEs). However, disparities in organisational capabilities and technological readiness continue to hinder its widespread implementation. This study investigates the relationships between organisational resilience, infrastructure systems, manufacturing systems, data transformation, and technology adoption among SMEs in Johor, Malaysia. Drawing on an SME technology-readiness framework, the study examines the relative contributions of organisational adaptability and technological capabilities to adoption outcomes. A quantitative cross-sectional survey involving 203 SME representatives was conducted, and the data were analysed using descriptive statistics, reliability analysis, Pearson correlation, and multiple regression. The findings revealed significant positive correlations between all four independent variables and technology adoption ($r = 0.310–0.675$, $p < 0.001$). The regression model explained 53.1% of the variance in technology adoption ($R^2 = 0.531$; adjusted $R^2 = 0.521$; $F(4, 198) = 56.036$, $p < 0.001$). Organisational resilience ($\beta = 0.394$, $p < 0.001$) emerged as the strongest significant predictor, followed by infrastructure systems ($\beta = 0.305$, $p < 0.001$). Conversely, manufacturing systems and data transformation did not demonstrate significant independent associations after controlling for the other predictors, suggesting that their positive bivariate relationships may partly reflect shared explanatory variance. The findings contribute to SME technology-adoption literature by highlighting the relative importance of organisational adaptability and enabling infrastructure alongside operational and data-related capabilities. Practically, the study suggests that SME managers and policymakers should prioritise organisational capability development, strategic leadership, accessible digital infrastructure, and targeted technical support to strengthen technology readiness. Nevertheless, the geographical concentration of the sample and the relatively low internal consistency of the organisational resilience measure warrant cautious interpretation. Future research should employ more geographically diverse samples and further validate the measurement constructs to strengthen the robustness and generalisability of the findings.

Keywords: Technology adoption; Small and medium enterprises; Organisational resilience; Infrastructure systems; Johor

INTRODUCTION

Technology adoption has become an essential driver of operational efficiency, competitiveness, and business sustainability in an increasingly digitalised economy. The advancement of digital technologies has transformed how organisations manage their operations, allocate resources, and respond to changing market demands. For small and medium enterprises (SMEs), adopting appropriate technologies is particularly important for improving productivity, strengthening decision-making, and maintaining competitiveness. However, SMEs frequently encounter challenges such as financial constraints, inadequate infrastructure, limited technological expertise, and insufficient human resources, which may hinder their digital transformation efforts. SMEs play a significant role in Malaysia's economic development by contributing to employment, entrepreneurship, and national economic growth. According to SME Corporation Malaysia (2024), SMEs contributed approximately RM613.1 billion to

Malaysia's gross domestic product in 2023. Despite their economic importance, technology adoption among SMEs remains uneven due to differences in organisational capabilities, resource availability, and technological readiness. These challenges are particularly relevant in Johor, a strategically located state with substantial industrial and commercial activities and close economic connections with Singapore. Although Johor offers considerable opportunities for technological advancement, SMEs may differ in their ability to integrate digital technologies into their business operations.

Previous studies have identified various factors influencing technology adoption among SMEs. Premkumar and Roberts (1999) highlighted the importance of organisational characteristics and external pressures, while Fulantelli and Allegra (2003) emphasised technological awareness, training, and support. Nevertheless, further empirical examination is needed to understand how organisational and technical capabilities are associated with technology adoption, particularly within the Johor SME context. Examining these factors simultaneously is important because SMEs may possess certain technological resources while lacking the organisational capabilities required for successful implementation. Accordingly, this study examines four factors associated with technology adoption: organisational resilience, infrastructure systems, manufacturing systems, and data transformation. Organisational resilience reflects an enterprise's ability to adapt to disruptions and changing business conditions, while infrastructure systems provide essential resources supporting technological implementation. Manufacturing systems represent operational processes and technological arrangements, whereas data transformation involves organising and converting information to support business decision-making. These factors were adapted from the framework developed by Chonsawat and Sopadang (2020), providing a foundation for investigating technology adoption among SMEs. This study aims to determine the level of technology adoption among SMEs in Johor, examine the relationships between the four identified factors and technology adoption, and evaluate their individual contributions through multiple regression analysis. Using quantitative survey data collected from 203 respondents, the study provides empirical evidence concerning the organisational and technical conditions associated with technology adoption.

LITERATURE REVIEW

Technology Adoption and Technology Readiness

Technology adoption refers to the process through which organisations introduce, implement, and utilise technological solutions to improve business operations, productivity, and competitiveness. For small and medium enterprises (SMEs), technology adoption provides opportunities to enhance operational efficiency, strengthen decision-making, and respond effectively to changing market demands. However, the extent of technology adoption may vary depending on organisational resources, technological capabilities, and management readiness. The Technology Readiness Index (TRI), introduced by Parasuraman (2000), provides a theoretical foundation for understanding individuals' willingness to embrace and utilise new technologies. The framework identifies four dimensions: optimism, innovativeness, discomfort, and insecurity, which reflect positive and negative attitudes towards technological advancement. Although TRI primarily examines individual-level technology readiness, its underlying concepts offer useful background for understanding technological acceptance within organisations. Nevertheless, the present study focuses on firm-level organisational and technical factors rather than directly measuring the four TRI dimensions. Building on the framework adapted from Chonsawat and Sopadang (2020), this study examines four factors associated with technology adoption among SMEs: organisational resilience, infrastructure systems, manufacturing systems, and data transformation. These constructs represent different aspects of organisational capabilities and technological preparedness that may support technology implementation.

The selection of the four predictors is grounded primarily in the SME Industry 4.0 readiness indicators proposed by Chonsawat and Sopadang (2020), rather than in the individual-level Technology Readiness Index. They capture complementary firm-level conditions: organisational resilience reflects adaptive and strategic capacity; infrastructure systems reflect enabling resources and connectivity; manufacturing systems reflect operational process readiness; and data transformation reflects the capacity to convert information into usable operational inputs. This distinction matters because acquiring technology does not necessarily mean a firm has the managerial capability, operational arrangements, or information resources to use it effectively. The four constructs are examined together to distinguish their bivariate relationships from their unique associations with

adoption, while recognising that the framework is an adapted readiness model rather than a comprehensive causal theory.

Organisational Resilience and Technology Adoption

Organisational resilience refers to an organisation's ability to anticipate, adapt to, and recover from disruptions while maintaining essential business functions. In the context of SMEs, organisational resilience is particularly important because smaller enterprises often face financial limitations, operational uncertainties, and changing market conditions. Resilient organisations are generally better positioned to respond to technological changes and adjust their business strategies accordingly. Organisational resilience encompasses several dimensions, including business models, business strategies, leadership, and responses to supply chain disruptions. Akgun and Keskin (2014) highlighted the relationship between organisational resilience and product innovativeness, while Arham et al. (2024) emphasised the importance of leadership in supporting organisational adaptation and innovation. Effective leadership and strategic planning may encourage SMEs to recognise technological opportunities, allocate resources, and manage resistance to organisational change. Furthermore, technological solutions such as digital inventory systems, automated processes, and information-sharing platforms may support organisational responses to supply chain disruptions. SMEs with stronger resilience capabilities may therefore demonstrate greater willingness and capacity to implement technologies that enhance operational continuity. Accordingly, the following hypothesis is proposed:

H1: Organisational resilience has a positive influence on technology adoption among SMEs in Johor.

Infrastructure Systems and Technology Adoption

Infrastructure systems represent the foundational facilities, technological resources, financial capabilities, and supporting services required for business operations. Adequate infrastructure is essential for SMEs seeking to implement digital technologies because technological adoption often depends on reliable connectivity, suitable equipment, financial investment, and organisational support. Infrastructure limitations may restrict SMEs' ability to integrate advanced technologies into their existing operations. Jude Edeh et al. (2025) highlighted the potential implications of inadequate infrastructure for SME competitiveness and sustainable business growth. Similarly, financial constraints may prevent SMEs from acquiring technological equipment, upgrading existing systems, or providing employees with appropriate technical training. In contrast, SMEs with sufficient infrastructure and financial resources may be better prepared to introduce digital systems and sustain technological improvements. Infrastructure readiness therefore represents an important enabling condition for technology adoption. Based on this argument, the following hypothesis is developed:

H2: Infrastructure systems positively influence technology adoption among SMEs in Johor.

Manufacturing Systems and Technology Adoption

Manufacturing systems refer to the processes, equipment, operational technologies, and production arrangements used to transform inputs into products or services. Technological developments have increasingly encouraged organisations to integrate automation, digital monitoring, and process improvements into their operational systems. For SMEs, effective manufacturing systems may facilitate technology adoption by improving operational coordination, reducing manual activities, and supporting more efficient resource utilisation. Technologies such as automated equipment, integrated production systems, and digital process monitoring can potentially enhance productivity and operational consistency. However, adopting these technologies may require substantial investment, technical expertise, and adjustments to existing business processes. The relationship between manufacturing systems and technology adoption is therefore relevant to understanding whether operational capabilities are associated with SMEs' technological advancement. Although manufacturing-related technologies may offer operational benefits, their implementation depends on organisational needs and available resources. Consequently, the following hypothesis is proposed:

H3: Manufacturing systems positively influence technology adoption among SMEs in Johor.

Data Transformation and Technology Adoption

Data transformation refers to the process of collecting, converting, organising, and utilising business information to support operational activities and decision-making. As businesses increasingly depend on digital information, the ability to manage and transform data has become an important aspect of organisational technological capability. For SMEs, effective data transformation may improve information accessibility, operational monitoring, customer management, and strategic planning. Digital recordkeeping, integrated information systems, and data analysis tools can support more informed decisions and reduce dependence on fragmented manual processes. Nevertheless, SMEs may face challenges related to limited technological expertise, inadequate information systems, and insufficient resources to manage digital data. Organisations with stronger data transformation capabilities may be better positioned to integrate technologies into their business activities and utilise digital information effectively. Therefore, the following hypothesis is formulated:

H4: Data transformation positively influences technology adoption among SMEs in Johor.

Conceptual Framework

The conceptual framework of this study was adapted from Chonsawat and Sopadang (2020) and consists of four independent variables: organisational resilience, infrastructure systems, manufacturing systems, and data transformation. Technology adoption serves as the dependent variable. The framework proposes that each independent variable is positively related to technology adoption among SMEs. By examining these relationships simultaneously, the study seeks to identify the relative contributions of organisational and technical factors to technology adoption. The framework provides a structured basis for empirical analysis using Pearson correlation and multiple regression techniques, allowing the study to distinguish between individual relationships and the unique explanatory contributions of each factor within the overall model.

The proposed framework distinguishes organisational capacity (resilience), resource readiness (infrastructure), process readiness (manufacturing systems), and information readiness (data transformation). These dimensions were selected because they represent different, potentially overlapping prerequisites for technology implementation identified in the adapted readiness framework (Chonsawat & Sopadang, 2020). Manufacturing systems are retained despite including service-sector SMEs because operational system readiness may be relevant across sectors, although the applicability of manufacturing-oriented items may differ by industry. The analysis tests associations, not causal determinants, and the constructs should not be interpreted as exhaustive explanations of adoption.

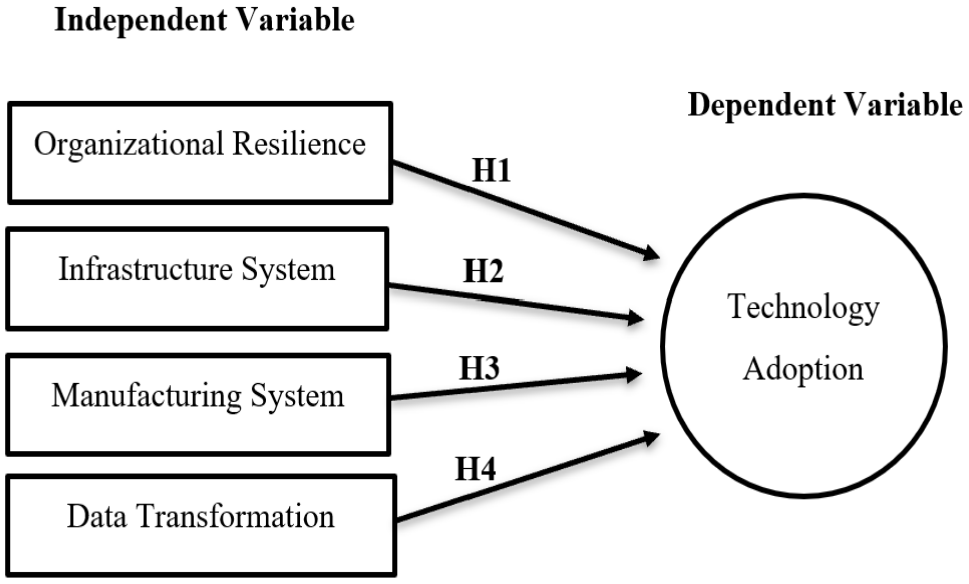

Figure 1.0: Conceptual Framework of The Study

METHODOLOGY

Research Design

This study used a quantitative research approach and a cross-sectional questionnaire survey to examine factors associated with technology adoption among small and medium enterprises (SMEs) in Johor, Malaysia. A quantitative design was considered appropriate because it enables the systematic measurement of organisational characteristics and the statistical examination of relationships between variables. The study focused on four independent variables, namely organisational resilience, infrastructure systems, manufacturing systems, and data transformation, with technology adoption serving as the dependent variable. The cross-sectional design allowed data to be collected within a single study period to assess the reported level of technology adoption and the relationships among the identified constructs.

Population and Sampling

The target population comprised SMEs operating across various industries in Johor. Respondents were individuals holding managerial or ownership positions who were expected to possess knowledge of their organisations' operational activities and technology adoption practices. A total of 203 respondents participated in the study, comprising 115 chief executive officers, directors, or business owners (56.7%) and 88 general managers (43.3%). Their organisational responsibilities made them relevant informants for evaluating technological implementation and organisational capabilities. The study describes using a simple random sampling technique to select respondents. However, the study did not provide detailed documentation on the sampling frame, respondent selection procedures, or individual selection probabilities. Consequently, the probability-based nature of the sampling process could not be independently verified. The sample was therefore interpreted as providing empirical evidence from the participating SMEs rather than establishing statistical representativeness of all SMEs in Johor.

Research Instrument and Data Collection

Data were collected using a structured questionnaire designed to measure technology adoption and the four independent variables. The measurement framework was adapted from Chonsawat and Sopadang (2020), with items organised according to the constructs examined in the study. The questionnaire consisted of four items each for organisational resilience, infrastructure systems, manufacturing systems, and technology adoption, while data transformation was measured using three items. A five-point Likert scale was employed to capture respondents' levels of agreement with statements concerning organisational capabilities, operational systems, and technology adoption. This approach enabled quantitative summarisation of responses and use in subsequent statistical analyses. The survey collected information from SMEs across different industries and districts within Johor, providing variation in business characteristics and organisational conditions.

Organisational resilience was measured using four questionnaire items and demonstrated relatively low internal consistency (Cronbach's $\alpha = 0.561$), suggesting potential limitations in the reliability of the measurement scale. This result may reflect the multidimensional nature of organisational resilience, which encompasses adaptive capacity, leadership, strategic flexibility, and business continuity planning. Therefore, interpret the findings for this construct with caution. Future research should strengthen the measurement instrument by examining item wording, corrected item–total correlations, inter-item correlations, Cronbach's alpha if an item is deleted, and factor loadings to identify potential measurement weaknesses. Furthermore, expert evaluation and cognitive pretesting are recommended to improve item clarity, content validity, and conceptual alignment. Subsequent studies should also reassess the reliability and dimensionality of the refined instrument using an independent sample to establish a more robust and valid measurement of organisational resilience in the context of SME technology adoption.

Data Analysis

Comprehensive regression reporting requires additional statistical analysis using the original SPSS dataset to obtain unstandardised regression coefficients, standard errors, and 95% confidence intervals. Further diagnostic

assessments, including residual-versus-fitted plots, normal Q–Q plots, standardised residuals, leverage statistics, and Cook's distance, are also recommended to evaluate the underlying regression assumptions and identify potential outliers or influential observations. These analyses would provide greater confidence in the reliability, validity, and robustness of the regression findings. However, the available summary statistics do not provide enough information to verify these diagnostic measures, highlighting the need to examine the original dataset before drawing definitive conclusions about the model's statistical assumptions. The collected data were analysed using descriptive and inferential statistical techniques. Descriptive statistics summarised respondent characteristics and the reported level of technology adoption. Internal consistency reliability was assessed using Cronbach's alpha to evaluate the consistency of measurement items within each construct.

Pearson correlation analysis was conducted to examine the direction and strength of the bivariate relationships between organisational resilience, infrastructure systems, manufacturing systems, data transformation, and technology adoption. The study then examined multicollinearity diagnostics to assess potential overlap among the independent variables before estimating the regression model. Multiple linear regression analysis was performed to evaluate the individual contributions of the four independent variables to technology adoption when considered simultaneously. The regression model enabled the study to identify which factors demonstrated statistically significant associations with technology adoption after accounting for the other predictors. The study interpreted statistical significance using p-values with a threshold of 0.05. Given the cross-sectional nature of the study, the regression results reflect statistical associations rather than evidence of causal relationships.

The regression analysis demonstrated satisfactory explanatory power, accounting for 53.1% of the variance in technology adoption ($R^2 = 0.531$; adjusted $R^2 = 0.521$). Furthermore, the variance inflation factor (VIF) values, ranging from 1.173 to 2.291, indicate that multicollinearity was not a major concern in the regression model. These findings provide preliminary support for interpreting the relationships between the independent variables and technology adoption. Nevertheless, additional statistical information, including unstandardised regression coefficients, standard errors, and 95% confidence intervals, would allow a more comprehensive assessment of the precision of the estimated relationships. Further diagnostic assessments involving residual plots, normal Q–Q plots, standardised residuals, leverage statistics, and Cook's distance would also strengthen the evaluation of regression assumptions and potential influential observations.

RESULTS

Respondent Profile

A total of 203 respondents representing small and medium enterprises (SMEs) in Johor participated in the study. Of these, 115 respondents (56.7%) were chief executive officers, directors, or business owners, while 88 (43.3%) were general managers. The respondents represented various industries, with food and beverages accounting for the largest proportion (32.0%), followed by textiles and apparel (19.7%) and wholesale and retail trade (18.7%). Geographically, most respondents were in Johor Bahru (90.1%), followed by Kota Tinggi (6.4%) and Kulai (3.4%). Furthermore, 85.7% of the participating enterprises employed fewer than ten workers, while 67.0% reported annual sales below RM200,000. These characteristics indicate that the sample predominantly comprised smaller enterprises, particularly those operating in Johor Bahru.

Reliability Analysis

Cronbach's alpha was employed to assess the internal consistency of the measurement constructs. The results demonstrated satisfactory reliability for technology adoption ($\alpha = 0.818$), infrastructure systems ($\alpha = 0.768$), manufacturing systems ($\alpha = 0.779$), and data transformation ($\alpha = 0.788$), with all coefficients exceeding the commonly accepted threshold of 0.70. However, organisational resilience, measured using four questionnaire items, recorded a lower reliability coefficient ($\alpha = 0.561$), indicating limitations in its internal consistency. This result may reflect variations in item content or the potentially multidimensional nature of organisational resilience, although these explanations cannot be confirmed from Cronbach's alpha alone. Nevertheless, organisational resilience demonstrated a statistically significant positive association with technology adoption ($\beta = 0.394$, $p < 0.001$), suggesting its potential relevance within the proposed regression model. Given the relatively low reliability coefficient, interpret this relationship cautiously, as measurement limitations may

reduce the precision of the estimated association. The original measurement items were retained because the available statistical output did not provide sufficient item-level evidence to justify their modification or removal. Further validation through corrected item–total correlations, inter-item analysis, dimensionality assessment, and expert evaluation is recommended to strengthen measurement quality in future studies.

Descriptive Analysis

Descriptive analysis was conducted to examine respondents' assessments of the organisational and technical factors associated with technology adoption. Data transformation recorded the highest mean score (M = 4.09, SD = 0.743), followed by infrastructure systems (M = 3.80, SD = 0.765) and organisational resilience (M = 3.74, SD = 0.698). Manufacturing systems recorded the lowest mean score (M = 2.91, SD = 1.053), suggesting comparatively lower assessments and greater variation in responses relating to manufacturing capabilities. The thesis reported an overall mean of 3.635 and characterised technology adoption as moderate. Table 1 presents the descriptive statistics for each construct.

Table 1. Descriptive Statistics of Each Construct

Construct	Mean	Standard Deviation
Organizational resilience	3.74	0.698
Infrastructure system	3.80	0.765
Manufacturing system	2.91	1.053
Data transformation	4.09	0.743
Overall reported score	3.635	Not reported

Note: Overall reported score is as stated in the original study. Separate technology adoption scale mean requires verification.

Pearson Correlation Analysis

Pearson correlation analysis revealed positive and statistically significant relationships between all four independent variables and technology adoption. Organisational resilience demonstrated the strongest correlation ($r = 0.675$, $p < 0.001$), followed by infrastructure systems ($r = 0.651$, $p < 0.001$). Manufacturing systems also showed a positive relationship ($r = 0.509$, $p < 0.001$), while data transformation recorded the weakest correlation ($r = 0.310$, $p < 0.001$). These results indicate that higher reported organisational resilience, infrastructure readiness, manufacturing capabilities, and data transformation were associated with higher technology adoption scores. The stronger correlations observed for organisational resilience and infrastructure systems suggest that these factors may be particularly relevant to technological adoption among the surveyed SMEs. Nevertheless, correlation analysis establishes statistical associations rather than causal relationships. Table 2 presents the reliability coefficients and bivariate correlations.

Table 2. Reliability and Bivariate Correlations with Technology Adoption

Construct	Cronbach's α	Pearson r	p
Technology adoption	0.818	—	—
Organizational resilience	0.561	0.675	< 0.001
Infrastructure system	0.768	0.651	< 0.001

Manufacturing system	0.779	0.509	< 0.001
Data transformation	0.788	0.310	< 0.001

Multicollinearity Analysis

Multicollinearity diagnostics were conducted to assess linear associations among the independent variables before interpreting the multiple regression results. The variance inflation factor (VIF) values were 2.059 for organisational resilience, 2.291 for infrastructure systems, 1.743 for manufacturing systems, and 1.173 for data transformation, with corresponding tolerance values of approximately 0.486, 0.436, 0.574, and 0.853, respectively. All VIF values were below the commonly applied threshold of 5.0, while tolerance values exceeded 0.20, indicating that severe multicollinearity was not evident in the regression model. Nevertheless, some degree of shared explanatory variance may exist among the predictors. This may help explain why manufacturing systems ($r = 0.509$) and data transformation ($r = 0.310$), despite demonstrating significant positive correlations with technology adoption, did not exhibit statistically significant independent associations in the multiple regression analysis ($\beta = 0.093$, $p = 0.149$; $\beta = 0.062$, $p = 0.243$, respectively). Unlike Pearson correlation, which examines the unadjusted association between two variables, multiple regression estimates each predictor's contribution after accounting for the remaining independent variables. Consequently, the findings suggest that manufacturing systems and data transformation did not make statistically significant unique contributions to technology adoption in the current model, rather than indicating that these factors are irrelevant. Further examination of partial correlations, coefficient confidence intervals, and alternative model specifications would help clarify their independent explanatory contributions and strengthen the interpretation of the findings.

Multiple Regression Analysis

Multiple linear regression analysis was conducted to examine the relative contributions of organisational resilience, infrastructure systems, manufacturing systems, and data transformation to technology adoption among SMEs. The overall regression model was statistically significant, $F(4, 198) = 56.036$, $p < 0.001$, accounting for 53.1% of the variance in technology adoption ($R^2 = 0.531$; adjusted $R^2 = 0.521$). These results indicate that the four independent variables collectively demonstrated substantial explanatory power within the study sample, while the remaining 46.9% of the variance was unexplained by the model, potentially reflecting other organisational, technological, and environmental factors not examined in this study.

Among the four predictors, organisational resilience exhibited the largest positive standardised regression coefficient ($\beta = 0.394$, $p < 0.001$), followed by infrastructure systems ($\beta = 0.305$, $p < 0.001$). Both variables demonstrated statistically significant positive associations with technology adoption after controlling for the other predictors, highlighting the potential importance of organisational adaptability and technological infrastructure in supporting SME technology adoption. In contrast, manufacturing systems ($\beta = 0.093$, $p = 0.149$) and data transformation ($\beta = 0.062$, $p = 0.243$) did not demonstrate statistically significant independent associations within the regression model. These findings suggest that organisational resilience and infrastructure systems were more strongly associated with technology adoption in the adjusted analysis, whereas the unique contributions of manufacturing systems and data transformation were not statistically established. Nevertheless, the significant association involving organisational resilience should be interpreted cautiously given the relatively low internal consistency of its measurement scale ($\alpha = 0.561$). Table 3 presents the detailed regression results.

Table 3. Multiple Regression Predicting Technology Adoption

Predictor	**Standardized β**	**p**	**VIF**
Organizational resilience	0.394	< 0.001	2.059
Infrastructure system	0.305	< 0.001	2.291

Manufacturing system	0.093	0.149	1.743
Data transformation	0.062	0.243	1.173

Note: $R = 0.729$; $R^2 = 0.531$; Adjusted $R^2 = 0.521$; $F(4, 198) = 56.036$; $p < 0.001$; SE = 0.545. Organisational resilience (H1) and infrastructure systems (H2) were supported; manufacturing systems (H3) and data transformation (H4) were not supported.

Although the regression model demonstrated meaningful explanatory power ($R^2 = 0.531$; adjusted $R^2 = 0.521$), certain limitations in statistical reporting warrant consideration. The available results provide standardised regression coefficients, significance levels, and multicollinearity diagnostics but do not include unstandardised coefficients, coefficient-specific standard errors, 95% confidence intervals, or residual diagnostics. The reported standard error of estimate (0.545) reflects the overall prediction error of the model rather than the precision of individual regression coefficients. While these limitations do not invalidate the reported statistical associations, they restrict a comprehensive assessment of coefficient precision and model assumptions. Accordingly, the findings should be interpreted with appropriate caution, and further examination of the original dataset is recommended to verify regression assumptions and strengthen the assessment of mod

DISCUSSION

The findings provide empirical evidence of the organisational and technological factors associated with technology adoption among small and medium-sized enterprises (SMEs) in Johor, Malaysia. The multiple regression model explained 53.1% of the variance in technology adoption ($R^2 = 0.531$), indicating substantial explanatory power within the study sample. Among the four examined predictors, organisational resilience and infrastructure systems demonstrated statistically significant positive associations with technology adoption, highlighting the relevance of organisational capabilities and technological readiness in supporting digital transformation.

Organisational resilience exhibited the largest standardised regression coefficient ($\beta = 0.394$, $p < 0.001$), suggesting that SMEs with greater adaptive capabilities, strategic preparedness, and management support tend to report higher levels of technology adoption. Organisational resilience may help enterprises respond to operational disruptions, technological changes, and market uncertainties while facilitating the integration of new technologies into existing business processes. This finding is consistent with Akgun and Keskin (2014), who emphasised the relationship between organisational resilience and innovativeness, and Arham et al. (2024), who highlighted the importance of leadership in organisational adaptation. For resource-constrained SMEs, strategic flexibility and management commitment may be particularly relevant to technology adoption. Nevertheless, the strength of this association should be interpreted cautiously given the relatively low internal consistency of the organisational resilience measure.

Infrastructure systems also demonstrated a statistically significant positive association with technology adoption ($\beta = 0.305$, $p < 0.001$). This finding underscores the importance of adequate technological infrastructure and supporting operational resources in facilitating digital transformation. SMEs with stronger infrastructure readiness may be better positioned to acquire appropriate technologies, integrate digital systems, and maintain the operational support required for implementation. The result is consistent with previous research identifying infrastructure deficiencies and resource constraints as barriers to technological advancement among SMEs. Improving access to affordable digital infrastructure and technical assistance may therefore help enterprises strengthen their capacity to adopt technology.

In contrast, manufacturing systems ($\beta = 0.093$, $p = 0.149$) and data transformation ($\beta = 0.062$, $p = 0.243$) did not demonstrate statistically significant independent associations with technology adoption. Although both variables exhibited significant positive Pearson correlations with technology adoption ($r = 0.509$ and $r = 0.310$, respectively), their associations were not statistically significant after controlling for the other predictors. This difference is not contradictory, as Pearson correlation measures an unadjusted relationship, whereas multiple regression evaluates each predictor's unique contribution within the model. The findings may reflect shared

explanatory variance among the independent variables, particularly organisational resilience and infrastructure systems. Although multicollinearity diagnostics did not indicate severe multicollinearity, some overlap among predictors may still influence their individual contributions. Differences in industry characteristics, technological maturity, and organisational implementation capabilities may also offer possible explanations, although these were not directly examined. Consequently, the findings should not be interpreted as evidence that manufacturing systems and data transformation are irrelevant, but rather that the present model did not establish their independent associations.

From a theoretical perspective, the study contributes to the understanding of SME technology adoption by examining organisational resilience, infrastructure systems, manufacturing systems, and data transformation within an integrated framework adapted from Chonsawat and Sopadang (2020). The findings highlight the importance of considering organisational adaptability alongside technological infrastructure when examining firm-level technology adoption. Although the Technology Readiness Index (Parasuraman, 2000) provides a relevant background perspective, the present study focuses on organisational characteristics rather than the individual attitudes assessed by the original framework. Accordingly, its contribution lies in providing empirical evidence of organisational and technological correlates of technology adoption without directly testing the Technology Readiness Index.

Practical and Policy Implications

The findings offer practical implications for SME managers, policymakers, and business support agencies seeking to strengthen technology adoption. For SME managers, a phased approach is recommended, beginning with an assessment of organisational resilience, leadership commitment, employee digital competencies, and existing technological infrastructure. Based on this assessment, enterprises should prioritise affordable digital solutions that address operational challenges and align with their financial resources and organisational capabilities. Implementation progress can subsequently be monitored through measurable indicators, including process completion time, operational error rates, system utilisation, and employee participation in digital training.

At the policy level, government agencies and SME support organisations could strengthen digital transformation initiatives through targeted digital-readiness assessments, accessible technical advisory services, infrastructure assistance, and structured implementation support. Such initiatives may be particularly beneficial for smaller enterprises facing resource and capability constraints. Rather than concentrating exclusively on financial incentives or technology acquisition, support programmes should also emphasise organisational preparedness, workforce development, and sustained technology utilisation. However, these recommendations are evidence-informed proposals rather than interventions whose effectiveness the present cross-sectional study has causally established.

Limitations of the Study

Several limitations should be considered when interpreting the findings. First, the cross-sectional research design does not permit causal conclusions regarding the relationships between the examined variables and technology adoption. Second, the concentration of respondents in Johor Bahru and the predominance of very small enterprises may limit the generalisability of the results to other geographical regions, industries, and firm-size categories. Third, organisational resilience recorded a Cronbach's alpha of 0.561, below the commonly accepted threshold of 0.70, indicating insufficient internal consistency. This limitation raises concerns regarding measurement precision and warrants cautious interpretation of its statistically significant regression coefficient. Although differences in item content or the multidimensional nature of organisational resilience may explain the lower reliability, these possibilities cannot be confirmed without further item-level analysis and construct validation. Finally, the available methodological and statistical documentation does not provide sufficient information to independently verify all aspects of the sampling procedure or comprehensively assess the regression assumptions. Although the reported multicollinearity diagnostics did not indicate severe collinearity, additional assessments of residual behaviour, linearity, homoskedasticity, and influential observations were unavailable for verification. These limitations do not negate the reported statistical associations but restrict a more comprehensive evaluation of the model's robustness. Therefore, interpret the findings within the study's methodological and geographical boundaries.

RECOMMENDATIONS FOR FUTURE RESEARCH

Future research should address these limitations through broader sampling strategies, improved measurement validation, and more comprehensive research designs. Stratified sampling across multiple Malaysian states, industries, and firm-size categories would enhance sample representativeness, while transparent reporting of recruitment procedures and response rates would strengthen methodological rigour. Sector-specific analyses could also provide deeper insights into differences in technology adoption across business environments. Further attention should be given to refining the organisational resilience instrument through expert content validation, pilot testing, item-level reliability analysis, and dimensionality assessment. Longitudinal research designs would also be valuable for examining how organisational capabilities, infrastructure readiness, and technology adoption evolve over time and for clarifying the temporal ordering of their relationships. Additionally, future studies could investigate the potential mediating or moderating roles of organisational resilience and infrastructure readiness, alongside other technological, organisational, and environmental factors. Incorporating objective adoption indicators, such as system utilisation records and operational performance measures, would reduce reliance on single-respondent perceptions and provide stronger evidence of actual technology implementation. These research directions could advance a more comprehensive understanding of the conditions associated with sustainable technology adoption among Malaysian SMEs.

CONCLUSION

This study provides empirical evidence of the organisational and technological factors associated with technology adoption among small and medium-sized enterprises (SMEs) in Johor, Malaysia. Based on survey responses from 203 SME representatives, the findings identified organisational resilience and infrastructure systems as statistically significant positive predictors of technology adoption, while manufacturing systems and data transformation did not demonstrate significant independent associations in the multiple regression model. Collectively, the four predictors explained 53.1% of the variance in technology adoption, highlighting the relevance of organisational capabilities and technological infrastructure in understanding SME digital transformation.

The findings suggest that successful technology adoption involves more than acquiring digital technologies, with organisational adaptability, strategic preparedness, and infrastructure readiness emerging as important considerations. From a practical perspective, SME managers should prioritise strengthening organisational capabilities, developing employee competencies, and investing in appropriate technological infrastructure. Policymakers and business support agencies could complement financial assistance with targeted digital-readiness assessments, technical advisory services, and implementation support to facilitate technology adoption among resource-constrained enterprises.

Nevertheless, the findings should be interpreted within the study's methodological limitations, particularly its cross-sectional design, geographical concentration, and the relatively low internal consistency of the organisational resilience measure. Future research should employ more representative samples, refined measurement instruments, and longitudinal approaches to strengthen the validity and generalisability of the findings. Overall, this study contributes to the SME technology adoption literature by demonstrating the relative importance of organisational resilience and infrastructure systems within an integrated analytical framework. It further offers evidence-informed directions for strengthening organisational preparedness and supporting sustainable digital transformation among Malaysian SMEs.

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