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Investment in digital technology and entrepreneurial trajectory: Is there any competitive edge?

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Abstract

Purpose – We examine how investment in digital technology shapes entrepreneurial trajectory – entrepreneurial opportunities, business models and performance given the competitive environment of the firm.
Design/methodology/approach – We choose all the observations from the listed firms of the Dhaka Stock Exchange Limited in Bangladesh, an emerging economy in Southeast Asia. We choose firms that have more exposure to technological investment each year in the value-generation process from 2019 to 2021. We use ordinary least square, controlling all fixed effects, to explore the impact of investment in IT on the entrepreneurial trajectory.
Findings – Following the "resource-based perspective" of the firms, we find that more investment in technologies improves entrepreneurial trajectory, even in a competitive environment.
Practical implications – This paper will assist regulators and policymakers in adopting the right legislation, regulatory reform and enforcement strategies to enhance the information technology implementation processes.
Originality/value – We expect that this paper will provide an incentive for managers and entrepreneurs to think more about the role of investment in technologies to improve and shield entrepreneurial trajectory in the long run.

Keywords Bangladesh, Investment in digital technology, Competitive environment, Entrepreneurial trajectory
Paper type Research paper

1. Introduction

Due to recent developments in digital technologies, many aspects of entrepreneurship have changed (Nambisan, 2016; Svahn *et al*., 2017; von Briel *et al*., 2017). As a result, the potential for entrepreneurial activities at the intersection of digital technologies and entrepreneurship, or "digital entrepreneurship," has increased (Davidson and Vaast, 2010; Nambisan, 2016; Yoo *et al*., 2010). Despite the growing importance of digital technology for entrepreneurship, our understanding of the digital components of entrepreneurship is still restricted. Moreover, due to the influence of digital technologies on entrepreneurial outcomes and processes, new issues and problems at the intersection of entrepreneurship and digital technologies have started to emerge. As a result, the fundamental hypotheses related to the landscape of digital entrepreneurship in past studies are challenged (Nambisan, 2016; Nambisan *et al*., 2017; Yoo *et al*., 2010). Moreover, past papers do not give a clear direction to exploit the unique features

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of digital entrepreneurship (Davidson and Vaast, 2010; Lyytinen *et al*., 2016; Nambisan, 2016).

It is outlined in the past papers that digital entrepreneurship plays an increasingly important economic and societal role in terms of the source of innovation, job creation and economic growth (European Commission, 2015; Gimmon and Levie, 2010; Grilli and Murtinu, 2014; Leong *et al*., 2016; Nambisan, 2016). Several entrepreneurial processes and outcomes are streamlined by digital breakthroughs in technologies (von Briel *et al*., 2017; von Briel and Recker, 2016; Yoo *et al*., 2010; Lusch and Nambisan, 2015; Nambisan, 2013; Nambisan, 2016; Nambisan *et al*., 2017). Moreover, the integration of a wide range of digital tools allows entrepreneurial firms to create an impact on their innovation processes by drastically improving the existing products and services (Yoo *et al*., 2010).

Despite the existing benefits, digital technologies always bring new opportunities for firms and enterprises (Ciriello *et al*., 2018; Henfridsson *et al*., 2018; Oberlander *et al*., 2021). For example, firms can continuously digitalize their functions and capabilities into physical units in order to make more cost-effective decisions in the competitive business environment (Yoo *et al*., 2010; Lokuge *et al*., 2019). Also, firms can utilize digital technologies to integrate goods and services beyond organizational, functional and geographical boundaries (Sebastian *et al*., 2017) as they always quicken the change and bring a major transformation in firms (Bharadwaj *et al*., 2013; Ghezzi *et al*., 2015) other than with the power of outweighing the status quo to propel development (Bharadwaj *et al*., 2013). Nowadays, it is claimed that digital technologies give firms a new method to operate in a "business ecosystem" (Presch *et al*., 2020) that changes the dynamics of value networks (Gray *et al*., 2013). It is also claimed that digital technologies bring a fundamental shift in business and society through the newly developed concepts of circular and sharing economies (Ng and Wakenshaw, 2017). The past papers explored the connection between digital technologies and entrepreneurship as well as how digitization affects different aspects of entrepreneurial trajectory individually (opportunities, business models and performance) such as Devaraj and Kohli (2003) on operational and financial performance, Nambisan *et al*. (2017) on business opportunities, Björkdahl (2020) on operational performance, Lehrer *et al*. (2018), Hansen and Sia (2015), Lee and Berente (2012) on operational and financial performance. Moreover, Bharadwaj *et al*. (2013) focus on how firms can preserve competitive advantage through digital technologies. We do not find a single paper that explored how digital technologies improve all the fundamental dimensions of firms more specifically during the rise in competition. We claim that digital technologies may not improve all the fundamentals, which are regarded as entrepreneurial trajectories together (Garud and Rappa, 1994; Henfridsson and Yoo, 2014; Davidsson, 2015), concomitantly. Dosi (1982) and Dimov (2010) claimed that trajectory not only depends on the opportunities and performance of the firms but also captures innovation in the business models. Hence, following the gaps in existing literature, we focus on entrepreneurial trajectory collectively – *opportunities*, *business models* and *performance* – and explore the impact of digital technologies on entrepreneurial trajectory. We also focus on how digital technologies shield the trajectory during the highly competitive environment. This paper contributes to the existing literature in two ways: First, it explores the effect of digital technologies on collective entrepreneurial trajectory; second, it explores how digital technology protects entrepreneurial trajectory during the competitive environment. Since information technology (IT) investment comprises unique resources of the firms, following the resource-based view (RBV), we assume that investment in digital technology contributes to the entrepreneurial trajectory.

We organize this paper in the following ways. Section 1 presents the introduction with relevant contributions. Section 2 presents a theoretical lens. Section 3 summarizes the past literature and proposed hypotheses. Section 4 presents the research design, followed by Section 5 that presents findings, analysis and discussion. Finally, this paper concludes with some implications and future research directions.

2. Theoretical lens

To explore the impact of investment in digital technologies on entrepreneurial trajectory, we look into the inside view of the firms. The inside view of the firms can be seen through the perception of the RBV. RBV outlines that valuable resources usually ensure superior performance of the firms (Barney, 1991). We assume that investment in cutting-edge digital technologies improves firms' entrepreneurial trajectory. According to RBV, firms can be considered as a pool of physical, human and intellectual resources. We can refer digital technologies as a part of intellectual and unique resources that contribute to the fundamentals of the firms.

3. Literature review and hypotheses

Following the essence of entrepreneurship, identifying potential business opportunities and taking advantage of them by combining currently existing resources or developing new ones in order to produce and market new products and services (Hitt *et al*., 2001), Kuratko (2016) urged for a dynamic process of vision, transformation and creativity. Singh (2001) outlined the opportunity as a realistic, profit-seeking and potential business model that introduces novel goods and services in addition to improving the existing goods and services. To exploit all the new opportunities, McDaniel (2005) highlighted the importance of digitization in existing operations. Since opportunities demand cognitive recognition which depends on individuals being able to spot patterns and make connections, Kraus *et al*. (2019) explored how digital technologies make it possible for firms. Since the right opportunities through an iterative process of movement and reaction by entrepreneurs (Schumpeter, 1934) lead to the success of entrepreneurial firms (Ardichvili *et al*., 2003), digital technologies create new commercial opportunities (Eckhardt and Shane, 2003). Ardichvili *et al*. (2003) also urged the creation of a new business model with new discoveries and novel ideas by introducing digital technologies. Drucker (1985) and Schumpeter (1934) drew the same conclusion that technological innovation can discover new entrepreneurial opportunities. Their findings are relevant even when there is uncertainty in market demand (Sarasvathy, 2001) and participants possess unequal access to knowledge about the market conditions (Kirzner, 1973, 1997; Shane, 2000, 2003). Foisal *et al*. (2023), in their most recent study, outlined how entrepreneurial firms can find and build new concepts and develop a network of internal resources to exploit current and future opportunities. Singh (2001), Foisal *et al*. (2023), Eckhardt and Shane (2003) and Ardichvili *et al*. (2003) explored how digital technologies affect a part of the entrepreneurial trajectory. The full picture of entrepreneurial trajectory was absent in their papers. Moreover, the strong empirical evidence was absent to support their hypotheses.

Following the construction of a business model, a system of connected and interdependent activities that governs how a corporation conducts business with its customers, partners and suppliers, suggested by Amit and Zott (2012), Osterwalder and Pigneur (2010) found that a designed business model built on technological innovation serves as a cornerstone of organization's value creation, delivery and strategy formulation (Verhoef *et al*., 2021). Zott and Amit (2008) also asserted that business models serve as a structural framework for describing an organization's value propositions, associated network, cost and revenue sources and other key differentiators. In this respect, only innovative firms play a significant role in bringing about these developments (Sorri *et al*., 2019; Zaheer *et al*., 2019). Their findings are amplified by Nambisan (2016), who outlined that business models on digital technologies change many industries by fostering the creation of new business models (Cuc, 2019). Li *et al*. (2012, 2018) and Veit *et al*. (2014) looked at business models built on digital technologies as better resource utilization. They claimed that a business model is said to be digitalized once it leads to significant changes in how a firm operates and generates its revenues. The recent studies by He *et al*. (2022), Vrontis *et al*. (2022) and Dallos (2021) claimed that digital technologies allow firms to develop a business model that benefits the society and the environment. Clearly, Amit and Zott (2012), Osterwalder and Pigneur (2010) and other past studies explored the role of digital technologies on business model innovation only.

Creating a technological bond depending more on data and intellectual property within and outside the home country (Grotnes, 2009; Lind *et al*., 2012), firms can increase their operational and business performance (O'Donovan *et al*., 2015; Atzori *et al*., 2011; Gubbi *et al*., 2013; Miorandi *et al*., 2012; Weber, 2010; Boss *et al*., 2007). Digital technologies such as big data, the Internet of Things and artificial intelligence (Kraus *et al*., 2019; Nambisan *et al*., 2017) are also changing performance of all sizes (Li *et al*., 2018). Digital technologies also improve the individual performance of human resources in firms (Anim-Yeboah *et al*., 2020). In their most recent study, Foisal *et al*. (2023) explored how digital technologies improve business performance, which inspires innovative business ventures and boosts operational efficiency through quick deployment cycles for new goods and services.

A recent study by George *et al*. (2021) explored how adopting a digital toolbox shapes business models, exploits new opportunities, develops an ecosystem and ensures new ways of thinking and innovation. They proposed that digital sustainability spurs empirical advances in entrepreneurship, innovation and strategy with a potentially positive impact on society.

Even if the past pool of literature does provide a clear direction on how digital technologies improve performance, exploit opportunities, improve the business model or affect two of these dimensions of entrepreneurial trajectory, there is not even a strong empirical paper on how investment on digital technologies improves the entrepreneurial trajectory together – *performance*, *opportunities* and *business model*. Moreover, past literature completely fails to provide evidence on how investment in digital technologies provides a shield to the firms during the competitive environment. Since nowadays firms are deploying more capital on their IT infrastructure in quest for better decision-making, we therefore look for how investment in IT shapes the entrepreneurial trajectory as a whole during the competition. Following this series of arguments, we want to propose the following hypotheses.

H1. Investment in digital technology improves entrepreneurial trajectory.

H2. Investment in digital technology shields firms' entrepreneurial trajectory even during intense competition.

We expect that this paper provides a forward-looking view to the regulators, policymakers and managers in realizing the role of investment in IT within the firms and industries.

4. Research design

Sample and data

We choose all the firm-year observations from the firms enlisted in the Dhaka Stock Exchange Limited in Bangladesh, an emerging economy of Southeast Asia. We choose a mixture of firms that have more exposure to investment in IT each year in the value generation process. However, the sampling technique used in this paper is purposive. The main reason for choosing this sampling technique is the unavailability of data of the listed firms subject to substantial investment in IT. We use the time frame from 2019 to 2021 of 50 firms with 150 firm-year observations. The main reason to select the short time frame from 2019 to 2021 is that firms in Bangladesh started significant investments in IT from 2019. Also, we deal with a short data set due to lack of investment in IT data in the publicly available annual reports of the firms.

Model and measurement

We estimate two different models in the following forms. The main purpose of estimating two different models is to check the robustness of the results.

$$ET_{it} = \alpha_0 + \alpha_1 Ln(Investment\_IT)_{it} + \sum_{i=1}^{p} a_{1i} + \sum_{i=1}^{q} a_{2i} + \sum_{i=1}^{r} a_{3i} + \varepsilon_{1t} \quad (1)$$

$$ET_{it} = \alpha_0 + \alpha_1 Ln(Investment_{IT})_{it} + \alpha_2 Ln(Age)_{it} + \theta Ln(Investment_{IT})_{it} \times Ln(Age)_{it} + \amalg_i Z_{it} + \sum_{i=1}^{p} a_{1i} + \sum_{i=1}^{q} a_{2i} + \sum_{i=1}^{r} a_{3i} + \varepsilon_{2t} \quad (2)$$

ET stands for entrepreneurial trajectory that captures opportunity, performance and business models. Z_{it} is the vector of all the control variables. α_1 measures the impact of investment in digital technologies on ET. α_2 measures the impact of age on ET. θ measures the heterogeneous effects of age. More specifically, θ measures the effects of investment in digital technologies during the period of competition (usually in the matured stage). a_{1i}, a_{2i} *and* a_{3i} represent firm, industry and time fixed effects, respectively. Firm effects capture all the unobservables that vary across the firms. Industry effects capture all the unobservables that vary across the industries. Time effects capture all unobservables that remain fixed at a particular time across firms and industries but vary across time. Once we control all the fixed effects, the econometric model will become free from omitted variable bias. The measurement of the variables used in the proposed models is given in Table 1. To estimate the two models (1) and (2), we use ordinary least squares. We assume that there is no endogenous variable in our prescribed models. We can rationalize our assumption in the sense that nowadays during the extremely competitive environment, investment in digital technologies is no more a choice rather it is a necessity. Also, firms have usually no control over operating expenditures (OPEX). Hence, there is only one-way feedback from all independent variables to the dependent variable. Therefore, based on our strong assumption, it is irrelevant to employ instrumental variable

Table 1. Definition and measurement of variables

Definition of variables	Measurement
Opportunity	We measure opportunity based on future sales growth. Future sales growth is measured by the geometric mean of the last three years' sales growth. We denote it by *Sales_Growth*
Performance	We measure performance based on two classic but popular performance measures – return on assets (*ROA*) and return on equity (*ROE*)
Business model	A particular business model of a firm contributes to the value creation. From this viewpoint, we assess the business model based on the two value drivers – total sales and economic value added (EVA). We measure these value drivers by the natural logarithm of sales and EVA. Since these value drivers considerably vary across small and large firms, we take natural logarithms to normalize the data. This normalization also allows us to control the heterogeneity across the firms
Digital technology	One way to measure digital technology is to use the number of digital technologies used by the firms. However, most of the firms usually do not disclose the type and the number of technologies to protect their competitive advantage. Hence, a popular way to measure digital technologies is to use proxy variables recommended by Sheng and Mykytyn (2002). They recommend using investment in information technology by the firms in each year. We refer to this as *Ln (Investment_IT)*
Age	Age of the firm. We measure this as the total length of operation of a firm from the date of incorporation. We also normalize this variable to control the variability across the firms
Control variables	
OPEX	Total operating expenditures of the firms. We normalize this variable by using natural logarithm
FOWN	Percentage of foreign ownership of the total stocks being traded in the stock exchange
GAFF	Group affiliation. It is a dummy variable taking 1 if a firm lies in a corporate group (parent–subsidiary relationship)

Source(s): Authors' own creation

two-stage least square or generalized method of moments (Wooldrige, 2002). To test the robustness of our results, we estimate two different models, with both controls and without controls.

5. Findings, analyses and discussion

We estimate two different models to check the effects of investment in digital technologies on entrepreneurial trajectories. The variables in our models are free from collinearity problems. In model (1), referred to baseline model without controls, we observe that there is a significant positive relationship between investment in IT and sales growth of firms, investment in IT and performance and investment in IT and business model. In model (2), the augmented model with controls, our results are consistent. Therefore, we can say that investment in IT improves ET. The results are reported in Table 2.

In model (2), we observe that the age of the firm has a significant negative impact on ET. It means that over time, the firms within the industries are becoming more competitive and ET is deteriorating. However, given this competitive environment, if we increase investment in IT, ET improves (see the interaction effect is positive and significant). Hence, we can define a strong end line between competitiveness (maturity) and investment in IT. Therefore, during the high competition among firms within the industries, investment in IT provides a shield in improving the ET.

OPEX of a firm are negatively related to ET, while foreign ownership (FOWN) is positively related. This implies that firms' ET decreases even if firms are exposed to high OPEX. However, FOWN has a significant positive impact on ET. Hence, we may claim that FOWN lowers the financial constraints of domestic firms by providing a positive signal into the financial market, improves access into the international market through the global value chain and exposes firms into cutting-edge technologies (Ze'ghal and Maaloul, 2010; Casta *et al*., 2005).

Group affiliation (GAFF) has a significant negative impact on ET. Hence, instead of creating synergy (improving ET), it rather decreases ET. Therefore, we can claim that the role of GAFF is minimal in improving ET.

The estimated results therefore imply that more investment in digital technologies and infrastructural development creates avenues for ET. If we look into the goal of investment of a firm, it usually focuses on creating more sales from the ongoing operations or by reengineering the ongoing operations with a high technological orientation. To achieve this long-term goal, more investment in digital technologies is required.

We use return on assets (ROA) and return on equity (ROE) as measures of firm performance. If we observe model (1), investment in digital technologies has a significant positive impact on the performance of a firm. The results remain unchanged in the augmented model after considering all control variables. We find a significant negative impact of age, OPEX and GAFF on ROA. It implies that if a firm becomes older, it needs to incur more OPEX and expose itself to heavy competition in the market within the same industry, resulting in a declining ROA. However, the relationship is positive if the firm has FOWN. It implies that firms with FOWN and significant investment in IT performed better than conventional ones (Ze'ghal and Maaloul, 2010; Casta *et al*., 2005).

Even if future performance is more likely related to the creation and existence of future opportunities of a firm, sometimes firms need to give more importance on the short-term goal (profit maximization). This is mainly due to mitigating the unexpected macroeconomic shocks and vulnerabilities that firms infrequently face. However, to achieve long-term objectives, firms should give more importance to the creation of future opportunities. In an economy with more firms, investment in IT needs to be predominant and its role with age becomes a key success factor for manufacturing firms (Rahman and Ferdous, 2011). Hence, firms increase their IT investment to reduce unnecessary costs in order to shield the sustained competitive advantage (Rahman and Ferdous, 2011). Moreover, service firms can better communicate and

Table 2. Regression results

	DV = ROA		DV = ROE		DV= sales growth		DV = Ln (Sales)		DV = Ln(EVA)	
	M-1	M-2	M-1	M-2	M-1	M-2	M-1	M-2	M-1	M-2
Ln (Investment_ IT)	0.004*** [2.95] (0.00)	0.003*** [3.18] (0.00)	0.009*** [5.95] (0.00)	0.001*** [6.33] (0.00)	0.01 [5.27] (0.00)	0.009*** [4.83] (0.00)	0.35*** [29.26] (0.00)	0.31*** [16.82] (0.00)	0.37*** [31.26] (0.00)	0.35*** [8.50] (0.00)
Ln(AGE)	–	−0.01*** [8.55] (0.00)	–	−0.05*** [4.01] (0.00)	–	−0.01*** [3.29] (0.00)	–	−0.17** [−1.99] (0.04)	–	0.11 [0.86] (0.39)
Ln (Investment_ IT) × Ln(AGE)	–	0.00001*** [9.11] (0.00)	–	0.00002*** [11.01] (0.00)		0.0004*** [6.33] (0.00)	–	0.00033*** [7.99] (0.00)		0.0007*** [8.37] (0.00)
Ln (OPEX)	–	−0.007*** [−4.21] (0.00)	–	0.005 [0.75] (0.45)	–	−0.004** [−2.22] (0.03)	–	0.02 [0.57] (0.57)	–	−0.28*** [20.48] (0.00)
FOWN	–	0.14** [2.12] (0.04)	–	0.26*** [2.99] (0.00)	–	0.16*** [2.91] (0.00)	–	−0.84 [−1.15] (0.25)	–	0.91 [1.44] (0.15)
GAFF	–	−0.02*** [−7.74] (0.00)	–	−0.13*** [−2.31] (0.02)	–	0.005 [1.23] (0.22)	–	−0.62*** [−4.07] (0.00)	–	−0.18*** [−3.17] (0.00)
Time effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm year obs.	150	150	150	150	150	150	150	150	150	150

Note(s): ***, ** and * denote significance at 1%, 5% and 10% levels, respectively. DV stands for the dependent variable. The value in the square bracket [..] represents the *t*-value, and the value in the round bracket (..) represents the probability value. Ln (Opex), FOWN and GAFF are control variables
Source(s): Authors' own creation

become more responsive to their customers by strengthening their IT infrastructure. Management also makes IT investments not only to save costs but also to shape product and service development to offer competitive prices in the market. Ensuring competitive prices of products and services in the future will eventually increase sales. In addition, more IT investment increases employee productivity and collaboration among stakeholders – employees, partners and customers (Rahman and Ferdous, 2011). The results are consistent if we consider ROE as an alternative measure of ROA.

We consider the business model which is a function of activities that create value (Huang *et al*., 2006). We consider two value drivers – the natural logarithm of sales and economic value added (EVA) to represent the business model. We find that investment in IT has a significant positive impact on the business model. If we consider sales, investing in IT increases sales of firms. The results are consistent across our two models. The sales decline as the firm grows older (aged) under extreme competition. However, we can shield the sales during competition by investing more in IT. Our results are consistent across all the components of ET.

However, we notice that since the firm incurs more OPEX, its capacity to invest more in value creation activities declines. Moreover, competitiveness in the market can be a potential threat to firms as the firms need to operate in the same industry. A business model that uses digital technologies lies at the heart of the new venture that improves products or services, value network – managing customer and partner relationships, value delivery – channels used to deliver the value proposition, and revenue model – revenue streams that help to generate more sales and value creation activities of firms (EVA). Consequently, more value creation activities improve the value of firms. Jablonski and Jablonski (2021) argued that digital investment is more powerful in understanding the modern principles of development and progress of manufacturing firms.

6. Conclusion and policy implications

This paper explores the impact of investment in digital technologies on entrepreneurial trajectory, reflecting a unique empirical perspective on digital entrepreneurship. We find that investment in IT has a significant positive impact on entrepreneurial trajectory. More specifically, investment in IT also helps firms to identify and exploit opportunities as measured by sales growth to develop business models that engage customers in value creation activities as measured by sales and EVA and to improve the performance of entrepreneurial firms as measured by ROA and return equity. We also find that investment in IT provides a shield to firms during the competitive environment.

By decoupling the digital components in digital entrepreneurship and by providing a differentiated understanding of digital technologies and their mechanisms, we can say that investment in digital technologies changes the landscape of future opportunities that the firms could exploit. Moreover, firms need to invest more in IT to change their business models in order to exploit future opportunities due to digitalization in the complex business environment. Our results strongly support the RBV that outlines "*unique resources arising from investment in digital technologies contribute into the entrepreneurial trajectory.*"

This paper provides an incentive for managers and entrepreneurs to think more about the role of investment in digital technologies to ensure sustainable performance in the long run. Therefore, in order to deal with divergent perspectives regarding IT approaches, executives and entrepreneurs must build a complex strategic decision-making process. Our findings can also assist regulators and policymakers, with a proper integration in IT infrastructure and entrepreneurial operations, in adopting the right legislation, regulatory reform and enforcement strategies to enhance the IT implementation processes. The regulators and policymakers will understand how the right integration in IT infrastructure and operational activities maintains firms' competitive advantage. Eventually, the policymakers will focus on the role of implementing cutting-edge technologies in firms in the long run.

However, this paper is subject to a few limitations. Even though it is recognized that management may employ other mass communication techniques, our paper exclusively looked into corporate annual reports. Therefore, disclosures in other media, such as newspapers and the Internet may be taken into account into the future extension of research. Additionally, we take into account firms that operate in a particular culture more specifically in a small country context. Therefore, studies in the future might look at firms that operate in multicultural settings subject to exposure into the global environment. Finally, we recommend that the findings will be useful for firms that seek to understand how digital technologies are shaping their entrepreneurial trajectories in addition to helping policymakers to understand the circumstances supporting digital entrepreneurship.

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