IT Governance Mechanism Pattern Catalogue For Small Businesses to Support Digital Transformation Journey

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***Abstract*— This study aims to 1) identify the IT governance (ITG) mechanisms that small businesses are likely to need during the digital transformation (DT) journey and 2) propose a pattern catalogue about IT governance mechanisms suitable for small businesses. IT governance is critical to help small businesses plan and control their DT strategy. This study would complement knowledge regarding the antecedents of successful DT among small businesses and could be a further research agenda. The findings of this study would benefit further research endeavors. This study used a systematic literature review and thematic analysis techniques. We have tabulated the review results of the primary articles. Based on the review findings, we propose a pattern catalogue about IT governance mechanisms that are expected to be more suitable for small businesses to manage and control their DT journey.**

Keywords*— *IT Governance, ITG Mechanisms, Digital Transformation, SME, Small Business.

I. INTRODUCTION

The rapid growth of digital technology innovation has brought significant potential for business entities to innovate by utilizing innovative digital tools [1]–[3]. However, adopting digital technology was not a simple thing that brought a challenge for business entities, especially small businesses [4], [5]. Companies need to transform their usual business simultaneously to facilitate appropriate work of digital tools and gain benefits from that digital tools investment [3]. The expectation is that digital transformation (DT) could be a strategic factor for companies to develop their competitive advantage and survivability.

According to the OECD [6] and World Economics Forum [7], more than 50% of small businesses fail within the first five years of their existence. However, successful DT can be a game-changer, helping these businesses not just survive, but thrive [8]. The potential of DT is a powerful tool that can significantly enhance their competitive advantage and bolster their survivability [3], [9]. Therefore, ensuring successful DT among small businesses is essential to escalating their competitiveness and resilience.

DT is more than just purchasing and operating digital tools for daily activities [10]. Small businesses should consider the targeted function of the invested digital tools to improve specific business functions in their organization [11]. In this case, De Haes et al. [12] argue that information technology (IT) governance is a critical aspect that companies must deal with to ensure successful DT in a business unit. IT governance is the organizational capacity to control the formulation and implementation of IT strategy to ensure the alignment of business and IT [12]. In this case, business-IT alignment would guarantee the benefit of IT investment to increase business performance and profitability [13], [14]. However, the established IT governance (ITG) models, such as COBIT, ITIL, and CMMI, are universal models designed for large enterprises that are hardly adopted by small businesses due to their complexity [15]. Small businesses have different characteristics from large enterprises. Small businesses have simple structures and business processes, informal business processes, and limited resources [16], [17]. Therefore, the existing IT governance concept and its mechanisms may need to be revised for the small business context. To address this gap, this study aims to 1) identify the IT governance mechanisms that small businesses are likely to need during the DT journey, and 2) propose a pattern catalogue about IT governance mechanisms that are suitable for small businesses.

IT governance mechanisms address three core elements: structures, processes, and relational mechanisms [12], [14]. *Structural mechanisms* refer to organizational units and roles responsible for making IT decisions and mechanisms enabling contacts between business and IT management decision-making functions [12], [14], [18]. The roles in structural mechanisms are responsible for executing, controlling, and evaluating the implementation of digital strategies and making appropriate decisions to ensure the effectiveness of digital investment to pursue business objectives. *Processes mechanism* refers to the formalization and institutionalization of IT strategy, monitoring procedures and performance for ensuring daily behaviors are consistent with IT policies and provide feedback to decisions [12], [14], [18]. According to the COBIT framework, the processes mechanisms have complex and detailed indicators that address a comprehensive company's IT and business aspects to ensure IT investment improves business value [12]. *Relational mechanisms* refer to the active engagement and collaborative relationships among corporate executives, IT management, and business leadership [12], [14], [18]. Relational mechanisms may include initiatives such as job rotation, formal announcements, advocacy efforts, communication channels, and educational programs that collectively aim to foster sustainable alignment between

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business and IT [12], [14], [18]. The strategic purpose of these relational mechanisms is to ensure that the structures and processes mechanisms for DT are properly established, promoting seamless integration between IT and business functions [14], [18].

In the current study, researchers use a systematic literature review (SLR) approach to propose simpler IT governance mechanisms that are expected to be more appropriate for small businesses. The review focuses on identifying IT governance mechanisms recommended by the primary articles and adapting them following small business uniqueness. We argue that IT governance is critical to help small businesses plan and control their DT strategy. The SLR helps the author make a rational argument for proposing refined IT governance mechanisms for small business contexts. In addition, this study complements the knowledge of DT strategy among small businesses and could be a conceptual foundation and initial discussion for further research endeavors. The conceptual framework of the current study is presented in Fig. 1.

The rest of the paper is organized as follows: Section 2 contains the research method for selecting primary literature. Section 3 presents the findings including the proposed IT governance mechanisms pattern catalogue for small businesses. Section 4 concludes the article.

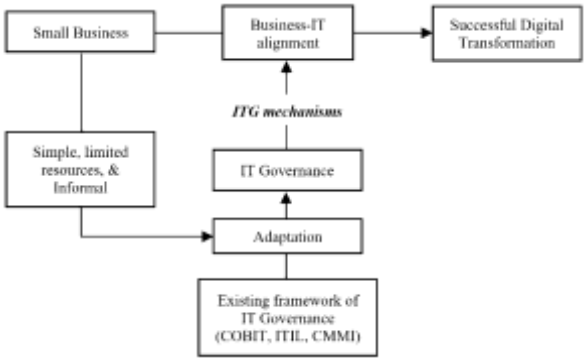


Fig. 1. Conceptual Framework

II. RESEARCH METHOD

This study used a SLR to identify the critical IT governance mechanisms for small businesses from academic literature. We performed SLR to facilitate evidence-based reviews that minimize bias through systematic procedures in identifying the relevant IT governance mechanisms [19], [20]. The primary literature was traced and collected from the Scopus database because it is considered one of the most credible academic repositories and provides a wide range of reputable publishers of academic articles.

A. Article Selection Protocol

This study selected literature using the article selection protocol presented in Fig. 2. The explanation of the article selection protocol is outlined as follows:

1. *Identification*. We identified the targeted literature from the Scopus database with the following keyword combinations "(TITLE-ABS-KEY ("it governance") AND TITLE-ABS-KEY (msme OR sme OR "small business" OR "small-medium enterprises" OR smes OR "small-medium enterprise"))". That search key resulted in 67 articles. Furthermore, we applied limitations to the initial result.
2. *Screening*. In this phase, we limited the publication channel to journal and conference papers. This limitation left 46 collected articles.
3. *Eligibility and Included.* We applied inclusion and exclusion criteria in this phase. This strategy effectively selects suitable primary articles according to the research objective. The inclusion criteria included: 1) The research article that discussed and proposed the critical variables of IT governance in the small business context; and 2) the article that proposed the mechanisms needed for IT governance in the small business context. Furthermore, the exclusion criteria are articles that do not explicitly discuss the critical variables and mechanisms for implementing IT governance in small businesses. The application of inclusion and exclusion criteria resulted in twelve articles included in the review. We reviewed the articles by identifying the research objectives and proposed IT governance mechanisms suitable for small businesses, classifying mechanisms following the criteria of core elements, including structural, process, and relational mechanisms, and constructing the catalogue.

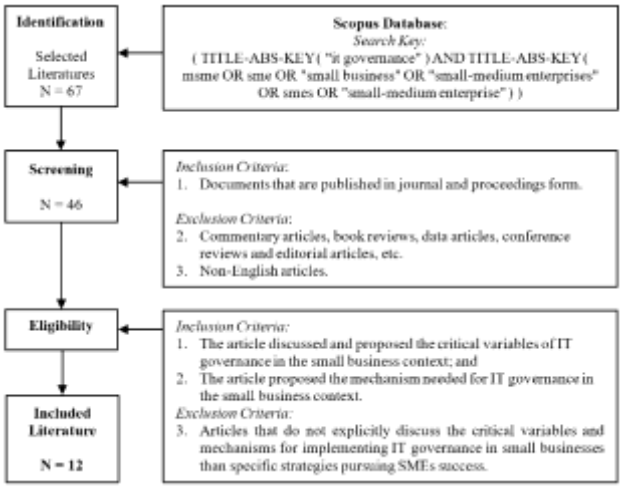


Fig. 2. Article Selection Protocol

B. Analysis Technique

We used a qualitative approach with thematic analysis to identify the critical aspects of small businesses' DT process and IT governance mechanisms critical for small businesses in operating DT strategies [21]. *Firstly*, we tabulated the collected information related to IT governance proposed or indicated by the primary article. *Secondly*, we classified the collected information related IT governance mechanisms with thematic analysis, which is structure, process, and relational. *Thirdly*, we proposed the catalogue of IT governance mechanisms for small businesses and its theoretical justification. To mitigate bias, the researchers defined the article selection protocol as the scope of the search, identified the relevant literature with different keyword combinations, applied pre-formulated inclusion and exclusion criteria, synthesized literature with SLR and thematic analysis, worked iteratively to review each other and discussed the proposed mechanisms and the definition by referring to the primary article.

III. FINDINGS

A. Profile of the Primary Articles

This study selected twelve articles to be reviewed. Four articles are published in a proceedings and eight articles are published in academic journals in different quartiles and publishers. The oldest article is Huang et al. [22], and the most recent article is Levstek et al. [15]. The limited amount of source literature indicates that research investigating IT governance in the small business context is still scarce and needs further exploration. The detailed profile of the primary articles is observable in Appendix 1.

B. IT Governance Mechanisms for Small Business Digital Transformation: A Pattern Catalogue

According to primary articles, the main challenges of small businesses in dealing with DT are a) difficult to measure the value of IT investments due to unclear evidence, b) limited financial and human resources, and c) misinvestment or overinvestment in IT tools. Therefore, we argue that simple, learnable, and more accessible IT governance could be relevant for small businesses to manage and control their DT journey. The proposed IT governance mechanisms are concerned with small businesses' simple structure and business process. The current study justified the proposed mechanisms by referring to the literature review result presented in Appendix 2 and the related academic literature relevant to the topics. The proposed mechanisms are presented in the form of a pattern catalogue. The summary of the IT governance mechanisms catalogue and its contribution to the DT journey is presented in Table 1. Furthermore, the theoretical justification of the proposed mechanisms is outlined below.

1) Structural Mechanisms Patterns

Primary studies argue that the management structure in small businesses tends to be limited without the board of directors (BODs) and IT departments [23], [24]. Small businesses also tend to manage business processes informally [23], [25]. However, even in minor aspects, the digital strategy still needs to be moderated by the top management participation in the IT governance structures [22]. Primary studies found that IT decision authority tends to be centralized in small businesses [22], [26]–[31]. Many small businesses only have a single leader who is also the business owner, so roles and responsibilities are commonly centralized to that key person [31], [32]. However, owner-managers of small businesses may need collaborative partners to make decisions. Owner-managers probably have limited IT knowledge, so they need a partner to consult their IT problem and consider solution alternatives to making decisions. Primary studies indicate this role in various terminology, including IT champion, IT consultant, and IT expert [24], [31], [33]. Primary studies also indicate that small businesses need someone dedicated specially to IT tasks [34]. This could be the owner-manager themselves or the employee that specifically ordered for IT tasks.

Even though small businesses' owner-manager also usually manage their IT transition by themselves, they probably need structures such as inter-functional task forces, IT steering committees, IT audit committees, and IT service providers to ensure adequate appreciation of such investment costs, risks, and results [22], [29]. Furthermore, as the IT investment would be expanded occasionally, the IT steering committee and audit committee should also be considered depending on the IT project characteristics and needs. [27]. The description of the proposed structural mechanisms for small businesses is outlined as follows:

1. *Centralized decision maker*: small business owner-manager responsible for making IT-related decisions, developing DT plans and strategies, controlling the plan's implementation, and evaluating the DT strategy.
2. *Decision contributor*: an individual with appropriate IT knowledge and capabilities who could contribute to delivering various alternatives regarding cost, function, and benefit regarding certain digital tools that are suitable to address specific business problems or innovation goals to owner-managers.
3. *Person in-charge in IT*: Individual dedicated to the IT task who is responsible for ensuring the digital tools are working properly and improving business work. This person could be an owner-manager or employee who is committed to IT-specific tasks.
4. *Inter-functional task force*: The task force consists of multidisciplinary employees, including IT and business persons, who are responsible for creating and implementing digital strategies to improve business value.
5. *IT service consultant/provider*: IT consultant or IT service provider responsible for specific IT-related services ordered by small businesses based on particular agreements.
6. *IT steering committee*: The executive-level committee is responsible for determining business priorities in IT investment to assist the executive management in implementing IT strategy.
7. *IT auditor/audit committee*: The person or committee at the BODs' level which is responsible for controlling the implementation of the IT strategy plan, the performance of IT strategy on business performance, and evaluating the accountability and general compliance of the implementation of the IT strategy.

2) Processes Mechanisms Patterns

The core objective of processes mechanisms is to ensure that DT decisions benefit the company's business and increase revenue [24]. In this case, small businesses commonly have no performance indicator or formal reporting of their management works due to their limited structure and simple business processes [31]. However, small businesses need a measurable strategy that enables them to further evaluation and improvement of the DT project. Levstek et al. [29] and Bergeron et al [35] argue that formal mechanisms and measurable strategies could help small businesses prevent IT investment failure. Kosasi et al. [35] propose redefining those aspects to create more appropriate mechanisms for small businesses. Wilkin [31] argues that small businesses need only planning, implementing, and monitoring IT investments to identify the effectiveness of invested IT in increasing their business value. In this case, we propose semi-formal documentation in processes mechanisms. Semi-formal documentation would be easier but still provide measurable strategy and performance indicators for DT. Moreover, small businesses should implement cost and benefit analysis before executing DT

[24], [34]. Small businesses could also adapt IT-balance scorecard mechanisms into simpler control mechanisms [24], [29]. IT upskilling planning is a must for small businesses to improve their IT knowledge, which is critical for the continuous improvement of companies' digitalization [24], [36].

Small businesses are typically not required to develop information systems from scratch and simply adopt open access or provided IT services. Nonetheless, small businesses may choose to create their own systems for reasons such as uniqueness, data security, and tailored design. Accordingly, we propose leveraging architectural investment management [24], [28], [31], [33]. At the advanced level, small businesses may need more complex systems and data databases to store and transmit confidential information. In that phase, small businesses must prioritize IT risk and information security within their process mechanisms [15], [30], [31], [33], along with project reporting and benefits management to effectively oversee IT investments and their impact on business performance [29], [31]. Furthermore, small businesses also need an architectural exception process to prevent overinvestment and waste investment during the DT agenda [15], [22], [27], [28]. The description of the proposed structured mechanisms for small businesses is outlined as follows:

1. *DT strategic plan with semi-formal documentation*. Semi-formal documentation regarding the DT strategy that the company wants to execute contains the digital tools specification and function, plan to use the digital tools, targeted improvement in business work, and targeted performance through the invested digital tools, which are helpful to identify and evaluate the performance of specific DT initiatives.
2. *Cost and benefit analysis and time frame*. Quantitative analysis based on the monetary aspect indicates the cost and benefits of related digital investments and the expected time for the benefit to be achieved.
3. *Simple control mechanisms (adapted IT balanced scorecard)*. Strategy to control the DT strategic plan implementation and digital investments' accountability to ensure the DT delivers business value and improves business performance. The control strategy could be informal and casual, referring to the initial plan and achievements of the targeted benefits of the digital investments. Small businesses could adapt IT balanced scorecard mechanisms to the simple way following the small business needs.
4. *IT upskilling planning*. Continuous learning to improve IT skills that small businesses need to succeed in their DT agenda. Both owner-managers and employees should perform the upskilling.
5. *Architectural investment management*. Advanced management that is implemented by small business owner-managers to manage the architectural investment of the information systems developed or customed by themselves or through collaboration with IT experts.
6. *IT risk and information security*. Advanced management to ensure the security of the company's information in the storage and during data transmission and the security of the adopted system from external threats like viruses, malware, and hackers.
7. *Project reporting and benefits management*. Advanced management to control the implementation of digitalization projects to ensure business-IT alignment through formal reporting and evaluation of the benefits of invested digital technologies.
8. *Architectural exception process.* The selection processes of the targeting digital tools to be invested in the small business that consider the priority of each application and eliminates the unnecessary tools to prevent waste investment and optimize the efficiency of the DT project.

3) Relational Mechanisms Patterns

DT in small business may involve multiple stakeholders who assist owner-managers in addressing their digital challenges. Owner-managers may need collaborative partners who have digital literacy to aid in making IT-related decisions, as well as a designated individual responsible for managing IT operations. In this case, Huang et al. [22] argue that owner-managers, employees, and IT stakeholders should behave appropriately with each other to have mutual respect and create a healthy working environment. Furthermore, small business leaders should communicate new policies, guidelines, and practices related to IT appropriately to their employees as the DT would bring new tasks and working experience simultaneously [22], [24], [29], [36]. The owner-manager should also ensure clear communication and agreement among IT stakeholders and collaborative partners to provide mutual benefits and build trust [28], [29], [31], [33]. Furthermore, as digital tools include communication technology to facilitate interaction between parties, various communication channels are needed for effective, efficient, and flexible communication [24], [27]. The communication channels could be email, intranet, paper documents, formal meetings, word of mouth, social media chat, and virtual meetings. Primary articles also highlight the importance of transferring knowledge, IT and business skills improvement, IT awareness, and productive collaborative work between parties to fulfill the knowledge gap related to IT tools and related tasks [15], [31]. Small business leaders were also recommended to develop facilitated mutual understanding and consensus about the task in implementing DT strategy, identify process problems to be solved, and facilitate internal collaboration [29], [31].

At the advanced level, small businesses need knowledge-intensive management for intense knowledge creation to innovate business processes, digital services, and products [15], [29]. The collaborative networks with external parties also needed to escalate the DT strategy and generating a shared competitive advantage [37]. Devos et al. [28] argue that output-based contracts and structured controls in IT governance in small businesses are probably less important than building trust among parties. The intense interaction between stakeholders with mutual benefit agreement should be considered and facilitate trust between parties. The description of the proposed relational mechanisms for small businesses is outlined as follows:

1. *Behave appropriately*: the owner-manager practices appropriate behavior and communication with involved parties in the DT agenda and encourages employees and IT stakeholders to behave appropriately as well.

2. *Communicate new policies and guidelines related to IT*: The owner-manager communicates their vision regarding the companies' DT plan and informs them of the new policies and guidelines related to the DT agenda.
3. *Communicate IT-related tasks*: The owner-manager communicates the new task and job description related to DT works and the person in charge of the related functions.
4. *Communicate agreement to collaborative parties (trust building)*: The owner-manager communicates agreement with IT stakeholders to fulfill mutual benefits among parties related to specific tasks and responsibilities and builds trust during DT project.
5. *Utilize various communication channels*: Exploit multiple communication channels to enable flexible communication between parties to create more manageable and convenient working relationships.
6. *Facilitate shared understanding and consensus*: The owner-manager facilitates communication between DT stakeholders and employees to create shared understanding and consensus regarding implementing the digital strategy aimed at a harmonious working environment and minimizing interference during digital shifting.
7. *Facilitate knowledge transfer*: The owner-manager facilitates communication between DT stakeholders and employees to create new knowledge as a solution for digital shifting problems or improve the existing works of DT processes.
8. *Knowledge-intensive management*: Formal management of knowledge that facilitates knowledge transfer among knowledgeable employees to create new knowledge to escalate digital innovation in the small business aimed to deliver more business value, innovative digital services, and innovative products.
9. *Expand collaborative networks with external partners*: Owner-managers initiate a group of work with relevant external partners to escalate DT innovation in companies through collaborative work aimed at achieving shared advantages.

TABLE I. CONTRIBUTION OF ITG MECHANISMS TO SMALL BUSINESS DIGITAL TRANFORMATION JOURNEY

No.	Mechanisms	Contribution to DT Journey	Sources
A	***Structural Mechanisms***		
1	Centralized decision maker (owner-manager)	Efficient decision-making process related to DT strategy	A2, A3, A4, A5, A8, A10, A11, A12
2	Decision contributor (IT champion, IT expert)	Prevent misinvestment and ineffective DT strategy	A1, A3, A4, A8, A9, A11
3	Person in-charge in IT	Ensure technical implementation of DT project	A8, A11
4	Inter-functional task force (IT and business person)	Ensure IT and business alignment of DT project	A3, A6, A8, A11, A12
5	IT service consultant/provider	Ensure IT service availability	A6, A12
6	IT steering committee	Ensure the benefit of DT strategy on business value	A3, A4, A5, A7, A8, A11
7	IT auditor/audit committee	Control and evaluation of DT strategy and technical implementation	A8, A9
B.	***Processes Mechanisms***		
1	DT Strategic Plan (Semi-formal documentation)	Clear strategy and target of the DT project	A7, A8, A12
2	Cost and benefit analysis and time frame	Measurable investment of DT project	A7, A8, A11, A12
3	Simple control mechanisms (adapted IT balanced scorecard)	Ensure the benefit achievement of DT project	A7, A8
4	IT upskilling planning	Improvement of IT capability	A6, A7
5	Architectural investment management	Ensure compatibility of IT architecture in the DT project	A1, A2, A7, A10, A12,
6	IT risk and information security	Secure confidential information during migration	A1, A9, A10, A12
7	Project reporting and benefits management	Measurable benefits of the DT project	A9, A12
8	Architectural exception process	Prevent misinvestment/ overinvestment in the DT project	A2, A3, A5, A9
C.	***Relational Mechanisms***		
1	Behave appropriately	Engagement among the DT project stakeholders	A2, A3
2	Communicate new policies and guidelines related IT	Ensure DT project implementation	A3, A4, A5, A7, A10
3	Communicate IT-related tasks	Minimize interference during digital migration	A1, A10, A12
4	Communicate agreement to collaborative parties (trust building)	Build trust between DT stakeholders	A1, A2, A8, A12
5	Utilize various communication channels	Efficient and effective communication during the DT project	A3, A4, A5, A7
6	Facilitate shared understanding and consensus	Synergy among DT project stakeholders and employees	A8, A12
7	Facilitate knowledge transfer	Ensure new task mastering among employees	A12
8	Knowledge-intensive management	Stimulate sustainable digital innovation	A8, A9
9	Expand collaborative networks with external partners	Fulfill resources gap and reach shared advantages	A8, A12

IV. CONCLUSION

This study found that IT governance mechanisms are critical for the successful DT of business entities [18]. Many business entities with poor IT governance finally failed in their transformation journey. These issues have become more critical for small businesses as many have yet to formalize business model strategies and are resistant to complex mechanisms and standards. Nevertheless, small businesses still need IT governance to ensure their DT effectively improves business value and competitive advantage. This study focused on simplifying the existing IT governance mechanisms and proposed the adapted mechanisms to help small businesses govern their DT agenda. The IT governance mechanisms consist of structure, processes, and relational mechanisms [12], [14], [18]. The proposed pattern catalogue has been presented and explained in the previous section. The proposed mechanisms would contribute to ensuring the successful implementation of the DT strategy, evaluate and improve it, and ensure its benefit in the creation of new business value. This catalogue needs further validation, both internal validation and empirical validation.

Our study makes a significant contribution by proposing a set of IT governance mechanisms that are not only effective but also flexible and simple, making them ideally suited for adoption by small businesses. These mechanisms are designed to be easy to understand and apply, allowing small businesses to develop their own advanced mechanisms as they progress on their transformation journey. This concept is crucial, as small businesses need to document measurable strategies to evaluate and refine their DT strategy, ensuring that it delivers business value. At the same time, a documented, measurable strategy is the cornerstone of IT governance.

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REFERENCES

[1] M. Nasiri, M. Saunila, J. Ukko, T. Rantala, and H. Rantanen, "Shaping Digital Innovation Via Digital-related Capabilities," *Inf. Syst. Front.*, no. 2019, 2020, doi: 10.1007/s10796-020-10089-2.

[2] G. H. Sagala and Sumiyana, "The intersection of hedonic and utilitarian values on integrated-social media retailers," *Int. J. Bus. Inf. Syst.*, vol. 33, no. 4, pp. 505–530, 2020.

[3] G. H. Sagala and D. Őri, *Toward SMEs digital transformation success: a systematic literature review*, no. 0123456789. Springer Berlin Heidelberg, 2024. doi: 10.1007/s10257-024-00682-2.

[4] M. Roux, S. Chowdhury, P. Kumar Dey, E. Vann Yaroson, V. Pereira, and A. Abadie, "Small and medium-sized enterprises as technology innovation intermediaries in sustainable business ecosystem: interplay between AI adoption, low carbon management and resilience," *Ann. Oper. Res.*, 2023, doi: 10.1007/s10479-023-05760-1.

[5] M. Ghobakhloo and M. Iranmanesh, "Digital transformation success under Industry 4.0: a strategic guideline for manufacturing SMEs," *J. Manuf. Technol. Manag.*, vol. 32, no. 8, pp. 1533–1556, 2021, doi: 10.1108/JMTM-11-2020-0455.

[6] OECD, "Entrepreneurship at a Glance 2016," Paris, 2016.

[7] WEF, "Future Readiness of SMEs and Mid-Sized Companies: A Year On - INSIGHT REPORT, NOVEMBER 2022, World Economic Forum," 2022.

[8] V. Corvello, S. Verteramo, I. Nocella, and S. Ammirato, "Thrive during a crisis: the role of digital technologies in fostering antifragility in small and medium-sized enterprises," *J. Ambient Intell. Humaniz. Comput.*, no. 0123456789, 2022, doi: 10.1007/s12652-022-03816-x.

[9] M. K. Hu and D. M. H. Kee, "Fostering sustainability: reinventing SME strategy in the new normal," *Foresight*, vol. 24, no. 3–4, pp. 301–318, 2022, doi: 10.1108/FS-03-2021-0080.

[10] R. Rupeika-Apoga, K. Petrovska, and L. Bule, "The effect of digital orientation and digital capability on digital transformation of SMEs during the COVID-19 pandemic," *J. Theor. Appl. Electron. Commer. Res.*, vol. 17, no. 2, pp. 669–685, 2022.

[11] J. Cenamor, V. Parida, and J. Wincent, "How entrepreneurial SMEs compete through digital platforms: The roles of digital platform capability, network capability and ambidexterity," *J. Bus. Res.*, vol. 100, pp. 196–206, 2019.

[12] S. De Haes *et al.*, "Enterprise governance of IT," *Enterp. Gov. Inf. Technol. Achiev. Alignment Value Digit. Organ.*, pp. 15–74, 2020.

[13] R. Pereira and M. M. da Silva, "IT governance implementation: The determinant factors," *Commun. IBIMA*, vol. 2012, p. 1, 2012.

[14] R. Almeida, R. Pereira, and M. da Silva, "IT governance mechanisms: A literature review," in *Exploring Services Science: 4th International Conference, IESS 2013, Porto, Portugal, February 7-8, 2013. Proceedings 4*, 2013, pp. 186–199.

[15] A. Levstek, A. Pucihar, and T. Hovelja, "Towards an Adaptive Strategic IT Governance Model for SMEs," *J. Theor. Appl. Electron. Commer. Res.*, vol. 17, no. 1, pp. 230–252, 2022, doi: 10.3390/jtaer17010012.

[16] V. Corvello, S. Verteramo, I. Nocella, and S. Ammirato, "Thrive during a crisis: the role of digital technologies in fostering antifragility in small and medium-sized enterprises," *J. Ambient Intell. Humaniz. Comput.*, vol. 14, no. 11, pp. 14681–14693, 2023, doi: 10.1007/s12652-022-03816-x.

[17] L. Toomsalu, S. Tolmacheva, A. Vlasov, and V. Chernova, "Determinants of innovations in small and medium enterprises: A European and international experience," *Terra Econ.*, vol. 17, no. 2, pp. 112–123, 2019, doi: 10.23683/2073-6606-2019-17-2-112-123.

[18] R. Mulyana, L. Rusu, and E. Perjons, "IT governance mechanisms influence on digital transformation: A systematic literature review," *27th Annu. Am. Conf. Inf. Syst. AMCIS 2021*, pp. 0–10, 2021.

[19] D. J. Cook, C. D. Mulrow, and R. B. Haynes, "Systematic reviews: synthesis of best evidence for clinical decisions," *Ann. Intern. Med.*, vol. 126, no. 5, pp. 376–380, 1997.

[20] D. Tranfield, D. Denyer, and P. Smart, "Towards a methodology for developing evidence-informed management knowledge by means of systematic review," *Br. J. Manag.*, vol. 14, no. 3, pp. 207–222, 2003.

[21] C. Okoli, "A guide to conducting a standalone systematic literature review," *Commun. Assoc. Inf. Syst.*, vol. 37, no. 1, pp. 879–910, 2015, doi: 10.17705/1cais.03743.

[22] R. Huang, R. W. Zmud, and R. L. Price, "Evaluating the effects of it governance structures in small and medium-sized enterprises," *Assoc. Inf. Syst. - 12th Am. Conf. Inf. Syst. AMCIS 2006*, vol. 1, pp. 338–347, 2006.

[23] A. C. Albayrak and A. Gadatsch, "IT Governance model for small and medium sized enterprises," in *Munich, European, Mediterranean \& Middle East Conference on Informafion Systems (EMOIS)*, 2012, pp. 380–390.

[24] M. C. Lee, "IT governance implementation framework in small and medium enterprise," *Int. J. Manag. Enterp. Dev.*, vol. 12, no. 4–6, pp. 425–441, 2013, doi: 10.1504/IJMED.2013.056445.

[25] X. Zhou, Y. Jin, H. Zhang, S. Li, and X. Huang, "A map of threats to validity of systematic literature reviews in software engineering," in *2016 23rd Asia-Pacific Software Engineering Conference (APSEC)*, 2016, pp. 153–160.

[26] R. Huang, R. W. Zmud, and R. L. Price, "Influencing the effectiveness of IT governance practices through steering committees and communication policies," *Eur. J. Inf. Syst.*, vol. 19, no. 3, pp. 288–302, 2010, doi: 10.1057/ejis.2010.16.

[27] R. Huang, R. W. Zmud, and R. L. Price, "IT governance practices in small and medium-sized enterprises: Recommendations from an empirical study," *IFIP Adv. Inf. Commun. Technol.*, vol. 301, no. Weill 2004, pp. 158–179, 2009, doi: 10.1007/978-3-642-02388-0_12.

[28] J. Devos, H. Van Landeghem, and D. Deschoolmeester, "Rethinking IT governance for SMEs," *Ind. Manag. Data Syst.*, vol. 112, no. 2, pp. 206–223, 2012, doi: 10.1108/02635571211204263.

[29] A. Levstek, T. Hovelja, and A. Pucihar, "IT Governance Mechanisms and Contingency Factors: Towards an Adaptive IT Governance Model," *Organizacija*, vol. 51, no. 4, pp. 286–310, 2018, doi: 10.2478/orga-2018-0024.

[30] F. Lin, S. Chou, and W. K. Wang, "Is practitioners' views on core factors of effective IT governance for Taiwan SMEs," *Int. J. Technol. Manag.*, vol. 54, no. 2–3, pp. 252–269, 2011, doi: 10.1504/IJTM.2011.039314.

[31] C. L. Wilkin, "The role of it governance practices in creating business value in smes," *J. Organ. End User Comput.*, vol. 24, no. 2, pp. 1–17, 2012, doi: 10.4018/joeuc.2012040101.

[32] M. Proudlock, "IT adoption strategies: best practice guidelines for professional SMEs," *J. Small Bus. Enterp. Dev.*, vol. 6, no. 3, pp. 240–252, 1999.

[33] F. Bergeron, A. M. Croteau, S. Uwizeyemungu, and L. Raymond, “IT governance theories and the reality of SMEs: Bridging the gap,” *Proc. Annu. Hawaii Int. Conf. Syst. Sci.*, vol. 2015-March, pp. 4544–4553, 2015, doi: 10.1109/HICSS.2015.542.

[34] J. D. C. Verdún and A. J. A. Jávega, “Identifying IT governance best practices in Spanish small and medium organisations,” *Proc. IADIS Int. Conf. Inf. Syst. 2009, IS 2009*, pp. 34–40, 2009.

[35] S. Kosasi, Vedyanto, and I. D. A. Eka Yuliani, “Enhancing online business marketing to expand market shares through IT governance,” *Int. Conf. Electr. Eng. Comput. Sci. Informatics*, vol. 2017-Decem, no. September, pp. 19–21, 2017, doi: 10.1109/EECSI.2017.8239131.

[36] S. Khalil and M. Belitski, “Dynamic capabilities for firm performance under the information technology governance framework,” *Eur. Bus. Rev.*, vol. 32, no. 2, pp. 129–157, 2020, doi: 10.1108/EBR-05-2018-0102.

[37] G. H. Sagala and D. Őri, “Antifragility, resilience and collaborative networks of SMEs: a theoretical foundation,” *Eur. J. Innov. Manag.*, 2024, doi: 10.1108/EJIM-09-2023-0797.

Appendix 1. List of Primary Articles

No.	Primary Article	Publication Channel	Publisher
A1	Bergeron et al. (2015)	Proceedings	48th Hawaii International Conference on System Sciences, IEEE
A2	Devos et al. (2012)	Journal (Scopus – Q1)	Industrial Management & Data Systems (Emerald)
A3	Huang et al. (2006)	Proceedings	Americas Conference on Information Systems (AMCIS) 2006, Association for Information Systems
A4	Huang et al. (2010)	Journal (Scopus – Q1)	European Journal of Information Systems (Taylor & Francis)
A5	Huang et al. (2009)	Proceedings	Information Systems–Creativity and Innovation in Small and Medium-Sized Enterprises: IFIP WG 8.2 International Conference, Creative SME 2009. Springer Berlin Heidelberg
A6	Khalil & Belitski (2020)	Journal (Scopus – Q1)	European Business Review (Emerald)
A7	Lee (2013)	Journal (Scopus – Q3)	International Journal of Management and Enterprise Development (Inderscience)
A8	Levstek et al. (2018)	Journal (Scopus – Q2)	Organizacija (Sciendo)
A9	Levstek et al. (2022)	Journal (Scopus – Q1)	Journal of theoretical and applied electronic commerce research (MDPI)
A10	Lin et al. (2011)	Journal (Scopus – Q2)	International Journal of Technology Management (Inderscience)
A11	Verdún & Jávega (2009)	Proceedings	Proceedings of the IADIS International Conference Information Systems 2009
A12	Wilkin (2012)	Journal (Scopus – Q2)	Journal of Organizational and End User Computing (IGI Global)

Appendix 2. Review Tabulation

No	Authors	Research Objective	IT Governance Mechanisms		
			Structure	Process	Relational
A1	Bergeron et al. (2015)	To build a conceptual framework for ITG in small and medium-sized enterprises (SMEs).	• Clear IT-related roles of the business owner (*central role of decision making*) • IT champion (*informal role*)	• IT strategic alignment • IT performance tracking	• Informal mechanisms • Develop mutual understanding during collaboration among stakeholders • IT training • Proper communication
A2	Devos et al. (2012)	To critically rethink the concepts and the theoretical foundations of IT governance in small- and medium-sized enterprises (SMEs).	• Centralized decision making	• Leader commitment • Improve IT knowledge • Need assessment and adapt software functionality following SMEs requirements • Assess outsourced IT project • Credible software vendor • Simple and informal control systems • Incentive mechanism (for adverse selection and moral hazard)	• Trust building mechanism (trust between collaboration partners) • Commitment building • Open communication • Well behave
A3	Huang et al. (2006)	To represent an initial effort to link IT governance to efficiency and the breadth in IT use in SMEs.	• Centralized structure • Decision maker: IT and Business Leader • Decision contributors: steering committee - executive managers (Formal & Informal participation)	• Identification of current or existing IT tools potential in the company • Optimizing IT utilization in term of *breadth in current IT use* • Improved efficiency in IT use	• Number of communication channels used to communicate IT governance decisions, processes, and desirable behaviours throughout the enterprise • The number of broadband channels (e.g. emails, Internet) used to communicate IT policies and procedures
A4	Huang et al. (2010)	To provide evidence on the influence of governance practices from three small-medium-sized organizations.	• Centralized structure (efficiency reason) • IT steering committee (including owner, enterprise-level and operational-level senior manager)	• Involving senior managers both formally and informally in IT-related decision-making processes • Communication of IT governance policies, guidelines and procedures (efficiency and breadth of IT use)	• Number of communication channels • Electronic communication channel
A5	Huang et al. (2009)	To examine the nature and influence of IT governance in SMEs through interviews with executives from three SMEs.	• Centralized (CIO, IT steering committee: CEO, CFO, CIO, controller)	• Senior management, corporate executives, and operational executives should be involved in IT governance processes. • Formal and informal IT governance interactions • Improve the breadth of potential IT use in SMEs	• Behave appropriately as they engage with others • Enterprise policies, guidelines, and practices regarding appropriate and deviant IT-related behaviours • Variety of communication channels, each of which is characterized by distinctive capabilities

				• IT decisions occur through formal and informal pathways. • Strategic IT directions and deliberate on alternative solutions for critical business and IT issues	• IT governance policies, guidelines and practices should be communicated through a number of channels (Email, Intranet, Paper Document, Formal Meeting, Word of Mouth)
A6	Khalil & Belitski (2020)	To investigate the role of dynamic capabilities in the IT governance view framework and explore the relationship between three domains of IT governance (Strategy, Management and Operations) and firm performance.	• Innovate business models • IT deployment innovative skills • CIO/CTO • IT group • Decision-making • Leading inter-disciplinary staff • ICT skills and training	• Business training • Investment in applications • Investment in Cloud • IT budget efficiencies • Investment in cross-disciplinary training • Generating strategies • Technology standardization and infrastructure • Standardize data in-house • Resilience to lack business skills • Time to constraints and financial barriers	• Not been identified
A7	Lee (2013)	To assess whether IT governance is applicable to SMEs.	• CIO or head information management • IT service provider (internal department or external provider) • IT manager (operational task)	• IT strategy and planning • IT Evaluation (Key performance indicator; IT Balance Scorecard) • IT operation: 1) Business executives and IT executives together make IT decisions; 2) IT executives process IT Standard Operational Procedure (SOP) to executive IT activities; 3) Business executives make decisions on IT investment; 4) cost effective use of IT; 5) effective of IT for asset utilisation	• IT governance communication practice • Number of communication channels • Communicate IT governance policies, guideline and practices throughout the SME • Active participation in formal meetings • The steering committee have regular interaction with CIO
A8	Levstek et al. (2018)	Guideline for further research towards the development of an adaptive strategic IT governance (ITG) model for small and medium-sized enterprises (SMEs).	• Integration of governance alignment tasks in roles and responsibilities: IT strategy committee; IT steering committee; CIO on Board; IT councils; IT leadership councils; E-business advisory board; E-business task force; IT project steering committee • IT organization structure: centralized; federal; decentralized • IT expertise at level of board directors • IT audit committee at level of board directors • CIO on executive committee: CIO reporting to CEO and/or COO • ITG function/officer. • Architecture steering committee; IT investment committee or capital improvement; Business/IT relationship managers	• IT BSC; strategic information system planning; business system planning; critical success factors • Competitive factors; competitive forces model of Porter; business process reengineering; value chain models of Porter • Framework ITG; COBIT; COSO/ERM; ITIL • Service level agreements • Business/IT alignment model; strategic alignment model; ITG maturity models; portfolio management; information economics; business cases • IT-Business value: ROI; VALIT; chargeback; ITG assurance and self-assessment; project governance/management methodology; IT budget control and reporting; demand management; architectural exception process	• Active participation by principal stakeholder: Corporate internal communication addressing on a regular basis; IT leadership; internal meeting between business and IT executive; Executive management give the good example • Collaboration between principal stakeholders: shared understanding of business/IT objectives; cross-functional business/IT training; cross-functional business/IT job rotation • Partnership rewards and incentives • Business/IT collocation • ITG awareness campaigns • Business/IT account management; knowledge management on ITG; web-based (IT) portals; senior management announcements; office of CIO or ITG
A9	Levstek et al. (2022)	To present an empirical evaluation of key ITG mechanisms from the literature that clearly shows that several are not universally but situationally necessary, thus demonstrating the need for new contingency-based ITG models.	Universal: • Strategic ITG Committee Situational: • Integration of governance • IT competencies at the top management level • IT investment committee • IT organizational structure • IT audit committee	Universal: • IT portfolio management • IT risk management • Resource management • Business/IT alignment • Compliance management • Improvement and innovative management Situational:	Universal: • Active principal participation • IT leadership • ITG awareness campaigns • Senior management announcements • Partnership rewards and incentives

				• Financial reporting and control • Project reporting and benefits management • Architectural exception process • ITG assurance and self-assessment • Strategic information system planning • IT performance measurement • Digital transformation • Investment management • Outsourcing management	• Shared understanding of business/IT objectives • Corporate internal communication addressing on a regular basis • Executive/senior management give the good example Situational: • Knowledge management on ITG
A 10	Lin et al. (2011)	To evaluate the general status of IT governance in Taiwan's small and medium enterprises (SMEs) and examine whether the key components necessary for achieving effective IT governance are in place.	• Executive management	• Define information architecture • Acquire and identify technology infrastructure • Develop and maintain procedures • Define accountability and training • Assess risk and ensure system security • Acquisition and implementation • Ensure compliance with external requirement - Monitoring and evaluation	• Communicate management aims and direction • Communication between the business and IT stakeholders • Service support
A 11	Verdún & Jávega (2009)	To analyze the status of ITG in SMEs and define and implement best practices on this type of organizations.	• Define the organizational structure and roles (BoD and IT steering committee) • Decision-making organs (Define who is the decision maker) – Managing director/owner, not delegated • Person in charge of IT	• Evaluate and consider IT function • Follow-up of IT initiatives • Palling for budget, timing, cost and benefit analysis • Monitor the progress • Chargeback mechanisms (IT function as cost center) • Including IT cost into product pricing	• Not been identified
A 12	Wilkin (2012)	To deliver new understanding about SME practices related to governing IT.	• Roles and responsibilities at owner manager level for strategy • Facilitation of an interactive working environment • IT champion(s) • IT consultants to explore strategic opportunities	• Focus on strategic imperatives • Measurement of performance (operational and missed opportunities) • Improved planning to strengthen IT • Identification of relevant emerging IT and timing of investments • Flexible approaches to IT usage	• Active collaboration between stakeholders to expand IT • Incentives to reward IT innovation • Valuing interaction to expand knowledge • Increased IT training to improve IT functionality educational programs to increase understanding of IT functionality and business value