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Institutional Stimulus and Firm Innovativeness: Examining the Roles of Digital Technologies Adoption and Inbound Openness

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ABSTRACT

Drawing on the structure–conduct–performance (SCP) paradigm, this study proposes and tests a framework of how government institutional stimulus can spur small- and medium-sized enterprises' (SMEs) innovativeness. An analysis of survey data from 195 SMEs operating in Ghana—a resource-constrained developing economy—indicates that (1) institutional stimulus has a positive relationship with SME innovativeness; (2) the effect of institutional stimulus on SMEs' innovativeness is channeled through the adoption of relevant digital technologies; and (3) the positive effect of institutional stimulus on firm innovativeness through the adoption of digital technologies is strengthened under high levels of inbound openness. Our findings make important contributions to the extant innovation and R&D management literature and have practical implications.

1 | Introduction

Firm innovativeness has been a central source of competitive advantage since the beginning of the industrial revolution (Prajogo and Ahmed 2006). Accordingly, innovation has become central to corporate strategy (Doh and Kim 2014; Szczygielski et al. 2017; Jugend et al. 2018). Extant research has revealed that SMEs that have been able to successfully capitalize on their innovation initiatives acquire a range of benefits—from higher profits to higher market share to higher financial performance, among others (Narver and Slater 1990; Cooper 1986; Calantone et al. 1995; Kang and Park 2012; Zeng et al. 2019). Furthermore, firm innovativeness has been shown to be important for societal growth and development (Ahlstrom 2010). For instance, Baumol (2002), Baumol and Strom (2007), and Christensen and Raynor (2013) posit that SME innovativeness brings innovation to the market, which in turn enables economic growth, provides employment, and significantly improves people's lives, which leads to the development of society. Thus, firm innovativeness is vital to societal and human evolution.

Among the numerous extant studies on firm innovativeness, academic researchers have identified the role of government stimulus (also known as institutional stimulus) as an antecedent to firm innovativeness (Szczygielski et al. 2017; Kang and Park 2012; Doh and Kim 2014; Jugend et al. 2018). Institutional stimuli are policies and measures implemented by the central and local governments to support innovation activities (Shu et al. 2015). According to Shu et al. (2015, 290), governments "play a critical role in innovation." For instance, in 2022, to enable SMEs to recover from the Covid-19 pandemic, the Ghanaian government disbursed 5 million US dollars to 373

SMEs across 15 regions and issued a 5-year technology development plan, geared toward promoting indigenous innovations (World Bank Group 2022). Four months after receiving the grants, the SMEs reported that they greatly enhanced their innovation capabilities and output, while enabling them to create over 369 jobs (World Bank Group 2022). To this end, the role of institutional stimulus on SME innovativeness has gained a wide audience among academic researchers, with mixed theoretical viewpoints.

On the one hand, scholars hold the theoretical viewpoint that institutional stimulus has a positive relationship with firm innovativeness (Nguyen et al. 2023). For instance, in most developing economies, such as Ghana, SMEs are constantly faced with resource liability (including national-level resources), poor financial and market infrastructure, as well as weak and dysfunctional institutional framework (Boso et al. 2013; Boso, Story, et al. 2013). Accordingly, within such a resource-constrained environment, the provision of institutional stimulus and support for SMEs to innovate is crucial for their success, innovativeness, and survival. Consequently, scholars who are proponents of this viewpoint (Kang and Park 2012; Zeng et al. 2019; Zemtsov and Kotsemir 2019; Su et al. 2019; Torregrosa-Hetland et al. 2019; Sá and de Pinho 2019), posit a positive relationship between formal institutional stimulus and firm innovation. On the other hand, scholars posit that institutional stimulus alone does not improve firm innovativeness (Shu et al. 2015; De Marco et al. 2020). The proponents of this school of thought argue that a firm has to adopt an innovation orientation outlook for institutional stimulus to be able to improve firm innovativeness. Hence, institutional stimulus alone is not enough for firm innovativeness. For example, De Marco et al. (2020) find that European Union funding did not improve SMEs' innovativeness when awarded to SMEs that engaged less in open innovation than others. Also, Shu et al.'s (2015) findings show that formal government institutional support has a negative effect on firm innovation activities, while Guan and Yam (2015) find that institutional financial stimulus for Chinese SMEs failed to enhance innovation performance. In the same vein, Liu et al. (2020) and Lin and Luan (2020) find that governmental institutional support structures have a U-shaped effect on green process innovation and innovation efficiency. Furthermore, Zhang and Guan (2018) reveal that formal institutional stimulus, in the form of subsidies, favors short-term innovation, while it hinders long-term innovation performance. Therefore, there is an ongoing debate on the impact of institutional stimulus on firm innovativeness, and our study findings will further extend the literature in this research domain.

Following on from the mixed theoretical viewpoints in the extant literature, our study aims to further examine the mechanism through which institutional stimulus enhances firm innovativeness. According to various scholars (see Doh and Kim 2014; Szczygielski et al. 2017; Jugend et al. 2018), the innovation process depends on a set of internal (firm) and external institutional structures that can support and improve innovative processes within organizations. For example, digital technologies play an important role in the innovation process. Dalenogare et al. (2018) and Bai et al. (2020) define digital technologies as the adoption of mobile computing, electronic commerce, internet of things, business intelligence, big data analytics, and social media and platforms. Zahoor et al. (2022) posit that these contemporary digital technologies have afforded SMEs an avenue for tremendous innovation and competitiveness growth. Hence, the integration of these digital technologies makes SMEs' innovative processes more open, digital, automated, flexible, intelligent, agile, and well equipped to meet the challenges of a dynamic and global market (Kamble et al. 2020; Zhong et al. 2017; Bai et al. 2020; Claus 2019). Nevertheless, these effects are only possible through collaborative integrative affects across firm units—both internal and external (Bai et al. 2020). Yet, extant studies have so far failed to investigate the role of digital technologies on the relationship between formal institutional stimulus and SME innovativeness.

Furthermore, as noted by Parida et al. (2012), firms include external partners such as customers, suppliers, and even competitors in their innovative projects and activities—to ensure that they deliver superior innovative products and services, creating competitive advantage. Consequently, studies have shown that firms do cooperate, exchange knowledge, invest in R&D-related services, and co-develop innovative products and services with their external partners (Parida et al. 2012). Thus, inbound openness—the willingness of SMEs to adopt ideas, technologies, and knowledge from external partners in addition to internal ideas and knowledge to advance their technology, business model, and organizational processes, which improves innovativeness—is central to SMEs' innovation activities (Wang et al. 2015; Chesbrough 2004, 2006; Bigliardi et al. 2020). Yet, extant studies have failed to account for its role in the relationship between formal institutional stimulus and SME innovativeness.

In light of the gaps above, this study answers calls by various scholars (see Kang and Park 2012; Doh and Kim 2014; Shu et al. 2015; Guan and Yam 2015; Jugend et al. 2018; Krammer 2019) for more research studies to examine the institutional stimulus and firm innovativeness relationship as well as the mechanisms and conditions through which institutional stimulus improves firm innovativeness. On this note, we build our model from the structure–conduct–performance (SCP) paradigm, positing that institutional stimulus is positively related to SME innovativeness. Furthermore, we argue that the adoption of digital technologies is the mechanism through which institutional stimulus leads to SME innovativeness. In addition, we posit that the positive effect of institutional stimulus on SME innovativeness through the adoption of digital technologies is strengthened under high levels of inbound openness and weakened under low levels of inbound openness.

Hence, our study seeks to answer three interrelated research questions: (1) What is the relationship between institutional stimulus and firm innovativeness? (2) How does the adoption of digital technologies act as a facilitating mechanism in the institutional stimulus–SME innovativeness relationship? and (3) To what extent does inbound openness condition the relationship among institutional stimulus, adoption of digital technologies, and SME innovativeness? To answer our research questions and test our arguments, we collected survey data from 195 SMEs operating in Ghana—a major Sub-Saharan African (SSA) market. Our findings contribute to the innovation and R&D management literature in several ways.

First, our study findings show that institutional stimulus has a positive relationship with SME innovativeness. Second, our findings reveal that the adoption of digital technologies positively mediates the positive relationship between institutional stimulus and SME innovativeness. Furthermore, the results show that inbound openness strengthens the relationship among institutional stimulus, adoption of digital technologies, and SME innovativeness In sum, these findings fully extend the SCP paradigm to the innovation and R&D research domain. The next section presents the theoretical background and hypotheses arguments.

2 | Theoretical Background and Hypotheses

2.1 | Structure–Conduct–Performance (SCP) Paradigm and Firm Innovativeness

The SCP paradigm posits that firms derive superior performance by conforming to external environmental conditions in the area where they operate (Ralston et al. 2015). The central logic behind the SCP paradigm is that the external environmental conditions (structure) shape the behavior (conduct) of firms in the formulation and implementation of internal processes and procedures, which influences performance (Nwoba et al. 2021). The SCP paradigm is based on the principle that there is a match between the external environmental structures and the firm's internal processes (Peng et al. 2008). As noted by Porter (1991), the standard commercial and economic operating practices—set by formal institutions like governments and agencies—have an impact on internal firm processes and procedures and, in turn, their performance. Standing on the premise of the SCP paradigm, this study theorizes that institutional stimulus by central and local governments (the structure in societies) influences the conduct of SMEs through the adoption of digital technologies and development of high capabilities of inbound openness, which in turn strengthens firm innovativeness (performance).

Therefore, we argue that firms that operate in enabling institutional structures will have access to high levels of institutional support. This provides firms with additional resources and capabilities not at their disposal hitherto. As such, the institutional stimulus serves as a springboard which facilitates firm innovativeness through the provision of know-how, training, and educational opportunities, technology, machinery, and equipment, which help to refine their business operations. In sum, the SCP paradigm provides new insights into the external environment and internal structures that support firm innovativeness.

2.2 | Institutional Stimulus and Firm Innovativeness

The SCP paradigm argues that firms operate in a structural arrangement/market, which determines the firm's strategy and ability to effectively compete in its industry of operation (Zhang and Jedin 2022). Hence, the structure of the market determines the actions undertaken by firms (conduct), and this has an influence on organizational performance (Brege et al. 2021). In line with the SCP paradigm, we argue that the government and its agencies provide the "institutional structure" reflected in the institutional stimuli provided by the government in the form of enabling governmental policies, access to funding, and technological support. Therefore, we posit that governments of emerging markets provide institutional stimulus and create an enabling environment (structure) of which SMEs can take advantage to facilitate firm innovativeness. Thus, when SMEs operate in a "structure" that is enabling and not restrictive, they are empowered to engage in innovative activities.

SMEs contribute significantly to economic growth in Ghana. In 2023, SMEs accounted for approximately 80% of total employment in Ghana, over 90% of businesses were SMEs, and SMEs contributed around 60% of the country's GDP (Statista 2023). Despite the immense economic contributions of SMEs, they face various obstacles in their business operations ranging from limited access to funding, to lack of technology, and bureaucratic government operations (Frimpong et al. 2022). In these environments, firm innovativeness, especially for SMEs, is limited due to the challenges in accessing external resources and configuring these to develop organizational capabilities. We posit that the government can help to alleviate some of these challenges and enhance firm innovativeness through the implementation of relevant policies and programs.

We argue that central governments, local governments, and their agencies play a critical role in creating an enabling environment that facilitates firm innovativeness. This can be done in three major ways. *First*, central and local governments can implement policies and programs that provide increased market access to SMEs, thereby enhancing new product development to meet market needs and facilitating new product sales. For example, in Nigeria, a Sub-Saharan emerging economy, the Small and Medium Enterprises Development Agency of Nigeria (SMEDAN) offers a national enterprise development program targeted at micro, small, and medium enterprises (Peter et al. 2018). Similarly, the Ghana Economic Transformation Project (GETP) was introduced by the government to support SME recovery from the Covid-19 crisis (World Bank Group 2022). Furthermore, the provision of institutional stimuli for SMEs has facilitated SME innovativeness in countries such as India, South Korea, Taiwan, and China (Kusi et al. 2015). Another case in point is the institutional stimuli provided by the Ghanaian government through the provision of training to SMEs, the provision of increased access to capital, and through providing means of collaboration between SMEs and other market partners (Zaato et al. 2020). As such, the presence of institutional stimuli is especially vital for the innovativeness and survival of SMEs due to the high failure rates often associated with SMEs, owing to lower amounts of start-up capital, a relatively small number of employees, and a high level of dependency on the owners/founders (Çera et al. 2019; Watson and Everett 1999).

Second, the technological support provided by central and local governments gives SMEs access to otherwise inaccessible technological advancements, which is a building block for innovation. Access to technological support is especially crucial for product innovations as technology and technological advancements are drivers of product innovativeness and, by extension, firm innovativeness as they facilitate the development of new products (Garcia and Calantone 2002). *Third*, when the central and local governments provide SMEs with help with obtaining licenses for the importation of technology,

manufacturing, and other equipment, this provides the incentive for the SMEs to maximize these to facilitate firm innovativeness. This is especially true because access to technology can enhance service innovation, and the availability of manufacturing equipment can facilitate the manufacturing of new products.

When firms are exposed to high levels of government-enabled institutional stimulus, they are more likely to take advantage of the opportunities and provisions made, and this provides them with the know-how, resources, and capabilities that refine their business operations and organizational culture, which facilitate firm innovativeness. Therefore, we contend that institutional stimulus provided by central and local governments reflected in policies and programs, technological support, and financial support is positively related to firm innovativeness (Shu et al. 2015). Hence, we formally hypothesize that institutional stimulus is positively related to firm innovativeness.

Hypothesis 1. *Institutional stimulus is positively related to firm innovativeness.*

2.3 | The Mediating Role of the Adoption of Digital Technologies

Technological advancements have been a defining feature of the 21st century, and these are reflected in increased levels of e-commerce, adoption of Industry 4.0 technologies (I4T), emergence of cloud computing, big data analytics, use of social media platforms, mobile computing, and internet of things (Tortorella and Fettermann 2018). When adopted by SMEs, these technological advancements can facilitate firm innovativeness by enhancing manufacturing processes, increasing production outputs, reducing lead time, and improving product quality (Kamble et al. 2018).

The adoption of digital technologies results in increased cost savings, and the improved efficiency, effectiveness, and responsiveness of manufacturing systems (Kamble et al. 2018). Specifically, cloud computing provides the benefits of improved service speeds (Yu et al. 2017); internet of things helps to connect devices and results in high accuracy and efficiency (Xu et al. 2014); and big data analytics refers to the ability of firms to collect large volumes and variety of data and analyze these speedily to inform business decisions and improve firms' competitive advantages (Olabode et al. 2022).

However, the adoption of digital technologies requires substantial capital, which might not be readily available to SMEs because of their size and limited resource base. As such, the support programs, access to finance, and collaborative partners provided by governmental institutional arrangements provide the platform for SMEs to adopt these technologies in their business operations. Therefore, SMEs are better enabled to adopt digital technologies when they are provided with institutional stimuli, and this facilitates their innovative activities.

In line with the SCP paradigm, we expect that the "conduct" of SMEs operating in institutional environments characterized by enabling innovation mechanisms are better placed to take advantage of digital technologies because of the resources at their disposal. Hence, it is expected that the institutional stimuli reflected in support programs, access to financial resources, and linkage between SMEs and other firms will propel SMEs to adopt digital technologies, which can facilitate firm innovativeness. Therefore, the actions taken by SMEs are influenced by the institutional stimuli they are exposed to in their industry of operation. As such, we hypothesize that adoption of digital technologies mediates the relationship between institutional stimulus and firm innovativeness.

Hypothesis 2. *Adoption of digital technologies mediates the relationship between institutional stimulus and firm innovativeness.*

2.4 | Inbound Openness as a Contingency Factor

Inbound openness refers to the willingness of firms to adopt ideas, technologies, and knowledge from external partners in addition to internal ideas and knowledge to advance their technology, business model, and organizational processes (Chesbrough 2004, 2006), and improve innovativeness (Bianchi et al. 2016). Inbound openness can be defined as "an outside-in process to access knowledge and technology that often resides beyond a firm's boundaries to complement the firm's internal innovation base" (Wang et al. 2015, 222). Extant research suggests that inbound openness is positively related to firm innovativeness (Bigliardi et al. 2020) and can help increase revenue, lead to innovation, attract talented human resource personnel, provide insights about new product success, and help firms develop innovative assets (Rigby and Zook 2002).

In line with prior studies (e.g., Wang et al. 2023) that examine boundary variables when adopting the SCP paradigm, we extend the SCP paradigm by arguing that the institutional stimulus–digital technology adoption–firm innovativeness relationship is strengthened when inbound openness is present because inbound openness changes the mechanism in three ways. *First*, high levels of inbound openness imply that firms are willing to readily adopt technologies from external partners, cooperate with external partners on innovation projects, regularly engage in information exchange with external partners, and buy R&D services from external partners (Parida et al. 2012). This implies that SMEs with high levels of inbound openness have developed working relationships with external partners which provide them with the necessary knowledge, experience, know-how, and expertise to enhance firm innovativeness.

Second, in H2, we argue that the adoption of digital technologies mediates the relationship between institutional stimulus and firm innovativeness. We expect that SMEs characterized by high levels of inbound openness will have engaged in technological collaborations with external partners. As such, the adoption of digital technologies such as I4T, big data analytics, and internet of things can be utilized to harness competitive advantages and enhance firm innovativeness. In line with resource orchestration literature (Andersén 2021) we argue that firms with high levels of inbound openness are more likely to have the expertise and ability to bundle and exploit resources gained from external collaborations with digital technologies to gain innovation

performance outcomes. This can help in mitigating resource scarcity and inadequate resources and capabilities, which are characteristic of SMEs (Lichtenthaler 2008). Therefore, high levels of inbound openness provide SMEs with external technological know-how and insight that can facilitate the adoption of digital technologies to enhance firm innovativeness. Hence, high levels of inbound openness can enable SMEs to fill in internal technological gaps, which can help to improve the quality of innovative activities (Parida et al. 2012). To this end, we posit that high levels of inbound openness would positively enhance the institutional stimulus, adoption of digital technologies, and SME innovativeness relationship.

Third, inbound openness exhibited in collaborations and partnerships with other firms, including consumers and suppliers, increases the available resources, competencies, technologies, and capabilities available to firms, and this can facilitate and enhance innovativeness (Buganza and Verganti 2009). This is especially vital for SMEs, as collaborations and partnerships can help to fill in skill gaps and reduce resource scarcity (Usman et al. 2018). As such, we argue that high levels of inbound openness will increase the level of resources and capabilities available to organizations, which will further enhance the mediating role of technology adoption on the institutional stimulus–firm innovativeness relationship.

Furthermore, SMEs with low levels of inbound openness will have a reduced number of resources at their disposal, and this can have adverse effects on the effective adoption of digital technologies. Furthermore, the adoption of digital technologies can involve steep learning curves (Malerba 1992; Datta et al. 2015), which might be more difficult for SMEs with low levels of inbound openness to undertake. Under these circumstances, we argue that low levels of inbound openness can weaken the institutional stimulus, adoption of digital technologies, and firm innovativeness relationship.

Therefore, we hypothesize that:

Hypothesis 3. *The positive effect of institutional stimulus on firm innovativeness through the adoption of digital technologies is strengthened under high levels of inbound openness and weakened under low levels of inbound openness.*

Figure 1 presents the study's hypothesized relationships.

3 | Methods

3.1 | Sample and Data Collection

We test our model on a sample of SMEs operating in Ghana. Ghana provides a unique context for our study as recent socioeconomic developments have led to investments and growth in businesses, especially SMEs. For example, in 2023, SMEs accounted for approximately 80% of total employment in Ghana, over 90% of businesses were SMEs, and SMEs contributed around 60% of the country's GDP (Statista 2023). This makes it imperative to examine how SMEs can continue to innovate and grow in order to continue to support the Ghanaian economy. In terms of the economic landscape, the country has been witnessing positive developments such as continental trade agreements and trade liberalization; increases in digitalization and digital platforms; and a competitive business environment (Amankwah-Amoah et al. 2021; African Development Bank Group 2018; Amankwah-Amoah, Boso et al. 2018; Amankwah-Amoah et al. 2018), much of which has led to high entrepreneurial activities. For example, in 2017, the government of Ghana, as part of its digitalization drive and campaign, introduced the digital address systems for households and businesses, and has more recently introduced e-business registration. Relatedly, the Ghanaian government, through its business agencies, has in recent years developed many innovation policies and initiatives that aim to make SMEs access resources and support for innovative activities. For example, as part of the Covid-19 pandemic, in 2022, the government supported SMEs across the country with 5 million US dollars through a 5-year technology development plan that sought to promote indigenous innovations (World Bank Group 2022). Such initiatives are pivotal in supporting innovation among local SMEs, especially in such contexts where there are resource constraints and dysfunctional institutions.

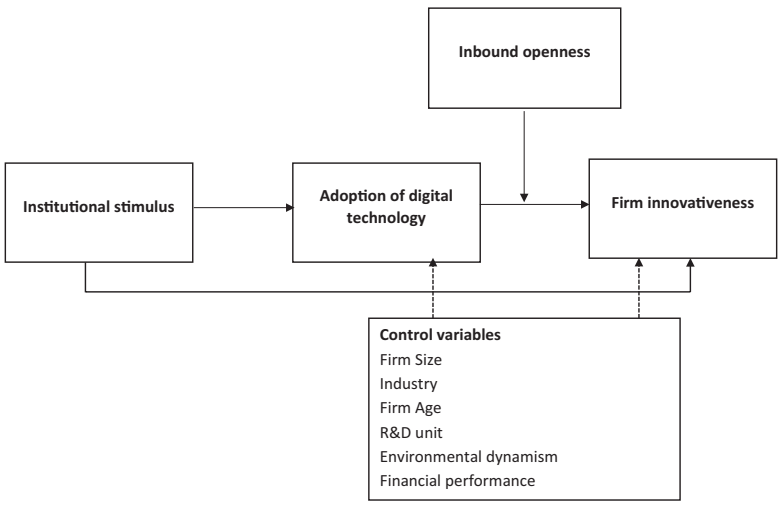

FIGURE 1 | Conceptual framework.

However, in spite of these developments, Ghana, like most developing economies, is characterized by weak institutions and regulatory frameworks—a phenomenon that can either enhance or reduce the competitiveness and growth of SMEs. Considering the paradoxical nature of the Ghanaian economic and institutional landscape, we examine how Ghanaian SMEs can leverage the availability of institutional stimuli (e.g., those provided in 2022) as well as recent developments in digital technologies to drive their innovativeness. While Ghana provides a specific context to answer our research questions, the business and institutional environment of the country bears resemblance to other African countries and developing economies; in turn, our research findings will have wider implications.

To construct our sample frame, we selected 627 established SMEs from the Ghana Company Register, which is available at the Registrar General's Department—the department responsible for business registrations in Ghana. As per previous studies (e.g., Wiklund and Shepherd 2011; Boso et al. 2013; Boso, Story, et al. 2013; Donbesuur et al. 2020), we used the following criteria in selecting the participating SMEs: (1) a minimum of 3 years of business operation experience, (2) independent firms that have no association with any company group, (3) firms that employed between 5 and 500 full-time staff, and (4) firms with complete contact information for the owners, managers, and/or CEOs and sales/finance managers. Subsequently, a well-developed survey questionnaire (in English) was sent to a data collection agency to administer to the selected sample of 627 SMEs.

To attenuate the likely effect of common method bias, we worked with the data collection agency to ensure that the multiple respondents approach was used during the survey administration. Thus, key and different respondents included CEOs and/or owner-managers as well as sales/finance managers. Specifically, CEOs and/or owner-managers answered questions on innovation, institutional stimulus, and other firm characteristics, while some finance managers also answered questions on the financial activities of the firms such as sales. In some instances, the CEOs and/or owner-managers also answered the financial questions as they had full knowledge of the financial details as well. After two (2) rounds of data collection activities, the data collection agency returned 195 usable questionnaires—representing a 31.1% response rate. The low response rate is attributed to respondents who were not willing to provide data on sales. Accordingly, we discarded every questionnaire that did not contain data on sales. The sample was split between the two key industrial sectors—Manufacturing (34.5%) and Service Industries (65.5%). The average firm size (measured by number of full-time employees) is 40, while the average age is 9 years 2 months.

3.2 | Measures

We adapted existing scales from the extant literature to measure the study's multi-item constructs. All multi-item variables were measured with 7-point rating scales. Some of the items were reworded to reflect the study context and help enhance their meaning and the understanding of our respondents.

Inbound openness explains firms' actions that involve the pursuit and integration of knowledge from external sources for innovation purposes such as new product and service development (Sisodiya et al. 2013). Accordingly, we measure inbound openness with four items adapted from Parida et al. (2012). The items capture various knowledge and ideas that firms source from external partners. Respondents were asked to indicate the extent to which they agree with statements that capture inbound openness (1 = strongly disagree to 7 = strongly agree). Sample items include "external partners such as customers, competitors and suppliers are involved in our innovation projects."

Institutional stimulus is measured with four items that describe various policies and measures initiated by central and local governments for innovation activities (Shu et al. 2015). Respondents were asked to rate how the provision and implementation of these stimuli have met their expectations (1 = far below expectation to 7 = far above expectation).

This study conceptualizes *digital technological adoption* as the extent to which firms adopt and use various technologies for their activities and operations. This was measured with seven items (e.g., internet of things, mobile computing, electronic commerce, business intelligence, big data analytics, etc.) adapted from Tortorella and Fettermann (2018) and Kamble et al. (2020). The sampled firms were asked to rate their satisfaction with the adoption of digital technologies for their businesses (1 = very dissatisfied to 7 = very satisfied).

Finally, we measured *firm innovativeness* as a ratio of a firm's new product/service sales to total sales. This is an objective measure that captures the actual innovativeness (innovation performance) of the firm and has been consistently used by previous studies (e.g., Wang et al. 2020; Kafouros et al. 2015). As part of completing the questionnaire, we asked respondents to provide this information by way of an open-ended question. Specifically, we asked that they provide information on new product/service sales and total sales for the immediate past year.

Based on previous studies and the unique characteristics of the study context (e.g., Kafouros et al. 2015; Boso et al. 2013; Boso, Story, et al. 2013), we controlled for many factors that may influence our model. Specifically, we included financial performance, environmental dynamism, R&D unit, industry type, firm age, and size as control variables. The degree of financial performance can influence the number of resources that can be invested in innovation activities. This was measured by asking respondents to indicate the extent to which they have achieved their financial objectives (such as profit margin, sales growth, etc.). We controlled for environmental dynamism as a more dynamic environment and/or stable environment is likely to affect the extent of firm innovation (see Boso et al. 2017). Environmental dynamism was measured by four (4) items adopted from Jaworski and Kohli (1993). We measured the existence of an R&D unit by asking respondents to indicate if they have an R&D unit (Yes = 1 and No = 0). Firm size was measured by the logarithm of the total number of employees, while firm age was measured by the logarithm of the number of years since the firm's establishment. Finally, industry was measured as "Manufacturing" = 1 and "Service" = 0. Previous innovation research (e.g., Kafouros et al. 2015) has shown that R&D intensity,

firm size, and firm age could have a potential effect on innovation performance.

4 | Analysis

4.1 | Measurement Model

We estimated a five-factor measurement model through confirmatory factor analysis (CFA) using Amos 27 in order to establish the validity and reliability of the study variables. The CFA estimation provided the following fit indices (χ^2/df = 1.58, RMSEA = 0.05, CFI = 0.96, NFI = 0.91; SRMR = 0.05), with all standardized factor loadings being significant ($p < 0.001$) for the measurement items (see Table 1). Other validity and reliability checks revealed that (i) all the constructs have a composite reliability (CR) score greater than 0.70; (ii) the average variance extracted (AVE) for all the constructs exceeds the 0.70 recommended threshold, and (iii) the square root of the AVEs (shown in bold at the diagonals of Table 2) is higher than the squared correlation coefficient of each construct. According to the rule of thumb for model fit indices and thresholds (e.g., Hair Jr. et al. 2017; Hair et al. 2014; Fornell and Larcker 1981), we can safely conclude that our five-factor measurement model is valid, reliable, and fits our data.

4.2 | Hypotheses Testing

We tested our hypothesized relationships using regression analysis and the PROCESS macro in SPSS. Specifically, following previous literature and recommendations (Hayes 2013; Preacher and Hayes 2008; Oo et al. 2019), we test hypotheses H1 using regression analysis and H2 and H3 with the PROCESS macro (Model 4 and Model 14). The use of these two techniques helps to test the respective hypotheses distinctively and appropriately. For each multi-item variable, a composite score was generated by computing mean values using their respective items. To test the moderation relationships (H3), we used the mean-centering approach to calculate our interaction term: inbound openness × digital technological adoption (TECH × INBOP). This approach helps minimize the issue of multicollinearity that usually characterizes multiple regressions with moderating estimates. As a result, we recorded the largest variance inflation factor (VIF) of the regression estimates as 1.34 (shown by Model 6 in Table 3), which is lower than the recommended threshold of 10 (Neter et al. 1990). Table 3 presents the results of our regression analysis, while Table 4 presents the mediation analysis.

The results from Table 3 (Model 4) indicate that institutional stimulus is positively related to firm innovativeness ($\beta = 0.474$, $p < 0.001$) —confirming H1. To test H2, we used PROCESS macro (Model 4) to analyze the indirect effect of institutional stimulus on firm innovativeness through digital technology adoption. Accordingly, Table 4 indicates that adoption of digital technologies mediates the relationship between institutional stimulus for SME innovation and firm innovativeness (indirect effect = 0.07, 95% CI = 0.016–0.142). Lastly, using PROCESS macro Model 14, we find support for our moderated-mediation hypothesis—H3—that the positive effect of institutional stimulus on firm innovativeness

TABLE 1 | Reliability and validity of measurement model.

Constructs and their measurement items	Factor loadings (*t*-values)
Institutional stimulus (CR = 0.89; AVE = 0.82)	
The central and local governments and their agencies have...	
...implemented beneficial policies and programs.	0.82 (fixed)
...provided needed technology support.	0.90 (14.90)
...played a significant role in providing financial support.	0.71 (11.08)
...helped your firm obtain license for imports of technology, manufacturing, and other equipment.	0.84 (13.72)
Inbound openness (CR = 0.94; AVE = 0.90)	
External partners such as customers, competitors, and suppliers are involved in our innovation projects	0.93 (fixed)
Cooperate and co-develop with our external partners for all our innovation projects	0.94 (25.23)
Regularly network to exchange knowledge with our external partners	0.91 (22.63)
Often buys R&D-related services from our external partners	0.82 (17.19)
Digital technology adoption (CR = 0.95; AVE = 0.86)	
Internet of things	0.79 (fixed)
Mobile computing	0.87 (14.51)
Electronic commerce	0.86 (14.26)
Business intelligence	0.92 (15.55)
Digital platforms	0.90 (15.06)
Big data analytics	0.83 (13.60)
Social media	0.83 (13.51)
Environmental dynamism (CR = 0.90; AVE = 0.83)	
Demand for products/services increases in our industry	0.85 (fixed)
Competitors are constantly trying out new competitive strategies	0.84 (14.47)
Customer needs and demands are changing rapidly in our industry	0.86 (14.81)
New markets are emerging for products and services in our industry	0.78 (12.86)
Financial performance (CR = 0.83; AVE = 0.50)	
Sales growth	0.73 (fixed)
Sales volume	0.82 (11.53)
Profit growth	0.67 (9.44)
Market share	0.66 (8.68)
Overall performance	0.65 (7.54)
χ^2/DF = 381.81/241; CFI = 0.96; NFI = 0.90; RMSEA = 0.05; SRMR = 0.05	

TABLE 2 | Correlations, means and standard deviations.

No.	Variables	Mean	SD	1	2	3	4	5	6	7	8	9	10
1	Inbound openness	4.46	0.77	**0.94**									
2	Digital technology adoption	4.78	1.5	−0.09	**0.92**								
3	Institutional stimulus	4.64	1.32	−0.09	0.42***	**0.90**							
4	Financial performance	4.23	0.71	−0.01	0.03	−0.03	**0.70**						
5	Environmental dynamism	4.83	1.28	−0.01	−0.02	0.02	0.01	**0.91**					
6	Firm innovativeness	0.08	0.03	0.07	0.26***	0.22**	0.10	−0.23**					
7	Firm size[b]	3.53	0.52	0.02	−0.09	−0.09	−0.09	−0.17**	−0.05				
8	Firm age[b]	2.07	0.53	0.09	0.01	−0.03	−0.02	0.02	−0.08	0.26***			
9	R&D unit[a]	0.65	0.47	0.02	−0.06	−0.12*	−0.05	−0.02	−0.02	−0.04	0.13*		
10	Industry type[a]	0.34	0.47	0.04	0.10	0.14*	−0.06	0.08	0.09	0.09	0.15*	0.00	

Note: Square root of AVEs at the diagonal (in bold).
[a]Dummy variable.
[b]Natural logarithm transformation of original values.
*$p < 0.05$.
**$p < 0.01$.
***$p < 0.001$.

through the adoption of digital technologies is strengthened under high levels of inbound openness (*index of moderated mediation*: Index = 0.003, 95% CI = 0.001–0.005). To interpret this further, Table 5 and Figure 2 show that the effect of institutional stimulus on firm innovativeness through digital technology adoption is enhanced at high levels of inbound openness.

5 | Discussion and Theoretical Implications

Building on the SCP paradigm, the aim of this study was to examine (1) the relationship between institutional stimulus and SME innovativeness; (2) the mediating role of the adoption of digital technology in the relationship between institutional stimulus and SME innovativeness; and (3) the moderating role of inbound openness in the relationship between institutional stimulus, adoption of digital technologies, and SME innovativeness. To answer this study's research questions and achieve the research aim, we collected survey data from 195 SMEs operating in Ghana—a major SSA market. Our findings make important theoretical contributions to the extant innovation and R&D management literature.

First, our findings show that institutional stimulus has a positive relationship with SME innovativeness. This finding aligns with the theoretical viewpoint that institutional stimulus has a positive relationship with firm innovativeness (Kang and Park 2012; Zeng et al. 2019; Zemtsov and Kotsemir 2019; Su et al. 2019; Torregrosa-Hetland et al. 2019; Sá and de Pinho 2019). Specifically, we find that there is a positive relationship between the policies and measures implemented by the central and local governments to support innovation activities, which enhances firm innovativeness. Importantly, our findings show that central and local governments (the structure in society) are supporting firm innovation activities through the implementation of favorable policies and programs, needed technological and financial support, and import licenses for technology, manufacturing, and other equipment—which influences SME conduct. These institutional stimuli, in turn, enable SMEs to be more innovative. Hence, institutional stimulus from the central and local governments (structure in any society) influences the conduct and performance (firm innovativeness) of SMEs, in line with the SCP paradigm. This finding extends the R&D and innovation literature on the relationship between institutional stimulus and firm innovativeness, with findings from emerging market SMEs.

Second, our findings reveal that the adoption of digital technologies positively mediates the positive relationship between institutional stimulus and SME innovativeness. In response to the call by Kang and Park (2012), Doh and Kim (2014), Shu et al. (2015), Guan and Yam (2015), Jugend et al. (2018), and Krammer (2019) for more research studies to examine the mechanisms and processes through which institutional stimulus improves firm innovativeness, our study findings show that the adoption of digital technologies is one mechanism through which institutional stimulus impacts firm innovativeness. Importantly, our findings show that the institutional stimulus enables SMEs to invest in, adopt, and implement mobile computing, electronic commerce, internet of things, business intelligence, big data analytics, and social media and platforms, in turn enhancing firm innovativeness. In line with the SCP paradigm, our findings reveal that the

TABLE 3 | Regression estimates.

Independent variables	Digital technologies			Firm innovativeness		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Control paths						
Intercept	5.691*** (4.81)	2.940*** (2.51)	0.12*** (4.59)	0.090** (3.17)	0.08** (2.72)	0.084** (3.09)
Firm size[b]	−0.355 (−1.61)	−0.230 (−1.12)	−0.01 (−1.06)	−0.004 (−0.76)	−0.003 (−0.57)	−0.003 (−0.58)
Industry[a]	0.360 (1.54)	0.166 (0.76)	0.01* (1.99)	0.008 (1.56)	0.008 (1.44)	0.007 (1.36)
Firm age[b]	0.110 (0.50)	0.123 (0.61)	−0.01 (−0.97)	−0.005 (−0.95)	−0.005 (−1.07)	−0.007 (−1.48)
R&D unit[a]	−0.232 (−1.00)	−0.074 (−0.34)	−0.00 (−0.22)	0.001 (0.14)	0.001 (0.21)	0.002 (0.34)
Environmental dynamism	−0.059 (−0.68)	−0.05 (−0.68)	−0.01*** (−3.71)	−0.007*** (−3.76)	−0.007*** (−3.68)	−0.007*** (−3.52)
Financial performance	−0.056 (0.36)	0.086 (0.61)	0.00 (1.46)	0.006 (1.60)	0.005 (1.51)	−0.006 (1.65)
Direct effect						
Institutional stimulus		0.474*** (6.12)		0.006**(3.12)	0.004 (1.89)	0.002 (1.13)
Mediating effect						
Digital technological adoption (TECH)					0.004 (2.53)	0.004** (2.67)
Moderating effects						
Inbound openness (INBOP)						0.004 (1.32)
TECH × INBOP						0.006*** (3.58)
Goodness of Fit Test						
R^2	0.03	0.17	0.09	0.13	0.16	0.22
ΔR^2	—	0.14	—	0.04	0.03	0.06
F-value	0.96	6.33***	3.33**	4.37***	4.73***	5.59***
Highest VIF	1.13	1.15	1.13	1.15	1.25	1.34

Note: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$ unstandardized estimates reported; *T*-values are reported in parentheses.
[a]Dummy variables.
[b]Natural logarithm transformation of original values.

institutional stimulus from central and local governments (the structure in a society) influences the conduct of firms through the adoption of digital technologies, which in turn enables SMEs to be more innovative (performance). Building on the SCP paradigm, our study extends the R&D and innovation literature by showing that the adoption of digital technologies positively mediates the institutional stimulus–firm innovativeness relationship.

Third, the current study is novel in scrutinizing the moderating role of inbound openness in the institutional stimulus, adoption of digital technologies, and firm innovativeness relationships, in line with the SCP paradigm. As noted by Doh and Kim (2014), Szczygielski et al. (2017), and Jugend et al. (2018), the innovation process depends on a set of external (and internal) structures that can support and improve innovative processes within organizations. Thus, with this finding, we have been able to establish that the more SMEs cooperate and co-develop their innovation projects with external partners, the higher the effectiveness of the relationship between institutional stimulus, adoption of digital technologies, and firm innovativeness. Thus, we examine and present the mechanisms which strengthen the institutional stimulus, adoption of digital technologies, and firm innovativeness relationship. With this finding, we extend the SCP paradigm to the innovation and R&D research domain as it shows that the more a firm is willing to utilize its external ideas and resources (conduct), the higher the effects of its adoption of digital technologies on firm innovation.

6 | Practical Implications

Our findings have several practical implications for policymakers. *First*, as SMEs play an important role in economic development, governments should enact policies and programs that

TABLE 4 | Direct and indirect effects.

	Estimates	SE	LL 95% CI	UL 95% CI
Institutional stimulus ➔ firm Innovativeness	0.006[a]	0.002	0.002	0.009
Institutional stimulus ➔ digital technological adoption	0.477[a]	0.076	0.326	0.628
Digital technological adoption ➔ firm Innovativeness	0.004[a]	0.002	0.001	0.007
Indirect effect of institutional stimulus on firm Innovativeness via digital technological adoption	0.073[a]	0.032	0.016	0.142

Note: $N = 195$; Bootstrap sample size = 5000.
Abbreviations: LLCI = lower limit confidence interval, SE = standard error, ULCI = upper limit confidence interval.
[a]Indicates non-zero within the boundaries (significant).

TABLE 5 | Conditional effect of digital technology adoption on firm innovativeness at different values of inbound openness.

Inbound openness	Effect size	SE	LL 95% CI	UL 95% CI
−0.774	−0.001	0.002	−0.004	0.004
0.000	0.004	0.002	0.001	0.007
0.774	0.009	0.002	0.005	0.013

would enable SMEs to be more innovative. For instance, governments should develop sound initiatives and policies such as functional markets, financial and economic stimuli, and property and copyright laws that can spur and protect the innovation activities of SMEs. *Second*, our findings emphasize the significance of technological adoption and external collaborations (inbound openness) in promoting SMEs' innovativeness. Specifically, SMEs can enhance their innovation performance and become more competitive if they continue to develop their technological capabilities, while seeking and exchanging knowledge with their external partners. In practical terms, SMEs can invest in relevant digital technologies and commit time and other resources to engaging customers, suppliers, competitors, and other stakeholders as part of their innovation activities.

6.1 | Limitations and Future Research Directions

Like with most research studies, there are theoretical and methodological limitations associated with our study findings, which provide an avenue for future research directions. First, the study only collected data from a single emerging market, which restricts the capacity to apply the findings to a wider context. Therefore, future research studies should consider a cross-country comparative study to gain a more comprehensive understanding of the institutional stimulus, adoption of digital technology, and firm innovativeness relationship. Second, incorporating a qualitative research methodology could enable insights on reasons behind the kinds of digital technologies SMEs adopt as well as which have more effects on firm innovativeness, further extending the literature in this research domain. Third, the study only considered inbound openness as the mechanism that strengthens the positive effect of institutional stimulus on firm innovativeness through the adoption of digital technologies. As noted by scholars (e.g., Doh and Kim 2014; Szczygielski et al. 2017; Jugend et al. 2018), the innovation process depends on a set of internal (firm) and external institutional structures

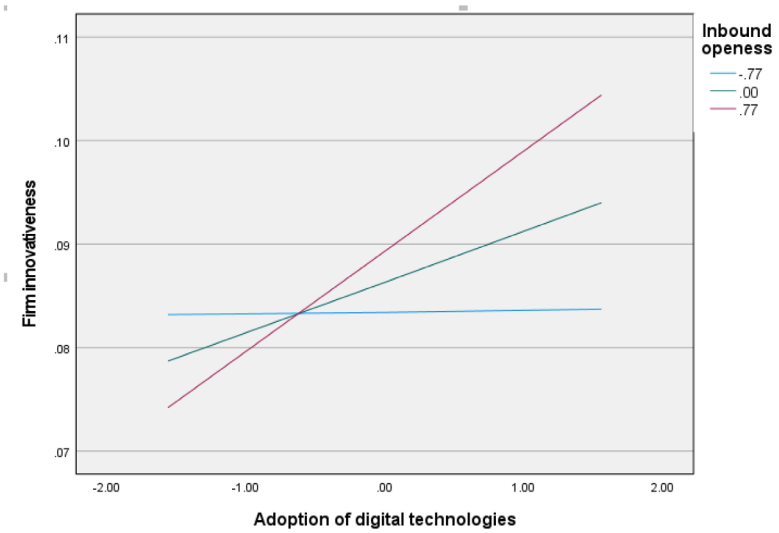

FIGURE 2 | The interaction effect of inbound openness on the relationship between digital technological adoption and firm innovativeness. Levels of the moderator (inbound openness) are −1 standard deviation, mean, and +1 standard deviation. Mean-centered scales of the independent variable (adoption of digital technologies) are reported. [Colour figure can be viewed at wileyonlinelibrary.com]

that can support and improve innovative processes within organizations. Hence, it is important for other studies to examine relevant internal and external mechanisms that might strengthen or weaken these relationships. Fourth, future research could consider using other alternative research techniques such as fuzzy set qualitative comparative analysis (FSQCA). Fifth, our study examined the combined influence of the adoption of digital technologies; however, unique nuances can be unearthed through the examination of the influence of individual types of digital technologies (e.g., internet of things, mobile computing, electronic commerce, etc.) on the relationship between institutional stimulus and firm innovativeness. Hence, future studies can examine the nature of these relationships in developing economy contexts to further broaden our insight into this phenomenon.

Ethics Statement

The authors have nothing to report.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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