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Reem Khamis Hamdan *Editor*

Integrating Big Data and IoT for Enhanced Decision-Making Systems in Business

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Editor

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Preface

The second volume of *Integrating Big Data and IoT for Enhanced Decision-Making Systems in Business* presents a curated selection of 53 chapters that reflect current research and practices in digital transformation, sustainability, and innovation across various business domains. Divided into two parts, the first part explores the intersection of Big Data and emerging trends in education, marketing, and entrepreneurship, while second part focuses on sustainable and innovative practices in business and financial environments. Together, they highlight how data-driven technologies like IoT and AI are reshaping organizational strategies, enabling more informed decision-making, and driving responsible growth.

We thank all contributors for their valuable insights, which we hope will inspire continued research and development in this critical and rapidly evolving field.

Janabiyah, Bahrain/London, UK — Dr. Reem Khamis Hamdan

The Effect of Research and Development Capabilities Towards the Business Performance of Manufacturing Enterprises

S. Mohamed Absar Haneef and S. Sudha

Abstract *Purpose* "The purpose of this paper is to study the effect of Research & development capabilities towards the performance of manufacturing companies by taking an example from the Regional OEM sector in Chennai and Chengalpattu districts in Tamil Nadu, India." *Design/methodology/approach* "This paper develops a conceptual model contains Research and Development Capabilities and Business Performance. The research applied SEM - Structural Equation Modeling is used to evaluate the model with 400 Manufacturing enterprises in the OEM Sector. *Findings* "The observed results of our analysis showed that Research and Development Capabilities positively impact Business Performance. *Practical implications* "This research underscores the importance of having an R & D innovational environment in manufacturing enterprises to improve its performance. The study provides practical implications for company leaders and policymakers, suggesting that investments in R & D to sustain competitive advantages, foster long-term growth and improved performance. *Originality* "There is a scarcity of research concerning the Manufacturing enterprise development with present advanced technological improvements, this study is believed to be the first that caters to the effect of R & D capabilities on Manufacturing enterprises for improving operational competitiveness in OEMs with a practical approach."

Keywords OEMs · Manufacturing · Research and development capabilities · Business performance

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1 Introduction

The present fast developing business landscape, Original Equipment Manufacturers (OEMs) plays a vital role in running economic growth, improving jobs, and pushing the limitations of innovation in product development and services. OEMs are at the heart of various industries, including automotive, electronics, and machinery, where they not only design and manufacture key products but also drive technological advancements that reshape entire sectors. The competition among OEMs is increasingly influenced by their ability to leverage emerging technologies and manage operational efficiency effectively. Among the critical factors contributing to their success are their capabilities in digital infrastructure and their R & D processes.

Digitalization of business operations has become a game changer for OEMs, enabling them to tap into the vast capability of data, improve decision-making, and enhance operational efficiency. Digital infrastructure refers to an OEM's ability to adopt and implement innovative digital technologies that support not only the automation of manufacturing processes but also the seamless integration of data from various parts of the business ecosystem. This digital backbone helps OEMs stay agile and competitive, granting them to amend quickly to marketplace demands to enhance product offerings.

Simultaneously, R & D capabilities are integral to the long-term growth and sustainable of OEMs. A strong R & D function allows companies to develop innovative products, improve existing designs, and explore new markets. It is through R & D that OEMs can meet customer needs, address new regulatory requirements, and stay ahead of competitors. The combination of digital infrastructure and robust R & D capabilities fosters a conducive environment for innovation, leading to improved business performance outcomes.

Business performance outcomes are influenced by numerous factors, and for OEMs, the interplay between digital infrastructure capabilities, R & D capabilities, and operational strategies has an intense effect on their competitive edge. Modern infrastructure enables OEMs to optimize their processes, increase collaboration, and drive efficiency, while R & D provides the critical innovations needed to differentiate products and services in an increasingly crowded market. These capabilities together create a constructive collaboration that enhances the performance of OEMs, also drives their long-term success in a globalized, technology-driven economy.

The paper intentions to offer practical suggestions for OEM decision-makers to align their strategies with the latest technological advancements and drive competitive advantages. Furthermore, it will examine the challenges and opportunities inherent in digital and R & D investments, offering a thorough evaluation of their effect on OEM business performance in the current global market context.

2 Literature Review

This study explores how R & D expenses influence firm performance, highlighting that increased R & D spending may reduce performance, with variations based on ownership structures. (Arif Khan et al., 2023). The arrival of digital technologies and invention has transformed business operations across industries, presenting extraordinary opportunities for Manufacturing enterprises to improve their competitiveness, operational efficiency, and overall performance. Research (Gao & Sarwar, 2022) shows that the Technology Acceptance and innovation plays a vital relationship between analytics and Supply chain operations. Research (Mustafa & Yaakub, 2018) study has presented evidence on the challenges of innovation, tools/Tech, and its impact on the Business Performance.

2.1 Research and Development Capabilities

The study examines how factors like R & D Capability, brand equity, patents, capital, collectively influence business outcomes, providing a comprehensive analysis of innovation drivers. (He & Estébanez, 2023). An enterprises digital capability can be explained as a skill in utilizing digital technology to accomplish strategic goals and encourage R & D and innovation. Manufacturing companies with strong digital infrastructure are in a better state to adjust to technological improvements, capitalize on emerging opportunities, and distinguish themselves in competitive environment (Cheshbrough & Teece, 2019).

The Study from Gregor found that digital capabilities including cloud computing, real-time data analytics, and agile techniques help businesses be more responsive, flexible, and innovative. This agility is crucial for navigating uncertain environments, mitigating risks, and sustaining long-term growth. Organizations encounter barriers to developing and leveraging digital capabilities effectively. These barriers include legacy IT systems, skills gaps, cultural resistance to change, and cybersecurity concerns (Lacity & Willocks, 2018).

"Studies highlight that digital capability drives Research and Development Capabilities within Manufacturing enterprises by enabling agile decision-making, personalized customer experiences, and the creation of innovative items and services" (Soto-Acosta et al., 2018). The value of digital capability in encourage R & D innovation among Manufacturing enterprises has been highlighted in research steered by the OECD in 2020.

2.2 Business Performance Outcomes

The combined impact of innovation and digital capability on Manufacturing enterprises' performance outcomes is multifaceted. Studies indicate that mature Manufacturing enterprises experience higher profitability, productivity gains, and improved market competitiveness compared to their less digitally innovative enabled counterparts (Avgerou, 2017; Carayannis & Campbell, 2019; Lacity & Willocks, 2018). This research analyzes the effect between R & D and performance within S & P 500 enterprises over multiple economic cycles, offering insights into how innovation drives firm value (Kruglov & Shaw, 2023).

Furthermore, "digital transformation & innovation contributes to improved customer satisfaction, strengthened supplier relationships, and enhanced overall organizational resilience and performance. The realization of these benefits is contingent upon overcoming various challenges, including financial constraints, skills shortages, cybersecurity threats, and resistance to change" (Mansfield-Devine, 2018).

The literatures underscore the transformative capability of R and D Capabilities in shaping the Business Performance of Manufacturing enterprises. By leveraging digital and innovation strategically, Manufacturing enterprises can enhance their operational agility, drive sustainable growth, and contribute to economic resilience.

3 Hypothesis Development

Hypothesis 1 Research and Development Capabilities are Positively related to Business Performance in Original Equipment manufacturing enterprises.

"The technological Research and development innovations and persistent changes in essential, enterprises need both internal and external resources to remain economical and creative" (Gao et al., 2015). The following book discusses that the R & D may drive the competitive advantage and improve performance including manufacturing OEM while giving focus on strategic innovation management and its effect on efficiency in operation and long-term growth (Tidd & Bessant, 2014). The paper analyses the innovation on product and process affects the business operational performance in manufacturing organizations, it also suggests the R & D improves performance by reducing cost, process complexities (Prajogo & Sohal, 2001). This paper presents the case study from manufacturing companies in Australia. The study suggest that companies adopt innovative practices gets significant improvements in the performance of process and production which has direct influence on the Business Performance and profitability (Mansury & Love, 2008).

Thus, with reference from the above-mentioned literatures about Research and Development Capabilities will have impact on Business Performance. Figure 1 Illustrates the conceptual framework of the research.

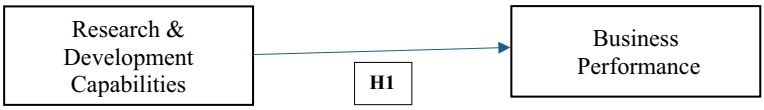

Fig. 1 Author's own conceptual model

4 Methodology Research Design

A conceptual model that includes Research and Development Capabilities, and performance is developed in this article. To validate this model, we utilized Structural Equation Modeling (SEM) with 201 Manufacturing enterprises in the OEM Sector. We used a 2-part survey using a five-point Likert measure to gather data from the contributors. The 5-point Likert scale provides a straightforward way to interpret responses due to its ordinal nature, where each point represents a degree of agreement or disagreement. This simplicity aids in data analysis and comparison across respondents. (Hair et al., 2009). The scale typically includes a neutral midpoint, allowing respondents to indicate a lack of opinion or neutrality on the topic, which can provide more nuanced insights compared to scales without a midpoint (Carifio & Perla, 2007). Responses from a 5-point Likert scale can be analyzed using both parametric and non-parametric statistical methods, depending on the data distribution and research objectives (Norman & Streiner, 2008).

The research used Google Forms to distribute the survey to our target audience online. Our survey of OEM employees in the Chengalpattu area of Tamil Nadu, India, yielded 400 valid replies. Table 1 provides the detailed information on the research methodology parameters used.

The four parts of this survey give more weight to the specifics of each variable (discussed further below). As a data gathering tool, this scale is fine-tuned according to a certain approach. According to Castrillon and Madakovic (2010), it also functions as a scale model that may be adjusted to a range of ordinal measurements. Research and Development Capabilities – "A Seven item, five-point Likert

Table 1 Explains the research methodology parameters

Type of research	Descriptive
Research approach	Quantitative
Sampling and population	Employees from manufacturing OEMs in Chengalpattu district of Tamilnadu state in India
Sample size	400
Study location	Chennai and Chengalpattu region from Tamilnadu, India
Primary data collection	Questionnaire
Data collection period	December 2024 to March 2025
Data collection software	Online forms
Data analysis software	MS Excel2016, SPSS, SPSS AMOS

scale was employed to assess this variable these questions will explain the importance of the R and D capability within their organizations." The Questionnaire was inspired from the research of Bhatti et al. (2022) Business Performance—"A Seven item, five-point Likert scale was employed to assess this variable these questions are related to the importance of the Performance measure within their organizations." The Questionnaire was inspired from the research of Bhatti et al. (2022) The measure elements calculate the level of agreement with the statement (From strongly disagree to strongly agree).

Sample Size Calculation Sample Size (SS) $= Z^2P(1 - P)/M^2$

SS—Sample size of infinite population

Z—Z score

P—Population proportion

M—Margin of Error

SS = 1.962 *0.5 *(1 – 0.5)/0.5^2

(Cochran, 1977).

5 Statistical Analysis and Results

SEM—Structural Equation Modelling based on IBM SPSS AMOS is used to evaluate hypotheses in the article. The SEM path diagram is shown in Fig. 2. Covariance based - SEM is a statistical method for producing SEM estimates (Hair et al., 2009). Confirmatory factor analysis (CFA) in CB-SEM uses statistical models to estimate and verify correlations between dependent and independent variables, establishing the constructs' reliability and validity. Latent variables are used to aid in this assessment process (Akter et al., 2016).

5.1 Factor Reliability and Validity

For Testing Factor Reliability, we used Cronbach Alpha to confirm the reliability.

Cronbach alpha of "0.7" as a satisfactory value of reliability of the model (Taber, 2017).

For Testing Factor Validity, we used KMO and Barlett Test.

The value of KMO should be above 0.6 (Hadia et al., 2016). For Bartletts evaluate the significant value less than 0.05 indicates that these data acceptable for further analysis (Pallant, 2013).

The data from Tables 2 and 3 confirms the Factor Reliability and Validity values are well within the acceptable limit.

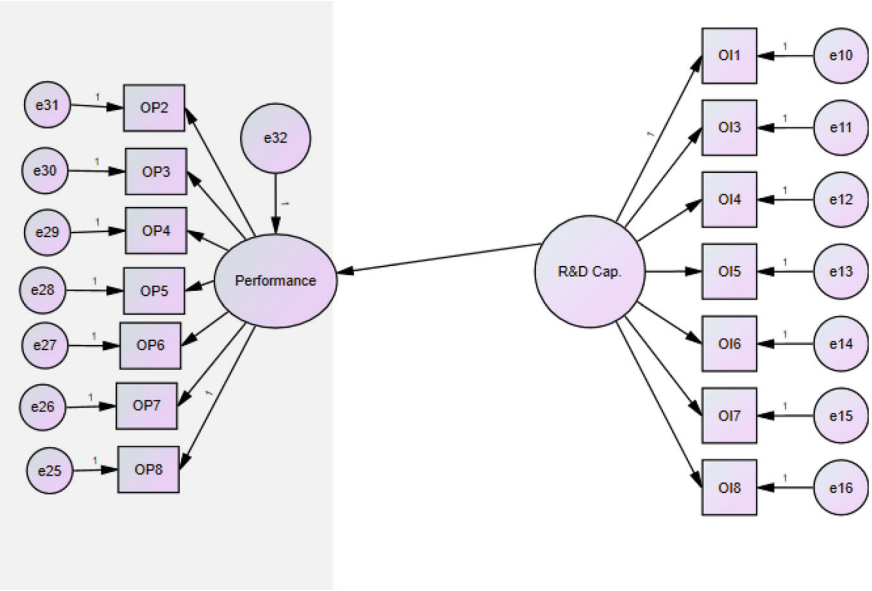

Fig. 2 Path diagram of the model. *Source* Authors primary data model

Table 2 Factor reliability

Dimension	Cronbach alpha value	Items
Research and development capabilities	0.910	7
Business performance	0.911	7
Overall	0.952	14

Table 3 Factor validity

Dimension	KMO	Bartlett test of sphericity
Research and development capabilities	0.928	0.000
Business performance	0.933	0.000
Overall	0.972	0.000

In SEM, **AVE—(Average Variance Extracted)** and CR—**Construct Reliability** are essential for evaluating the **measurement model.** The Result of AVE and CR are given in Table 4

$$AVE = \frac{\Sigma\lambda^2}{n} \quad CR = \frac{\left(\sum\lambda\right)^2}{(\Sigma\lambda)^2 + \sum\delta} \quad \delta = 1 - \lambda^2$$

Formula Source: (Fornell & Larcker, 1981)

Table 4 AVE and CR results

Dimension	Average_Variance_Extracted (AVE)	Construct reliability (CR)
Research and development capabilities	0.651	0.93
Business performance	0.652	0.93

Table 5 Demographic variable assessment

Variables	Options	Frequencies	% Rounded number (%)
Age	20–40 Yrs	Open ended	70
	> 40 Yrs	Question	30
Association with OEM	0–8 Yrs	Open ended	60
	Greater than 8 Yrs	Question	40
Overall experience	0–8 Yrs	Open ended	65
	Greater than 8 Yrs	Question	35
Gender	Male	346	84
	Female	54	16
Education	Undergraduate	255	64
	Postgraduate and higher	145	36

Source Authors primary data

5.2 Demographics Data Analysis

Demographic and Job Profile of the for the Primary Data (Sample Size: 400) available in Table 5.

5.3 Confirmatory Factor Analysis and Regression

Model Fit The metrics employed goodness-of-fit indices like the GFI and CMIN Chi-Square to assess the model's accuracy. AGFI - Adjusted goodness of fit is an economical measure of model, while the CFI comparative fit index reflects model fit in this case (Keramati & Mojir, 2010). The other metrics of fit, including TLI, AGFI, GFI, and CMIN/DF—chi square divide by degree of freedom, were also determined to be 0.98, 0.934, 0.952, and 1.831, respectively. The model's CFI value is 0.983, RMSEA – Root means square error of approx. value is 0.046. Additionally, our model's p-value was found to be 0.01 in the analysis. These readings are all within the acceptable range as shown in Table 6 (Miljko, 2020).

Table 6 Model fit

Acronym	Explication	Accepted fit	Resulting fit
CMIN/DF	Chi-square divided by degree of freedom	< 3: Acceptable < 5: Reasonable	1.831
RMSEA	Root means square error of approximation	< 0.05: Excellent < 0.08: Acceptable	0.046
GFI	Goodness of fit index	> 0.9: Reasonable > 0.95: Excellent	0.952
CFI	Comparative fit index	> 0.9: Acceptable > 0.95: Excellent	0.982
TLI	Tucker Lewis index	> 0.9: Reasonable > 0.95: Excellent	0.98

Source LISREL 8: User's reference guidebook

Result of the model from AMOS:

Number of Distinct Sample Moments: 105

Number of distinct parameters to be estimated: 29

DF (105 − 29): 76

Result:

Chi-square = 139.155

DF = 76 According to Jorgeskog and Surbom (1996), an adequate fit is indicated by a Probability value <= 0.05. Here a *p*-value of 0.014 seems to be acceptable.

Probability level = 0.014.

5.4 Hypothesis Testing

In AMOS, the SEM technique was used to evaluate the straight and implied impacts.

H1: From Table 6 we could see the Hypothesis P-Value is significant as shown in Table 7.

The Research and Development Capabilities have a significant positive effect on the Business Performance The result matches with the other results that we have seen in the Literatures.

Table 7 Hypothesis regression results

	Estimate	Standard error	C.R	P
Business performance ← R&D cap	0.994	0.064	15.651	***

Overall Hypothesis Summary:

Research and Development Capabilities → Business Performance → Significant

6 Discussion

The article investigates the significant position of Research & Development capabilities in influencing business performance in Manufacturing enterprises in the Original Equipment Manufacturing (OEM) sector. It builds on previous research by validating the relationship involving R & D and business outcomes in the context within Chengalpattu district in Tamil Nadu, India, and compares its results with global studies.

The findings confirm that R&D innovation is a key driver for competitive benefit in manufacturing enterprises, particularly for Manufacturing enterprises. Beyond improving business performance, Research and development acts a crucial part in enhancing client satisfaction, employee engagement, and business fulfillment. In the face of rapidly changing technology, this study emphasizes that manufacturers need to invest in R & D to keep pace with advancements in the engineering.

The technologies stay to change, the capability to innovate becomes important for achieving sustainable growth in Manufacturing enterprises. Additionally, the article utilizes SEM with AMOS, a strong method that evaluates complicated relations within latent and observable variables. The use of this model specifies a more complete insight of the dynamics relating R & D capabilities and business performance. The 5-point Likert scale employed for data gathering offers valuable ordinal data, making the understandings achieved from this study actionable for OEMs.

The practical implications of this study suggest that managers in Manufacturing enterprises can leverage the insights on R & D capabilities to identify areas that need investment and effort for performance improvements. By aligning R & D strategies with business goals, managers can drive operational excellence and get a viable edge in the market.

7 Conclusion

This study concludes that R & D capabilities significantly impact the business performance of Manufacturing enterprises OEMs. Through R & D and innovation, Manufacturing enterprises can enhance operational effectiveness, customer satisfaction, and employee engagement, all of which contribute to improved performance and competitiveness. The insights from this research provide managers with actionable strategies to integrate R & D into their business models and innovation strategies to drive growth.

However, the study is limited to the Chengalpattu district in Tamil Nadu, meaning its findings may not be applicable to the entire country of India. Further research is needed in different regions to account for variations in macro and microeconomic conditions. Additionally, potential studies can explore the mediation effects of different dynamic capabilities and investigate the obligation of I4.0 and other modern technology in steering innovation and business performance.

The article also indicates exploring the connection within innovation, sustainability, business performance could provide immersed visions in to in what way the variables interact. A comparative study across different sectors within the manufacturing industry would also be valuable for drawing broader, more generalizable conclusions.

References

Akter, S., Wamba, S. F., Gunasekaran, A., Dubey, R., & Childe, S. J. (2016). How to improve firm performance using big data analytics capability and business strategy alignment. *International Journal of Production Economics, 182*, 113–131.

Arif Khan, M., Bin, M., Wang, C., Bilal, H., Ali Khan, A., Ullah, I., Iqbal, A., Rahman, M. U. (2023). Impact of R & D on firm performance: do ownership structure and product market competition matter? *SAGE Open.*

Avgerou. (2017). Theoretical framing of ICT4D research. In *Information and communication technologies for development, 504.*

Bhatti, S., Ahmed, A., & Ferraris, A. (2022). Big data analytics capabilities and MSME innovation and performance: A double mediation model of digital platform and network capabilities. *Annals of Operation Research.* https://doi.org/10.1007/s10479-022-05002-w

Carayannis, E. G., Campbell, D. F. (2019). Democracy and the environment are endangered species.

Carifio, J., & Perla, R. (2007). Ten common misunderstandings, misconceptions, persistent myths and urban legends about Likert scales and Likert response formats and their antidotes. *Journal of Social Sciences, 3*(3), 106–116.

Castrillon, M. A. G., & Madakovic, T. (2010). El aprendizaje organizacional, prueba piloto de instrumentos tipo Likert. *Forum Empresarial Puerto Rico: Universidad de Puerto Rico, 15*, 65–101

Chen, Y., Wang, Y., Nevo, S., Jin, J., Wang, L., & Chow, W. S. (2014). IT capability and organizational performance: The roles of business process agility and environmental factors. *European Journal of Information Systems, 23*(3), 326–242.

Cheshbrough, H., & Teece, D. J. (2019). Strategic management of open innovation: A dynamic capabilities perspective. *California Management Review, 62*(1), 77–94.

Cochran, W. G. (1977). *Sampling techniques* (3rd ed.). Wiley.

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research.*

Gao, G., Xie, E., & Zhou, K. Z. (2015). How does technological diversity in supplier network drive buyer innovation? Relational process and contingencies. *Journal of Operations Management, 36*, 165–177.

Gao, J., & Sarwar, Z. (2022). How do firms create business value and dynamic capabilities by leveraging big data analytics management capability. *Information Technology Management*. https://doi.org/10.1007/s10799-022-00380-w

Hadia, N. U., Waal, J. P., & Meer, H. J. (2016). The role of big data analytics in technology adoption: Evidence from emerging markets. *Journal of Strategic and International Studies*, 35–50.

Hair Jr, J. F., Anderson, R. E., Tatham, R. L., & Black, W. C. (2009). *Multivariate data analysis* (7 ed.). Pearson Education, Inc.

He, M., & Estébanez, R. P. (2023). Exploring the impact of R & D intensity, human capital, patents, and brand value on business performance in small and medium enterprises (SMEs). *Economic Research-Ekonomska Istraživanja.*

Jorgeskog, K. G., & Surbom, D. (1996). *LISREL 8: User's reference guide.* SSI Scientific Software International.

Keramati, A., & Mojir, N. (2010). A process-oriented perspective on customer relationship management and organizational performance: An empirical investigation. *Industrial Marketing Management, 39*(7), 1170–1185.

Kruglov, P., & Shaw, C. (2023). Financial performance and innovation: Evidence from USA, 1998–2023. In *General economics (econ.GN).*

Lacity, M. C., & Willocks, L. P. (2018). A new approach to automating services. In *MIT Sloan Management Review*.

Mansfield-Devine, S. (2018). DevOps: Finding room for security. *Network Security, 2018*(7), 15–20.

Mansury, M. A., & Love, P. E. (2008). Innovation, productivity, and profitability: A case study of the manufacturing sector in Australia. *Technovation, 28*(9), 624–632.

Miljko. (2020). How to interpret SEM model fit results in AMOS. In *statistischedatenanalyse*

Mustafa, H. K., & Yaakub, S. (2018). Innovation and technology adoption challenges: Impact on SMEs' company performance. *International Journal of Accounting, Finance and Business, 3*(15), 57–65.

Norman, G. R., & Streiner, D. L. (2008). *Biostatistics: The bare essentials* (3rd ed.). Decker Inc.

Pallant, J. (2013). *SPSS survival manual: A step by step guide to data analysis using IBM SPSS.* McGraw-Hill Education.

Prajogo, D. I., & Sohal, A. S. (2001). The relationship between innovation and business performance: A comparison of small and large firms. *Journal of Manufacturing Technology Management, 12*(6), 404–416.

Soto-Acosta, P., Popa, S., & Conesa, I. (2018). Information technology, knowledge management and environmental dynamism as drivers of innovation ambidexterity: A study in SMEs. *Journal of Knowledge Management, 22*(10), 0448.

Taber, K. S. (2017). *Theoretical frameworks in research: A guide for students and researchers.* Routledge.

Powell, T. C., & Dent-Micallef, A. (1997). Information technology as competitive advantage: The role of human, business, and technology resources. *Strategic Management Journal, 18*(5), 375–405.

Tidd, J., & Bessant, J. (2014). *Strategic innovation management*. Wiley.