# FDI impact: catalyzing digital capabilities in host nations

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## Abstract

**Purpose** – This study aims to investigate the impact of foreign direct investment (FDI) on national digital capability, specifically differentiating the impact between FDI greenfield and mergers and acquisitions (M&A). The research also investigates factors shaping digital capabilities, encompassing government transparency and absorptive capability, while exploring the mediating influence of absorptive capability in the FDI–digital capability relationship.

**Design/methodology/approach** – An econometric model has been developed to examine the interrelationship between national digital capability, FDI inflows, national absorptive capability and government transparency. The data set encompasses 55 countries over a period of nine years (2013–2021). National digital capability data is derived from the well-established index published by the World Competitive Centre (WCC). The sources of the explanatory variables align with standard practices, drawing from reputable institutions (UNCTAD and the World Bank, among others).

**Findings** – The findings reveal a significant positive impact of FDI, particularly in greenfield investments, on national digital capability. Government transparency and research and development (R&D) investment are crucial factors contributing to digital capabilities. Additionally, the absorptive capacity, reflected by R&D investment, also emerges as a potential moderating factor, influencing the impact of FDI inflows on digital capabilities.

**Practical implications** – The results recommend that policymakers and stakeholders should carefully consider the role of FDI, especially in greenfield investments, as a catalyst for enhancing national digital capability. The findings also underscore the significance of promoting government transparency and directing investments towards R&D to nurture digital capabilities. Moreover, understanding the mediating role of absorptive capability can inform strategies aimed at optimizing the impact of FDI on digital capabilities.

**Originality/value** – This study contributes uniquely to the existing literature by being the first to systematically explore the influence of FDI on national digital capability. Furthermore, it presents innovative empirical findings on the role of absorptive capability in enhancing the FDI impact on national digital capability, an area that remains relatively uncharted in current literature.

**Keywords** Foreign direct investment (FDI), Digital capabilities, Greenfield investments, Mergers and acquisitions (M&A), Government transparency, Absorptive capability, Research and development (R&D)

**Paper type** Research paper

## 1. Introduction

In the 21st century, characterized by rapid advancements and technological prominence, national digital capability has emerged as a decisive factor in its overall development and

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global competitiveness. National digital capability refers to a country's ability to harness and leverage digital technologies effectively for economic, social and governance purposes (Hund *et al.*, 2021; Tai *et al.*, 2017; Yang *et al.*, 2019; Zhu *et al.*, 2022). A strong digital capability enables countries to drive economic growth and enhance their competitiveness in the global market. Furthermore, it allows countries to foster innovation, improve productivity and create new business opportunities (Chandra *et al.*, 2022; Clavijo and Pantaleón, 2020). For example, nations equipped with formidable digital capabilities can leverage cutting-edge technologies such as artificial intelligence, big data analytics and the Internet of Things to address complex challenges, refine decision-making processes and drive transformations across diverse industries. This not only fosters economic diversification but also gives rise to novel industries (Yeboah, 2023). Especially from a social standpoint, digital capabilities empower populations to access a broader spectrum of cultural elements, facilitate seamless communication and expand their access to various services such as education and health care.

Among the various factors influencing national digital capability, foreign direct investment (FDI) can be considered an important factor. FDI is widely recognized for its potential to expose host countries to new technologies, ideas and practices that may otherwise be inaccessible to them. This exposure creates spillover effects that enhance the capabilities of domestic companies as they learn from and adapt to the approaches of foreign firms (Fon *et al.*, 2021; Hao *et al.*, 2020; Jiang *et al.*, 2011; Luo *et al.*, 2019; Sinani and Meyer, 2004; Wang and Chen, 2014; Wei and Liu, 2006).

However, there exists a significant gap in research on the impact of FDI on national digital capability. While an extensive body of literature has delved into the impact of FDI flows on the stock of knowledge, technological progress and productivity in host countries (Demena and van Bergeijk, 2017; Driffield and Love, 2007; Liu and Wang, 2003), empirical research on the influence of FDI on national digital capability remains notably limited. Current studies primarily involve conceptual analyses, with some advocating that FDI can enhance capacity and competitiveness for small and medium-sized enterprises (SMEs) (Ciuriak and Ptashkina, 2019; Eden, 2016), while others argue that FDI can facilitate digital knowledge and technology (Echandi *et al.*, 2015). Clearly, the empirical evidence of FDI's impact on digital capability is scarce. Only a few empirical studies have explored this realm (Chen and Chen, 2009; Nguyen, 2022). However, Chen and Chen (2009) concentrate more on technological capability than specifically on digital capability, while Nguyen (2022) focuses solely on one country, Vietnam.

The primary objective of this research is to examine how FDI impacts a country's digital capability. The study, in particular, seeks to analyze the impact of FDI net inflows on national digital capabilities, especially delving into the distinct effects of its two components: greenfield investments and mergers and acquisitions (M&A). In addition, the paper examines the contributions of government transparency and absorptive capability to digital capabilities. A particular focus will be placed on exploring the mediating role of absorptive capability in the relationship between FDI and digital capabilities.

Data for the study is gathered from reputable sources such as the World Competitive Centre (WCC), the World Bank, the United Nations Conference on Trade and Development (UNCTAD) and the Transparency International Organization. The data set spans 55 countries over the period from 2013 to 2021. The paper estimates an econometric model with fixed effects for time and human development levels, controlling for relevant factors such as infrastructure, financial coverage and trade openness. The findings of the study underscore the significant positive impact of FDI, particularly in terms of greenfield investments, on digital capability. Government transparency and investment in research and development

(R&D) are identified as crucial factors in fostering the digital capabilities of nations. Furthermore, the absorptive capability of R&D activities is highlighted as a potential moderator capable of influencing the impact of FDI inflows on digital capabilities.

The paper's contributions to the literature can be summarized in two folds. Firstly, we are the first to investigate the impact of FDI on national digital capability across a large set of countries, thereby providing a systematic conclusion regarding the relationship between FDI and national digital capability. Secondly, we present new empirical findings concerning the role of absorptive capability in augmenting the FDI impact on national digital capability. Although absorptive capability has been recognized for strengthening the impact of FDI on innovation and IT investment in the host country (Chen and Chen, 2009; Silajdzic and Mehic, 2016; Ubeda and Pérez-Hernández, 2017), there is no evidence regarding its impact on the relationship between FDI and digital capability.

The structure of the paper unfolds as follows. Section 2 provides a literature review encompassing digital capabilities and their determinants. Section 3 proposes the hypotheses, while the Section 4 presents the data and empirical approach used. Section 5 presents the results, and the final section concludes the study while also outlining potential avenues for further research suggested by these findings.

## 2. Literature review

### *2.1 Concept of digital capability*

Generally, digital capability refers to the ability to identify and leverage digital technologies and practices to create new or improved products, services, processes and business models that meet evolving customer needs, enhance operational efficiency and generate competitive advantages while ensuring long-term viability (Hund *et al.*, 2021; Tai *et al.*, 2017; Yang *et al.*, 2019; Zhu *et al.*, 2022). At the national level, digital capability refers to a country's capacity and preparedness to effectively use digital technologies and resources for economic, social and governance purposes (IMD, 2023). This can be reflected in various aspects, such as digital infrastructure, digital innovation and entrepreneurship and digital skills and human capital.

The presence of robust digital infrastructure, including high-speed internet connectivity, broadband networks and reliable telecommunications systems, becomes a pillar to enable digital capability. It is the basis for seamless communication, data transmission and access to digital services and platforms. Thus, the concept of the digital capability of one country cannot be disregarded as a basic element. Furthermore, fostering an environment conducive to digital innovation and entrepreneurship is a crucial aspect of national digital capability (Xu *et al.*, 2022). Beyond the adoption and incorporation of digital technologies by existing firms, startups are recognized as disruptive actors to introduce them. An environment that supports and promotes the development of startups, promotes research and development in digital technologies and cultivates a culture of innovation and experimentation becomes key to increasing the digital capability of a country. Such an environment will encompass mechanisms for funding, incubation programs and collaboration between academia, industry and government (Pauceanu, 2022). Finally, it is worthy to highlight the role of digital skills and human capital. A skilled and digitally literate workforce plays a vital role in harnessing digital technologies (Gao *et al.*, 2022; Khin and Ho, 2018). National digital capability necessitates equipping the population with the necessary skills and knowledge to effectively use digital tools, navigate online platforms and engage in digital activities. This includes proficiency in areas such as digital literacy, coding, data analytics and cybersecurity.

The digital capability has gained recognition for its advantages in better understanding the evolution of firms (Bruno *et al.*, 2023; Rupeika-Apoga *et al.*, 2022; Wang *et al.*, 2022;

Zhe and Hamid, 2021) and, consequently, the economy they are in (Solomon and van Klyton, 2020; Tian *et al.*, 2023). At the firm level, with the increasing emphasis on digital transformation across industries, organizations with strong digital innovation capabilities are better equipped to adapt to changing market conditions, enhance their competitiveness and improve their overall performance. By leveraging emerging technologies and effectively managing digital resources, these organizations can innovate more quickly and efficiently, enabling them to create new products, services and business models that meet evolving customer needs (Dang, 2022). The importance of digital innovation capability is further emphasized by the fact that it has become a critical factor in determining an organization's long-term success in today's digital age (Tai *et al.*, 2017; Yang *et al.*, 2019).

Digital capability is becoming increasingly important for institutions as they seek to catch up with more advanced economies and compete on a global scale, especially when they face unique challenges such as limited access to traditional services, underdeveloped infrastructure and a lack of resources. Developing a strong digital innovation capability allows firms in developing/emerging countries to compete with more established firms by developing innovative products and services, improving efficiency and enhancing the customer experience (Heredia *et al.*, 2022).

At the national level, digital capability fosters entrepreneurship and innovation. By providing a platform for startups and small businesses to develop and scale their ideas, countries can drive economic growth and create new job opportunities (Clavijo and Pantaleón, 2020). Digital capability creates a supportive ecosystem for startups, helping them access financing, mentorship and market opportunities (Chillakuri *et al.*, 2020). Digital capability also plays a critical role in improving access to essential services (Chandra *et al.*, 2022). For example, digital technologies can be used to provide education, health care and financial services to underserved populations, particularly in rural areas. This not only improves the quality of life but also provides opportunities for new businesses to emerge and grow. For instance, recent research emphasizes that advancements in health care information technology, such as mobile health applications, wearable devices, digital medicine, virtual health care and big data-based clinical solutions, have emerged as vehicles to transform and enhance health-care services (Davies *et al.*, 2018; Zhao *et al.*, 2023). Consequently, developing robust capabilities can contribute to the improvement of health-care services.

### *2.2 Impact of foreign direct investment on digital capability*

While there is an extensive body of literature exploring the impact of FDI flows on technological advances and productivity in host countries (Demena and van Bergeijk, 2017; Driffield and Love, 2007; Liu and Wang, 2003), research on the influence of FDI on national digital capability is still limited. Existing studies primarily consist of conceptual analyses, lacking substantial empirical evidence to firmly establish the relationship. Notably, scholars have proposed that FDI, especially in the realm of digital FDI, can act as a pathway to enhance capacity and competitiveness, particularly for SMEs (Ciuriak and Ptashkina, 2019; Eden, 2016). FDI not only injects capital but also facilitates the transfer of embedded digital knowledge and technology, leading to job creation and productivity gains (Echandi *et al.*, 2015).

Although some studies have presented evidence of the impact of FDI on the digital capabilities of destinations, the focus is limited, paying attention to specific countries or regions (Chen and Chen, 2009; Nguyen, 2022). To be more specific, Nguyen (2022) underscores the importance of investing in Vietnam's digital technology and ICT sectors, using both domestic resources and external sources such as FDI. It emphasizes how FDI

inflows from developed countries assist developing nations in adopting modern technology and acquiring advanced management expertise, fostering economic growth and promoting the development of smart production industries. The research of Nguyen (2022), however, has limitations in terms of research scope. Chen and Chen (2009) examine the impact of FDI on regional technological capabilities in China and conclude that FDI has a limited effect on enhancing indigenous innovation capabilities. The research demonstrates that regions with higher technological capabilities tend to attract higher quality inward FDI. Moreover, the study highlights the significance of robust technological capabilities and abundant human capital within domestic enterprises as essential factors for stimulating the spillover effects of FDI. The study by Chen and Chen (2009), however, specifically centres on national technological capability and, as a result, may not offer a comprehensive exploration of national capability in terms of leveraging digital tools and digital technologies in a specific context. The scarce empirical evidence on the impact of FDI on national digital capability, coupled with its narrow focus on specific countries, hinders a comprehensive understanding of the phenomenon on a global scale. As a result, a thorough and robust assessment of the influence of FDI on digital capability from a global standpoint is yet to be realized.

## 3. Hypotheses

### *3.1 Impact of foreign direct investment on national digital capability*

The existing literature has predominantly affirmed that FDI plays a pivotal role in fostering technological advancements within host countries. This phenomenon can be attributed to three primary channels. Firstly, foreign investors can introduce cutting-edge technologies into their projects (in fact, technological superiority is a key motivator for FDI, particularly in cases of horizontal investments). Studies have demonstrated the ubiquity of this effect across a diverse array of countries, industries and contexts (Driffield *et al.*, 2010; Patibandla and Petersen, 2002; Rugman and Verbeke, 2001). Secondly, as FDI inflows act as a catalyst for the host country's development, various stakeholders endeavour to enhance the country's attractiveness to attract such investments. Local governments, in particular, play a crucial role by providing physical infrastructure, training the local workforce and establishing a legal and institutional framework conducive to the needs of foreign investors (Friedman *et al.*, 1992; Nam Jeon and Young Ahn, 2004; Osland and Björkman, 1998; Vindelyn and Omar, 2005; Wallin Andreassen, 1995; Wint and Williams, 2002). Thirdly, the presence of new foreign firms prompts responses from local companies. Competing firms within the same industry, facing increased competition, strive to enhance their competitiveness by embracing advanced technologies or even developing proprietary technologies to secure a stronger position (Antonietti *et al.*, 2015; Blind and Jungmittag, 2004; Vahter, 2011). In addition, firms that identify an opportunity to supply the new entrants adapt by producing outputs that meet the higher standards of quality or sophistication set by the incoming foreign firms. This ripple effect extends to downstream sectors, fostering technological advancements and progression up the technological ladder. Moreover, the mere existence of foreign firms generates additional spillover effects on local industries, driven by demonstration effects, the rotation of employees and other factors.

The impact of FDI on the technological landscape of host countries has been extensively researched and well documented. While some studies have delved into specific technologies and capabilities, such as sustainable technologies (Ayamba *et al.*, 2020; Melane-Lavado *et al.*, 2018; Wu *et al.*, 2023), there remains a gap in understanding the effects on the digital capability of the host country. However, given the analogous channels at play, it is plausible to propose the hypothesis that similar effects extend to the realm of digital capabilities:

*H1*. FDI inflows increase the digital capabilities of the host countries.

FDI can be directed through two distinct avenues: M&A and greenfield investments. The technological implications of these investment types can vary significantly. In the case of M&A, FDI tends to continue with existing firms, making modifications to their technologies more challenging compared to greenfield investments. Besides, as previous research has shown, the impact of acquisitions by foreign firms is mediated by other elements such as culture (Sung-Jun Lee *et al.*, 2015; Björkman *et al.*, 2007), degree of international diversification (Gu *et al.*, 2019) and managerial abilities (Duan *et al.*, 2022), among other factors. Meanwhile, in greenfield projects, investors can use desired technologies without the constraints posed by existing premises, installations and workforce (Davies *et al.*, 2018; Harms and Méon, 2018; Kim, 2009).

As a result, the technological impact of FDI inflows in the host country differs between greenfield investments and M&A, with a more substantial expected effect for greenfield investments. Therefore, we propose the following hypothesis:

*H1a.* Greenfield FDI inflows will exert a greater influence on the digital capabilities of the host countries compared to M&A investment.

### *3.2 Impact of government transparency on national digital capability*

Host governments assume a pivotal role in cultivating national digital capability. Responsibilities span across the education system, which is instrumental in nurturing a populace equipped with the skills to both use digital services and engage with items incorporating digital technologies (Morte-Nadal and Esteban-Navarro, 2022). Moreover, governments oversee the development and maintenance of technological infrastructure, essential for integrating technology into businesses and regulate industries critical to technological advancement (Papaioannou and Dimelis, 2017).

Governments can emerge as catalysts for widespread digital technology adoption, as exemplified by Estonia's paradigmatic case (Kitsing, 2011). Those aspiring to enhance efficiency implement digital technologies within their operations, delivering services to citizens through digital channels. This expansion of digital services not only contributes to the creation and upkeep of digital infrastructure, such as optical fibre networks, but also familiarizes the population with digital technology, exerting a demonstration effect across various sectors. Conversely, governments that neglect the populace's needs may lack the impetus to advance digitally based services or develop an education system aligned with the contemporary demands of society (Bjerke-Busch and Aspelund, 2021; Mu and Wang, 2022).

Therefore, we can infer that a government's transparency, demonstrated through policies aligned with societal interests and an emphasis on education, facilitates the advancement of services and curtails the potential for corruption (or quasi-corruption) practices. This, in turn, translates into the practical realization of enhanced digital capabilities for the country. As a result, we propose the following hypothesis:

*H2.* The transparency of the government will increase the digital capabilities of the country.

### *3.3 Role of local technological developments in national digital capabilities*

The digital capability of a country refers to its capacity to identify and harness digital technologies, practices and opportunities for the creation of new or enhanced goods, services and business models. There are various avenues through which such capabilities can be

cultivated, with R&D standing out as the primary one by its nature. R&D encompasses activities geared towards generating innovations or acquiring valuable knowledge for innovation (Bilbao-Osorio and Rodríguez-Pose, 2004).

Within the dimensions that these activities can encompass, one crucial focus is on digital innovations. These innovations involve the application of digital technologies and resources to achieve advancements in products or processes, as well as innovations that represent progress in using existing digital technologies and knowledge (Ciriello *et al.*, 2018; Hund *et al.*, 2021). Naturally, the extent of a country's research and development endeavours directly correlates with its ability to effectively use and apply new technologies. Thus, we propose the following hypothesis:

*H3.* Countries with higher R&D expenditures will have more digital capabilities.

However, the impact of R&D on the development of digital capabilities extends beyond their direct consequences. These activities have a broader impact, shaping the mindset and capabilities of various entities such as businesses, research institutions and society as a whole, fostering a greater openness to and proficiency in incorporating additional positive effects proposed in *H3* (*H3*).

A significant body of literature has corroborated that R&D activities not only contribute to the generation of digital capabilities but also enhance the absorptive capacity for spillover effects introduced by foreign multinationals in a country (Duan *et al.*, 2021; Vahter, 2011). This contribution arises from the creation of knowledge, the development of a skilled workforce, the establishment of facilities such as laboratories and testing centres and the cultivation of institutions and managerial practices. These elements collectively ensure that the knowledge and expertise inherent in FDI inflows are more effectively assimilated in the host country.

Therefore, the overall impact of R&D activities within a country encompasses not only their role in generating digital capabilities but also their influence on the absorptive capacity developed within the host country. This, in turn, modifies the impact of FDI inflows. Consequently, beyond the hypothesis connecting R&D activities with a country's digital capabilities, we can propose additional hypotheses.

*H3a.* Countries with higher R&D expenditures will experience a more significant impact of FDI inflows on digital capabilities.

The research framework, which presents three proposed hypotheses, will be illustrated in Figure 1 as follows.

## 4. Methodology

### *4.1 Empirical approach*

To assess the validity of the hypotheses outlined in Section 3, an econometric model will be used for estimation:

$$DC_{i,t} = \alpha + \beta \times FDI_{i,t} + \gamma_1 \times Government_Transparency_{i,t} + \gamma_2 \times R\&D_{i,t} + Z_t + \varepsilon_{i,t} \quad (1)$$

where, the subscripts i and $t$ represent the country and time (in years), respectively. *H1* can be empirically examined through the parameter $\beta$ in the econometric model. *H2* can be tested using the parameter $\gamma_1$ and *H3* can be evaluated using the parameter $\gamma_2$. The same model can be used to examine hypothesis *H1a* by conducting the estimation with FDI

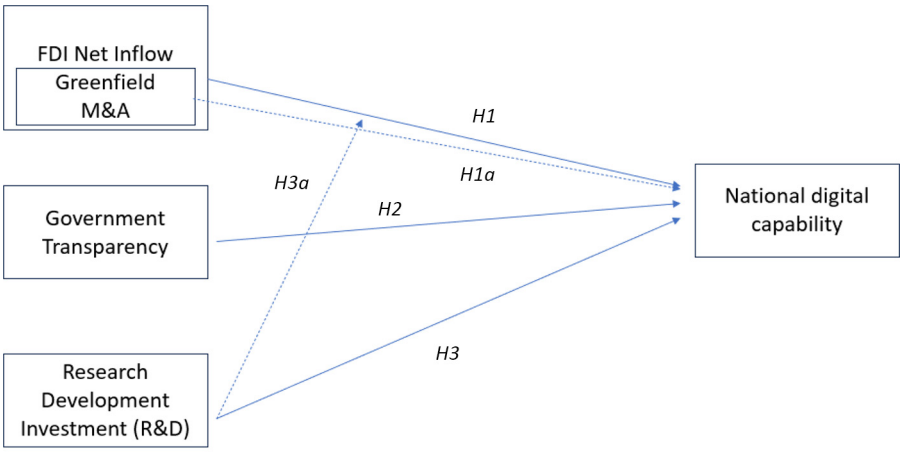


**Figure 1.**
Conceptual model illustrating the impact of FDI and other determinants on national digital capabilities

**Source:** Developed by the authors

inflows separately for M&A and greenfield. The aim is to observe the difference in the estimated value of $\beta$ for each of these components.

Furthermore, to validate *H3a* concerning the correlation between R&D and the influence of FDI on digital capability, we have introduced the variable $Absorptive\ Capability_{i,t}$ and the interaction term $FDI_{i,t} \times Absorptive\ Capability_{i,t}$ have been made. The updated econometric model is expressed as follows:

$$DC_{i,t} = \alpha + \beta \times FDI_{i,t} + \vartheta \times Absorptive\ \ Capability_{i,t} + \delta \times \left(FDI_{i,t} \times Absorptive\ \ Capability_{i,t}\right) + Z_t + \varepsilon_{i,t} \quad (2)$$

In which *H3a* can be evaluated through the parameter $\delta$.

### *4.2 Materials*

*4.2.1 Variable description.* Table 1 provides a summary of the definitions for all variables used in the regression models, along with their respective sources. Additional details are presented beyond this table.

4.2.1.1 Dependent variable. The dependent variable is denoted as $DC_{i,t}$, capturing the national level of digital capability. It serves as the outcome variable of interest, reflecting the degree to which a country possesses the necessary digital capability to compete effectively in the global digital economy. It is measured as the Digital Competitiveness Index gathered from the database of the World Competitive Center (2023). This index assigns scores to each country based on factors including their knowledge base, technological advancements and preparedness for future digital advancements.

The data referred to $DC_{i,t}$ was collected from the WCC, the research arm of the International Institute for Management Development (IMD). WCC has been at the forefront of pioneering research for over three decades, specifically in the realms of how nations and enterprises engage in competition to establish the groundwork for future prosperity. Annually, the centre releases meticulously crafted reports that delineate the methodologies used in the collection and measurement of data. Notably, the National Digital Competitive

**Table 1.** Summary of variable description

| Variables | Definition | Measurement | Data source |
|---|---|---|---|
| *Dependent variables* | | | |
| $DC_{i,t}$ | Reflect the national capacity for adopting and exploring digital technologies, leading to transformation in government practices, business models and society as a whole, considering three factors: knowledge, technology and future readiness | The variable's values have been obtained from the World Competitive Centre. The values are of an annual nature, spanning the time period from 2013 to 2021 and are in logarithmic form | World Competitive Centre (2023) |
| *Independent variables* | | | |
| $FDI(NetInflow)_{i,t}$ | This variable refers to the net direct investment flows into a country from foreign sources during a specified period, typically a year. It represents the difference between the foreign direct investment inflow (investment into the country) and the outflow (investment leaving the country) | The variable's values have been obtained from the World Bank database. The values are of an annual nature, spanning the time period from 2013 to 2021, in logarithmic form and lagged by one year | World Bank (2023) |
| $FDI(GreenField)_{i,t}$ | This variable quantifies the annual monetary value of FDI greenfield projects that a specific country has received. Greenfield projects refer to newly established ventures or expansions initiated by foreign investors involving the construction and development of new facilities | The variable's values have been obtained from the UNCTAD database. The values are of an annual nature, spanning the time period from 2013 to 2021, in logarithmic form and lagged by one year | UNCTAD (2023) |
| $FDI(M\&A)_{i,t}$ | This variable represents the annual monetary valuation of cross-border mergers and acquisitions (M&A) transactions received by a particular country. It encompasses both the financial inflow from acquisitions and the outflow from divestitures, providing a comprehensive measure of the monetary impact of international M&A activity on the specified country each year | The variable's values have been obtained from the UNCTAD database. The values are of an annual nature, spanning the time period from 2013 to 2021, in logarithmic form and lagged by one year | UNCTAD (2023) |

(*continued*)

Table 1.

| Variables | Definition | Measurement | Data source |
|---|---|---|---|
| *Government_ Transparency*$_{i,t}$ | Proxy for government transparency level, scoring on a scale of 0 (highly corrupt, low transparent) to 100 (very clean, high transparent) | The data has been collected from the Transparency International Organization (2023). The values are of an annual nature, spanning the time period from 2013 to 2021 and lagging by one year | Transparency International organization (2023) |
| *R&D*$_{i,t}$ | Proxy for investment in research and development activities as a percentage of GDP | The data on *R&D*$_{i,t}$ has been collected from the World Bank. The values are of an annual nature, spanning the time period from 2013 to 2021 and lagging by one year | World Bank (2023) |
| *Absorptive Capability*$_{i,t}$ | A categorical variable denoting the national absorptive capability is used, where a value of 0 signifies low absorptive capability and a value of 1 signifies high absorptive capability | The variable is based on the variables *R&D*$_{i,t}$, which denote the level of research and development investment within a given country as a proportion of its GDP | Authors |
| *Control variables* | | | |
| *Trade Openness*$_{i,t}$ | Trade openness is measured by the ratio of a country's total international trade (exports plus imports) to its gross domestic product (GDP). A higher trade-to-GDP ratio generally indicates a more open economy, while a lower ratio suggests a relatively closed economy | The variable's values have been obtained from the World Bank database. The values are of an annual nature, spanning the time period from 2013 to 2021 and lagging by one year | World Bank (2023) |
| *Infrastructure*$_{i,t}$ | Proxy for the quality of non-financial infrastructure measured as the ratio of investment in physical assets to GDP | The variable's values have been obtained from the World Bank database. The values are of an annual nature, spanning the time period from 2013 to 2021 and lagging by one year | World Bank (2023) |

(*continued*)

Table 1.

| Variables | Definition | Measurement | Data source |
|---|---|---|---|
| $ATM_{i,t}$ | Proxy for national financial coverage, measured as the number of ATMs per 100,000 adults | The variable's values have been obtained from the World Bank database. The values are of an annual nature, spanning the time period from 2013 to 2021, in logarithmic form and lagged by one year | World Bank (2023) |
| $Year_t$ | A full set of year dummies controlling for unobserved heterogeneity in the form of cyclical changes that may not be captured by the other control variables | The $Year_t$ dummy variable encompasses 10 potential values, with 1 assigned to represent the year 2013, 2 allocated for the year 2014 and so forth, with the final value of 10 designating the year 2021 | Authors |
| $Z_t$ | A full set of human development level dummies, controlling for unobserved heterogeneity across different levels of human development | There are four values of human development level, based on the human development index collected from the United Nations Development Programme (UNDP). Level 0 represents countries with a low human development index, with a value below 0.55. Level 1 represents countries with a medium human development index, ranging from 0.550 to 0.699. Level 2 represents countries with a high human development index, ranging from 0.700 to 0.799. Level 3 represents countries with a very human development index, with a value of 0.800<br>Consequently, the variable $Z_t$ can assume one of four discrete values, namely, 0, 1, 2 or 3 | UNDP (2023) |

**Source:** Developed by the authors

Index, a key metric gathered across diverse countries, undergoes a comprehensive evaluation. This rigorous approach lends credence to the reliability and integrity of the data sourced from the WCC. This database is also used in previous academic research (Ayuningrum, 2021; Bai-Ngern and Tubtiang, 2020; Conrad, 2021; Hokkanen, 2022).

4.2.1.2 Independent variables. The set of independent variables to test the raised hypotheses aims to capture three key elements:

(1) the FDI inflows;
(2) the absorptive capacity of the country; and
(3) the government transparency.

To comprehensively assess the influence of foreign direct investment inflows on national digital capability, the variable that measures the net FDI inflows, as reported by UNCTAD, will be included. As outlined in *H1a*, acknowledging potential distinctions in the effects of FDI inflows in M&A and greenfield investments, we will alternatively include inflows in M&A and inflows in greenfield investments in addition to total FDI inflows. These data were gathered from UNCTAD. It is acknowledged that the total FDI net inflow corresponds to the aggregate of M&A, greenfield investments and other relevant categories (UNCTAD, 2022).

The quantification of national absorptive capability adheres to the established methodology initially proposed in the literature (Griffith *et al.*, 2004, 2003; Yang and Lin, 2012). This involves using the proportion of total investment in R&D activities within a country relative to its GDP, as articulated by many others (Griffith *et al.*, 2004, 2003; Yang and Lin, 2012). An increase in R&D expenditure is conventionally linked to greater competitiveness, enhanced productivity and the potential genesis of novel industries, products and services (Dobrzański *et al.*, 2021; McMorrow and Röger, 2009). Therefore, following this approach, we will include the R&D expenditures (normalized on the GDP) for each year, as provided by the World Bank database.

Furthermore, to explore how absorptive capability influences the impact of FDI on national digital capability, a categorical variable capturing national absorptive capability is used. First of all, we have categorized the sample countries into two equally sized groups based on their R&D investment. Group 1 consists of 50% of sample countries with lower R&D, while Group 2 comprises 50% of sample countries with higher R&D. Subsequently, the assignment for the categorical variable is as follows: Group 1 will be assigned the value of 0, and Group 2 will be assigned the value of 1.

The third explanatory variable focuses on government transparency. While various approaches exist in the literature to capture government transparency, it is common to use an index that synthesizes relevant elements. In this paper, an index provided by the Transparency International Organization (2023), will be used within the econometric framework. This index ranges from 0 to 100, signifying the spectrum from low transparency (associated with a higher likelihood of corruption) to very clean/high transparency (indicating a lower likelihood of corruption).

4.2.1.3 Control variables. Besides, it is essential to incorporate a series of control variables that capture any other effect to provide clearer results for the variables of interest. The control variables aim to measure the extent of trade openness, the quality of infrastructure, national financial coverage, the development level of each country, as well as any specific year effect that could exist.

Trade openness measures the total value of a country's exports and imports divided by its GDP. Higher trade openness generally may facilitate access to international markets and foster digital innovation (Dotta and Munyo, 2019; Keho, 2017). The data is collected annually

from the World Bank (2023). The non-financial infrastructure quality measures the total value of the investment in physical assets, such as machinery, equipment, buildings and infrastructure, divided by its GDP. A well-developed and reliable infrastructure, such as telecommunications networks, internet connectivity and transportation systems, provides a conducive environment for entrepreneurship and innovation (Petkovska *et al.*, 2019). Besides, a good infrastructure supports the efficient exchange of information and enables the adoption of advanced digital technologies (Van de Wetering *et al.*, 2018). The data is collected annually from the World Bank (2023). To proxy the national financial extension of technology-based financial services, the number of ATMs per 100,000 adults is included. A higher density of ATMs may signify a robust financial system and technological capabilities, indicating a well-developed banking sector (El-Chaarani and El-Abiad, 2018; Sedera *et al.*, 2022). It can foster economic development (Amable and Chatelain, 2001). This data is collected annually from the World Bank (2023). Finally, to capture the current developmental level of each country, the categorization by the United Nations Development Programme (UNDP) based on the HDI will be used. According to UNDP (2023), human development serves as a more crucial indicator of economic development than mere economic growth because it includes a reference to the educational level of the population. Therefore, the inclusion of dummies for the categories of human development level that the UNDP establishes will allow for control of any other unobserved variations across countries that could consistently impact the digital capabilities.

*4.2.2 Other concerns.* To address concerns related to causal relationships, the explanatory and control variables in the econometric model are intentionally lagged. By introducing a time lag, the study aims to establish a temporal precedence, minimizing the potential for reverse causality or spurious associations.

In the context of potential multicollinearity concerns, following previous authors (Elfakhani and Mackie, 2015), the variance inflation factors (VIF) test was conducted. As delineated in Table 2, where the VIF values associated with the variables used in the regression analysis were found to be consistently below 5, it is discerned that the regression models are minimally impacted by multicollinearity issues (Senthilnathan, 2019).

We additionally examine the potential presence of heteroskedasticity in the data, exploiting the panel data structure by using the Breusch–Pagan test, following the Halunga *et al.* (2017) approach. In it, the null hypothesis posits the existence of homoscedasticity, indicating (at the statistical acceptance levels) that the residuals are distributed with equal variance. The result of the Breusch–Pagan test reveals that the $p$-value is 0.4299, exceeding the significance levels. In this instance, we do not reject the null hypothesis, allowing us to assert that concerns regarding heteroskedasticity are minimal in this model.

| Model 1 | | Model 2 | | Model 3 | |
|---|---|---|---|---|---|
| Variable | VIF | Variable | VIF | Variable | VIF |
| $FDI(NetInflow)_{i,t}$ | 1.24 | $FDI(M\&A)_{i,t}$ | 1.52 | $FDI(Greenfield)_{i,t}$ | 1.34 |
| $R\&D_{i,t}$ | 2.09 | $R\&D_{i,t}$ | 1.99 | $R\&D_{i,t}$ | 2.13 |
| $ATM_{i,t}$ | 1.31 | $ATM_{i,t}$ | 1.27 | $ATM_{i,t}$ | 1.31 |
| $Infrastructure_{i,t}$ | 1.25 | $Infrastructrue_{i,t}$ | 1.14 | $Infrastructrue_{i,t}$ | 1.26 |
| $Trade\_Openness_{i,t}$ | 1.24 | $Trade\_Openness_{i,t}$ | 1.33 | $Trade\_Openness_{i,t}$ | 1.3 |
| Government Transparency$_{i,t}$ | 2.37 | Government Transparency$_{i,t}$ | 2.7 | Government Transparency$_{i,t}$ | 2.36 |

**Source:** Developed by the authors

**Table 2.** VIF analysis

*4.2.3 Final data sample.* The time span considered for data collection encompassed the maximum availability of the digital innovativeness index, spanning from 2013 to 2021. Following data retrieval, a rigorous process was used to eliminate countries from the data set that exhibited incomplete or missing information regarding the digital innovativeness index. As a result, the final data set comprises 55 countries with complete and reliable data, ensuring a robust foundation for subsequent analyses and findings.

## 5. Results and discussion

### *5.1 Descriptive and preliminary tests*

Table 3 provides an overview of descriptive statistics derived from our data set. The Digital Capabilities Index demonstrates a moderately high mean (68.21), indicating a decent level of digital capabilities on average. Within the realm of FDI, the total net inflow reveals a significant standard deviation ($57,464.66m), indicative of significant variability in FDI across the sampled entities. Notably, greenfield investments exhibit a higher mean and lower standard deviation compared to M&A, suggesting a potential preference for expanding existing operations over establishing new ventures. The R&D/GDP ratio shows a relatively modest mean of 1.51%, signalling that, on average from 2013 to 2021, countries allocate a modest percentage of their GDP to research and development initiatives. The maximum R&D/GDP is 5.44%, indicating that certain countries significantly contribute to R&D activities. Government transparency scores, boasting a mean of 58.49, reflect a moderate level of transparency across countries. Certain countries exhibit markedly low transparency (e.g. 25.00 points), underscoring potential areas for further examination and policy considerations. Concurrently, some other nations showcase relatively high transparency, reaching a maximum of 92.00 points.

### *5.2 Econometric results*

Table 4 presents the results of the regression model covering 55 countries from 2013 to 2021. The results underscore a positive impact of FDI components on enhancing national digital capability, robustly supporting *H1*. Moreover, the estimated coefficient for FDI greenfield is larger than that for M&A (0.021 compared to 0.09). These results substantiate *H1a*, suggesting that within the context of M&A, FDI tends to persist with established firms, encountering heightened challenges in modifying their technologies compared to greenfield investments. Conversely, in greenfield projects, investors possess the flexibility to implement desired technologies without the constraints imposed by existing premises, installations and workforce. Consequently, the technological influence of FDI inflows in the host country varies between greenfield investments and M&A, with greenfield investments exerting a more pronounced effect. Importantly, our findings align with existing literature on this subject (Davies *et al.*, 2018; Harms and Méon, 2018; Kim, 2009).

| Variables | Mean | SD | Min | Max |
|---|---|---|---|---|
| Digital capabilities index | 68.21 | 17.61241 | 31.91 | 100 |
| FDI net inflows (total, in $ millions) | 23,779.56 | 57,464.66 | −330,338.47 | 333,979.03 |
| FDI net inflows (greenfield, $ millions) | 9,419.64 | 13,431.88 | 0.00 | 123,335.50 |
| FDI net inflows (M&A, $ millions) | 6,951.52 | 17,634.72 | −55,040.07 | 255,111.80 |
| R&D/GDP (in %) | 1.51 | 1.07 | 0.08 | 5.44 |
| Government transparency | 58.49 | 18.94 | 25.00 | 92.00 |

**Table 3.**
Descriptive statistics

**Source:** Developed by the authors

| Variables | (1) Model 1 | (2) Model 2 | (3) Model 3 |
|---|---|---|---|
| $FDI(Netflow)_{i,t}$ | 0.013*** (0.0038) | | |
| $FDI(M\&A)_{i,t}$ | | 0.009*** (0.0027) | |
| $FDI(Greenfield)_{i,t}$ | | | 0.021*** (0.0035) |
| Government Transparency$_{i,t}$ | 0.008*** (0.0005) | 0.008*** (0.0005) | 0.008*** (0.0004) |
| $R\&D_{i,t}$ | 0.065*** (0.0070) | 0.058*** (0.0072) | 0.065*** (0.0068) |
| $Infrastructure_{i,t}$ | 0.000*** (0.0001) | 0.000*** (0.0001) | 0.000*** (0.0001) |
| $ATM_{i,t}$ | 0.005*** (0.0012) | 0.006*** (0.0014) | 0.004*** (0.0012) |
| $Trade\_Openness_{i,t}$ | 0.000*** (0.0001) | 0.000*** (0.0001) | 0.000*** (0.0001) |
| Constant | 2.970*** (0.1007) | 3.203*** (0.0652) | 3.081*** (0.0658) |
| Year FE | Yes | Yes | Yes |
| HDI FE | Yes | Yes | Yes |
| Observations | 360 | 344 | 409 |
| $R^2$ | 0.834 | 0.851 | 0.845 |
| F-test | 115.26 | 124.91 | 142.70 |
| Significant F | 0.0000 | 0.0000 | 0.0000 |

**Notes:** The standard error is presented in parentheses. Significance levels are denoted by asterisks, where ***, ** and * represent statistical significance at the 1, 5 and 10% levels, respectively, using two-sided tests
**Source:** Developed by the authors

**Table 4.** Econometric analysis: OLS with heteroskedasticity robust error

The results from Table 4 also provide insights into the impact of government transparency on digital capability. The statistically significant positive values of the estimated coefficients support *H2*, indicating that more transparent governments promote the digital capabilities of their countries. This influence may stem from the potential mitigation of corruption or quasi-corruption practices as well as increased responsiveness to population demands for advanced technologies, even if such advancements impact different interest groups. The results, accordingly, are consistent with the existing literature (Bjerke-Busch and Aspelund, 2021; Mu and Wang, 2022).

Table 4 presents the impact of R&D investment on shaping digital capabilities. The estimated coefficient values are all positive and statistically significant, affirming a positive and strong impact of R&D investment on national digital capabilities. The results, therefore, support *H3*. The results then also support the findings of other studies that found that R&D positively impacts national capability in terms of knowledge, innovation and productivity (Bilbao-Osorio and Rodríguez-Pose, 2004). Besides, the impact of R&D appears more pronounced in the context of greenfield investments when compared to M&A transactions.

Table 5 presents an econometric estimation that extends the model by incorporating absorptive capability, as suggested by *H3a*, as a moderating element influencing the impact of FDI inflows on national digital capability. The table highlights an interaction term between FDI net inflow and absorptive capability [1]. This interaction captures how the impact of FDI on the dependent variable (national digital capability) is contingent on the country's research and development levels. The coefficients for the impact of absorptive capability on FDI net inflow, M&A and greenfield are 0.002 ($p < 0.05$), 0.010 ($p < 0.01$) and ($p < 0.05$), respectively. This suggests that countries with higher absorptive capability (R&D expenditures) are likely to experience a more substantial impact of FDI inflows on digital capabilities.

The overall conclusions drawn from the estimations in Table 5 align with the findings for *H1*, *H2* and *H3*. The interaction of FDI inflows with absorptive capability yields

| Variables | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| $FDI(NetInflow)_{i,t}$ | 0.006 (0.0043) | | |
| $FDI(M\&A)_{i,t}$ | | −0.009* (0.0051) | |
| $FDI(Greenfield)_{i,t}$ | | | 0.011** (0.0052) |
| $Absorptive\ Capability_{i,t}$ | 0.057*** (0.0076) | 0.043*** (0.0074) | 0.059*** (0.0074) |
| $FDI(NetInflow)_{i,t} \times Absorptive\ Capability_{i,t}$ | 0.002** (0.0008) | | |
| $FDI(M\&A)_{i,t} \times Absorptive\ Capability_{i,t}$ | | 0.010*** (0.0024) | |
| $FDI(Greenfield)_{i,t} \times Absorptive\ Capability_{i,t}$ | | | 0.004** (0.0020) |
| Government $Transparency_{i,t}$ | 0.008*** (0.0004) | 0.008*** (0.0004) | 0.008*** (0.0004) |
| $ATM_{i,t}$ | 0.000*** (0.0001) | 0.000*** (0.0001) | 0.000*** (0.0001) |
| $Infrastructure_{i,t}$ | 0.004*** (0.0011) | 0.005*** (0.0011) | 0.003*** (0.0011) |
| $Trade\_Openness_{i,t}$ | 0.000*** (0.0001) | 0.000*** (0.0001) | 0.000*** (0.0001) |
| Constant | 3.153*** (0.0904) | 3.339*** (0.0433) | 3.218*** (0.0453) |
| Year FE | Yes | Yes | Yes |
| HDI FE | No | No | No |
| Observations | 363 | 347 | 412 |
| $R^2$ | 0.829 | 0.849 | 0.839 |
| F-test | 120.72 | 132.98 | 147.42 |
| Significant F | 0.0000 | 0.0000 | 0.0000 |

**Notes:** The standard error is presented in parentheses. Significance levels are denoted by asterisks, where ***, ** and * represent statistical significance at the 1, 5 and 10% levels, respectively, using two-sided tests
**Source:** Developed by the authors

**Table 5.** Impact of national absorptive capability on the relationship between FDI and national digital capacity. OLS estimations with hetereskodescity-robust error estimates

intriguing results. For total FDI inflows and the two examined categories (M&A and greenfield), the coefficients of the interactions are statistically significant and positive. This implies that the effect of FDI inflows on generating national digital capability increases as the country demonstrates higher research and development activity, as proposed by *H3a*. The results support the existing literature that absorptive capability is a significant factor influencing the spillover effect of FDI on national technological and innovation capabilities and so on (Marcin, 2008; Murovec and Prodan, 2009).

### 5.3 Robustness tests

The presented findings affirm a direct correlation between FDI inflows and national digital capability. To conduct a robustness test, a model was proposed introducing FDI inflows in a quadratic relationship, allowing for a more comprehensive understanding of the connection between FDI inflows and national digital capability. This is important because of the significant differences observed among the analyzed countries. The results, outlined in Table 6, indicate that the impact of FDI on national digital capability is generally nonlinear, exhibiting a U-shaped relationship. The coefficients suggest that FDI may have an unfavourable effect at low levels, but once it surpasses a certain threshold and reaches a sufficiently high level, it contributes positively and significantly to national digital capability. However, the calculated thresholds for the turning points of FDI (0.051, 0.3 and 0.18 for FDI Net Inflow, M&A and greenfield, respectively), along with the actual values of observed FDI inflows, lead to the conclusion that, in reality, the level of FDI across countries is substantial enough to directly and positively impact a country's digital capability at an increasing rate.

This suggests that as FDI inflows grow larger, their influence on the digital capabilities of host countries increases. Larger FDI inflows create conditions that make synergies among receiving firms more likely, and they also serve as a stimulus for the development of necessary policies to accommodate these synergies.

| Variables | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| $FDI(NetInflow)_{i,t}$ | −0.078 (0.0895) | | |
| $FDI(\text{NetInflow})^2_{i,t}$ | 0.002 (0.0019) | | |
| $FDI(M\&A)_{i,t}$ | | −0.013* (0.0079) | |
| $\text{FDI}(\text{M\&A})^2_{i,t}$ | | 0.002*** (0.0006) | |
| $FDI(Greenfield)_{i,t}$ | | | −0.053** (0.0238) |
| $\text{FDI}(\text{Greenfield})^2_{i,t}$ | | | 0.005*** (0.0015) |
| Government $\text{Transparency}_{i,t}$ | 0.008*** (0.0005) | 0.007*** (0.0005) | 0.008*** (0.0004) |
| $R\&D_{i,t}$ | 0.065*** (0.0070) | 0.059*** (0.0073) | 0.067*** (0.0069) |
| $Infrastructure_{i,t}$ | 0.000*** (0.0001) | 0.000** (0.0001) | 0.000*** (0.0001) |
| $ATM_{i,t}$ | 0.005*** (0.0012) | 0.006*** (0.0014) | 0.004*** (0.0012) |
| $Trade\_Openness_{i,t}$ | 0.000*** (0.0001) | 0.000*** (0.0001) | 0.000*** (0.0001) |
| Constant | 4.016*** (1.0304) | 3.269*** (0.0685) | 3.359*** (0.1034) |
| Year FE | Yes | Yes | Yes |
| HDI FE | Yes | Yes | Yes |
| Observations | 360 | 344 | 409 |
| $R^2$ | 0.835 | 0.855 | 0.848 |
| F-test | 108.27 | 120.03 | 136.82 |
| Significant F | 0.0000 | 0.0000 | 0.0000 |

**Notes:** The standard error is presented in parentheses. Significance levels are denoted by asterisks, where ***, ** and * represent statistical significance at the 1, 5 and 10% levels, respectively, using two-sided tests
**Source:** Developed by the authors

**Table 6.** Robustness test. Nonlinear effect of foreign direct investment (FDI) on national digital capabilities. OLS estimations with hetereskodescity-robust error estimates

In addition, in addressing potential autocorrelation concerns within the original OLS model, we conducted a generalized least squares (GLS) analysis (Hansen, 2007). The findings, as displayed in Table 7, are in alignment with the results obtained from the original OLS model. The Wald Chi-square test examines the collective significance of all estimated coefficients in the model. The associated $p$ values are recorded as 0.0000, affirming the overall significance of the model.

## 6. Conclusion

In conclusion, this research sheds light on the role of FDI in shaping a nation's digital capability. Acknowledging the gap in the literature on empirical studies exploring the specific influence of FDI on national digital capability, our research seeks to address and contribute to this gap by conducting a systematic examination across 55 countries spanning the period from 2013 to 2021. Using data from sources such as the WCC, World Bank, UNCTAD and Transparency International Organization, the study uses an econometric model with fixed effects to control for relevant factors.

The empirical results underscore the significant positive impact of FDI on a country's digital capability. The results particularly emphasize a larger impact in the context of greenfield investments, compared to M&A. To be more specific, foreign investments in new projects, commonly associated with greenfield investments, contribute more to the development of a country's digital capability compared to mergers and acquisitions of existing firms. Nevertheless, it is important to highlight that the influence of FDI M&A on national digital capability is also significant and positive. In addition, government transparency and investments in R&D emerge as crucial factors in fostering digital capabilities. Importantly, this research introduces a novel dimension by highlighting the mediating role of absorptive capability in shaping the impact of FDI inflows on national digital capability. Put differently, countries with higher absorptive capability (reflected by their R&D investment) can experience a more substantial impact of FDI inflows on their digital capabilities.

| Variables | (1) Model 1 | (2) Model 2 | (3) Model 3 |
|---|---|---|---|
| $FDI(NetInflow)_{i,t}$ | 0.007* (0.004) | | |
| $FDI(M\&A)_{i,t}$ | | 0.003* (0.0016) | |
| $FDI(Greenfield)_{i,t}$ | | | 0.011*** (0.003) |
| Government $Transparency_{i,t}$ | 0.008*** (0.0006) | 0.009*** (0.0005) | 0.008*** (0.0004) |
| $R\&D_{i,t}$ | 0.073*** (0.0102) | 0.061*** (0.0079) | 0.070*** (0.007) |
| $Infrastructure_{i,t}$ | 0.003** (0.0014) | 0.003** (0.0012) | 0.0015 (0.0011) |
| $ATM_{i,t}$ | 0.000*** (0.0001) | 0.000*** (0.0001) | 0.000*** (0.0001) |
| $Trade\_Openness_{i,t}$ | 0.000*** (0.0001) | 0.000** (0.0001) | 0.000***(0.0001) |
| Constant | 3.163*** (0.0963) | 3.278*** (0.0624) | 3.248*** (0.0607) |
| Year FE | Yes | Yes | Yes |
| HDI FE | Yes | Yes | Yes |
| Observations | 359 | 343 | 409 |
| Wald $\chi^2$ | 115.26 | 1652.04 | 1671.49 |
| Significance | 1127.70 | 0.0000 | 0.0000 |

**Table 7.**
Robustness test. Econometric analysis: GLS model

**Notes:** The standard error is presented in parentheses. Significance levels are denoted by asterisks, where ***, ** and * represent statistical significance at the 1, 5 and 10% levels, respectively, using two-sided tests
**Source:** Developed by the authors

The contributions of this paper to the existing literature are twofold. Firstly, it pioneers a comprehensive investigation into the relationship between FDI and national digital capability across a diverse set of countries, providing valuable insights into this underexplored realm. Secondly, the research introduces fresh empirical evidence regarding the augmenting role of absorptive capability in the FDI–digital capability relationship.

This research offers some insights for policymakers and stakeholders. Advocating for the active promotion of FDI, particularly through greenfield investments, emerges as a strategic avenue for bolstering national digital capability. Policymakers are advised to prioritize transparency in government operations, acknowledging its pivotal role in fostering an environment conducive to the effective utilization of digital technologies. Furthermore, governments are encouraged to place emphasis on cultivating absorptive capability through strategic R&D investments, recognizing it as a critical factor in maximizing the benefits derived from FDI and leveraging its potential impact on digital capabilities.

However, the study recognizes specific limitations. The findings are based on data from 55 countries, determined by the availability of digital capability data, which may potentially restrict the generalizability of the results. To address this limitation, future research should contemplate expanding geographical coverage to include a more diverse array of countries, providing a more comprehensive perspective on the intricate relationship between FDI and digital capability. In addition, there might be potential variations in the impact of vertical and horizontal FDI that have not been studied in this paper, prompting a call for further exploration into sectoral nuances and distinctions between these forms to deepen our understanding of their effects.

## Note

1. As outlined in Section 4 and Table 1, absorptive capability is a categorical variable with two values: 0 representing low absorptive capability and 1 denoting high absorptive capability. This categorization is determined by the countries' R&D investment, with 50% of sampled nations having lower R&D investment receiving a value of 0, while the remainders are assigned a value of 1.

## References


Amable, B. and Chatelain, J.-B. (2001), "Can financial infrastructures foster economic development?", *Journal of Development Economics*, Vol. 64 No. 2, pp. 481-498.

Antonietti, R., Bronzini, R. and Cainelli, G. (2015), "Inward greenfield FDI and innovation", *Economia e Politica Industriale*, Vol. 42 No. 1, pp. 93-116.

Ayamba, E.C., Haibo, C., Abdul-Rahaman, A.-R., Serwaa, O.E. and Osei-Agyemang, A. (2020), "The impact of foreign direct investment on sustainable development in China", *Environmental Science and Pollution Research*, Vol. 27 No. 20, pp. 25625-25637.

Ayuningrum, A.P. (2021), "The effect risk of credit, efficiency, and gcg of bank profitability (study in conventional commercial banks registered on the Indonesia stock exchange period 2012-2019)", *Management Analysis Journal*, Vol. 10 No. 2, pp. 139-145.

Bai-Ngern, K. and Tubtiang, A. (2020), "Leadership in the digital era", 2020 5th International STEM Education Conference (ISTEM-Ed), IEEE.

Bilbao-Osorio, B. and Rodríguez-Pose, A. (2004), "From R&D to innovation and economic growth in the EU", *Growth and Change*, Vol. 35 No. 4, pp. 434-455.

Bjerke-Busch, L.S. and Aspelund, A. (2021), "Identifying barriers for digital transformation in the public sector", in Schallmo, D.R.A. and Tidd, J. (Eds), *Digitalization: Approaches, Case Studies, and Tools for Strategy, Transformation and Implementation*, Springer, Berlin.

Björkman, I., Stahl, G. and Vaara, E. (2007), "Cultural differences and capability transfer in cross-border acquisitions: the mediating roles of capability complementarity, absorptive capacity, and social integration", *Journal of International Business Studies*, Vol. 38 No. 4, pp. 658-672.

Blind, K. and Jungmittag, A. (2004), "Foreign direct investment, imports and innovations in the service industry", *Review of Industrial Organization*, Vol. 25 No. 2, pp. 205-227.

Bruno, R.L., Korosteleva, J., Osaulenko, K. and Radosevic, S. (2023), "Sectoral digital capabilities and complementarities in shaping young firms' growth: evidence from Europe", *Entrepreneurship and Regional Development:*, Vol. 36 Nos 1/2, pp. 1-21.

Chandra, M., Kumar, K., Thakur, P., Chattopadhyaya, S., Alam, F. and Kumar, S. (2022), "Digital technologies, healthcare and COVID-19: insights from developing and emerging nations", *Health and Technology*, Vol. 12 No. 2, pp. 547-568.

Chen, Y. and Chen, J. (2009), "The impact of FDI on regional technological capabilities: evidence from China", *Journal of Knowledge-Based Innovation in China*, Vol. 1 No. 2, pp. 143-158.

Chillakuri, B., Vanka, S. and Mogili, R. (2020), "Linking sustainable development to startup ecosystem in India-a conceptual framework", *International Journal of Business and Globalisation*, Vol. 25 No. 2, pp. 139-153.

Ciriello, R.F., Richter, A. and Schwabe, G. (2018), "Digital innovation", *Business and Information Systems Engineering*, Vol. 60 No. 6, pp. 563-569.

Ciuriak, D. and Ptashkina, M. (2019), "Leveraging the digital transformation for development: a global South strategy for the data-driven economy".

Clavijo, Y.T. and Pantaleón, H. (2020), "Foreign direct investments into fintech and blockchain technology startups in Latin America", *The University of Miami Inter-American Law Review*, Vol. 51 No. 1, pp. 53-83.

Conrad, A. (2021), *Trade Unions in the Digital Age: Country Fiche on German Manufacturing Sector*, Ruhr University of Bochum, Bochum.

Dang, H.P.L. (2022), *The Impact of Transactional Website Adoption on Banks' Performance. PQDT - Global*, Bangor University (United Kingdom) PP, Wales, Ann Arbor.

Davies, R.B., Desbordes, R. and Ray, A. (2018), "Greenfield versus merger and acquisition FDI: same wine, different bottles?", *Canadian Journal of Economics/Revue Canadienne D'économique*, Vol. 51 No. 4, pp. 1151-1190.

Demena, B.A. and van Bergeijk, P.A.G. (2017), "A meta-analysis of FDI and productivity spillovers in developing countries", *Journal of Economic Surveys*, Vol. 31 No. 2, pp. 546-571.

Dobrzański, P., Bobowski, S., Chrysostome, E., Velinov, E. and Strouhal, J. (2021), "Toward innovation-driven competitiveness across African countries: an analysis of efficiency of R&D expenditures", *Journal of Competitiveness*, Vol. 13 No. 1, pp. 5-22.

Dotta, V. and Munyo, I. (2019), "Trade openness and innovation", *The Innovation Journal*, Vol. 24 No. 2, pp. 1-13.

Driffield, N. and Love, J.H. (2007), "Linking FDI motivation and host economy productivity effects: conceptual and empirical analysis", *Journal of International Business Studies*, Vol. 38 No. 3, pp. 460-473.

Driffield, N., Love, J.H. and Menghinello, S. (2010), "The multinational enterprise as a source of international knowledge flows: direct evidence from Italy", *Journal of International Business Studies*, Vol. 41 No. 2, pp. 350-359.

Duan, Y., Deng, Z., Liu, H., Yang, M., Liu, M. and Wang, X. (2022), "Exploring the mediating effect of managerial ability on knowledge diversity and innovation performance in reverse cross-border M&As: evidence from Chinese manufacturing corporations", *International Journal of Production Economics*, Vol. 247, p. 108434.

Duan, Y., Liu, S., Cheng, H., Chin, T. and Luo, X. (2021), "The moderating effect of absorptive capacity on transnational knowledge spillover and the innovation quality of high-tech industries in host countries: evidence from the Chinese manufacturing industry", *International Journal of Production Economics*, Vol. 233, p. 108019.

Echandi, R., Krajcovicova, J. and Qiang, C.Z.-W. (2015), "The impact of investment policy in a changing global economy: a review of the literature", World Bank Policy Research Working Paper (7437).

Eden, L. (2016), "Multinationals and foreign investment policies in a digital world", E15Initiative, International Centre for Trade and Sustainable Development and World Economic Forum, Geneva, available at: www.E15initiative.Org

El-Chaarani, H. and El-Abiad, Z. (2018), "The impact of technological innovation on bank performance", El-CHAARANI H. and El-Abiad (2018).

Elfakhani, S. and Mackie, W. (2015), "An analysis of net FDI drivers in BRIC countries", *Competitiveness Review*, Vol. 25 No. 1, pp. 98-132.

Fon, R.M., Filippaios, F., Stoian, C. and Lee, S.H. (2021), "Does foreign direct investment promote institutional development in africa?", *International Business Review*, Vol. 30 No. 4, p. 101835.

Friedman, J., Gerlowski, D.A. and Silberman, J. (1992), "What attracts foreign multinational corporations? Evidence from branch plant location in the United States", *Journal of Regional Science*, Vol. 32 No. 4, pp. 403-418.

Gao, Y., Yang, X. and Li, S. (2022), "Government supports, digital capability, and organizational resilience capacity during COVID-19: the moderation role of organizational unlearning", *Sustainability*, Vol. 14 No. 15, p. 9520.

Griffith, R., Redding, S. and Reenen, J.V. (2004), "Mapping the two faces of R&D: productivity growth in a panel of OECD industries", *Review of Economics and Statistics*, Vol. 86 No. 4, pp. 883-895.

Griffith, R., Redding, S. and Van Reenen, J. (2003), "R&D and absorptive capacity: theory and empirical evidence", *Scandinavian Journal of Economics*, Vol. 105 No. 1, pp. 99-118.

Gu, V.C., Cao, R.Q. and Wang, J. (2019), "Foreign ownership and performance: mediating and moderating effects", *Review of International Business and Strategy*, Vol. 29 No. 2, pp. 86-102.

Halunga, A.G., Orme, C.D. and Yamagata, T. (2017), "A heteroskedasticity robust breusch–pagan test for contemporaneous correlation in dynamic panel data models", *Journal of Econometrics*, Vol. 198 No. 2, pp. 209-230.

Hansen, C.B. (2007), "Generalized least squares inference in panel and multilevel models with serial correlation and fixed effects", *Journal of Econometrics*, Vol. 140 No. 2, pp. 670-694.

Hao, Y., Wu, Y., Wu, H. and Ren, S. (2020), "How do FDI and technical innovation affect environmental quality? Evidence from China", *Environmental Science and Pollution Research*, Vol. 27 No. 8, pp. 7835-7850.

Harms, P. and Méon, P. (2018), "Good and useless FDI: the growth effects of greenfield investment and mergers and acquisitions", *Review of International Economics*, Vol. 26 No. 1, pp. 37-59.

Heredia, J., Castillo-Vergara, M., Geldes, C., Carbajal Gamarra, F.M., Flores, A. and Heredia, W. (2022), "How do digital capabilities affect firm performance? The mediating role of technological capabilities in the "new normal", *Journal of Innovation and Knowledge*, Vol. 7 No. 2, p. 100171.

Hokkanen, H. (2022), "A business model perspective to retail transformation".

Hund, A., Wagner, H.-T., Beimborn, D. and Weitzel, T. (2021), "Digital innovation: review and novel perspective", *The Journal of Strategic Information Systems*, Vol. 30 No. 4, p. 101695.

IMD (2023), "imd world competitiveness booklet 2023".

Jiang, C.X., Yang, Q., Li, S. and Wang, Y. (2011), "The moderating effect of foreign direct investment intensity on local firms' intangible resources investment and performance implications: a case from China", *Journal of International Management*, Vol. 17 No. 4, pp. 291-302.

Keho, Y. (2017), "The impact of trade openness on economic growth: the case of cote d'Ivoire", *Cogent Economics and Finance*, Vol. 5 No. 1, p. 1332820.

Khin, S. and Ho, T.C.F. (2018), "Digital technology, digital capability and organizational performance: a mediating role of digital innovation", *International Journal of Innovation Science*, Vol. 11 No. 2, pp. 177-195.

Kim, Y.-H. (2009), "Cross-border M&A vs. greenfield FDI: economic integration and its welfare impact", *Journal of Policy Modeling*, Vol. 31 No. 1, pp. 87-101.

Kitsing, M. (2011), "Success without strategy: E-government development in Estonia", *Policy and Internet*, Vol. 3 No. 1, pp. 1-21.

Liu, X. and Wang, C. (2003), "Does foreign direct investment facilitate technological progress? Evidence from Chinese industries", *Research Policy*, Vol. 32 No. 6, pp. 945-953.

Luo, Y., Zhang, H. and Bu, J. (2019), "Developed country MNEs investing in developing economies: progress and prospect", *Journal of International Business Studies*, Vol. 50 No. 4, pp. 633-667.

McMorrow, K. and Röger, W. (2009), "R&D capital and economic growth: the empirical evidence", *EIB Papers*, Vol. 14 No. 1, pp. 94-118.

Marcin, K. (2008), "How does FDI inflow affect productivity of domestic firms? The role of horizontal and vertical spillovers, absorptive capacity and competition", *The Journal of International Trade and Economic Development*, Vol. 17 No. 1, pp. 155-173.

Melane-Lavado, A., Álvarez-Herranz, A. and González-González, I. (2018), "Foreign direct investment as a way to guide the innovative process towards sustainability", *Journal of Cleaner Production*, Vol. 172, pp. 3578-3590.

Morte-Nadal, T. and Esteban-Navarro, M.A. (2022), "Digital competences for improving digital inclusion in e-government services: a mixed-methods systematic review protocol", *International Journal of Qualitative Methods*, Vol. 21, p. 16094069211070936.

Mu, R. and Wang, H. (2022), "A systematic literature review of open innovation in the public sector: comparing barriers and governance strategies of digital and non-digital open innovation", *Public Management Review*, Vol. 24 No. 4, pp. 489-511.

Murovec, N. and Prodan, I. (2009), "Absorptive capacity, its determinants, and influence on innovation output: cross-cultural validation of the structural model", *Technovation*, Vol. 29 No. 12, pp. 859-872.

Nam Jeon, B. and Young Ahn, S. (2004), "Multinational corporations and host country receptivity: perceptions from three Asian countries", *Multinational Business Review*, Vol. 12 No. 2, pp. 17-36.

Nguyen, T.H. (2022), "Technology, ICT, digital transformation in Vietnam in the integration era—and FDI effects for digital technology and ICT sector", in *Proceedings of International Conference on Communication and Artificial Intelligence*, Springer, Singapore, available at: https://link.springer.com/book/10.1007/978-981-19-0976-4?page=3#toc

Osland, G. and Björkman, I. (1998), "MNC–host government interaction: government pressures on MNCS in China", *European Management Journal*, Vol. 16 No. 1, pp. 91-100.

Papaioannou, S.K. and Dimelis, S.P. (2017), "Does upstream regulation matter when measuring the efficiency impact of information technology? Evidence across EU and US industries", *Information Economics and Policy*, Vol. 41, pp. 67-80.

Patibandla, M. and Petersen, B. (2002), "Role of transnational corporations in the evolution of a high-tech industry: the case of India's software industry", *World Development*, Vol. 30 No. 9, pp. 1561-1577.

Pauceanu, A.M. (2022), "Fundamentals of innovation", *Innovation, Innovators and Business: Arab World Edition*, Palgrave Macmillan and Springer, Singapore, available at: https://link.springer.com/content/pdf/10.1007/978-981-19-7408-3.pdf

Petkovska, M.T., Daniloska, N., Boshkovska, D., Petkovski, V. and Majstoroska, J. (2019), "Government institutional support for fostering SME's innovation in Western Balkan countries", Economic Development Journal of the Institute of Economics–Skopje.

Rugman, A.M. and Verbeke, A. (2001), "Subsidiary-specific advantages in multinational enterprises", *Strategic Management Journal*, Vol. 22 No. 3, pp. 237-250.

Rupeika-Apoga, R., Petrovska, K. and Bule, L. (2022), "The effect of digital orientation and digital capability on digital transformation of SMEs during the COVID-19 pandemic", *Journal of Theoretical and Applied Electronic Commerce Research*, Vol. 17 No. 2, pp. 669-685.

Sedera, R.M.H., Risfandy, T. and Futri, IN. (2022), "Financial inclusion and bank profitability: evidence from Indonesia", *Journal of Accounting and Investment*, Vol. 23 No. 3, pp. 398-412.

Senthilnathan, S. (2019), "Usefulness of correlation analysis", SSRN 3416918.

Silajdzic, S. and Mehic, E. (2016), "Absorptive capabilities, FDI, and economic growth in transition economies", *Emerging Markets Finance and Trade*, Vol. 52 No. 4, pp. 904-922.

Sinani, E. and Meyer, K.E. (2004), "Spillovers of technology transfer from FDI: the case of Estonia", *Journal of Comparative Economics*, Vol. 32 No. 3, pp. 445-466.

Solomon, E.M. and van Klyton, A. (2020), "The impact of digital technology usage on economic growth in Africa", *Utilities Policy*, Vol. 67, p. 101104.

Sung-Jun Lee, S., Kim, J. and Park, B.I. (2015), "Culture clashes in cross-border mergers and acquisitions: a case study of Sweden's Volvo and South Korea's Samsung", *International Business Review*, Vol. 24 No. 4, pp. 580-593.

Tai, J.C.F., Wang, E.T.G. and Wang, K. (2017), "Investigating the impact of IT ambidexterity on digital innovation capability", 21st Pacific-Asia Conference on Information Systems (PACIS 2017).

Tian, Z., Li, Y., Niu, X. and Liu, M. (2023), "The impact of digital economy on regional technological innovation capability: an analysis based on china's provincial panel data", *Plos One*, Vol. 18 No. 7, p. e0288065.

Ubeda, F. and Pérez-Hernández, F. (2017), "Absorptive capacity and geographical distance two mediating factors of FDI spillovers: a threshold regression analysis for Spanish firms", *Journal of Industry, Competition and Trade*, Vol. 17 No. 1, pp. 1-28.

UNCTAD (2022), World Investment Report 2022.

UNDP (2023), "Data and statistics readers guide", available at: https://hdr.undp.org/reports-and-publications/2020-human-development-report/data-readers-guide#:~:text=Human development classification&text=The cutoff-points are HDI,for very high human development

Vahter, P. (2011), "Does FDI spur productivity, knowledge sourcing and innovation by incumbent firms? Evidence from manufacturing industry in Estonia", *The World Economy*, Vol. 34 No. 8, pp. 1308-1326.

Van de Wetering, R., Versendaal, J. and Walraven, P. (2018), "Examining the relationship between a hospital's IT infrastructure capability and digital capabilities: a resource-based perspective", AMCIS.

Vindelyn, S. and Omar, M. (2005), "FDI, international business and regulation: the behaviour of UK multinational corporations", *European Business Review*, Vol. 17 No. 1, pp. 69-82.

Wallin Andreassen, T. (1995), "Small, high cost countries' strategy for attracting MNCs' globalinvestments", *International Journal of Public Sector Management*, Vol. 8 No. 3, pp. 24-38.

Wang, D.T. and Chen, W.Y. (2014), "Foreign direct investment, institutional development, and environmental externalities: evidence from China", *Journal of Environmental Management*, Vol. 135, pp. 81-90.

Wang, X., Gu, Y., Ahmad, M. and Xue, C. (2022), "The impact of digital capability on manufacturing company performance", *Sustainability*, Vol. 14 No. 10, p. 6214.

Wei, Y. and Liu, X. (2006), "Productivity spillovers from R&D, exports and FDI in china's manufacturing sector", *Journal of International Business Studies*, Vol. 37 No. 4, pp. 544-557.

Wint, A.G. and Williams, D.A. (2002), "Attracting FDI to developing countries: a changing role for government?", *International Journal of Public Sector Management*, Vol. 15 No. 5, pp. 361-374.

World Bank (2023), "World development indicators", available at: https://databank.worldbank.org/ (accessed 10 June 2023).

Wu, L., Wang, L. and Lin, L. (2023), "Learn to be green: FDI spillover effects on eco-innovation in China", *Industrial and Corporate Change*, Vol. 32 No. 5, pp. 1192-1216.

Xu, G., Hou, G. and Zhang, J. (2022), "Digital sustainable entrepreneurship: a digital capability perspective through digital innovation orientation for social and environmental value creation", *Sustainability*, Vol. 14 No. 18, p. 11222.

Yang, C.-H. and Lin, H.-L. (2012), "Openness, absorptive capacity, and regional innovation in China", *Environment and Planning A*, Vol. 44 No. 2, pp. 333-355.

Yang, Z., Sun, J., Li, X. and Zhang, Y. (2019), "Informal alignment in digital innovation for corporate sustainability", Informal Alignment in Digital Innovation for Corporate Sustainability.

Yeboah, S. (2023), "Unravelling the tapestry: understanding the factors shaping current account imbalances in Ghana".

Zhao, Y., Zhang, T., Dasgupta, R.K. and Xia, R. (2023), "Narrowing the age-based digital divide: developing digital capability through social activities", *Information Systems Journal*, Vol. 33 No. 2, pp. 268-298.

Zhe, B.O.M. and Hamid, N.A. (2021), "The impact of digital technology, digital capability and digital innovation on small business performance", *Research in Management of Technology and Business*, Vol. 2 No. 1, pp. 499-509.

Zhu, X., Yu, S. and Yang, S. (2022), "Leveraging resources to achieve high competitive advantage for digital new ventures: an empirical study in China", *Asia Pacific Business Review*, Vol. 29 No. 4, pp. 1-26.

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