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A PRISMA-Informed Systematic Review on Digital Innovation: Insights from SMEs and Incumbents

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Abstract: ***With roots in IS literature, digital innovation has become a common theme for researchers from a wide range of fields. Despite the availability of plenty of research on digital innovation, however, the literature seems to lack adequate/sufficient research on its antecedents; i.e. the initial factors that affect digital innovation. Besides that, examination of SMEs and incumbent firms in terms of the conditions and factors that affect digital innovation is also lacking. Hence, this paper aims to understand and explain the antecedents of digital innovation and to distinguish SMEs and incumbent firms from this perspective, asking the following two research questions: 1. What is known, so far, about the antecedents of digital innovation in SMEs and in incumbent firms? and 2. Which theories and approaches have been used to study digital innovation in SMEs and/or in incumbent firms? With this purpose, the paper systematically reviews the related literature on the antecedents of digital innovation following PRISMA (The Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement set forth by Liberati et al. (2009) and it presents comprehensive answers to the research questions by a meticulous examination of 47 papers out of an initial set of 189 papers. The paper concludes by providing thoughts on future research opportunities for scholars of digital innovation.***

Keywords: Digital innovation, SME, incumbent firm

1. Introduction

Digital innovation has become a common theme for researchers, especially in the field of IS. Yet, research concerning the properties that individuals, organizations, and their environments should hold at the very beginning, in order for digital innovations to be initiated, developed and implemented, seems to be lacking. In response to Nambisan *et al.* (2017)'s call that "the time for theorizing about digital innovation is, now", this paper focuses on these properties referring to them as "the antecedents of digital innovation" and explores the properties that are required to exist in organizations, in individuals and in their environments so that new ideas can turn into profitable / successful digital innovations.

As organizations are being surrounded by digital technologies today, it is now a necessity for organizations to make use of them in their products, services and processes. While it might be easier for startup companies established in the last couple of years and technology giants like Amazon and Alibaba, it is rather difficult for SMEs and incumbent firms who are used to doing things in their own way.

2. General Overview of the Concepts

Simly put, digital innovation is defined as *"the carrying out of new combinations of digital and physical components to produce novel products"* where these new combinations build upon digitization (Yoo *et al.*, 2010). With a focus on the outcome of innovation (i.e. product innovation), this definition can been widened to encompass the process of innovating (i.e. process innovation) and defined as *"the use of digital technology during the process of innovating"* (Nambisan *et al.*, 2017). Finally, digital innovation can also be used to refer to business model innovations and be defined as "*a product, process, or business model that is perceived as new, requires some significant changes on the part of adopters, and is embodied in or enabled by IT*" (Fichman *et al.*, 2014).

In this paper, we adopt a digital innovation definition that is based on these three important definitions from the literature: First, we build on Yoo *et al.* (2010) and, unlike some scholars, we believe that Yoo *et al.* (2022) have referred not only to *'goods'*, but to *'goods and services'*, by saying "products". Yet, as this definition solely focuses on the creation of novel products and disregards the processes and business models of the innovator company, we also make use of Nambisan *et al.* (2017) - who basically emphasize the use of digital technology in the process of innovating while also pointing out that it can be used to refer to the outcome of innovation - and Fichman *et al.* (2014) - who provide a wider definition of digital innovation so as to include business models. In this paper, we refer to novel processes and novel business models, as well as novel goods and services. So basically, our understanding of digital innovation,

1) may refer to the "innovating process" and it may, as well, refer to the "outcome of innovation"
2) requires the combination (or recombination) of "*physical+digital*" or "*digital+digital*" components (artefacts)
3) may show up in the form of
   - ***A new product*** (a good or a service) to be offered to the customer market,
   - ***A new process*** (or an improvement in a process) to enhance company operations, as well as a new process to be offered to the customer,
   - Or, ***a new business model*** (or a change in the business model),

all of which are realized by the use of digital technologies.

Small and medium-sized enterprises (SMEs) and large incumbent firms operate under markedly different conditions that affect their digital innovation efforts. Incumbent firms typically have established, hierarchical structures and formalized processes – often described as *"command-and-*

control" organizations with siloed departments and rigid routines (Dery *et al.*, 2017). These structures have historically optimized efficiency, but they can impede rapid innovation. Employees in traditional large companies face bureaucratic *"speedbumps"* such as multi-layered approvals and asynchronous communication channels, leading to a disconnect between what employees *can* do and what they *need* to do to meet digital-era demands (Dery *et al.*, 2017). Moreover, incumbents tend to exhibit organizational inertia stemming from legacy systems, path-dependent routines, and a culture averse to risk (Li *et al.*, 2023). This inertia makes it difficult for them to respond quickly to disruptive technologies, even when digital innovation is high on their strategic agenda. Paradoxically, incumbent firms usually possess abundant resources (financial capital, specialized talent, R&D facilities) and higher digital maturity, yet these advantages can be offset by inflexibility. In fact, research shows that large companies generally attain stronger digital maturity—benefiting from well-structured processes and clearly defined business workflows—whereas many SMEs lack clear process modeling and control over their digital status (Sandor and Guban, 2022). Thus, incumbents must intentionally cultivate agility: for example, by breaking down silos, encouraging cross-functional collaboration, and updating their workplace technologies and culture to be more supportive of innovation (Dery *et al.*, 2017). They may also adopt strategies to overcome inertia, such as forming strategic alliances, leveraging institutional support, and building dynamic capabilities and an entrepreneurial mindset internally – all of which can help mitigate the inhibitory effects of organizational rigidity (Li *et al.*, 2023).

By contrast, SMEs generally operate with leaner structures and more informal communication, which can foster greater agility and quicker decision-making. With fewer organizational layers, SMEs often respond to new technological opportunities more flexibly than bureaucratic large firms. This agility and closer customer proximity enable SMEs to innovate rapidly and adapt products or processes as needed. However, SMEs face significant resource constraints that can hinder digital innovation. Studies consistently find that SMEs lag behind larger firms in adopting advanced digital technologies, due in part to *limited financial resources, shortages of digital skills, and organizational resistance to change* (Omowole *et al.*, 2024). Many SMEs struggle to invest in expensive new IT systems or dedicated innovation teams, and they may not have personnel with specialized digital expertise. They also tend to have lower levels of formal digital strategy and planning, which can result in a piecemeal approach to innovation. Indeed, evidence indicates that SMEs as a group still *"lag behind larger firms in accessing and using data and digital technologies"*, with lower adoption rates across a wide range of digital tools (OECD, 2023). Beyond financial and human capital limitations, SMEs might also experience cultural barriers such as an owner–manager's hesitation to change longstanding business practices. Unlike large corporations that can dedicate R&D budgets to experimentation, SMEs often prioritize day-to-day operations and risk aversion, making it challenging to pursue unproven digital innovations. Furthermore, SMEs' digital maturity tends to be lower: their core business processes may be only loosely defined or undocumented, and they might lack a clear assessment of their digital capabilities (Sandor and Guban, 2022). This contrasts with large firms that have the benefit of refined processes and IT governance, which, while helpful for efficiency, must be recalibrated to allow innovation. In summary, SMEs are nimble and collaborative by nature, but underpowered in resources, whereas incumbents are resource-rich but burdened by structural inertia. These differences imply that the *antecedents* enabling digital innovation may play out differently in SMEs versus large firms – a central theme explored in this study

3. Conceptual Framework

In light of the above, we developed a conceptual framework to understand the antecedents of digital innovation in organizations, drawing on two key scholarly works: Ramdani *et al.* (2022) and Kohli & Melville (2019). This framework synthesizes prior insights into a holistic view of *what enables digital innovation to occur*, both before an innovation is initiated and as it unfolds. We refer to it as a conceptual (rather than theoretical) framework because it integrates and visualizes concepts from existing literature to explain our phenomenon of interest, rather than relying on a single established theory. A theoretical framework provides the foundational theories and constructs on which research builds, whereas a conceptual framework *"visualises what you anticipate the relationships between concepts… may be"*, given prior theory and context (Crupi *et al.,* 2020). Here, we combine and build upon prior studies to conceptually map the factors propelling digital innovation in different firm contexts.

Ramdani *et al.* (2022) approach digital innovation from an *adoption perspective*, essentially examining what leads firms – particularly SMEs – to adopt digital technologies. In their review, they identify four broad categories of antecedents: individual, technological, organizational, and environmental factors. This categorization echoes classic technology adoption models. Individual-level antecedents include characteristics of a firm's decision-makers such as their knowledge and experience with technology, education level, attitude toward change, motivation, age, and entrepreneurial orientation. These factors describe the people responsible for driving or approving digital innovation – in Ramdani *et al.*'s case, often the owner-managers of SMEs. Technological antecedents refer to perceived attributes of the digital technology itself (e.g. its usefulness, ease of use, compatibility with existing systems, security and privacy features, and trialability) which can facilitate or hinder adoption. Organizational antecedents include internal conditions like top management support, organizational readiness (e.g. IT infrastructure, digital skills), and organizational culture regarding innovation. Finally, environmental antecedents encompass external context factors such as competitive pressure in the market, networks of partners or suppliers, government support and policy incentives, customer demands, and vendor support for new technologies. Ramdani *et al.*'s framework posits a linear sequence: these antecedents shape a firm's intention to innovate, then its adoption decision, followed by implementation and usage of the digital innovation, ultimately leading to outcomes in organizational performance and process performance. In short, it portrays the journey from antecedents to innovation outcomes as a stepwise progression over time (mirroring classical innovation diffusion stages). This perspective is

particularly useful for understanding SMEs, where the decision to adopt a new digital technology may indeed hinge on such preconditions and unfold in stages.

Kohli and Melville (2019) offer a complementary lens, reviewing digital innovation through the actions that organizations undertake rather than a strict timeline. They propose four key digital innovation actions – *Initiating*, *Developing*, *Implementing*, and *Exploiting* – which an organization can perform, not necessarily in a fixed order or in every project. Initiating involves recognizing triggers and opportunities (identifying a digital innovation idea and deciding to pursue it), Developing covers the design and development or acquisition of the innovation (including adopting technologies needed), Implementing entails deploying the innovation (installing systems, training users, changing incentives, etc.), and Exploiting refers to deriving value and extending the innovation (e.g. leveraging data or scaling up the innovation to new uses) (Kohli and Melville, 2019). Importantly, Kohli & Melville emphasize that these activities occur within two environments: the internal organizational environment and the external competitive environment. Rather than asking "What happens first, second, third?" their framework asks "What does a firm need to do to innovate digitally, and what context surrounds those activities?". They do not explicitly label "antecedents," but they discuss capabilities and conditions that enable the *Initiation* of digital innovation – effectively pointing to antecedent factors for getting innovation off the ground. For instance, the ability to scan and sense opportunities in the external environment is highlighted as crucial for initiation. Firms require *technological opportunism* – an openness and capability to spot and leverage emerging technologies complementary to their existing technology base (Kohli and Melville, 2019). Similarly, *entrepreneurial alertness* is noted as a trait that helps organizations detect gaps between current offerings and market needs and to conceive digital solutions for those gaps. Another critical capability is organizational learning and knowledge management: firms that effectively generate, absorb, and apply knowledge (both from inside and outside the organization) are better positioned to initiate fruitful digital innovation.. As Kohli & Melville observe, companies need to *"draw learning from inside and outside their organization and apply it to foster effective initiation"* (SD) – for example, tapping into the "wisdom of crowds" or external communities to inform their innovation process. While Kohli & Melville focus on the innovation *process*, their insights imply that certain antecedent conditions (capabilities, awareness, and external sensing mechanisms) must be in place to successfully begin and carry out digital innovation.

Integrated Framework

"Triggers" and "Supporters": Building on these works and our own analysis, we propose a unified conceptual framework that centers on antecedents of digital innovation both *before* and *during* the innovation process. We distinguish between two roles that antecedent factors can play: triggering and supporting. In our view, *trigger factors* are those antecedents present *before* the innovation process starts – they spark, trigger, or enable the initiation of a digital innovation. These could include an entrepreneurial top manager's vision, a perceived market opportunity, a new technology becoming available, or organizational readiness in terms of funding and skills at the outset. *Support factors* are antecedents that matter *throughout the innovation process*, continuing to facilitate progress as the idea is developed and implemented. These might be, for example, a collaborative culture that sustains cross-department innovation teams, or ongoing top management support that ensures the project survives challenges. In our view, both triggerers and supporters are needed for any good idea to eventually turn into a successful digital innovation. A novel idea might never get off the ground without initial triggers like external stimuli or an innovative mindset to recognize its potential; likewise, even a well-launched project can falter without supporting factors (resources, skills, leadership buy-in, etc.) to carry it through execution. Our framework therefore spans the entire timeline of innovating – from before the first action to after implementation – highlighting where and when various antecedents exert influence.

By integrating Ramdani *et al.*'s adoption-centric categories with Kohli & Melville's action-oriented stages, this *conceptual framework* captures both contextual factors (who or what in the organization and environment enables innovation) and temporal dynamics (when those factors come into play). It is not a traditional "theory" with formal hypotheses, but rather an organizing schema that we derived from literature to guide our inquiry. This approach aligns with academic conventions: we use existing theories and models as foundations (our theoretical *underpinning*), and then present our own interpretation as a visual/organizational aid – a conceptual framework. In sum, we chose to label it *conceptual* because it visualizes and clarifies our constructs and their relationships in the context of digital innovation antecedents, rather than proposing a novel abstract theory from scratch (Crupi *et al.,* 2020). This framework sets the stage for examining what is already known (and not known) about the factors driving digital innovation in SMEs versus incumbents.

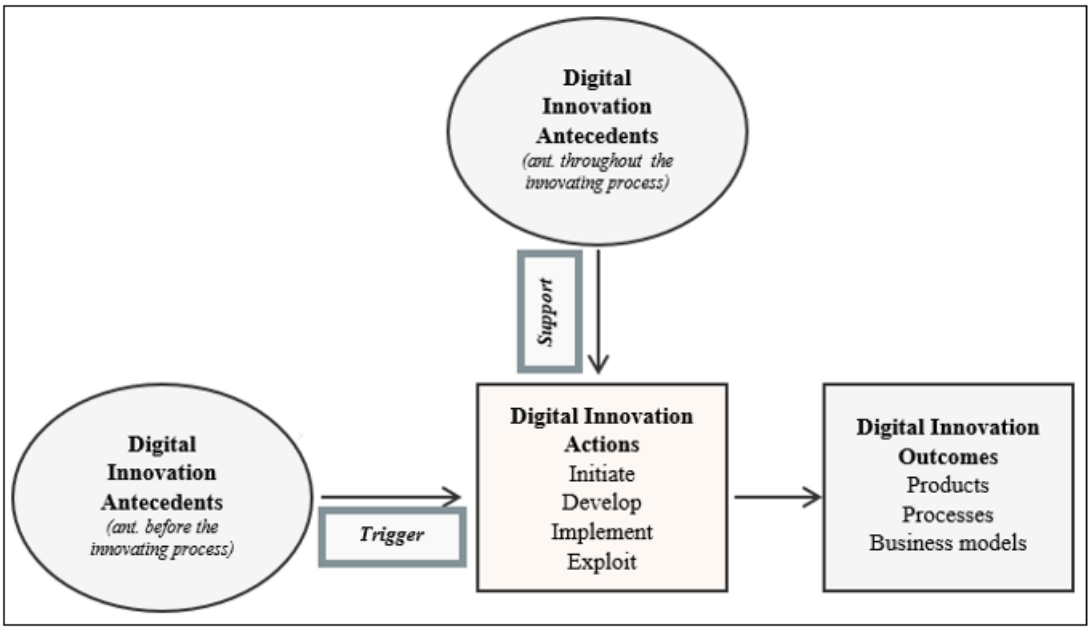

Figure 1: Integrated framework of the study

4. Purpose and Structure of the Paper

The main purpose of this paper is to explore the antecedents of digital innovation in SMEs and in incumbent firms. The paper aims, first, to figure out if the related literature makes any differentiation between SMEs and incumbent firms in terms of how they handle (initiate, motivate, sustain) digital innovation efforts, and second, to find out which theories have been considered useful in understanding the issue at hand.

The study has five main sections. The first section introduces the topic giving background information, provides a conceptual framework and explains the purpose and structure of the paper. The second section provides the methodology of the study. The third section presents findings and discusses them in detail. The fourth section draws a conclusion based on the findings. Finally, the fifth section points out at limitations of this study and presents recommendations for future research. Therefore, this study aims to answer the following research questions:

RQ1. What is known, so far, about the antecedents of digital innovation in SMEs and in incumbent firms?
RQ2. Which (if any) theories have been used to study antecedents of digital innovation in SMEs and/or in incumbent firms?

5. Methodology

This study was designed as a systematic review of current literature. A systematic review is *"a means for identifying, evaluating and interpreting all available research relevant to a particular research question, or topic area, or phenomenon of interest"* (Kitchenham, 2004). Set forth by Liberati *et al.* (2009), PRISMA (The Preferred Reporting Items for Systematic Reviews and Meta-Analyses) is a useful methodology for conducting systematic reviews. PRISMA provides a structured way of reviewing the literature which allows for transparency throughout the search, hence increasing the comprehensiveness and objectivity of the study. Following the PRISMA statement, this paper systematically searched for studies that have formerly been conducted by scholars of digital innovation and published in top journals. Consequently, the study provides a comparative examination of SMEs and incumbent firms in terms of the necessities to initiate and successfully complete digital innovations. The study also provides a theoretical background for understanding the antecedents of digital innovation in SMEs and incumbents.

In order to reach the aim of decreasing the probability of being biased in examining the relevant literature, systematic reviews require a methodology that is clear and well-defined, which can also be made transparent to readers through detailed explanation of the search process (Kitchenham, 2004). Hence, in this section, we explain the search process in detail.

Before actually starting the search, a search protocol was developed for the purpose of creating the dataset and to determine the methods of the analysis. The protocol guides/directs the search process and ensures transparency and reproducibility. The protocol instructed that the search be conducted

- in Web of Science (WoS) database,
- with the keywords "digital innovation" (digital innov*) and "antecedent" (antecedent*) in the title,

and that only articles and reviews in the so-called AIS (Association for Information Systems) Basket of 8 were to be included.

Table 1: List of journals in AIS Basket of 8

AIS Basket of 8
European Journal of Information Systems
Information Systems Journal
Information Systems Research
Journal of the Association for Information Systems
Journal of Information Technology
Journal of Management Information Systems
Journal of Strategic Information Systems
MIS Quarterly

The protocol allowed for a change, if the initial results at any stage were found to be too narrow. The changes made in line with the protocol had to be provided.

The Search Process

At the very beginning, we searched the Web of Science database for articles that include "digital innovation" and "antecedent" in the title. We then selected the journals in the AIS basket of 8 and filtered articles and reviews. As can be seen in Table 2, this initial search brought an insufficient number of results (i.e. 13) that would make our analysis incomprehensive.

Table 2: List of eligible articles acquired from AIS Basket of 8

No.	Authors	Source Title	Article Title
1	Fichman *et al.,*	MIS Quarterly	Digital innovation as a fundamental and powerful concept in the information systems curriculum
2	Kohli & Melville,	Information Systems J	Digital innovation: A review and synthesis
3	Huang *et al.,*	MIS Quarterly	Growing on steroids: Rapidly scaling th euser base of digital ventures through digital innovation
4	Chan *et al.,*	Information Systems J	Agility in responding to disruptive digital innovation: Case study of an SME
5	Mendling *et al.,*	European J of Information Systems	Building a complementary agenda for business process management and digital innovation**
6	Wang,	MIS Quarterly	Connecting the parts with the whole: Toward an information ecology theory of digital innovation ecosystems
7	Hanelt *et al.,*	European J of Information Systems	Digital M&A, digital innovation, and firm performance: an empirical investigation
8	Hylving & Schultze,	J of Strategic Information Systems	Accomplishing the layered modular architecture in digital innovation: The case of the car's driver information module
9	Che *et al.,*	Information Systems J	Online prejudice and barriers to digital innovation: Empirical investigations of Chinese consumers
10	Fink *et al.,*	J of Information Technology	The ownership of digital infrastructure: Exploring the deployment of software libraries in a digital innovation cluster
11	Hodapp & Hanelt,	J of Information Technology	Interoperability in the era of digital innovation: An information systems research agenda*
12	Chen *et al.,*	Information Systems Research	Making digital innovation happen: A Chief Information Officer issue selling perspective
13	Shi *et al.,*	J of Strategic Information Systems	Disciplined autonomy: How business analytics complements customer involvement for digital innovation

**Early access, **Editorial*

In line with the protocol condition that an alternative search plan could be followed in case of insufficient population of articles, we decided to repeat the search in a slightly different way. The first thing we changed was to search for the word "antecedent" in the abstract, instead of the title. We also added keywords like "factor*", "foster*", "driv*", "facilitat*" and "enabl*" that would evoke similar meanings or mean more or less the same thing as the word "antecedent" (date of search: August 12th, 2023). Therefore, our search in WoS looked like,

TI=("digital innov") AND (AB=(antecedent* OR factor* OR foster* OR driv* OR facilitat* OR enabl*))*

where,

"digital innov*"	*was expected to bring* →	*digital innovation / innovator(s) / innovating*
"antecedent*"		*antecedent(s)*
"factor*"		*factor(s)*
"foster*"		*foster(s) / fostering*
"driv*"		*drive(s) / driver(s) / driving*
"facilitat*"		*facilitate(s) / facilitator(s) / facilitating*
"enabl*"		*enable(s) / enabler(s) / enabling*

Feeling urged to get out of AIS Basket of 8 as the second change, we decided to repeat the search using filters, only. This time, we included articles in all journals that are indexed in Web of Science Core Collection and are written in English, and we came up with 188 results. Then we filtered three categories (i.e. Management, Business and Computer Science Information Systems) from Web of Science Categories. Finally from the document types, we selected articles (72) and review articles (5) and ended up with 77 papers to be included in the study.

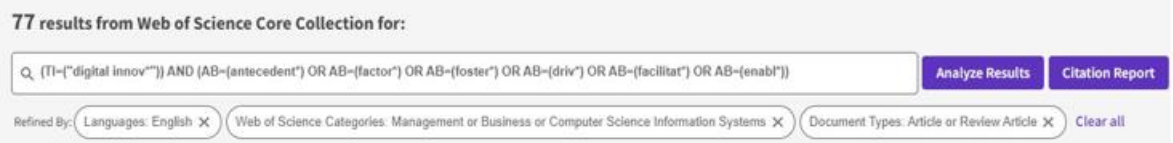

Figure 2: The screen shot from the Web of Science Core Collection search

Next, we screened the abstracts and eliminated papers which do not have the antecedent - digital innovation relationship. Then going through the full papers, we conducted eligibility check and eliminated nonrelevant papers (e.g., papers dealing with start ups).

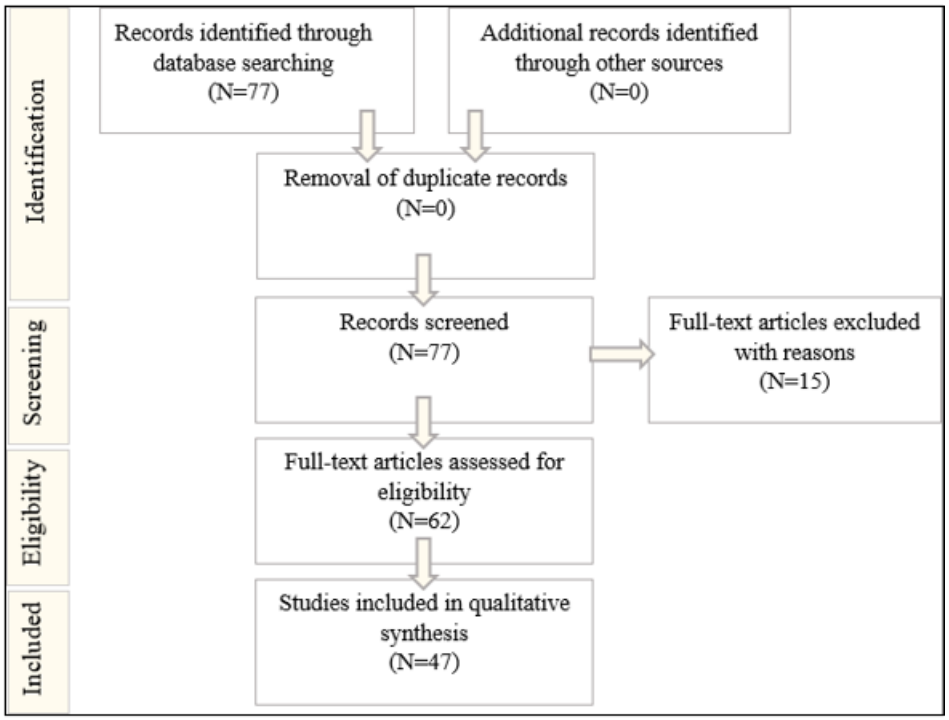

Figure 3: The "Preferred Reporting Items for Systematic Reviews and Meta- Analysis" (PRISMA) flowchart of the systematic literature review (SLR), based on Liberati *et al.* (2009)

6. Findings and Results

This section presents the findings derived from a systematic review of the literature on the antecedents of digital innovation, focusing on both SMEs and incumbent firms. Based on a rigorous screening and selection process informed by the PRISMA framework, the study identifies key enablers that trigger and support digital innovation in these two distinct organizational contexts. The following tables and figures illustrate the methodological steps and the distribution of the reviewed literature, laying the groundwork for a detailed analysis of the identified antecedents.

Table 3: List of eligible articles acquired from AIS Basket of 8

No	Authors	Article Title	Journal ISO Abb.	WoS Index
1	Kohli & Melville, 2014	Digital innovation: A review and synthesis**	Inf. Syst. J.	SSCI
2	Ayre *et al.*,	Supporting and practising digital innovation with advisers in smart farming	NJAS-Wagen. J. Life Sci.	SCI-Exp; SSCI
3	Raisanen & Tuovinen,	Digital innovations in rural micro-enterprises	J. Rural Stud.	SSCI
4	Ramdani *et al.*, 2022	Digital innovation in SMEs: a systematic review, synthesis and research agenda**	Inform. Technol. Dev.	SSCI
5	Mancha & Shankaranarayanan, 2021	Making a digital innovator: antecedents of innovativeness with digital technologies	Inf. Technol. People	SSCI
6	Agasisti *et al.*,	Digital innovation in times of emergency: Reactions from a school of management in Italy	Sustainability	SCI-Exp; SSCI
7	Ramilo *et al.*,	Key determinants and barriers in digital innovation among small architectural organizations	J. Inf. Technol. Constr.	ESCI
8	Schlieter *et al.*,	Scale-up of digital innovations in health care: Expert commentary on enablers and barriers	J. Med. Internet Res.	SCI-Exp; SSCI
9	Allataifeh & Moghavvemi,	The individual dimension of digital innovation: The altered roles of innovation agents and market actors	Sustainability	SCI-Exp; SSCI
10	Falter *et al.*,	Hacking hekla: Exploring the dynamics of digital innovation in rural areas*	Sociol. Rural.	SSCI
11	Hong *et al.*,	Determinants of digital innovation in the public sector	Gov. Inf. Q.	SSCI
12	Khrais & Alghamdi,	Factors that affect digital innovation sustainability among SMEs in the Middle East region	Sustainability	SCI-Exp; SSCI
13	Chohan,	Public value and citizen-driven digital innovation: A cryptocurrency study*	Int. J. Public Adm.	ESCI

14	Tahirkheli & Ajigini,	Factors influencing digital Innovation strategy in organizations: An empirical analysis	Inf. Resour. Manag. J.	ESCI
15	Fichman *et al.*,	Digital innovation as a fundamental and powerful concept in the information systems curriculum	MIS Q.	SCI-Exp; SSCI
16	Lokuge *et al.*,	Organizational readiness for digital innovation: Development and empirical calibration of a construct	Inf. Manage.	SCI-Exp; SSCI
17	Dery *et al.*,	The digital workplace is key to digital innovation	MIS Q. Exec.	SSCI
18	Del Giudice *et al.*,	A self-tuning model for smart manufacturing SMEs: Effects on digital innovation	J. Prod. Innov. Manage.	SCI-Exp; SSCI
19	El-Haddadeh,	Digital innovation dynamics influence on organisational adoption: The case of cloud computing services	Inf. Syst. Front.	SCI-Exp; SSCI
20	Turetken *et al.*,	Service-dominant business model design for digital innovation in smart mobility	Bus. Inf. Syst. Eng.	SCI-Exp; SSCI
21	Hanelt *et al.*,	Digital M&A, digital innovation, and firm performance: An empirical investigation	Eur. J. Inform. Syst.	SCI-Exp; SSCI
22	Pershina *et al.*,	Bridging analog and digital expertise: Cross- domain collaboration and boundary-spanning tools in the creation of digital innovation	Res. Policy	SSCI
23	Hensen & Dong,	Hierarchical business value of information technology: Toward a digital innovation value chain	Inf6. Manage.	SCI-Exp; SSCI
24	Trocin *et al.*,	How artificial intelligence affords digital innovation: A cross-case analysis of Scandinavian companies	Technol. Forecast. Soc. Chang.	SSCI
25	Van Looy,	A quantitative and qualitative study of the link between business process management and digital innovation	Inf. Manage.	SCI-Exp; SSCI
26	Opland *et al.*,	Employee-driven digital innovation: A systematic review and a research agenda**	J. Bus. Res.	SSCI
27	Firk *et al.*,	Top management team characteristics and digital innovation: Exploring digital knowledge and TMT interfaces	Long Range Plan.	SSCI
28	Liu *et al.*,	Status and digital innovation: A middle-status conformity perspective	Technol. Forecast. Soc. Chang.	SSCI
29	Nagaraj,	How product managers use senseshaping to drive the front-end of digital product innovation	Res.-Technol. Manage.	SCI-Exp; SSCI
30	Pittenger *et al.*,	Transformational IT leaders and digital innovation: The moderating effect of formal IT governance	Data Base Adv. Inf. Syst.	SSCI
31	Bahr & Fliaster,	The twofold transition: Framing digital innovations and incumbents' value propositions for sustainability*	Bus. Strateg. Environ.	SSCI
32	Shojaei & Burgess,	Non-technical inhibitors: Exploring the adoption of digital innovation in the UK construction industry	Technol. Forecast. Soc. Chang.	SSCI
33	Xie *et al.*,	How organizational readiness for digital innovation shapes digital business model innovation in family businesses*	Int. J. Entrep. Behav. Res.	SSCI
34	Shi *et al.*,	Disciplined autonomy: How business analytics complements customer involvement for digital innovation	J. Strateg. Inf. Syst.	SCI-Exp; SSCI
35	Khin & Ho,	Digital technology, digital capability and organizational performance: A mediating role of digital innovation	Int. J. Innov. Sci.	ESCI
36	Crupi *et al.*,	The digital transformation of SMEs - a new knowledge broker called the digital innovation hub	J. Knowl. Manag.	SSCI
37	Wiesbock & Hess,	Digital innovations embedding in organizations	Electron. Mark.	SSCI
38	Cueto *et al.*,	Digital innovations in MSMEs during economic disruptions: Experiences and challenges of young entrepreneurs	Adm. Sci.	ESCI
39	Goncalves *et al.*,	Cultural aspects of organizational agility affecting digital innovation	J. Entrep. Manag. Innov.	ESCI
40	Brock *et al.*,	Front end transfers of digital innovations in a hybrid agile-stage-gate setting	J. Prod. Innov. Manage.	SCI-Exp; SSCI
41	Kaiser *et al.*,	How to organize digital innovation? The role of involvement, structure, and technology	Int. J. Innov. Technol. Manag.	ESCI
42	Steinhauser,	Enabling the utilization of potentially disruptive digital innovations by incumbents: The impact of contextual, organisational, and individual factors in regulated contexts	Int. J. Innov. Manag.	ESCI
43	Chen *et al.*,	Making digital innovation happen: A Chief Information Officer issue selling perspective	Inf. Syst. Res.	SSCI
44	Alvarado-Vargas *et al.*,	Product attributes and digital innovation performance: The importance of country and firm level supporting environment	Int. J. Technol. Manage.	SCI-Exp; SSCI
45	Kompella,	Digital innovation in the public sector: The role of embeddedness in socio-technical transitions	Int. J. Innov. Technol. Manag.	ESCI
46	Imam,	Venturing and managing disruptive digital innovations: Financial management concept motivated propositions*	Int. J. Innov. Sci.	ESCI

47	Gernego *et al.*,	Challenges and opportunities for digital innovative hubs development in Europe	Manag. Theory Stud. Rural Bus. Infrastruct. Dev.	ESCI

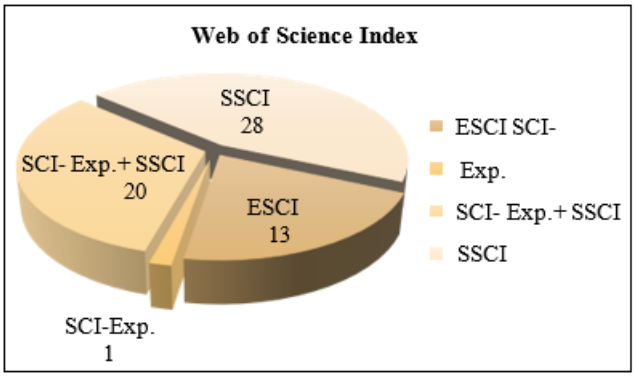

Figure 4: Distribution of articles to Web of Science indexes

The findings of the study are presented under two headings: Findings Concerning the Enablers of Digital Innovation in SMEs and Incumbents and Findings Concerning the Theoretical Lenses Used in Studying These Antecedents.

Findings Concerning the Enablers of Digital Innovation in SMEs and Incumbents

RQ1. What is known, so far, about the antecedents of digital innovation in SMEs and in incumbent firms?

Our systematic review of 47 studies reveals that despite growing interest in digital innovation, relatively few works explicitly focus on its antecedents, and even fewer draw direct comparisons between SMEs and large incumbents. Notably, when researchers use the term "antecedents" in the context of digital innovation, they often refer to factors that facilitate or hinder the *adoption* of digital technologies, especially in SMEs. In other words, much of the existing literature treats antecedents in line with IT adoption and diffusion theories, concentrating on why or how organizations start using digital tools, rather than examining antecedents of the entire innovation process (from ideation to implementation). For example, Ramdani *et al.* (2022) – one of the few explicit studies on *antecedents* – essentially analyze the drivers of SME digital technology uptake. They categorize these drivers into individual, technological, organizational, and environmental factors, as described earlier. This provides a useful taxonomy of influences, many of which are corroborated by other studies in our review:

1) **Individual (People) Factors:** A number of studies emphasize the characteristics of key individuals (owners, managers, or employees) who initiate or champion digital innovation. In SMEs, the owner or top manager's profile is often crucial. Traits such as their digital knowledge, skills, openness to innovation, age, and entrepreneurial orientation can determine whether the firm pursues digital innovation (Ramdani *et al.,* 2022). For instance, a tech-savvy, innovation-minded owner is more likely to invest in new digital solutions. However, Ramdani *et al.* (2022) note that focusing only on top managers overlooks the role of other employees. Indeed, some recent studies extend the individual perspective beyond owners. Fichman *et al.* (2014), for example, argue that effective digital innovators can be positioned at any level inside an organization and they must develop a dual vision: understanding the new possibilities afforded by emerging technologies *and* recognizing an unmet organizational or societal need that those technologies could fulfill (Fichman *et al.*, 2014). In other words, having personnel who can bridge cutting-edge tech knowledge with business domain knowledge is a key human antecedent of successful digital innovation. Along similar lines, Pershina *et al.* (2019) highlight *cross-domain collaboration* as vital: digital innovation often requires integrating expertise from diverse fields (business, engineering, design, etc.), so organizations benefit when individuals with different specializations collaborate creatively. This finding implies that a workforce's diversity of knowledge and the networks among experts can serve as antecedents by seeding more innovative ideas and solutions.
2) **Technological Factors:** Several studies, especially those examining technology adoption in SMEs, point to technology-specific factors as antecedents. Consistent with classic innovation diffusion theory, factors such as a technology's perceived usefulness (the degree to which it offers advantages or value), perceived ease of use (how effortless it is to implement and utilize), and compatibility with the firm's existing systems and processes influence adoption decisions (Jayeraj *et al.*, 2006; Ramdani *et al.*, 2022). Additional considerations include concerns about security and privacy of digital technologies and their trialability (ability to experiment on a small scale before full adoption (Jayeraj *et al.*, 2006; Ramdani *et al.*, 2022). In SME contexts, if a new digital tool is seen as complex or misaligned with current operations, it is less likely to be adopted and thus cannot serve as a basis for innovation. Conversely, accessible and demonstrably beneficial technologies are key enabling antecedents. It's worth noting that incumbent firms often have more legacy technology and complex IT architectures; thus, technological compatibility and integration capability can be significant antecedents for them as well. For an incumbent, the extent to which new digital innovations can leverage or at least coexist with existing systems (or whether the firm has the capacity to update its IT infrastructure) will affect innovation success. A few studies (e.g., those on interoperability or modular architecture in digital innovation) underline the importance of flexible IT platforms in incumbent firms as an antecedent to rapidly innovating. Overall, while the literature agrees that the nature of the technology matters, this is often studied through the lens of user adoption (TAM models, etc.) rather than organizational innovation per se.
3) **Organizational Factors**: Many antecedents of digital innovation reside within the organization's internal environment. Top management support is frequently cited – strong leadership commitment and a clear digital vision from executives set the stage for innovation. This factor appears in both SME and large-firm studies. In SMEs, if the owner/manager is enthusiastic about digital transformation, they will allocate resources and motivate employees accordingly. In large firms, having a top management team (TMT) with substantial digital knowledge and experience has been empirically linked to greater subsequent digital innovation output. For

example, Firk *et al.* (2022) found that the more digitally fluent the TMT of an incumbent firm is, the more the firm succeeds in producing digital innovations down the line. Another critical organizational antecedent is organizational readiness, which includes the availability of adequate resources (funding, IT infrastructure) and competencies (employee IT skills, innovation processes) to embark on digital innovation. Research on "organizational readiness for digital innovation" in contexts like family-run businesses (Xie *et al.* 2022) shows that firms well-prepared in terms of knowledge and infrastructure are better at implementing digital business model innovations. Organizational culture also plays a pivotal role. An innovative, learning- oriented culture that encourages experimentation and tolerates risk can significantly facilitate digital innovation, whereas a conservative or siloed culture can stifle it. Dery *et al.* (2017), focusing on incumbents, point out that creating a supportive *digital workplace* environment is key to fostering innovation. This might involve redesigning work practices to be more collaborative and flexible, breaking down silos, and empowering employees with digital tools – essentially making the internal climate conducive to innovation. Additionally, communication structures and internal networks affect innovation: open communication and cross-functional teams are positive antecedents, whereas rigid hierarchies and departmental barriers impede information flow and collective creativity. The literature suggests that many incumbent firms are challenged to reform their communication patterns (often reliant on formal, top-down channels) to be more agile and responsive. In SMEs, communication tends to be informal and direct due to smaller size, which can be an advantage as an antecedent (ideas can be shared and acted on quickly without excessive bureaucracy). Finally, some studies hint at organizational flexibility as an antecedent – the ability of a firm to pivot strategies, reconfigure processes, or adapt to change. This is closely related to the concept of dynamic capabilities in the organization, which we discuss further under theories (RQ2). In summary, an organization's leadership, culture, structure, and resource base collectively determine its readiness and enthusiasm for digital innovation.

4) **Environmental (External) Factors:** The ecosystem in which a firm operates can provide triggers or barriers for digital innovation. Competitive pressure is a well-documented antecedent (Ramdani *et al.*, 2022) – firms often innovate digitally to respond to rivals' moves or to differentiate themselves in the market. For instance, a small retailer might adopt e-commerce or data analytics because competitors are doing so, or an incumbent bank might invest in fintech innovations due to pressure from agile fintech startups. Customer demand and expectations can also push firms toward digital innovation (e.g., client demands for online services or real-time data can spark internal projects). The presence of a network of partners and suppliers is another external antecedent: being embedded in a strong network or cluster can expose a firm to new ideas and provide support for innovation. SMEs, in particular, benefit from external knowledge sources and collaborations since they lack in-house capacities. Indeed, one study in our review (Crupi *et al.* 2020) explores how Digital Innovation Hubs – external support organizations acting as knowledge brokers – help SMEs acquire know-how and resources for digital transformation (Crupi *et al.,* 2020). Such hubs and partnerships effectively become antecedents by enabling SMEs to overcome resource gaps. Another external factor is government support and institutional environment. Favorable policies, incentives (grants, tax breaks for R&D, innovation contests), and infrastructure investments (broadband internet availability, digital training programs) can significantly affect firms' propensity to innovate. Ramdani *et al.* (2022) list government support and market scope among important environmental antecedents for SME digital innovation. On the flip side, regulatory constraints or lack of support can hinder innovation (e.g., strict industry regulations might slow down digital experimentation in incumbent firms, or insufficient legal frameworks for digital business can discourage innovation). Finally, technological opportunity landscape – the external availability of new digital technologies (cloud services, AI tools, IoT platforms) – constitutes an antecedent in that firms can only innovate using what technology exists. Rapid advances in technology can "trigger" innovation by opening new avenues (for example, the rise of mobile app ecosystems in the external environment triggered digital service innovation in many companies).

When comparing SMEs vs. incumbents in the literature, we found that both types of firms share many antecedent factors, but the emphasis and context differ. In SME-focused studies, there is a stronger lens of *technology adoption* and overcoming barriers: for instance, how owner-manager characteristics and perceived tech benefits lead to the decision to adopt (or not adopt) a new digital solution. These studies often implicitly treat adoption as the innovation (e.g., adopting an e- business tool is itself the innovation for the SME). Consequently, external support (like government grants, consultant advice, or partner networks) emerges as crucial for SMEs – they need these trigger conditions to initiate digital projects given their constraints (Omowole *et al.*, 2024). In contrast, studies of incumbent firms often delve into internal processes and capabilities needed to continuously innovate in the digital realm. Concepts such as *digital transformation capability, digital strategy, and organizational agility* appear frequently. For example, incumbent firms may focus on developing digital platforms or re-configuring legacy processes, which requires strong managerial commitment and often a cultural shift (as noted by Firk *et al.*, 2022, incumbents struggle with the novel, cross-functional nature of digital innovation). Some research highlights that incumbents need to overcome internal resistance and inertia by fostering more entrepreneurial, learning-oriented cultures and by upgrading their workforce's digital competencies (Li *et al.*, 2023). Capabilities like opportunity recognition and knowledge management – mentioned by Kohli & Melville (2019) – are particularly salient in large organizations that must integrate digital innovation into complex structures. Additionally, a few studies address organizational structure choices in incumbents for digital innovation: for instance, whether to set up separate digital units, how to govern innovation initiatives, and how to balance exploiting existing IT assets with exploring new

technologies. SMEs, due to their size, rarely have formal R&D or separate innovation departments; innovation is typically part of the core business activities or driven by the CEO, making leadership and agility the decisive factors.

In summary, the literature to date indicates that antecedents of digital innovation are multi-faceted, including human, technological, organizational, and environmental factors. Both SMEs and incumbent firms require a mix of these antecedents to succeed, but their challenges differ. SMEs need to compensate for limited resources through external support, simpler technologies, and strong leadership vision, whereas incumbents must *adapt their complex organizations* by cultivating pro- innovation capabilities and mindsets to avoid stagnation. It is also evident that research explicitly comparing SMEs and incumbents is scant – our understanding is pieced together from studies focusing on one or the other. This study's conceptual framework and comparative approach aim to bridge that gap, recognizing that context (small vs. large firm) can modulate how antecedents operate.

Findings Concerning the Theoretical Lenses Used in Studying These Antecedents

RQ2. Which (if any) theories have been used to study antecedents of digital innovation in SMEs and/or in incumbent firms?

Our review found that researchers have drawn on several established theories and models to frame studies of digital innovation antecedents. Broadly, these can be grouped into two categories: (1) innovation adoption and diffusion theories, which have often been applied to SMEs and early-stage innovation decisions, and (2) organizational and strategic management theories, which are more common in studies of incumbent firms' innovation capabilities.

1) **Diffusion of Innovation (DOI) Theory:** Originally formulated by Everett Rogers (1983), DOI is a foundational theory explaining how new innovations spread within and across organizations. Several studies in our review, especially older and adoption-focused ones, implicitly or explicitly rely on DOI to identify antecedents. DOI theory highlights characteristics of the innovation (relative advantage, compatibility, complexity, etc.), the adopting organization, and the external environment as key influences on the adoption decision. For example, the categories used by Ramdani *et al.* (individual, technological, organizational, environmental) resonate with the DOI perspective. Early research on IT and digital innovation adoption frequently cited Rogers' theory to justify examining factors like perceived innovation attributes and peer pressures. Thus, DOI provides a theoretical basis for considering why some firms (or individuals within firms) choose to adopt a digital innovation earlier than others. In our context, DOI informs the idea that certain antecedent conditions increase the likelihood of digital innovation "taking off" in an organization.
2) **Theory of Planned Behavior (TPB):** As an extension of the Theory of Reasoned Action, Ajzen's TPB (1985) posits that an individual's behavior (such as adopting a technology) is driven by their intention, which in turn is influenced by attitudes, subjective norms, and perceived behavioral control. A few studies, particularly in SME adoption scenarios or where individual managers' decisions are key, have used TPB to frame their research questions. For instance, an SME owner's attitude toward digital technology (positive or fearful), the social norm or pressure they feel (e.g., seeing competitors succeed with digital tools), and their perceived control (do they feel able and competent to implement it?) can be seen as antecedents shaping their intention to pursue digital innovation. TPB often works in tandem with other models like TAM to explain individual-level decision-making in firms. While TPB is not always named in digital innovation studies, its constructs appear in examining manager behavior and openness to innovation.
3) **Technology Acceptance Model (TAM):** Davis's TAM (1989) is another individual-level theory focusing on *perceived usefulness* and *perceived ease of use* as the primary determinants of technology acceptance. TAM (and its extensions such as TAM2, UTAUT, etc.) has been widely used in IS research and appears in studies of digital innovation antecedents to explain user or manager acceptance of new digital solutions. For example, if employees find a proposed digital tool too complex or not useful, that perception could be an antecedent barrier to the organization's digital innovation initiative. Some SME studies model the adoption of specific digital innovations (like e-commerce platforms or enterprise software) using TAM variables to assess antecedents at the user level. TAM's prevalence in earlier studies provides a theoretical underpinning for why technological factors (usefulness, ease of use) and user attitudes are important antecedents.

The above three frameworks (DOI, TPB, TAM) are classic innovation and adoption theories, and they feature most prominently in what our review identified as "early studies" on antecedents. They are often applied to smaller firms or to the introduction of discrete technologies, focusing on the decision and intention phase of innovation. As digital innovation research has evolved, especially for incumbent firms and more complex innovation processes, scholars have turned to broader organizational theories:

1) **Technology-Organization-Environment (TOE) Framework:** The TOE framework (Tornatzky & Fleischer, 1990) is specifically tailored to organizational adoption of technological innovations, examining how factors in three contexts – the technological context, organizational context, and external environmental context – affect adoption. Our review found that TOE is a common theoretical lens for studying SME digital innovation antecedents. Many studies that categorize antecedents into similar groupings (like "internal vs. external factors") implicitly draw from TOE. For example, in an SME context, *technological* context might include the attributes of available digital technologies (echoing TAM/DOI), *organizational* context covers firm size, top management support, readiness (resources, skills), and *environmental* context includes competitive pressure, industry characteristics, and government support. Researchers favor TOE for SMEs because it provides a structured way to capture the multi-dimensional influences on adoption decisions. It has been particularly influential in studies of e-business adoption and other IT

innovations in SMEs, where authors often test which of the TOE factors are significant drivers. In our scope, TOE helps integrate the various antecedents at organizational level – it reminds us that a firm's readiness (organization), the fit and quality of the technology (technology), and the market/regulatory pressures (environment) collectively determine innovation uptake. Some studies explicitly focusing on SMEs' digital transformation cite TOE to argue that SMEs need a conducive mix of all three contexts to successfully innovate. TOE is less frequently mentioned with incumbents in our dataset, possibly because larger firms were often analyzed using more strategy-oriented theories, but its logic can apply to any firm size.

2) **Resource-Based View (RBV) and Dynamic Capabilities:** As research shifts to what enables sustained innovation and competitive advantage, the Resource-Based View of the firm (Barney, 1991) becomes relevant. RBV posits that a firm's internal resources (tangible and intangible) are key to its performance, and if those resources are valuable, rare, inimitable, and well-organized, they can yield competitive advantage. In the context of digital innovation, RBV-inspired studies look at a firm's digital resources and capabilities as critical antecedents. For example, having a skilled IT team, a robust data infrastructure, or proprietary digital platforms could be seen as resources that enable more innovation. Some studies (e.g., Khin & Ho, 2019) explicitly examine how *digital capability* – an organization's ability to leverage digital technologies – drives innovation and performance (Khin and Ho, 2019; Herediaa *et al.*, 2022). They often find that strong digital capabilities lead to greater innovation output, which then improves firm performance (essentially treating digital innovation as a mediator between capabilities and performance) Khin and Ho, 2019. Dynamic Capabilities, a related concept (Teece *et al.*, 1997), extend RBV by emphasizing a firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments. In our review, dynamic capabilities theory is used to understand how incumbent firms in particular adapt to digital disruption. For instance, an incumbent's ability to sense new technological trends, seize opportunities by reallocating resources, and reconfigure assets (e.g., reorganizing teams or acquiring new technologies) can be seen as higher-order antecedents of successful digital innovation. One study in our set examined how digital capabilities (as a dynamic capability) and an entrepreneurial culture can moderate the negative effects of organizational inertia on an incumbent's digital innovation efforts (Li *et al.*, 2023). The findings suggest that incumbents with strong dynamic capabilities and supportive culture are better at overcoming barriers and accelerating innovation. Thus, RBV and dynamic capabilities provide a theoretical explanation for why some firms innovate more effectively than others: it comes down to their unique resource endowments and adaptive capacities. These theories are especially pertinent to incumbent firms because such firms often rely on transforming existing assets and skills to enable digital innovation (versus a startup that might start from scratch). However, they apply to SMEs as well – for example, an SME's network relationships or proprietary knowledge can be key resources that spark innovation.

In addition to the above, a few other theoretical perspectives appeared occasionally. For example, sociotechnical systems theory underpins some discussions about aligning social (people, structure) and technical (technology) factors for innovation (though not always named explicitly). Institutional theory might be used when discussing how regulative, normative, and cognitive institutions influence innovation adoption (e.g., firms adopting digital practices because it becomes an industry norm or due to government mandates). Contingency theory is implicit in works that examine how context (size, industry) changes the effect of certain antecedents – relevant since our study is comparative. But the dominant themes were the ones outlined: adoption-centric theories (DOI, TPB, TAM) and organizational capability theories (TOE, RBV/DC).

To summarize the theoretical landscape: Early studies on digital innovation antecedents leaned heavily on classic IT adoption models – treating the problem similarly to why organizations adopt any new technology. These studies frequently involved SMEs and drew on DOI, TPB, and TAM to operationalize factors like perceived benefits, user attitudes, and so on. As the focus of research broadened to digital innovation as an ongoing process (especially in larger firms), scholars employed frameworks like TOE to encompass a fuller range of contextual factors, and RBV/dynamic capabilities to link innovation with strategic management theory. Notably, the Technology-Organization-Environment framework has been a workhorse for studying SME digital innovation, acknowledging the interplay of internal and external conditions. Meanwhile, studies of incumbents often reference dynamic capability theory to argue that continuous digital innovation requires not just one-time adoption decisions, but an organizational ability to transform and reconfigure resources over time (e.g., sensing and seizing digital opportunities faster than competitors). Our review confirms that there isn't a single unifying theory of "digital innovation antecedents" yet; instead, researchers borrow from multiple theoretical traditions depending on their emphasis. This suggests an opportunity for more integrative theoretical development (which our conceptual framework attempts to do). In our study, we consciously incorporate elements of these theories: for instance, our consideration of individual, technological, organizational, and environmental antecedents is rooted in DOI/TOE, and our notion of "supporter" antecedents throughout the innovation process resonates with dynamic capabilities (the ability to continuously support and reconfigure for innovation). By recognizing the theories used so far, we ensure our work builds on established knowledge while also highlighting where new theory-building (or combining of theories) is needed to fully understand digital innovation in different organizational contexts.

7. Discussion

Comparison with Prior Literature

Our findings both align with and extend the existing literature on digital innovation. Consistent with earlier research, we identified a range of factors – human, technological, organizational, and environmental – that act as precursors to

digital innovation. Many of these mirror-known IT adoption drivers: for example, the importance of top management support, adequate resources, and technology fit has long been noted in studies of IS implementation and innovation adoption. In that sense, our review reaffirms that *digital innovation does not happen in a vacuum*; it requires certain enabling conditions that prior literature on innovation diffusion and technology acceptance has well documented. SMEs need receptive leaders and user-friendly technologies to embrace innovation, just as DOI and TAM would predict, and incumbents need to align innovations with their strategy and capabilities, echoing RBV and dynamic capability notions. We also found evidence supporting the view that organizations must balance both internal and external considerations (as per the TOE framework) – a company might have a tech-savvy CEO and ample funds (strong internal factors), but if the external environment is unfavorable (say, low market demand or weak infrastructure), digital innovation can still stall. This reinforces the multi-dimensional perspective in prior literature that no single factor guarantees success; rather, it's the configuration of many antecedents that matters.

However, our study goes beyond past works by explicitly examining how these antecedents manifest differently in SMEs versus incumbent firms. The existing literature has rarely juxtaposed these contexts. Most studies focus on one or the other, often without discussion of firm size or maturity as a contingency. By synthesizing across studies, we observed that scale and maturity significantly influence innovation drivers. For instance, what Ramdani *et al.* (2022) observed in SMEs – the primacy of owner/manager traits and basic technology adoption factors – might not fully explain innovation in a multinational enterprise. Incumbent firms, as we found, face issues like siloed structures and inertia that barely register in SME studies. Conversely, certain antecedents like "government support" or "external partner network" are emphasized in SME literature (where they often compensate for internal limitations) but are seldom mentioned for large firms that have more internal self-sufficiency. Our comparative approach thereby *highlights an emerging gap*: the need for more context-specific theorizing in digital innovation. The literature so far treats "antecedents of digital innovation" somewhat generically or uses the term "antecedent" in narrow ways (often just to mean adoption facilitators). Our work contributes by clarifying that antecedents can be multi-stage (trigger vs. ongoing support) and that their relative importance may vary by organizational context. For example, organizational culture came through as a crucial factor for incumbents – supporting what authors like Westerman *et al.* (2014) or Bharadwaj *et al.* (2013) have anecdotally discussed about legacy firms needing cultural change for digital success. The fact that Dery *et al.* (2017) devoted attention to digital workplace culture in incumbents but we see little of that in SME studies is telling. It suggests that future research should not treat antecedents as one-size-fits-all, but rather account for differences in organizational size, age, and complexity. In short, our findings align with core innovation theories in general, but we add nuance by showing *where SMEs and large firms diverge in their innovation journeys*. This comparison with existing literature underscores that while any organization needs a conducive mix of people, tech, structure, and environment to innovate, how those needs are met can be context-dependent.

Another point of comparison is the temporal perspective on antecedents. Traditional literature often implies a linear stage model (awareness → adoption → implementation → outcomes). Ramdani *et al.*'s framework is an example of this linear view. Our results, enriched by Kohli & Melville's process view, suggest a less linear reality – organizations might experiment (implement in part) before fully deciding (adopt), or continuously iterate on a digital innovation. Thus, antecedents are not only *at the start* (triggers) but also *throughout* (supporters). We found supportive evidence in studies like Lokuge *et al.* (2018) and Xie *et al.* (2022) that organizational readiness and learning capacity continue to influence innovation implementation success. This resonates with broader innovation management literature that effective innovation requires ongoing leadership and learning, not just an initial decision. Our conceptual contribution here is highlighting that antecedents can be dynamic – a point not explicitly made in earlier works. Prior literature didn't clearly articulate that some factors must *persist* to keep innovation on track. By framing antecedents as triggers and supporters, we bridge the gap between adoption-focused research and implementation-focused research.

Finally, our study answers recent calls in the literature to deepen the theoretical understanding of digital innovation. Nambisan *et al.* (2017) famously argued that *"the time for new theorizing about digital innovation is now."* (Nambisan *et al.*, 2017) Prior research has given us rich descriptions of digital innovation cases and outcomes, but less on the prerequisites and mechanisms that lead to those innovations. Our systematic review addresses this by consolidating what is known about those prerequisites and identifying theoretical approaches that have been applied. In doing so, we noticed that many studies took a technology adoption angle, which is appropriate but somewhat limited – essentially treating digital innovation as a dependent variable explained by classic IT adoption factors. We bring to the forefront that digital innovation can also be studied through the prism of capability building (e.g., dynamic capabilities, knowledge integration) and that doing so might yield deeper insights for incumbent organizations. This comparison with existing work points to a shift: from viewing digital innovation as a one-off adoption event to viewing it as an ongoing organizational capability. We believe our findings encourage future researchers to combine these perspectives, examining both *the decision to initiate* (where adoption theories excel) and *the ability to execute and reinnovate* (where management and strategy theories excel).

In summary, relative to existing literature, our study confirms many established antecedents but also recontextualizes them. We emphasize context (SME vs. incumbent) and process stage (before vs. during innovation) as critical dimensions that have been underexplored. By doing so, we provide a more granular understanding of digital innovation antecedents, which aligns with and extends prior knowledge. Our comparative examination serves as a reality check that theories may need adaptation when moving from one setting to another. It also provides an integrative perspective that could inform more unified future models of digital innovation – an area that past research has treated in fragments (adoption, implementation, etc.) but is increasingly demanding a holistic approach.

8. Practical Implications for Firms and Policymakers

Our findings yield several actionable insights for practitioners – both for business leaders in firms of different sizes and for policymakers aiming to stimulate digital innovation in the economy.

For SME Owners/Managers: Given the critical antecedents identified, SME leaders should invest in strengthening the factors within their control. Firstly, building up digital knowledge and skills is paramount. SME owners can pursue training or hire advisors to improve their understanding of emerging technologies and how these can apply to their business. Since individual leadership is a strong antecedent in SMEs, an informed and proactive owner can be the spark for innovation. Moreover, cultivating a supportive organizational culture, even in a small company, can pay dividends. This means encouraging employees to experiment with new digital tools, tolerating some risk of failure, and rewarding creative problem-solving. SMEs often have the advantage of agility – to capitalize on it, leaders should formalize processes just enough to support innovation (e.g. set aside time or budget for trying new digital ideas) without stifling flexibility. Addressing resource constraints is another practical concern: SMEs should leverage external resources strategically. Our review suggests that partnering with external networks can provide knowledge and scale that small firms lack (Crupi *et al.,* 2020). SME managers might collaborate with other firms, join industry consortia, or engage with Digital Innovation Hubs and accelerators that provide access to expertise and technology. Such collaborations can function as extensions of the firm's own capabilities, effectively serving as external antecedents that *trigger and support* innovation. Additionally, SMEs should make use of cloud services and off-the-shelf digital solutions which often require lower upfront investment and can be trialed easily (aligning with the importance of trialability and ease of use). By starting with scalable technologies, SMEs can mitigate financial risk and scale their digital initiatives as they prove value. Finally, SMEs need to be mindful of change management – even in a small team, introducing a new digital way of working can meet resistance. Clear communication about the benefits and training to improve digital skills can help overcome internal resistance to change (Omowole, 2024). In short, SME leaders should actively create an environment where digital innovation is feasible: seek knowledge, encourage an open culture, network for support, and choose technologies wisely.

For Incumbent Firm Executives: In large organizations, the challenge is often not *awareness* of digital innovation (most incumbents know it's strategically important but rather overcoming internal constraints to execution. Our findings highlight the need for leadership and structural interventions to enable innovation. Top executives should demonstrate visible commitment to digital innovation – for example, by establishing a clear digital strategy, allocating dedicated funding, and setting innovation targets. A practical step is to invest in talent and teams that drive digital projects: appointing a Chief Digital Officer or empowering cross-functional innovation teams can help ensure digital initiatives don't get lost in bureaucracy. Incumbents should also assess and improve their internal capabilities related to digital technology. This could involve training existing staff in new digital skills, recruiting specialists (data scientists, UX designers, etc.), and updating IT infrastructure to be more modular and flexible. The concept of technological opportunism suggests firms might consider implementing systems to systematically scan for new tech trends (for instance, creating a small R&D or scouting unit). Our review suggests that organizational inertia is a major hurdle for incumbents. To counteract inertia, executives might look at organizational design: can decision-making be pushed closer to the front lines? Can the company adopt more agile methodologies (as in software development) beyond IT departments? Some incumbents create internal incubators or innovation labs separate from the main hierarchy to give digital projects room to grow outside the usual constraints. Others pursue open innovation approaches, partnering with startups or academia to infuse entrepreneurial energy. We found that an *entrepreneurial culture (EC)* within the firm helps attenuate inertia (Li *et al.*, 2023) , so initiatives that promote intrapreneurship – like hackathons, innovation contests for employees, or autonomy for units to experiment – are practical ways to shift culture. Moreover, incumbent firms should not underestimate the importance of knowledge management and learning. Setting up knowledge-sharing platforms, communities of practice, and lessons-learned repositories from past innovation projects can build a learning organization that continuously improves its innovation process. On the technology front, large firms may consider modernizing legacy systems incrementally (to improve compatibility for new digital tools) or using middleware to bridge old and new systems, thus reducing the friction when implementing innovations. In summary, incumbent managers should lead by example to champion digital innovation, deliberately break down structural barriers, and invest in the human and technical foundations that support continuous innovation.

For Policymakers and Ecosystem Enablers: Governments and industry bodies play a key role in creating an environment where both SMEs and large firms can thrive in digital innovation. One clear implication of our findings is the benefit of external support systems for SMEs. Policymakers can expand funding programs, grants, or tax incentives specifically targeted at SME digitalization projects, thereby addressing the financial antecedent barrier (Omowole, 2024). Initiatives such as innovation vouchers or subsidized training can encourage SMEs to take the first step in adopting new technologies. The establishment of Digital Innovation Hubs (DIHs), as promoted in the EU, is a promising approach: these hubs act as one-stop shops where SMEs can access expertise, pilot technologies, and even receive project support (Crupi *et al.*, 2020). Expanding the reach and capacity of such hubs can directly boost the antecedents (knowledge, network access, technical support) that SMEs often lack. Policymakers should also invest in digital infrastructure and education on a broad scale. Ubiquitous high-speed internet, for example, is fundamental so that even small businesses in remote areas can leverage cloud services and participate in digital markets. On the education front, integrating digital skill development in workforce training programs ensures a pipeline of talent that all companies can draw from. Our review underscores *skills gap* as a constraint; thus government-backed reskilling initiatives (e.g., coding bootcamps, SME manager digital training courses) will enhance the human capital antecedents for

innovation nationally.

Regulatory policy is another lever: Regulators should strive to create a balanced regulatory environment that protects consumers and security without unnecessarily hampering innovation. For instance, clear guidelines on data privacy and cybersecurity (aligned with frameworks like GDPR) help firms innovate with confidence knowing the compliance boundaries. In sectors with heavy incumbents, regulators might encourage sandbox environments where companies can experiment with new digital solutions under relaxed rules to test viability (common in fintech and healthcare for example). Additionally, fostering collaboration between large and small firms can be win-win. Policymakers could create matchmaking programs or consortia where incumbents mentor or partner with startups/ SMEs, allowing knowledge transfer and opening supply chain opportunities for smaller players. Large firms gain agility and fresh ideas, while SMEs gain access to resources and markets – together boosting overall innovation. An example is government-sponsored innovation challenges that pair tech startups with industry incumbents to solve specific problems (thereby acting as a trigger for innovation).

Finally, measurement and awareness campaigns can also drive change: governments might publish benchmarking reports on SME digital adoption, highlighting success stories to inspire others, and identify lagging areas needing attention. By publicly recognizing firms (of any size) that excel in digital innovation (through awards or press), policymakers can also set positive norms (leveraging the *subjective norm* concept from TPB to encourage a pro-innovation mindset across industries). In sum, policymakers should aim to *level the playing field* so that smaller firms have the support to innovate, and larger firms are nudged to continuously evolve rather than rest on laurels. Through a mix of financial incentives, infrastructure, education, and collaborative platforms, policy can strengthen the external antecedents (like networks and support) that we found to be especially crucial for SMEs, and ensure incumbents face healthy competition and encouragement to innovate.

9. Theoretical Contributions

This study makes several contributions to the scholarly understanding of digital innovation. First, by focusing on the antecedents of digital innovation, we address a relatively under-explored aspect of innovation research. Much of the digital innovation literature has centered on outcomes (e.g., new business models, performance impacts) or the innovation process itself, with less attention to the starting conditions that make such innovation possible. We contribute a comprehensive synthesis of those starting conditions, drawing together disparate threads from technology adoption studies, innovation management, and strategic IT research. In doing so, we clarify the concept of "antecedents of digital innovation" and distinguish it from related ideas. Prior studies like Ramdani *et al.* (2022) used "antecedents" mainly in the context of adoption facilitators. Our work broadens this notion to include any factor that *triggers, enables, or supports* the realization of digital innovation, whether before initiation or during implementation. This broader conceptualization allows scholars to discuss antecedents in a more nuanced way, acknowledging that innovation is not a single event but a journey with multiple critical inputs along the way.

Second, we develop a conceptual framework that integrates insights from multiple prior frameworks (adoption and process-oriented) into a unified model. This framework – highlighting trigger and supporter antecedents across individual, technological, organizational, and environmental dimensions – provides a foundation for future research to build on. It serves as a theoretical bridge between the innovation adoption literature (e.g., DOI, TAM, TOE) and the digital innovation process literature (e.g., the stages and actions proposed by Kohli & Melville). By linking these, our framework suggests that research on digital innovation can benefit from a multi-theory approach. For instance, a future empirical study might measure both adoption factors (like perceived usefulness of a technology) *and* dynamic capability factors (like a firm's learning orientation) to see how each contributes to successful innovation. Our framework would predict that both matter – some as early triggers, others as ongoing supports. Thus, one contribution is the proposition that time sequencing and continuity of antecedents is important: certain antecedents must come into play early (to initiate innovation), while others must persist (to implement and exploit innovation). Traditional theoretical models rarely make this temporal distinction explicitly; we offer a conceptual language to do so. This idea opens avenues for longitudinal studies of innovation, where researchers can track how initial conditions and continuous conditions interact to yield innovation outcomes.

Third, our study contributes a comparative perspective that highlights the role of organizational context (SME vs. incumbent) in digital innovation theory. Many theories in our domain (e.g., TAM, DOI, RBV) are intended to be general, but our findings indicate that their application and relative explanatory power may differ by context. For example, TAM's core constructs might explain an SME's adoption of a specific tool quite well, but in a big firm, TAM might need to be extended with constructs like "management championship" or "innovation climate" to fully explain adoption across a complex hierarchy. By examining SMEs and incumbents side by side, we provide empirical support for a *contingency view*: the antecedents of digital innovation are not universal; they are contingent on firm characteristics like size, structure, and resource endowment. This aligns with contingency theory and contributes to it by identifying which contingencies (e.g., resource abundance vs. scarcity, structural flexibility vs. formalization) modulate innovation drivers. For researchers, this means that theories of digital innovation should incorporate contextual variables rather than assume one model fits all. Our work specifically contributes to SME digital innovation literature by consolidating factors that have been scattered across various studies (often under the label of adoption or digitalization) and to incumbent firm literature by articulating the less tangible factors (like culture and capabilities) that are often mentioned qualitatively but not systematically compared. We also hope this comparative insight spurs more research into *why* these differences exist – for instance, deeper theoretical exploration of how organizational age or size creates certain innovation path dependencies or freedoms.

Fourth, we contribute to theory by cataloguing the theoretical

frameworks used to date and identifying gaps. We observed that a lot of past research relied on adoption theories (from the 1980s– 90s), which while valuable, might not fully capture modern digital innovation phenomena (which involve not just adoption but continuous adaptation). By noting the increased use of RBV and dynamic capabilities in recent studies, we signal a theoretical shift: scholars are recognizing digital innovation as an ongoing capability-building process. Our review therefore contributes a meta-perspective on theory: it suggests that *innovation-specific theories* (like those dealing with dynamic capabilities or digital ecosystems) are complementing or even supplanting pure adoption theories in this domain. This is a useful insight for theory-building – perhaps the field is moving toward an integrated theory of digital innovation that merges elements of adoption (for initiation) and adaptation (for implementation). We explicitly answer Nambisan *et al.*'s call for new theorizing by proposing that any new theory should be multi-layered, accounting for micro-level (individual) and macro-level (organizational, environmental) antecedents, and dynamic over time (Nambisan *et al.*, 2017). The work we present can serve as a stepping stone for that theorizing: it delineates the constructs and relationships that a robust theory of digital innovation antecedents might entail.

Lastly, our study's systematic approach itself is a contribution. By rigorously reviewing and synthesizing 47 recent studies, we provide a state-of-the-art summary that can guide both practitioners and academics. We identify where research has concentrated (e.g., adoption in SMEs) and where it has been sparse (explicit studies of incumbent antecedents, or direct SME-incumbent comparisons). This not only contributes new knowledge but also surfaces theoretical blind spots. For example, one might realize from our synthesis that while we borrow theories like TOE or TAM, there isn't yet a well- established theory that explains how *organizations transform digitally over time* considering their starting conditions. Our findings hint at what such a theory might need to include, thereby contributing toward its eventual development.

In conclusion, the theoretical contributions of this work are: (1) expanding and clarifying the concept of digital innovation antecedents, (2) offering an integrative conceptual framework bridging multiple theoretical perspectives, (3) introducing a contingency view via SME vs. incumbent comparison, (4) mapping the use of existing theories and suggesting the need for integrated new ones, and (5) responding to calls for theorizing in the digital innovation realm. We believe these contributions deepen the understanding of *why* and *how* digital innovation occurs (or fails to occur) in different organizational settings, providing a richer theoretical grounding for future studies.

10. Limitations and Future Research

Despite the careful approach and insights gained, this study has several limitations that should be acknowledged. First, our literature sample is restricted by design. We conducted a systematic review focusing on journal articles (and reviews) indexed in one of the major databases (i.e. Web of Science), and further emphasized those in well-regarded IS and management journals. This means we excluded conference papers, book chapters, and potentially valuable case studies or industry reports that discuss digital innovation antecedents. As a result, some relevant research findings might have been missed, especially emerging studies or niche contexts often reported outside of high-tier journals. By adhering to strict inclusion criteria (e.g., searching within titles/abstracts for certain keywords), we also might have overlooked studies that examine similar concepts under different terminology. For example, a paper might discuss "drivers of digital transformation" or "critical success factors for IT innovation" without using the word "antecedent," and such a study could have fallen outside our search net. Therefore, while our review is systematic and reproducible, it may not be exhaustive in capturing every insight on this topic. Future researchers could complement our work by exploring grey literature or broader search terms to see if additional antecedents or different emphases emerge.

Second, there is a bias in the literature itself that affects our findings. As we noted, many studies focus on SMEs or on specific technologies, and relatively fewer on incumbents or on holistic innovation processes. This imbalance in available research means our synthesis for incumbents relied on a smaller pool of studies (and sometimes had to infer from general digital transformation literature). The lack of direct comparative studies in prior literature required us to juxtapose findings from different contexts, which introduces interpretation on our part. It's possible that some differences we attribute to SME vs. large firm context could be partly due to other factors (industry differences, regional factors) if the underlying studies had such biases. We tried to control for this by sticking to broadly applicable studies, but it's a limitation of relying on existing research – the comparative angle is only as strong as the consistency of those studies.

Third, our conceptual framework has not been empirically validated in this study. We proposed the framework based on literature synthesis and logical reasoning. While we believe it captures the key constructs and relationships, we did not test it with primary data. There is a risk that some aspects of the framework (e.g., the distinction between trigger and supporter antecedents, or the relative importance of factors) might not hold in all settings or might overlap. For instance, an antecedent like "top management support" might be both a trigger and a supporter in practice, which complicates categorization. Future research should empirically evaluate our framework – for example, through case studies or surveys in both SMEs and incumbent firms – to assess which antecedents are indeed most critical and at what stages. It's also possible that our framework could be expanded (perhaps there are other categories or mediating mechanisms we did not include). Thus, we caution that the framework is a starting point for theory-building, not a finished theory.

Additionally, the nature of a systematic review means we are limited by what past researchers chose to study and report. There could be antecedents that exist in practice but have not been captured in academic literature. For example, we did not explicitly see studies on psychological factors like employee trust in leadership or external factors like global crises (which, as the COVID-19 pandemic showed, can suddenly accelerate digital innovation). Such factors might have emerged if our review included very recent post-2020 studies or

interdisciplinary perspectives. Our time frame and sources might have underrepresented those aspects. Thus, generalizability of our conclusions should consider that the digital innovation landscape is fast-evolving; what was a minor factor in past studies could become major in the future (e.g., sustainability concerns or remote work culture might become new antecedents for digital innovation).

Finally, while we tried to be objective in coding and synthesizing studies, there is inherent subjectivity in interpretation. Another researcher might categorize or emphasize factors differently. We mitigated this by sticking closely to how sources themselves described antecedents, but the risk of bias in qualitative synthesis remains. Also, any errors or omissions in the original studies (like mis-estimation of an effect or a context not reported) could propagate into our review conclusions. We recommend readers and future scholars to view our conclusions as trends and patterns supported by the literature, rather than absolute rules. Recognizing these limitations, we aimed to be transparent in our methodology and assumptions so that future work can refine and build upon our findings. By acknowledging these limitations, we hope to clarify the scope of our contributions and encourage further research to address the unanswered questions and gaps identified through this study.

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