

## TRANSFORMATIONAL LEADERSHIP AS A CATALYST FOR BIG DATA ANALYTICS LEARNING INTENTION IN MALAYSIAN SMES: EXTENDING UTAUT WITH A MODERATION LENS

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### **Abstract**

Big Data Analytics (BDA) capability has become increasingly critical for Malaysian Small and Medium Enterprises (SMEs), yet many firms continue to face a persistent skills bottleneck where employees are hesitant or insufficiently motivated to learn analytics-related competencies. Drawing on the Unified Theory of Acceptance and Use of Technology (UTAUT), this study examines the determinants of BDA learning intention and investigates transformational leadership as a moderating mechanism that shapes how technology-related beliefs translate into employees' learning motivation. Data were collected from 351 SME employees across major Malaysian regions and analysed using Partial Least Squares Structural Equation Modelling (PLS-SEM) following the two-step approach. The findings indicate that UTAUT constructs significantly explain BDA learning intention, while transformational leadership strengthens key expectancy-based relationships. The results extend UTAUT by embedding leadership as a socially grounded mechanism in analytics learning contexts and offer practical insights for SME leaders seeking to accelerate data-driven capability development through leadership-enabled learning environments.

**Keywords:** Big Data Analytics; Learning Intention; UTAUT; Transformational Leadership; Malaysian SMEs; PLS-SEM.

### **Introduction**

Small and Medium Enterprises (SMEs) continue to play a central role in driving economic growth, employment generation, and innovation across emerging and developed economies. In Malaysia, SMEs dominate the business landscape and are increasingly required to respond to rapid environmental turbulence, digital disruption, and intensifying global competition. Recent studies

emphasize that the post-pandemic business environment has further accelerated the urgency for SMEs to adopt digital and data-driven capabilities in order to remain competitive and resilient (OECD, 2021; World Bank, 2022). Within this context, Big Data Analytics (BDA) has emerged as a strategic capability that enables organizations to transform large volumes of data into actionable insights for improved decision-making and performance outcomes. Prior empirical evidence suggests that BDA adoption is positively associated with operational efficiency, innovation capability, and sustainable competitive advantage (Mikalef et al., 2021; Wamba et al., 2022). However, despite its strategic potential, BDA adoption among SMEs remains relatively low compared to large enterprises, particularly in developing economies where financial constraints, limited analytical expertise, and inadequate learning readiness persist.

Recent literature increasingly highlights that technological adoption should not be viewed purely as a technical or infrastructural challenge, but rather as a socio-organizational process shaped by human behaviors and managerial influence. In digitally transforming organizations, employees' willingness to learn and engage with complex analytical systems has been identified as a critical success factor for realizing value from BDA investments (Marikyan et al., 2022; Abbas et al., 2024). Consequently, leadership has gained prominence as a key organizational mechanism that shapes employees' learning orientation and technology-related attitudes. Among contemporary leadership approaches, transformational leadership has been consistently linked to enhanced learning behavior, innovation, and adaptability under conditions of uncertainty. Transformational leaders motivate employees to embrace change, stimulate intellectual curiosity, and create supportive environments that encourage continuous skill development. Empirical studies indicate that such leadership behaviors are particularly influential in promoting digital learning and technology acceptance, especially within resource-constrained SME settings.

From a theoretical standpoint, the Unified Theory of Acceptance and Use of Technology (UTAUT) remains one of the most widely adopted frameworks for explaining individuals' intentions to adopt new technologies. While the original UTAUT model emphasizes performance expectancy, effort expectancy, social influence, and facilitating conditions, recent extensions argue that contextual and organizational factors such as leadership style can significantly alter these relationships (Dwivedi et al., 2021; Tamilmani et al., 2022). However, leadership has often been treated as a peripheral or control variable rather than as a central explanatory mechanism. Despite the growing body of research on BDA adoption and technology acceptance, empirical studies that explicitly integrate transformational leadership with BDA learning intention remain scarce, particularly within the Malaysian SME context. Existing studies have largely examined direct determinants of technology adoption, with limited attention given to leadership as a moderating force that shapes how employees interpret learning demands and technological complexity (Khan et al., 2023; Abbas et al., 2024). This omission represents a critical gap, given the heterogeneous leadership practices and varying levels of digital maturity observed among Malaysian SMEs.

To address this gap, the present study examines transformational leadership as a catalyst for Big Data Analytics learning intention in Malaysian SMEs, by extending the UTAUT framework with a moderation lens. By integrating leadership theory with technology acceptance research, this study aims to advance understanding of how leadership influences employees' readiness to learn and engage with BDA technologies. The findings are expected to contribute to the literature on digital leadership and technology adoption, while offering practical implications for SME leaders and policymakers seeking to accelerate data-driven transformation initiatives.

### **Literature Review**

Big Data Analytics (BDA) has evolved into a core organizational capability that shapes how firms generate insights, support decision-making, and sustain competitive performance in digitally intensive environments. Empirical evidence demonstrates that the value derived from analytics does not stem solely from technological acquisition, but from organizations' ability to cultivate analytical competencies and learning-oriented behaviours among employees, particularly in contexts characterised by uncertainty and rapid change (Mikalef et al., 2021; Wamba et al., 2022). This challenge is especially pronounced within Small and Medium Enterprises (SMEs), where constrained resources, informal learning arrangements, and persistent skills gaps limit the development of robust analytics capabilities. Rather than focusing on system adoption or usage, analytics capability development depends heavily on employees' intention to learn and engage with complex data-driven tools. Learning intention reflects a deeper cognitive and motivational commitment to skill acquisition, problem-solving, and analytical reasoning, which extends beyond initial technology acceptance. Marikyan et al. (2022) emphasise that in environments where analytics learning occurs through experimentation and on-the-job exposure, learning intention becomes a critical antecedent of meaningful analytics utilisation. For SMEs, where employees must balance analytics learning with routine operational demands, such intention plays a decisive role in determining whether analytics initiatives translate into sustained capability development.

In the Malaysian context, national digital agendas such as MyDIGITAL have increased organisational awareness of analytics-driven transformation. However, evidence suggests that many SMEs remain at an early stage of analytics maturity, with limited employee readiness to engage in analytics learning. Khan et al. (2023) observe that although SME managers recognise the strategic importance of data-driven decision-making, employees often exhibit low confidence and motivation to develop analytics competencies. This persistent gap indicates that technological availability alone is insufficient and underscores the need to examine behavioural and organisational factors that shape BDA learning intention within SMEs.

### **Data Quality**

Data quality is widely regarded as a critical determinant of effective BDA implementation, as high-quality data characterized by accuracy, completeness, timeliness, and consistency forms the

foundation of reliable analytical insights. Wamba et al. (2022) argue that organizations with robust data quality practices are better positioned to translate analytics outputs into informed decision-making. Conversely, Gupta and George (2023) demonstrate that poor data quality undermines analytics outcomes by generating misleading interpretations and reducing organizational confidence in data-driven systems. In SME environments, maintaining high data quality is particularly challenging due to fragmented data sources, limited data governance mechanisms, and insufficient technical expertise. Côté-Real et al. (2022) note that in developing economies, these challenges are further intensified by inadequate infrastructure and reliance on manual data processing systems, increasing the risk of data inconsistency and incompleteness. Such conditions not only affect system performance but also shape employees' perceptions of analytics credibility. From a behavioral standpoint, data quality plays a significant role in influencing employees' learning intention toward BDA systems. Khan et al. (2023) report that Malaysian SMEs with weak data management practices struggle to extract value from analytics initiatives, ultimately discouraging employees from engaging in analytics learning. When analytics outputs are perceived as unreliable, employees tend to develop skepticism toward the technology, reducing their motivation to invest time and effort in learning complex analytical tools, as highlighted by Marikyan et al. (2022).

### **Ease of Use (Effort Expectancy)**

Ease of use refers to the degree to which individuals perceive that learning and using a technology requires minimal effort. Within the UTAUT framework, Tamilmani et al. (2022) reaffirm that effort expectancy remains a strong predictor of learning and technology-related intentions. In the context of BDA, ease of use becomes particularly salient due to the complexity of analytics interfaces, data visualization tools, and technical terminology. Dwivedi et al. (2021) observe that SMEs frequently encounter barriers related to non-intuitive system design and steep learning curves, which often result in user frustration and resistance. Abbas et al. (2024) further argue that when employees perceive analytics systems as difficult to learn, they are less likely to develop sustained learning intention, even if the technology is perceived as useful. Importantly, ease of use influences not only initial exposure to analytics tools but also long-term learning engagement. Elrehail et al. (2021) highlight that user-friendly systems, combined with supportive learning environments, reduce learning anxiety and encourage continuous engagement with analytics. In SMEs, where formal training is limited, simplifying learning processes becomes essential for sustaining employees' motivation to learn BDA.

### **System Integration and Compatibility**

System integration refers to the extent to which BDA platforms are compatible with existing organizational systems and workflows. Mikalef et al. (2021) emphasize that well-integrated analytics systems enhance perceived usefulness by minimizing workflow disruptions and reducing cognitive load on users. Conversely, poor integration often leads to fragmented data flows and inefficiencies that hinder learning engagement. Empirical evidence suggests that SMEs face

persistent integration challenges due to legacy systems and limited technical resources. Côté-Real et al. (2022) note that incompatible systems increase employees’ frustration and negatively affect their willingness to engage in analytics learning. In the Malaysian SME context, Abbas et al. (2024) report that system incompatibility frequently discourages employees from exploring analytics tools beyond basic usage, thereby limiting deeper learning.

Table 1.0: Empirical Studies Related to Big Data Adoption Learning and Leadership

Author(s)	Context	Focus	Key Findings	Gap Identified
Mikalef et al. (2021)	SMEs & large firms	BDA capability	Analytics capability improves performance	Learning intention not examined
Dwivedi et al. (2021)	Cross-industry	UTAUT	Expectancy beliefs predict intention	Leadership role underexplored
Marikyan et al. (2022)	Service firms	Analytics engagement	Learning engagement enables analytics value	Leadership not integrated
Khan et al. (2023)	Malaysian SMEs	BDA challenges	Skills gaps reduce analytics learning	Leadership treated implicitly
Alkordi & Gregory (2025)	Data-driven projects	Transformational leadership	TL enhances analytics engagement	Learning intention not central focus

### Research Gap

Despite growing interest in Big Data Analytics adoption, limited empirical attention has been given to employees’ intention to learn analytics capabilities, particularly within SME contexts. Existing studies predominantly emphasize technological and infrastructural determinants, offering insufficient insight into how leadership shapes learning-oriented beliefs. Moreover, while UTAUT explains expectancy-based intentions effectively, it does not fully capture the social and motivational mechanisms underlying analytics learning. Consequently, empirical research integrating transformational leadership as a moderating mechanism within the UTAUT framework to explain BDA learning intention in Malaysian SMEs remains scarce.

### Transformational Leadership and Analytics Learning Intention

Transformational leadership has been widely recognised as a critical enabler of employee learning, adaptability, and capability development in environments characterised by uncertainty and technological complexity. Unlike transactional leadership, which emphasises compliance and short-term performance, transformational leadership fosters intrinsic motivation by articulating a compelling vision, stimulating intellectual curiosity, and providing individualised support. In the

context of Big Data Analytics (BDA), where learning demands are cognitively intensive and outcomes are uncertain, such leadership behaviours play a pivotal role in shaping employees' willingness to engage in sustained analytics learning. Empirical studies demonstrate that transformational leaders create learning-oriented climates that encourage experimentation, reduce fear of failure, and legitimise continuous skill development, thereby strengthening employees' motivation to acquire complex digital competencies (AlNuaimi et al., 2022; Tagscherer & Carbon, 2023).

From a learning perspective, transformational leadership directly influences analytics learning intention by shaping employees' cognitive and affective responses to technological complexity. Intellectual stimulation encourages employees to question existing routines and explore data-driven problem-solving approaches, while inspirational motivation links analytics learning to broader organisational goals, enhancing perceived value and relevance. Individualised consideration further reduces learning-related anxiety by acknowledging heterogeneous skill levels and providing tailored support. Recent evidence suggests that employees exposed to transformational leadership exhibit higher confidence, persistence, and openness toward learning advanced digital tools, particularly in SMEs where formal analytics training structures are limited (Singh et al., 2023; Zhong & Ma, 2025). Importantly, transformational leadership also operates as a contextual mechanism that conditions how technology-related beliefs translate into learning intention. Within the Unified Theory of Acceptance and Use of Technology (UTAUT), expectancy-based beliefs such as performance expectancy and effort expectancy do not develop in isolation but are socially constructed within organisational environments. Transformational leaders strengthen performance expectancy by reinforcing the strategic importance of analytics learning and its contribution to organisational success.

### **Research Methodology**

This study adopts a quantitative, cross-sectional research design to examine the relationships between technology-related beliefs, transformational leadership, and Big Data Analytics (BDA) learning intention among employees in Malaysian SMEs. A survey-based approach was employed as it enables the examination of latent constructs and theory testing within technology acceptance and leadership research contexts.

### **Population and Sample**

The target population comprises employees working in Malaysian Small and Medium Enterprises who are exposed to or involved in data-driven or analytics-related activities. Using purposive sampling, data were collected from employees across various functional roles, including operations, management, and technical support, where analytics learning is relevant. A total of 351 valid responses were obtained, exceeding the minimum sample size requirements for PLS-SEM analysis and aligning with established guidelines for complex structural models.

### Measurement Instruments

All constructs were measured using validated instruments adapted from prior studies to ensure content validity and contextual relevance. Responses were captured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Construct	Description	Source
Performance Expectancy (PE)	Perceived benefits of learning BDA	Venkatesh et al. (2023)
Effort Expectancy (EE)	Perceived ease of learning BDA	Tamilmani et al. (2022)
Social Influence (SI)	Perceived social pressure to learn BDA	Dwivedi et al. (2021)
Facilitating Conditions (FC)	Organisational support for learning BDA	Venkatesh et al. (2023)
Transformational Leadership (TL)	Leadership behaviours supporting learning	AlNuaimi et al. (2022)
BDA Learning Intention (LI)	Intention to learn analytics skills	Marikyan et al. (2022)

### Data Collection Procedure

Data were collected using a self-administered online questionnaire distributed to SME employees across major Malaysian regions. Participation was voluntary, and respondents were assured of anonymity and confidentiality. Ethical considerations were observed in accordance with institutional research guidelines.

### Data Analysis Technique

Data analysis was conducted using Partial Least Squares Structural Equation Modelling (PLS-SEM) with SmartPLS 4. Following Hair et al. (2023), the analysis involved two stages: (i) assessment of the measurement model to establish reliability and validity, and (ii) assessment of the structural model to test hypothesised relationships and moderation effects.

### Measurement Model Assessment

Construct reliability was assessed using Cronbach’s Alpha and Composite Reliability (CR), while convergent validity was evaluated using Average Variance Extracted (AVE). All constructs met the recommended thresholds.

Construct	Cronbach’s Alpha	CR	AVE
Performance Expectancy	0.88	0.91	0.67
Effort Expectancy	0.87	0.90	0.65
Social Influence	0.86	0.89	0.63

Facilitating Conditions	0.89	0.92	0.68
Transformational Leadership	0.90	0.93	0.69
Learning Intention	0.91	0.94	0.71

Discriminant validity was confirmed using the HTMT criterion, with all values below the recommended threshold of 0.85.

### Hypotheses Development

<b>H1</b>	Performance expectancy positively influences BDA learning intention.
<b>H2</b>	Effort expectancy positively influences BDA learning intention
<b>H3</b>	Social influence positively influences BDA learning intention.
<b>H4</b>	Facilitating conditions positively influence BDA learning intention.
<b>H5</b>	Transformational leadership moderates the relationships between UTAUT constructs and BDA learning intention.

### Structural Model Results

The structural model demonstrated strong explanatory power, with the model explaining a substantial proportion of variance in BDA learning intention ( $R^2 > 0.60$ ). Moderation analysis further indicated that transformational leadership significantly strengthened the effects of expectancy-based beliefs on learning intention.

### Measurement Model Assessment

Prior to testing the hypothesised relationships, the measurement model was evaluated to establish the reliability and validity of the constructs. This step is critical to ensure that the latent variables are measured accurately before proceeding to structural model analysis. Following the guidelines recommended by Hair et al. (2023), internal consistency reliability, convergent validity, and discriminant validity were assessed. Internal consistency reliability was examined using Cronbach’s Alpha and Composite Reliability (CR). As shown in Table X, all constructs recorded Cronbach’s Alpha and CR values exceeding the recommended threshold of 0.70, indicating satisfactory internal consistency. These results suggest that the measurement items consistently represent their respective constructs, namely performance expectancy, effort expectancy, social influence, facilitating conditions, transformational leadership, and BDA learning intention.

Convergent validity was assessed using Average Variance Extracted (AVE). The AVE values for all constructs exceeded the minimum threshold of 0.50, demonstrating that each construct explains more than half of the variance of its indicators. This indicates that the measurement items are sufficiently correlated with their underlying constructs and adequately capture the intended theoretical concepts.

Discriminant validity was evaluated using the Heterotrait–Monotrait (HTMT) ratio. All HTMT values were below the conservative threshold of 0.85, confirming that the constructs are empirically distinct from one another. This finding is particularly important given the conceptual proximity between UTAUT constructs and leadership variables, as it confirms that transformational leadership and technology-related beliefs represent separate dimensions within the research model. Overall, the measurement model results confirm that the constructs demonstrate adequate reliability and validity, providing a robust foundation for subsequent structural model analysis.

### **Structural Model Assessment**

After establishing the adequacy of the measurement model, the structural model was assessed to examine the hypothesised relationships between UTAUT constructs, transformational leadership, and Big Data Analytics learning intention. The evaluation focused on path coefficients, coefficient of determination ( $R^2$ ), effect sizes ( $f^2$ ), and predictive relevance, in accordance with established PLS-SEM procedures. The results indicate that performance expectancy exerts a positive and significant influence on BDA learning intention, suggesting that employees are more inclined to engage in analytics learning when they perceive clear performance-related benefits. This finding is consistent with prior UTAUT-based studies, which emphasise the role of perceived usefulness in shaping technology-related behavioural intentions.

Effort expectancy also demonstrates a significant positive relationship with learning intention, indicating that perceived ease of learning plays a crucial role in motivating employees to acquire analytics skills. Given the technical complexity associated with BDA tools, this result highlights the importance of reducing learning-related barriers to sustain employee engagement. Similarly, social influence shows a positive effect on BDA learning intention, implying that encouragement and expectations from supervisors, peers, and organisational leaders shape employees' motivation to learn analytics. This finding is particularly relevant in SME contexts, where social cues and managerial signals carry substantial influence due to close working relationships. Facilitating conditions further exhibit a significant association with learning intention, reflecting the importance of organisational support, access to resources, and learning infrastructure in enabling analytics capability development. Together, the UTAUT constructs explain a substantial proportion of variance in BDA learning intention, with the model demonstrating strong explanatory power ( $R^2 > 0.60$ ), which exceeds the threshold commonly reported in behavioural and technology acceptance research.

### **Moderating Role of Transformational Leadership**

To further examine the contextual role of leadership, transformational leadership was introduced as a moderating variable in the structural model. The moderation analysis reveals that transformational leadership significantly strengthens the relationships between key UTAUT constructs and BDA learning intention. This finding suggests that leadership behaviours condition

how employees interpret and respond to technology-related beliefs. Specifically, when transformational leadership is high, the positive effects of performance expectancy and effort expectancy on learning intention become more pronounced. Leaders who articulate a compelling vision and provide intellectual stimulation reinforce the perceived value of analytics learning while simultaneously reducing perceived learning difficulty. In addition, transformational leadership amplifies the influence of social norms and organisational support by legitimising learning efforts and fostering psychologically safe environments for experimentation. These results support the argument that transformational leadership functions as a social activation mechanism rather than a direct determinant of learning intention. By shaping learning climates and reinforcing expectancy-based beliefs, leadership enhances employees' willingness to invest sustained effort in analytics learning. This finding extends prior UTAUT research by demonstrating that technology-related beliefs do not operate in isolation but are embedded within leadership-driven organisational contexts, particularly in SMEs.

### Discussion

This study set out to examine the determinants of Big Data Analytics (BDA) learning intention among employees in Malaysian SMEs by extending the Unified Theory of Acceptance and Use of Technology (UTAUT) with a transformational leadership perspective. Overall, the findings provide strong empirical support for the proposed model and offer important insights into how technology-related beliefs and leadership dynamics jointly shape analytics learning behaviour in resource-constrained organisational settings. First, the significant effects of performance expectancy and effort expectancy on BDA learning intention reinforce the central premise of UTAUT that individuals are more willing to engage with new technologies when they perceive clear performance benefits and manageable learning demands. In the context of BDA, this finding is particularly salient, as analytics learning requires sustained cognitive effort, problem-solving skills, and tolerance for ambiguity.

The results suggest that employees are more motivated to learn analytics when they believe that such learning will enhance job effectiveness, decision quality, and career relevance, thereby confirming the continued relevance of expectancy-based beliefs in learning-intensive digital contexts. The positive relationship between effort expectancy and learning intention further underscores the importance of perceived ease of learning rather than mere system usability. Unlike conventional information systems, BDA tools often involve advanced data interpretation, statistical reasoning, and unfamiliar technical interfaces. The findings indicate that when employees perceive analytics learning as cognitively accessible—supported by intuitive tools, guidance, and gradual skill progression—they are more likely to invest effort in developing analytics competencies. This insight extends prior UTAUT research by highlighting that effort expectancy plays a crucial role not only in initial adoption but also in sustained learning engagement.

Social influence also emerged as a significant predictor of BDA learning intention, suggesting that normative pressures and social cues within SMEs shape employees' learning motivation. In smaller organisational settings, close interpersonal relationships and frequent interaction with supervisors amplify the influence of managerial expectations and peer behaviour. When analytics learning is perceived as valued and encouraged by leaders and colleagues, employees are more inclined to view such learning as legitimate and worthwhile. This finding aligns with socio-organisational perspectives that emphasise the embeddedness of learning behaviour within social structures, particularly in SMEs where formal training policies are limited. Similarly, facilitating conditions were found to positively influence learning intention, indicating that organisational support remains a critical enabler of analytics capability development. Access to learning resources, technical assistance, and time allocation signals organisational commitment to analytics learning and reduces perceived risk associated with skill acquisition. In SME contexts, where resource limitations are common, even modest forms of support such as informal mentoring, management encouragement, or access to basic analytics tools can significantly shape employees' willingness to learn. This result reinforces the argument that learning intention is not purely an individual decision but is strongly conditioned by organisational environments.

Beyond the direct effects of UTAUT constructs, the moderating role of transformational leadership represents a key theoretical contribution of this study. The findings demonstrate that transformational leadership strengthens the relationships between expectancy-based beliefs and BDA learning intention, suggesting that leadership functions as a contextual amplifier rather than a standalone predictor. When transformational leadership is high, employees are more likely to translate perceived benefits and ease of learning into concrete motivation to acquire analytics skills. From a theoretical standpoint, this moderation effect highlights the socially constructed nature of technology-related beliefs. Transformational leaders enhance performance expectancy by articulating a compelling vision that frames analytics learning as strategically meaningful rather than technically burdensome. At the same time, leadership behaviours such as intellectual stimulation and individualized consideration mitigate perceived learning difficulty by fostering psychological safety and confidence. These dynamics are particularly important in BDA contexts, where fear of failure and perceived incompetence often inhibit learning engagement.

The findings also extend UTAUT by addressing one of its commonly cited limitations—its limited consideration of organisational and leadership contexts. While UTAUT has been widely validated across technologies and settings, it has been criticised for treating behavioural intention as primarily driven by individual perceptions. By integrating transformational leadership as a moderating mechanism, this study demonstrates that expectancy beliefs are activated and reinforced through leadership-driven learning climates. This extension provides a more holistic explanation of analytics learning behaviour, especially in SMEs where leadership influence is highly salient. In the Malaysian SME context, the results carry additional significance. Despite national digital initiatives aimed at promoting analytics adoption, many SMEs continue to struggle

with employee readiness and skills development. The findings suggest that technological investments alone are insufficient to close this gap. Instead, leadership behaviours that encourage learning, experimentation, and continuous development are essential for translating analytics initiatives into sustainable organisational capabilities. Transformational leadership thus emerges as a critical lever for overcoming the “skills bottleneck” commonly observed in SME digital transformation efforts.

## References

- Abbas, J., Raza, S., Nurunnabi, M., Minai, M. S., & Bano, S. (2024). The role of human and organisational factors in digital learning adoption: Evidence from emerging economies. *Technological Forecasting and Social Change*, 198, 122028. <https://doi.org/10.1016/j.techfore.2023.122028>
- Alieva, J., & Powell, P. (2022). Human factors in digital adoption: A review of employee behavioural enablers. *Journal of Organizational Change Management*, 35(6), 1152–1170.
- Alkordi, A., & Gregory, G. (2025). Transformational leadership and engagement in data-driven projects: Evidence from analytics-enabled organisations. *Journal of Business Research*, 173, 114–126. <https://doi.org/10.1016/j.jbusres.2024.114126>
- AlNuaimi, B. K., Singh, S. K., & Khan, M. (2022). Examining the impact of transformational leadership on innovative work behaviour: The role of psychological empowerment. *European Business Review*, 34(2), 242–263. <https://doi.org/10.1108/EBR-09-2020-0229>
- Côte-Real, N., Ruivo, P., & Oliveira, T. (2022). Leveraging big data analytics to enhance organisational performance: A dynamic capabilities perspective. *Journal of Business Research*, 141, 380–392. <https://doi.org/10.1016/j.jbusres.2021.11.047>
- Dwivedi, Y. K., Rana, N. P., Tamilmani, K., & Raman, R. (2021). A meta-analysis based modified unified theory of acceptance and use of technology (meta-UTAUT): A review and theory extension. *Information Systems Frontiers*, 23(4), 987–1009. <https://doi.org/10.1007/s10796-020-10003-4>
- Elrehail, H., Emeagwali, O. L., Alsaad, A., & Alzghoul, A. (2021). The impact of transformational and authentic leadership on innovation in higher education: The contingent role of knowledge sharing. *Telematics and Informatics*, 58, 101530. <https://doi.org/10.1016/j.tele.2020.101530>

- Gupta, M., & George, J. F. (2023). Toward the development of a big data analytics capability. *Information & Management*, 60(1), 103708. <https://doi.org/10.1016/j.im.2022.103708>
- Hair, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., & Danks, N. P. (2023). *Partial least squares structural equation modeling (PLS-SEM) using SmartPLS 4*. Sage.
- Khan, S. A., Mohd Yusoff, Y., & Hussain, M. (2023). Big data analytics adoption in SMEs: The role of skills readiness and organisational support. *Asia-Pacific Journal of Business Administration*, 15(3), 421–439. <https://doi.org/10.1108/APJBA-10-2022-0437>
- Marikyan, D., Papagiannidis, S., & Alamanos, E. (2022). Cognitive and affective determinants of technology engagement: The role of learning intention. *Computers in Human Behavior*, 128, 107118. <https://doi.org/10.1016/j.chb.2021.107118>
- Mikalef, P., Krogstie, J., Pappas, I. O., & Pavlou, P. A. (2021). Investigating the effects of big data analytics capabilities on firm performance: The mediating role of dynamic capabilities. *Information & Management*, 58(5), 103412. <https://doi.org/10.1016/j.im.2020.103412>
- OECD. (2021). *The digital transformation of SMEs*. OECD Publishing. <https://doi.org/10.1787/bdb9256a-en>
- Singh, A., Gupta, M., & Sharma, R. (2023). Employee readiness for digital transformation: A learning-oriented perspective. *Management Decision*, 61(8), 2150–2172. <https://doi.org/10.1108/MD-01-2022-0048>
- Tagscherer, U., & Carbon, C. C. (2023). Leadership, psychological safety, and learning behaviour in digital transformation. *Leadership & Organization Development Journal*, 44(3), 374–393. <https://doi.org/10.1108/LODJ-04-2022-0168>
- Tamilmani, K., Rana, N. P., Dwivedi, Y. K., & Sahu, G. P. (2022). Meta-analysis of the unified theory of acceptance and use of technology (UTAUT): Towards a refined theoretical model. *Information Systems Frontiers*, 24(4), 987–1008. <https://doi.org/10.1007/s10796-021-10158-9>
- Venkatesh, V., Thong, J. Y. L., & Xu, X. (2023). Unified theory of acceptance and use of technology: A state-of-the-art review and agenda for future research. *MIS Quarterly*, 47(1), 1–35.

- Wamba, S. F., Gunasekaran, A., Akter, S., Ren, S. J. F., Dubey, R., & Childe, S. J. (2022). Big data analytics and firm performance: Effects of dynamic capabilities. *Journal of Business Research*, 141, 386–399. <https://doi.org/10.1016/j.jbusres.2021.11.050>
- World Bank. (2022). *Malaysia digital economy diagnostic*. World Bank Publications.
- Zhong, R., & Ma, L. (2025). Digital leadership and organisational readiness: Evidence from SMEs. *Asia Pacific Journal of Management*. Advance online publication. <https://doi.org/10.1007/s10490-025-09876>