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ICT-Based Country-Level Determinants of Social Media Diffusion

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Abstract
There is a broad consensus that social media platforms have become critical tools for policymakers in achieving various policy objectives in a country. Therefore, an in-depth understanding of the ICT-based country-level determinants of social media diffusion has become necessary. To this end, we propose a government-people-technology (GTP) framework for categorizing the ICT-based country-level determinants of social media diffusion into three dimensions. Using this framework and utilizing archival data from 107 countries, we examine the roles of ICT in the government's vision, ICT law maturity, Internet bandwidth, ICT cost, ICT skill, and capacity to own ICT in influencing social media diffusion. A quantile panel data regression results reveal that ICT in the government's vision, ICT law maturity, Internet bandwidth, and capacity to own ICT were positively associated with social media diffusion. In contrast, ICT cost was negatively associated with it. Thus, by offering a new framework, we contribute to the technology diffusion literature by emphasizing the role of government, people, and supportive technologies in driving social media diffusion at the country level.

Keywords Social media diffusion · Country-level · Determinants · ICT diffusion · GTP framework

1 Introduction

Social media refers to web-based platforms that build on the ideological and technical foundations of Web 2.0 and facilitate people to create information, allow discussion, and facilitate the exchange of user-generated content (Kaplan & Haenlein, 2010; Kietzmann et al., 2011). It is widely acknowledged that social media platforms have become critical tools for policymakers in achieving various policy objectives related to various stakeholders, such as businesses, government, and citizens. To elaborate, an increase in social media use by people creates a positive environment for businesses by increasing businesses' ability (Kwayu et al., 2018) to reach more customers, improving their relationship with the customers, and providing a novel means for marketing and advertising (Dwivediet al., 2021; Jones et al., 2015; Kizgin et al., 2018; Schaupp & Bélanger, 2014).

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Similarly, social media platforms have become critical tools for policymakers to bring societal changes by empowering people. For example, these socio-technical platforms are powerful means to create awareness related to safer sex (Jones et al., 2012), health problems of smoking (Ramo & Prochaska, 2012), and general awareness of health issues such as COVID (Li & Liu, 2020). Further, social media allows people to be updated with the latest information and improves their awareness of various global issues (Dwivedi et al., 2018; Namisango et al., 2022), such as climate change (Anderson, 2017) and fake news (Li & Chang, 2022; Olan et al., 2022; Tran et al., 2021), in addition to helping people maintain their social relationships and improving overall well-being (Nam, 2021; Quinn, 2021). According to Lin and Kant (2021), social media has become an important digital platform for empowering people by increasing their participation and facilitating inclusion. For instance, Arayankalam et al. (2021), in their study, found that in countries with higher social media diffusion, citizens are also digitally empowered to enforce accountability through their participation, and thus, e-government platforms are more effective in combating corruption. These studies highlight the important role that a high social media diffusion can play in driving societal development. However, there is a wide variation in social media diffusion, defined as the extent to which social

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media platforms are used in a country (Krishnan & Lymm, 2016), worldwide. For instance, Ethiopia and Lesotho have a very low level of social media diffusion, whereas Sweden and Estonia have very high levels of social media diffusion. Given the tremendous potential of social media, it becomes a policy and academic imperative to understand the ways to increase social media diffusion in a country so that society and its various stakeholders can benefit from this new socio-technical communication platform.

Past empirical studies on social media diffusion can be broadly categorized into two streams. The first stream includes studies focusing on the individual-level factors influencing social media diffusion. For instance, Hansen et al. (2018) found that an individual's risk perception about social media, perceived trust in it, and propensity to take risks determine his/her social media use. Similarly, Bailey et al. (2018) found that an individual's perceived ease of use and perceived enjoyment in using social media indirectly influence his/her social media use through the perceived usefulness of social media. While social media use is very individualistic, there can be many macro-level factors that influence its adoption, and thus, just exploring the individual-level aspects may not be sufficient to understand social media diffusion. For instance, even if a person is digitally literate to use social media, without adequate Internet availability in a country, he/she may not be able to access social media. Accordingly, exploring such macro-level determinants of social media diffusion becomes crucial, which is the focus of the second stream of studies on social media diffusion. However, few studies have looked into macro-level antecedents that drive social media diffusion. For instance, through a cross-sectional study, Stump and Gong (2020) investigated the role of two national cultural dimensions (i.e., individualism and collectivism) on social media diffusion. However, this study is narrow in scope as the focus is mainly on the effect of culture. Another macro-level study by Krishnan and Lymm (2016) found that a country's information infrastructure and human capital positively and directly influence social media diffusion. While these studies have provided critical insights on the country-level determinants of social media diffusion, our focus is on the Information, Communication, and Technology (ICT)-based country-level determinants because social media, being an ICT-based platform, requires a supportive ICT-based ecosystem for its diffusion. While ICT is defined as a "diverse set of technological tools and resources used to communicate and to create, disseminate, store, and manage information" (Kaware & Sain, 2015, p. 27), we define an ICT-based supportive ecosystem as supportive factors that can influence social media diffusion in the national environment. For instance, in addition to supportive ICT infrastructure, such as the Internet, a mature ICT regulatory environment in a country facilitates adopting and using technologies, such as social media. Accordingly, the research question (RQ) that our study seeks to answer is:

> **RQ.** What are the ICT-based country-level determinants of social media diffusion?

To answer the above RQ, we argue that the ICT-based country-level determinants of social media diffusion can be categorized into three, namely, government, technology, and people, and accordingly propose a government-technology-people (GTP) framework to study social media diffusion. We tested our hypotheses using publicly available five-year panel data for 107 countries, and the results supported most of our hypotheses. Accordingly, we contribute to the literature on social media in many ways. First, we contribute to the technology diffusion literature by offering a broad framework to understand individuals' social media adoption at a country-level. Second, we contribute to social media literature by showing that two government-related factors (i.e., the importance of ICT in the government's vision and the maturity of ICT laws), people-related factors (i.e., the capacity of people to own ICT), and two technology-related factors (i.e., bandwidth and ICT cost) positively influence social media diffusion. And third, we also contribute methodologically to the literature by using a quantile panel data regression to get a deeper understanding of the effect of the antecedent factors on social media diffusion mentioned before. The plan of the paper is as follows. In the following section, we present our research framework and hypotheses. We then explain our research design and empirical results. Finally, we discuss the implications of our findings and conclude the study by restating the value of this work.

2 Research Framework and Hypotheses

While exploring the ICT-based country-level determinants of social media diffusion, it is important to scan the country-level studies on ICT diffusion. Our review of the past studies shows that these studies can be categorized into two groups: (1) studies that investigated ICT adoption or diffusion among organizations; and (2) studies that investigated ICT adoption or diffusion among people. Within the first category, the studies explored what country-level factors could drive ICT adoption among various organizations. For instance, in their study, Zhu et al. (2003) found that technology competence, firm scope and size, consumer readiness, and competitive pressure are the main predictors of e-business adoption in eight European countries. Singh et al. (2007) showed that ICT infrastructure, human capital, and governance were the key factors influencing e-government maturity, which is the extent of the government's ICT adoption in delivering public services. Similalrly, Das et al. (2017) found that income and ICT infrastructure are positively associated with

e-government maturity. Further, a study by Vu et al. (2020) indicated that institutional quality, broadband penetration, and Internet penetration are significant predictors of cloud computing adoption. Skare and Soriano (2021) established the role of globalization in positively affecting digital technology adoption among firms by facilitating technology transfers.

Within the second category, the studies explored what country-level factors could determine ICT adoption among people. For instance, according to Kiiski and Pohjola (2002), income has a positive relationship with Internet diffusion, while Internet access cost has a negative relationship. This finding was further corroborated by a study by Beilock and Dimitrova (2003) that found that income is a significant predictor of Internet diffusion. Extending these findings further, Baliamoune-Lutz (2003) observed that income and government trade policies influenced ICT diffusion in developing countries. Similarly, a study by Vicente and López (2006) found that the level of income, education, level of employment, gender, and percentage of friends with a mobile phone positively affected the likelihood of an individual using ICT. Furthermore, using canonical regression, Billon et al. (2009) investigated the antecedents of ICT adoption by people in a country. They found that income, education, government effectiveness, and proportion of service sector in developed countries determined ICT diffusion, whereas, in developing countries, age and proportion of the urban population were significantly associated with the ICT adoption. Also, in their study, Khan et al. (2020) found that the maturity of ICT laws in a country positively influenced ICT adoption by people and businesses.

While the above studies give important insights into the country-level determinants of ICT diffusion, it is also important to specifically study the country-level determinants of social media diffusion as social media is a primary platform for facilitating open communication and empowering citizens. Social media diffusion is defined as the extent to which social media platforms, such as Facebook and Twitter, are used in a country (Krishnan & Lymm, 2016). As mentioned previously, the extant studies on social media diffusion can be broadly categorized into two streams. The first stream consists of studies that focus on the individual-level factors that influence social media diffusion. For instance, Zolkepli and Kamarulzaman (2015), in their study in Malaysia, found that three types of needs, namely, personal (e.g., hedonic factors), social (e.g., social relationships), and tension release (e.g., belongingness and playfulness) drive social media adoption. Similarly, Akram and Albalawi (2016) established that perceived connectedness, enjoyment, usefulness, and ease of use are the major factors determining social media adoption. Corroborating this, Bailey et al. (2018) also found that individuals' perceived ease of use and enjoyment in using social media indirectly influence their social media use through the perceived usefulness of social media. Further, as per Hansen et al. (2018), individuals' risk perception about social media, perceived trust in it, and risk propensity influence their social media use. While these studies enhance our understanding of social media diffusion at the individual level, a complete picture of the phenomenon will only be apparent if we know the macro-level factors that can influence its adoption. To elaborate, for instance, even if people in a country are digitally literate to use social media, without adequate availability of the Internet in a country, they will not be able to access social media. Similarly, a mature ICT regulatory environment in a country facilitates the adoption and use of technologies, such as social media. Thus, just exploring the individual-level aspects may be inadequate to get a holistic understanding of social media diffusion. Accordingly, it becomes crucial to explore such macro-level determinants of social media diffusion, which is the focus of the second stream of studies on social media diffusion. For instance, Stump and Gong (2020) investigated the role of two national cultural dimensions (i.e., individualism and collectivism) on social media diffusion through a cross-sectional study. Another macro-level study by Krishnan and Lymm (2016) found that information infrastructure and human capital in a country positively and directly influence social media diffusion.

Many previous studies in social media diffusion have explored the antecedents of social media diffusion based on the technology-organization-environment (TOE) framework. The TOE framework, a general framework of organizational technology adoption, explains how three contexts, namely, technological, organizational, and environmental (Tornatzky & Fleischer, 1990), determine technology diffusion. While the technological context includes the benefits and costs related to the adoption of new technology, the organizational context refers to the organization's internal processes and structures that can influence technology adoption (Baker, 2012; Cao et al., 2014). And the environmental context refers to the factors outside an organization that can influence technology adoption (Baker, 2012). A study by Beier and Früh (2020) has used this framework and analyzed how various antecedents, such as educational program, patient volume, and competition intensity, influenced social media adoption by hospitals. However, as the TOE is an organizational-level framework for technology adoption, adopting this framework to investigate country-level determinants of social media diffusion may miss many essential factors. Another framework worth considering is the culture-policy-technology (CPT) framework, according to which culture, policy, and technology are the broad dimensions that drive technology adoption. For instance, in their study, Bajaj and Leonard (2004) proposed that three dimensions, namely, culture, policy, and technology, would influence e-commerce adoption. While the cultural dimension in the

CPT framework denotes the overall cultural climate, such as people's trust in a country, the policy dimension includes the policies on trade and Internet usage. And the technology dimension comprises ICT infrastructure and technical expertise in a country. While both these frameworks can help understand the determinants of social media diffusion, they are not exhaustive and, thus, need to be adequately adjusted to explain the phenomenon from a macro-level. Further, in their study on the digital divide, Dewan et al. (2005) observed that economic, demographic, and environmental factors drive IT penetration at a country-level. Furthermore, in their study, Durbhakula and Kim (2011) came up with the country characteristics-business-technology-government framework to explore the antecedents of e-business adoption. It has to be noted that social media is mostly used by people. Therefore, the above frameworks, which mainly focus on technology adoption by firms, need to be adequately adapted by focusing on the people dimension. Accordingly, taking cues from these studies and the previously discussed studies on ICT diffusion, we argue that the country-level determinants of social media diffusion can be categorized into three broad dimensions: government, technology, and people (GTP). While it is the role of the government to create and implement policies for social media diffusion, people are the ones who use and adopt social media. And the supportive technological infrastructure is necessary to facilitate social media diffusion. Figure 1 presents the GTP framework. We discuss these dimensions of the framework and the hypotheses in the subsequent sections.

2.1 Government

In line with Easton and Dennis (1965), in this study, we adopt a broad definition of government, which includes all the state entities (executive, legislative, or judicial) that comprise the structures, processes, actors, and policies that determine or implement the allocation of public resources in the state (Anderson & Henriksen, 2005). Being a legitimate authority to exercise power to govern affairs of the state formally, the government is the critical entity in public policy formulation and its implementation (Budd & Sancino, 2016).

Given its role in governing the state, government plays an influential role in developing various technologies and their diffusion in a country by dismantling the barriers to ICT diffusion using various strategies (Rothwell & Zegveld, 1981). For instance, the government may seek to enhance the awareness and trust of people and firms in new technologies and the development of relevant technology-related skills to use the new technology (Papazafeiropoulou et al., 2002). Further, the government may also engage in measures that express its intention to make firms and individuals perceive the potential benefit of technology in the 'right' way and understand the best practice for adopting it and encouraging them to do so (Papazafeiropoulou & Pouloudi, 2000). In other words, the government may take actions that are not forceful but shows the benefits of technology (e.g., social media), thereby nudging firms and people to adopt the technology. For instance, when the government regularly uses ICT platforms for its public communication, firms and the public also may start using such platforms for communications. For instance, a study by Arayankalam and Krishnan (2020) showed that the government's use of e-government would prompt firms to adopt B2C e-business by increasing trust in such technologies. Furthermore, governments may also play a crucial role in developing a supportive market environment for ICT diffusion. For instance, as the telecommunications market is a critical aspect of ICT diffusion, it is evident that new ICT-related technologies will never reach their full potential without the widespread availability of

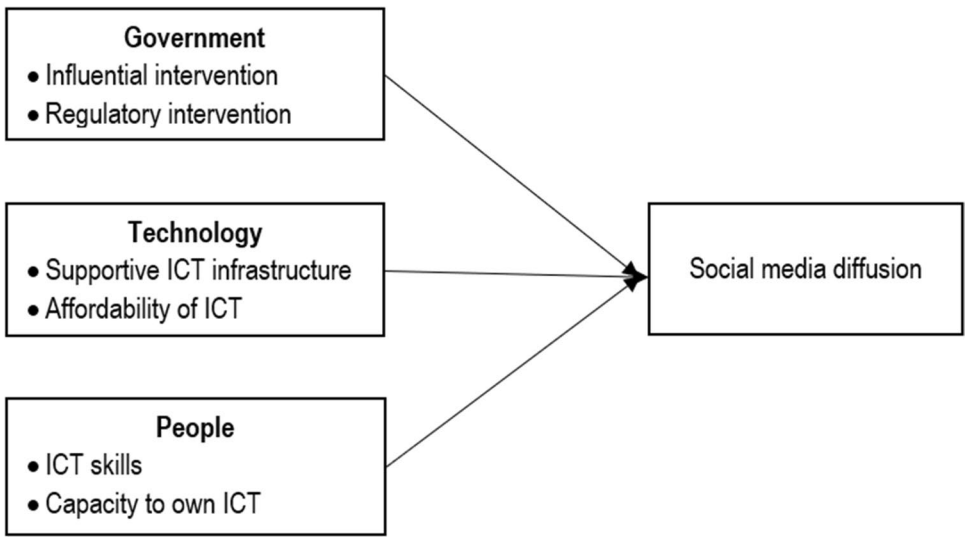

Fig. 1 Conceptual framework

communication infrastructure, such as the Internet, at an affordable price. Thus, the supportive government actions that facilitate the smooth functioning of the telecom market are vital for ICT adoption. Finally, prior research shows that government regulation and IT-related policies affect ICT adoption (AlBar & Hoque, 2019; Seeman et al., 2007). That is, through effective legal mechanisms, the government ensures that ICT use and diffusion take place in sync with the overall objectives of a country. In short, through various strategies, the government creates a demand-pull for ICT diffusion by enabling citizens and firms to use ICT and a supply push for ICT diffusion by promoting necessary supportive environments (e.g., availability of ICT infrastructure). While balancing supply push and demand-pull forces, the government can either be influential or regulatory in the strategy formulation for ICT diffusion (Brown & Thompson, 2011). The influential intervention is when the government uses its powers, without being forceful, to affect attitudinal and behavioral changes in those governed. On the other hand, the government's regulatory interventions are direct and forceful in nature where standards and rules are enforced (Henriksen & Andersen, 2008). Therefore, the government can influence ICT diffusion in a country through influential and regulatory interventions.

Specifically, this study argues that the government's influential and regulatory interventions can play a crucial role in social media diffusion in a country. We conceptualize these two government interventions for social media diffusion as (1) the government's incorporation of ICT in its vision; and (2) the government's creation of mature ICT laws, respectively. To elaborate, the government has various socio-economic developmental goals and visions (Tabellini, 2005; Yu, 2000). When the government incorporates ICT in its plans to achieve these visions, it brings additional benefits that can increase social media use without being forceful. For instance, the government envisions an ICT-driven business environment in this digital age, where business transactions are primarily online (Chen et al., 2021). Such a vision necessitates preparing the citizenry by educating them to be digitally literate to move from offline shops to online shops seamlessly. And when citizens are digitally literate, more of them will understand the utility of social media, increasing its use (Yu et al., 2017). Similarly, when the government envisions a digitally empowered society, where people use ICT in their day-to-day lives (e.g., online bill payments) (Dhal, 2020), it becomes critical for the government to ensure that IT devices, such as smartphones, are affordable. As more people buy and use these devices due to increased affordability, there will be an increase in social media use (Dumbrell & Steele, 2014). Thus, the government's vision of a digitally empowered society will influence people to use social media without being forceful. Given the above, we hypothesize:

H1: The importance of ICTs to the government's vision is positively related to social media diffusion

As a regulatory intervention of the government, mature ICT laws play a vital role in increasing ICT diffusion in a country. ICT laws include a set of government-framed rules and regulations to decide how people in a country engage with ICT (Bhattacherjee & Shrivastava, 2018). These legal frameworks form a regulatory basis for collecting, storing, and transferring online information, promoting a safe digital environment, and safeguarding citizens and firms from online frauds. As ICT laws in a country mature, there will be legal backing for data security and privacy. In their study, Boyer-Wright and Kottemann (2008) found that a robust ICT legal environment facilitates the greater adoption of e-government services by providing assurances about online security and privacy. We argue that ICT law maturity, defined as the degree to which ICT laws are developed in a country (Khan et al., 2020), can also positively influence social media diffusion in a country as citizens in such countries will be less concerned about data security and privacy issues, increasing their social media use. As a result, in countries with mature ICT laws, people are more likely to use social media than their peers in other countries, and therefore we hypothesize:

H2: Maturity of ICT laws is positively related to social media diffusion

2.1.1 Technology

In addition to government and people dimensions, technology is another critical dimension that will affect ICT diffusion. Past studies indicate that the technological dimension has two key aspects: infrastructure and affordability (Bhattacherjee & Hikmet, 2008; Orji et al., 2020). Technology infrastructure refers to supportive technologies (e.g., computer hardware and communication networks) necessary for the diffusion of a technology (Bhattacherjee & Hikmet, 2008). Further, the availability of such supportive infrastructure signals the readiness of technology and promotes its usage (Weill & Broadbent, 1998). For instance, as per Aboelmaged (2014), such supportive infrastructures, such as the degree of telecommunication, databases, and web applications, act as key resources for the diffusion of e-maintenance technology (Aboelmaged, 2014). In short, technology infrastructure plays a crucial role in ICT diffusion by providing the necessary supportive base for new technology and signaling readiness. In addition to supportive infrastructure, its affordability is also a critical aspect that can influence technology diffusion (Orji et al., 2020; Shin, 2016). It refers to the cost of supportive technology infrastructure required for a particular technology. For instance,

one basic infrastructure needed for mobile banking is the radio spectrum (Gruber, 2001; Sharma & Pandey, 2015). Unless spectrum is available at a low price, the cost of using mobile phones will be high, subsequently restraining mobile banking adoption (Shen et al., 2010). Similarly, Orji et al. (2020) found that affordability plays a vital role in adopting social media in the logistics industry. These studies indicate that affordability of the supportive technology infrastructure is also an important aspect that determines ICT diffusion. In sum, through its two aspects, supportive infrastructure and affordability, the technology dimension determines ICT diffusion.

Specifically, in this study, we argue that bandwidth, an essential supportive infrastructure to use social media, and ICT cost, a determinant of affordability of ICT infrastructure, are two critical antecedents of social media diffusion in a country. Elaborating further, social media platforms are much more than a traditional communication medium, where textual contents are predominant (e.g., e-mail). In contrast, social media platforms, such as Facebook, Twitter, and YouTube, in addition to interpersonal communication, allow sharing and watching multimedia content, such as videos, thereby creating a synthesis of "mass and interpersonal communication" (Flanagin, 2017, p. 450). Perfect examples of such synthesis of mass and interpersonal communication phenomena are platforms like YouTube and Instagram, where users can upload and watch multimedia content, such as photos and videos. However, accessing such multimedia content on such platforms requires a high-speed Internet connection (Jones & Cuthrell, 2011). Thus, when people have access to the Internet with high bandwidth, they will find more utility in social media platforms, resulting in its adoption. In other words, people in countries with high Internet bandwidth are more likely to use social media than their counterparts in other countries, and therefore we hypothesize:

H3: Internet bandwidth is positively related to social media diffusion

Another factor that can affect social media diffusion is the cost of ICT, which represents the affordability aspect of technology-dimension in the GTP framework. As the high-speed Internet is the basic supportive infrastructure necessary to access social media, the cost of ICT in the context of our study is the cost of accessing the Internet. Generally, there are two ways people access it. The first way involves accessing social media using fixed Internet, such as broadband. The other way is to access it on mobile phones using cellular networks. When the cost of accessing the Internet using either of these two means increases, the demand for the Internet reduces. As a consequence of peoples' reduced use of the Internet, which is the supportive infrastructure for social media, their social media use also will be less. A study by Dewan et al. (2005) also supports the inverse relationship between ICT cost and ICT diffusion. Thus, when the cost of ICT (i.e., high-speed Internet) in a country is high, there will be less demand from people for it, subsequently reducing social media use. In other words, people in countries with high ICT costs are less likely to use social media than their counterparts in other countries, and therefore we hypothesize:

H4: Cost of ICT is negatively related to social media diffusion

2.1.2 People

While the government can bring an ICT closer to people using two interventions, namely, influential and regulatory, it is ultimately people who will be the end-users of the ICT for various purposes. ICT has its use cases in various sectors, such as business, health, education, and entertainment, among others, and through such use cases, it provides people with new choices that are previously non-existent (Boyle et al., 2016; Evens & Donders, 2018; Kozma, 2011; Ren et al., 2022). For instance, over-the-top (OTT) platforms, such as Netflix and Amazon Prime, have brought entertainment to one's smartphones (Martínez-Sánchez et al., 2021). Similarly, online retail platforms, such as Amazon and Flipkart, have made it easier for people to buy consumer products using their handheld devices (Barta et al., 2021). As ICT certainly enhances people's quality of daily lives, past studies have sought to understand various people-specific factors that could facilitate ICT diffusion (Lee, 2003).

While many micro-level studies have found that peoples' perceived ease of use, usefulness, and risk, self-efficacy, attitudes, and facilitating conditions determine ICT diffusion (Lee, 2003; Slade et al., 2015; Venkatesh, 2000), we argue that peoples' skills and abilities to use ICT, and their capacity to acquire ICT play the most critical role at a macro-level. As per past studies, perceptions and attitudes are mental constructs (Harris & Sipay, 1990; Henerson et al., 1987; Van Coillie et al., 2014) that motivate people to adopt an ICT. However, to make them actually use ICT, people should have the capacity to acquire it and have the knowledge and skills to use it. As per Appelbaum et al. (2000), it is the combination of ability, motivation, and opportunity that determines behavior. While the mental constructs mentioned earlier develop a motivation to use ICT, and various interventions from the government provide the opportunities to use ICT, the ability to use ICT is contingent on possessing the necessary skills to operate an ICT by people and their capacity to acquire it. Thus, two macro-level people-specific factors

that will affect ICT diffusion are the ability to use ICT and the capacity to acquire ICT.

Specifically, in this study, we argue that people's skills to use ICT and their capacity to acquire ICT can play a crucial role in social media diffusion in a country. To elaborate, social media is much more than a mere communication platform because it is also a source of news, a platform for entertainment, a virtual avenue for businesses, and a professional platform for employees, among others (Saluja & Singh, 2014). Thus, compared to traditional ICTs, such as telephones, where the skills needed to operate them are just elementary, such as clicking a button, social media use demands more complex skills (Bobkowski & Smith, 2013). For instance, to use most social media platforms, such as Twitter and Facebook, the users should be able to read and write at the bare minimum. Further, although the new social media are very user-friendly and reduce the need for a user to be literate, a high educational level will help users have sufficient ICT skills to find utility in these platforms much quicker and use it. Furthermore, specific social media platforms, such as LinkedIn and ResearchGate, have affordances (e.g., article sharing) that require higher ICT skills and, thus, are used mainly by educated users. As ICT is becoming an embedded part of education, a high level of education also implies better ICT skills, facilitating social media use (Bruce, 1997; Krishnan & Lymm, 2016). In sum, we argue that when the ICT skills of people in a country are high, they will be more equipped and able to use social media. Given the above argument, we hypothesize:

H5: ICT skill is positively related to social media diffusion

While adequate ICT skills are a critical people-related factor, peoples' capacity to acquire the necessary ICT technologies for using social media becomes crucial for social media diffusion. To elaborate, people should have adequate income to afford costly devices, such as computers, tablets, and smartphones, to access social media platforms. Financial constraints limit their capacity to own such devices by not only reducing the resources at their disposal but also negatively influencing their purchase decisions to own these devices (Baishya & Samalia, 2020). People with low disposable income decide against owning costly ICT devices as they perceive low monetary value in such devices (Baishya & Samalia, 2020; Dood et al., 1991). Thus, when individuals' capacity to own ICT devices is high due to higher income, they will more likely buy the necessary ICT devices for social media use, increasing social media diffusion in a country. In other words, we argue that when the capacity of people to acquire ICT devices is high, they will be able to buy such devices and use social media. Given the above argument, we hypothesize:

H6: The capacity of people to own ICT is positively related to social media diffusion

Our research model depicting the hypotheses is shown in Fig. 2.

3 Research Design

3.1 Data

We tested our hypotheses using longitudinal data for 107 countries spanning five years from 2012 to 2016 from various archival sources, including World Economic Forum's (WEF) Network Readiness Index reports, United Nations (UN), and World Bank (WB) databases. These data sources contain information on social media diffusion and other country-level indicators relevant to our research. The data availability for the study variables determined the period and countries we chose. It is important to acknowledge that we removed some of the poorest countries, such as North Korea, which also have low social media diffusion levels due to a lack of data availability. Thus, these results more fairly describe the social media diffusion among countries already present, at least to a small degree. Although we acknowledge this as a limitation, we believe that our coverage of the remaining countries is comprehensive, following a long period from 2012 to 2016. The final dataset was a balanced panel for 107 countries with 535 data points. Please refer to Appendix A for the list of countries used in this study. Figure 3 depicts the global distribution of social media diffusion.

The *dependent variable* in this study is social media diffusion, and the *independent variables* are (1) ICT in the government's vision, (2) ICT law maturity, (3) Internet bandwidth, (4) ICT cost, (5) ICT skills, and (6) Capacity to own ICT. To remove any influence of confounding variables on the results, in line with past studies, we controlled for the effect of development status, Internet use, fixed broadband subscription, and time (by adding years as dummy variables). Table 1 presents the details of the variables, their operationalization, and the past studies that have used these variables. For better interpretation, we standardized the variables.

3.2 Reliability and Validity

The key variables used in our study are from the WEF's Global IT Report (WEFGITR, 2012, 2013, 2014, 2015, 2016) and World Bank. WEF's data collection and preparation processes give us confidence in data reliability across the years. To this end, WEF has collaborated with renowned institutions to put proper structures and guidelines in place.

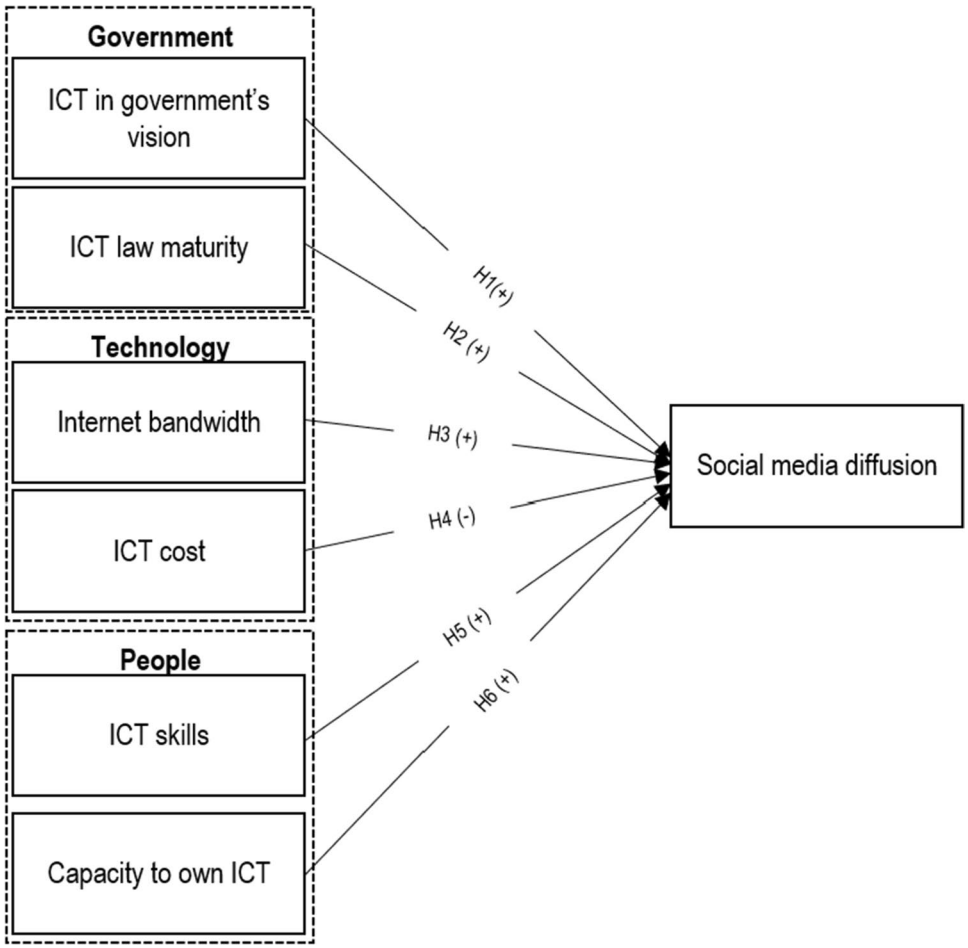

Fig. 2 Research model

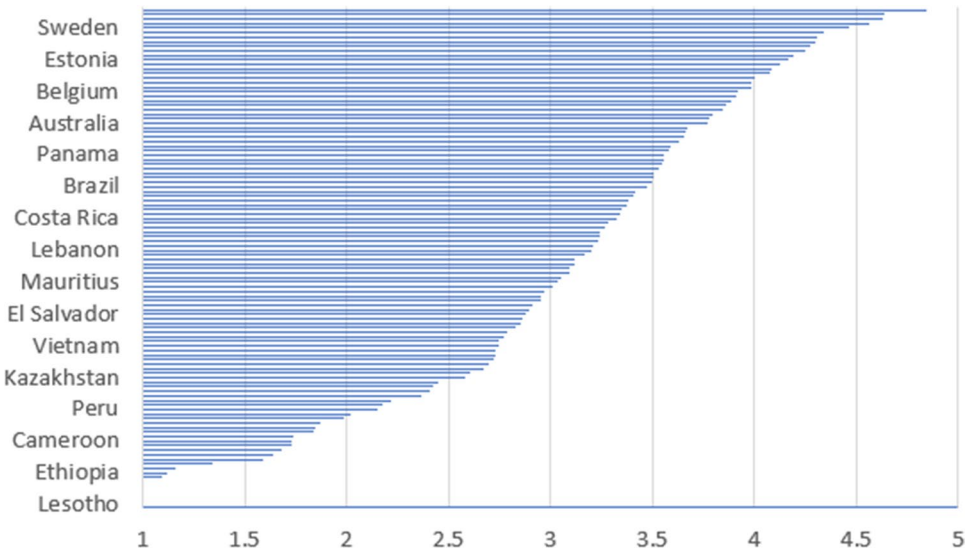

Fig. 3 Global distribution of social media diffusion

(Browne et al., 2008). For instance, the WEF and the Institute of Strategy and Competitiveness at the Harvard Business School collaborated to create best practices for ensuring greater data accuracy (Browne et al., 2008). To ensure that the sample is representative of the population, they followed standard protocols in the gathering and compilation processes of data. The Survey asks nearly 15,000 experts to provide their opinions on different aspects of the business and economic environment in which they operate (WEF-GITR, 2014). Further, the team used a randomized sampling

Table 1 Variable details

Variable	Measure	Source	Past studies/reports
Social media diffusion	Operationalized using the variable 'Use of virtual social networks.' It is measured by asking, the respondents, "In your country, how widely are virtual social networks (Facebook, Twitter, LinkedIn, etc.) used?" on a 1-to-7 point scale with "1" being "not at all used" and "7" being "used extensively."	WEFGITR	Arayankalam et al. (2021); Khan and Krishnan (2020)
ICT in the government's vision	Operationalized using the variable' Importance of ICTs to gov't vision.' It is measured by asking, "To what extent does the government have a clear implementation plan for utilizing ICTs to improve your country's overall competitiveness? [1 = not at all—there is no plan; 7 = to a great extent—there is a clear plan]."	WEFGITR	Larios-Hernández and Reyes-Mercado (2018)
ICT law maturity	Operationalized using WITR's variable 'Laws relating to ICTs.' It is measured by asking respondents, "How developed are your country's laws relating to the use of ICTs (e.g., e-commerce, digital signatures, consumer protection)? [1 = not developed at all; 7 = extremely well developed]."	WEFGITR	Bhattacherjee and Shrivastava (2018)
Internet bandwidth	Operationalized using 'International Internet bandwidth (kb/s) per Internet user'. It is the sum of the capacity of all Internet exchanges offering international bandwidth measured in kilobits per second (kb/s)	WEFGITR	Bullough et al. (2012)
ICT cost	Cost is operationalized as standardized mean of two measures: (1) Prepaid mobile cellular tariffs, which is the average per-minute cost of different types of mobile cellular calls (PPP $); and (2) Fixed broadband Internet tariffs, which is a monthly subscription charge for fixed (wired) broadband Internet service (PPP $)	WEFGITR	Stratu-Strelet et al. (2021)
ICT skills	ICT skills measure the literacy and abilities that enhance ICT diffusion and use. As per the International Telecom Union (ITU, 2009), a good proxy for ICT skills is "the level of education and literacy" (p. 16), and can be measured using adult literacy, secondary gross enrolment, and tertiary gross enrolment. Accordingly, ICT skills is operationalized as standardized mean of three measures: (1) adult literacy rate, (2) secondary gross enrolment, and (3) tertiary gross enrolment	WEFGITR	Alderete (2017); ITU (2009)
Capacity to own ICT	Measured as the per capita national income (log of GNI per capita)	World Bank	Kraemer et al. (2005)
Development status	Based on UN classification of countries as developed and developing	UN	Wang et al. (2016)
Internet use	Percentage of Individuals using the Internet	WEFGITR	Alderete (2017)
Fixed broadband subscription	Fixed broadband subscriptions per 100 inhabitants	WEFGITR	Alderete (2017)
Mobile phone subscriptions	Mobile telephone subscriptions (post-paid and pre-paid) per 100 population. This includes both analog and digital cellular systems (such as 3G) and 4G subscriptions	WEFGITR	Albiman and Sulong (2017)

process to ensure that biases did not corrupt the data. For instance, the surveys with a completion rate of less than 50% were removed to reduce response bias. Also, to remove the possibility of perception bias, data are collected from many experts (instead of one) for each country and then aggregated to the country level. In other words, for each country, data were collected from many experts and then aggregated to generate a single score for each variable. For instance, in 2008, when they started the Executive Opinion Survey, there were 91 respondents per country on average (Browne et al., 2008). Such aggregation ensured that the data was reliable across years. Also, through tests to remove outliers, they further established the reliability and validity of the data. Similarly, World Bank creates its databases by relying on official sources in countries and aggregating them to country-level. Specifically, in calculating GNI per capita (which represents the capacity to own ICT in this study) in U.S. dollars, the World Bank uses the gap-filled total aggregation method to yield estimates for a consistent set of countries from one period to the next (WB, n.d.). In short, while the respondents for the two databases may differ, as both have used proper aggregation techniques, the data from these databases are representative of countries, and their variables are appropriate for country-level analysis as this study. Finally, it is worthy to note that due to the high quality of data in the WEF's and World Bank's databases, they have been regularly utilized in studies published in top-tier journals, such as Government Information Quarterly (e.g., Bhattacherjee & Shrivastava, 2018), Information & Management (e.g., Das et al., 2017), and Communications of the Association for Information Systems (e.g., Srivastava & Teo, 2010).

3.3 Method

The functional representation of our model is as below.

$$SMD = f(GIV, ICL, IBW, TRF, SKL, GNI, DEV, INP, FBB, MPS, Time\ (in\ years))$$

where *SMD* is social media diffusion, *GIV* is ICT in the government's vision, *ICL* is ICT laws maturity, *IBW* is Internet bandwidth, *TRF* is ICT cost, *SKL* is ICT skills, *GNI* is capacity to own ICT, *DEV* is development status, *INP* is Internet use, *FBB* is fixed broadband subscription, and MPS is mobile phone subscription.

As we use a panel dataset for analysis, it is essential to check for cross-sectional dependence and non-stationary regressors, as overlooking these issues may lead to spurious and biased results. Accordingly, to ensure that the data is stationary, we performed the Fisher-type unit-root test (Maddala & Wu, 1999), Im, Pesaran, and Shin (IPS) test (Im et al., 1997), and Hadri LM test (Hadri, 2000). The tests showed that data does not have unit roots and is stationary. Further, we used the Shapiro–Wilk test to check for the normality of the data. The test indicated that the data was not normal. When the data do not follow a normal distribution, using the panel quantile regression approach is a recommended econometric method for unbiased estimation of parameters.

Accordingly, we use quantile panel data regression (QRPD), a non-additive fixed effect panel quantile regression model suggested by Powell (2022), to investigate the effects on social media diffusion. Quantile panel regression allows estimating the parameters by providing the heterogeneity of the panel data model varying with multiple quantiles. It is also useful to better understand the distribution of social media diffusion. The QRPD estimator assumes the non-additive fixed effects model maintaining non-separable disturbances in the panel data model. There are two advantages over quantile panel data estimators with additive fixed effects (Powell, 2022). First, as the method is a generalization of mean regression analysis to other quantiles, it is appropriate for identifying asymmetric features of the variables. Second, this method takes into account the unobserved individual heterogeneity. Third, the method gives unbiased results even when the number of parameters is large and the number of periods is small. Hence, the QRPD is adopted to examine the relationship between social media diffusion and its related factors in this study. The quantile function of the panel data model is shown as follows:

$$Qy_{ii}(\tau|\alpha_i, x_i) = \alpha_i + x_{it}^T \beta(\tau_k), i = 1, \ldots, N; t = 1, \ldots, T,$$

where N and T denote the numbers of observations on the individual i and the time t, respectively. α_i is the unobserved individual heterogeneity. As shown, the effects of the predictor variables x_{it} are allowed to depend upon the quantile τ. It is worthy to note that the quantile panel data regression method allows arbitrary correlations between the predictors, thereby increasing confidence in the results (Powell, 2022). We used the adaptive Markov Chain Monte Carlo procedure as a numerical optimization method (Borozan, 2019). To conduct a panel quantile regression analysis, in line with the past studies (e.g., Borozan, 2019; Liu et al., 2019), we used the qregpd package in Stata 17.

4 Results

4.1 Preliminary analysis

Table 2 shows the correlations between the variables of interest. As the correlation between some of the variables

Table 2 Correlation between variables

	SMD	GIV	ICL	IBW[a]	TRF	SKL	GNI[a]	DEV	INP[a]	FBB[a]
SMD	1									
GIV	0.430*	1								
ICL	0.679*	0.773*	1							
IBW[a]	0.657*	0.320*	0.616*	1						
TRF	-0.201*	-0.083*	-0.126*	-0.217*	1					
SKL	0.629*	0.184*	0.577*	0.708*	-0.257*	1				
GNI[a]	0.706*	0.369*	0.713*	0.728*	-0.242*	0.831*	1			
DEV	0.439*	0.064	0.451*	0.577*	-0.004	0.632*	0.583*	1		
INP[a]	0.723*	0.314*	0.630*	0.675*	-0.281*	0.836*	0.831*	0.553*	1	
FBB[a]	0.672*	0.221*	0.592*	0.755*	-0.312*	0.884*	0.834*	0.590*	0.861*	1
MBS[a]	0.572*	0.182	0.423*	0.561*	-0.351*	0.619*	0.615*	0.302*	0.675*	0.657*

SMD Social media diffusion, *GIV* ICT in government's vision, *ICL* ICT Laws, *IBW* Bandwidth, *TRF* ICT cost, *SKL* ICT skills, *GNI* Income, *DEV* Development status, *INP* Internet use, *FBB* Fixed broadband subscription, *MPS* Mobile phone subscription

[a]Logarithmically transformed

*$p < 0.05$ (Two-tailed)

(e.g., Income and ICT skills) was above 0.70, the results can be biased due to multicollinearity. To check for the presence of multicollinearity, we calculated the variance inflation factor (VIF) between the variables. We found that VIF values were between 1.22 and 7.1, less than the acceptable threshold level of 10 (Belsley et al., 2004; Gujarati, 2003). In sum, we confirmed that the issue of multicollinearity affecting the results was minimal.

Further, in Fig. 4, we present a graphical comparison of the effect of independent variables on social media

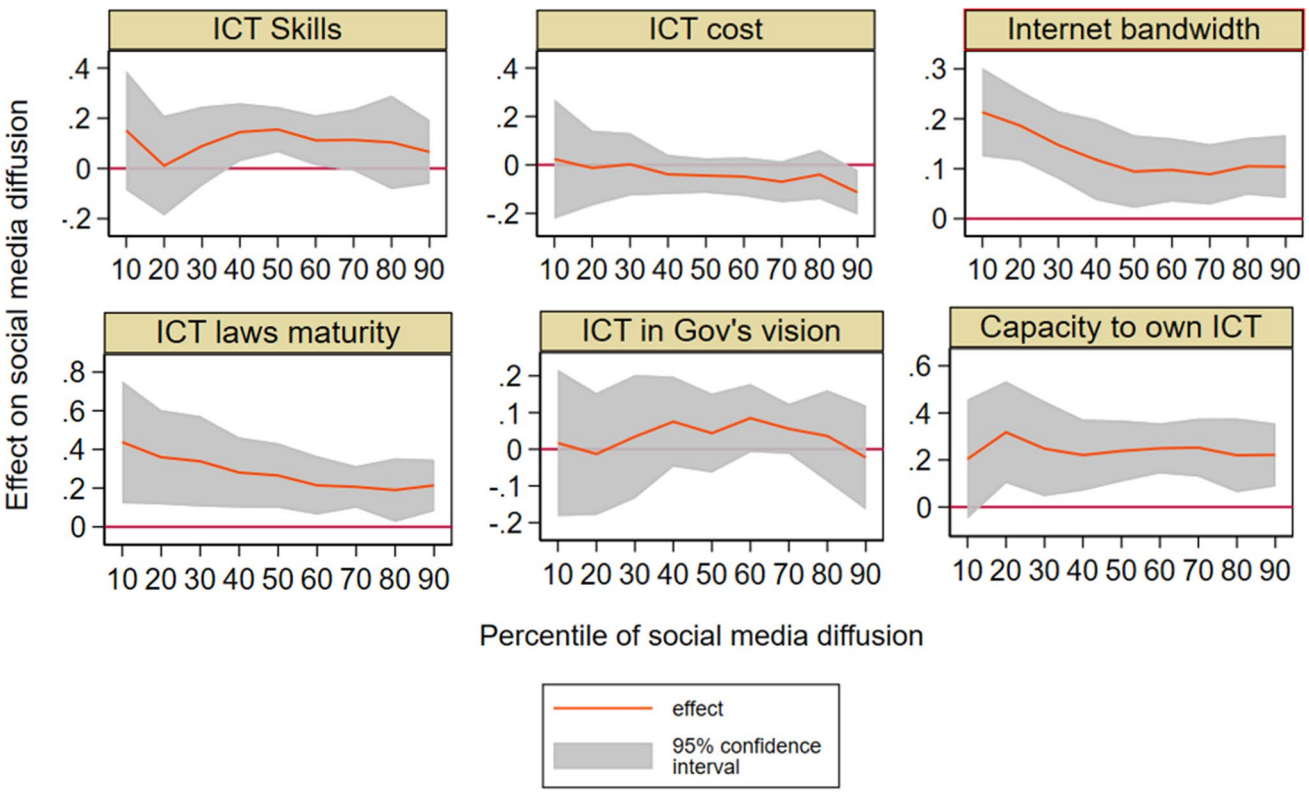

Fig. 4 Overview of the effect of predictors on social media diffusion

diffusion, along with 95% confidence intervals. The graphs show the coefficient of the independent variables on the y-axis against the quantiles of social media diffusion on the x-axis. Although these graphs are generated using the pooled data across five years in our panel dataset, they give a broad picture of the impact of the independent variables across the quantiles of the conditional distribution of social media diffusion. For instance, in the case of the effect of ICT law maturity on social media diffusion, the plot shows that the positive effect is more prominent in the lower quantiles. This implies that the marginal impact of an increase in ICT laws maturity is higher in countries with lower social media diffusion levels. Similarly, in the case of the capacity to own ICT on social media diffusion, the plot shows that the positive effect is more prominent in the lower and middle quantiles. This implies that the marginal impact of an increase in the capacity to own ICT is higher in countries with lower and middle levels of social media diffusion. However, as mentioned before, as these plots are based on pooled data for five years, they do not give a complete picture. Accordingly, we conducted the quantile panel data regression analysis for deeper insights.

4.2 Empirical results

Table 3 presents the results of the quantile panel regression on the effect of six predictors, namely, ICT in government's vision, ICT laws maturity, Internet bandwidth, ICT cost, ICT skills, and capacity to own ICT, on social media diffusion. Further, as mentioned before in Fig. 2, some countries with high social media diffusion are Sweden, Estonia, and Belgium; and some countries with low social media diffusion are Lesotho, Ethiopia, and Cameroon. We present the results for quantile (10^{th}, 20^{th}, 30^{th}, 40^{th}, 50^{th}, 60^{th}, 70^{th}, 80^{th}, and 90^{th}) percentiles of the conditional distribution of social media diffusion.

First, the estimated coefficient of 'ICT in government's vision' was positive and statistically significant in higher quantiles, while it was not statistically significant in lower and middle quantiles. More specifically, the relationship between ICT in the government's vision and social media diffusion was positive and significant in the 60^{th}, 70^{th}, and 80^{th} quantiles. The significant positive results at higher quantiles indicate that ICT in the government's vision induces social media diffusion in countries like Sweden and Estonia, with high social media diffusion. Results also indicate no evidence for the effect in countries, such as Ethiopia, with lower and medium levels of social media diffusion. Thus, the results partially supported H1. Second, the estimated coefficient of 'ICT laws maturity' was positive and statistically significant in all the quantiles. The significant positive results indicate that as the maturity of ICT laws in a country increases, social media diffusion will also increase. Thus, the results lent support to H2. Third, the estimated coefficient of 'Internet bandwidth' was positive and statistically significant in most of the quantiles. The significant positive results indicate that the Internet bandwidth in a country increases, social media diffusion in it also will increase, supporting our prediction in H3. Fourth, the estimated 'ICT cost' coefficient was negative

Table 3 Quantile panel regression results

Independent variable	Estimated coefficients for different quantiles (dependent variable: SMD)								
	10th	20th	30th	40th	50th	60th	70th	80th	90th
GIV	0.010	0.154***	0.051	0.020	0.012	0.082***	0.083***	0.034*	0.026
ICL	0.396***	0.300***	0.243***	0.289***	0.301***	0.183***	0.116***	0.094**	0.107***
IBW[a]	0.383***	-0.034	0.147***	0.114***	0.158***	0.064**	0.031***	0.103***	-0.030
TRF	0.118***	0.024	-0.032**	0.004	0.000	0.026	-0.004	-0.031***	-0.040**
SKL	-0.162***	0.131*	-0.080	-0.037	-0.054	0.004	0.093***	-0.034	-0.011
GNI[a]	-0.023	-0.297*	0.022	0.089***	0.051	0.073***	0.136***	0.182***	0.242***
Controls									
DEV	0.015	0.031	0.123**	-0.059	-0.035*	-0.040*	-0.094***	-0.097*	0.188***
INU[a]	0.400***	0.632***	0.465***	0.349***	0.421***	0.383***	0.340***	0.428***	0.234***
FBB[a]	0.068***	0.056	-0.060	-0.019	-0.071	0.011	0.054*	-0.014	0.047
MPS[a]	0.145***	0.012	0.155***	0.135***	0.156***	0.108***	0.053***	0.050**	-0.012
Year dummies	yes	yes	yes	yes	y es	yes	yes	yes	yes

SMD Social media diffusion, *GIV* ICT in government's vision, *ICL* ICT Laws, *IBW* Bandwidth, *TRF* ICT cost, *SKL* ICT skills, *GNI* Capacity to own ICT (Income), *DEV* development status, *INU* Internet use, *FBB* Fixed broadband subscription, *MPS* Mobile phone subscription

Panel data from 2012 to 2016; [a]Logarithmically transformed

***$p < 0.001$; **$p < 0.01$; *$p < 0.05$ (Two-tailed)

and statistically significant only in higher quantiles. The significant negative results at higher quantiles indicate that ICT cost reduces social media diffusion in countries, such as Sweden and Belgium, with high social media diffusion. Results also indicate no evidence for the effect in countries, such as Ethiopia and Lebanon, with low levels of social media diffusion. Thus, the results partially supported H4. Fifth, the estimated coefficient of 'ICT skills' was not statistically significant in all the quantiles except in the 70th quantile. Thus, the results did not support H5 due to inconclusive evidence. Lastly, the estimated coefficient of 'Capacity to own ICT' was positive and statistically significant in middle and higher quantiles, while it was not statistically significant in lower quantiles. More specifically, the relationship between ICT in the government's vision and social media diffusion was positive and significant at the 40^{th}, 60^{th}, 70^{th}, 80^{th}, and 90^{th} quantiles. The significant positive results at the middle and higher quantiles indicate that when people's capacity to own ICT increases, social media diffusion in countries in medium to high quantiles also increases. Results also indicate no evidence for the effect in countries, such as Ethiopia, with lower levels of social media diffusion. Thus, the results partially supported H6.

In conclusion, the empirical results either conclusively or partially reveal that ICT in the government's vision, ICT laws maturity, Internet bandwidth, ICT cost, and capacity to own ICT influence social media diffusion.

4.3 Additional analyses

We tested our model using the quantile panel data regression in our primary analysis. To augment the results from the primary analysis, we re-analyzed the data using the random-effect method and pooled regression method. As these methods do not give quantile-level details of the results and also place stringent conditions on data distributions (i.e., normality), they may not be as consistent and efficient as the quantile panel data regression. Nevertheless, the results from these models add to the confidence in the model by allowing comparison with the results from primary analysis. The results are presented in Table 4.

Table 4 Additional analysis for comparison

DV: SMD	Random-effect model (β)	Pooled OLS regression (β)
GIV	0.117#	-0.032
ICL	0.157*	0.355***
IBW[a]	-0.024	0.111*
TRF	0.040	0.033
SKL	-0.066	-0.123
GNI[a]	0.215*	0.140*
Controls		
DEV	0.125	-0.036
INU[a]	0.188*	0.297***
FBB[a]	0.149*	0.048
MBS[a]	0.122**	0.107
Year dummies	Yes	Yes
R^2	0.437	0.660

SMD Social media diffusion, *GIV* ICT in government's vision, *ICL* ICT Laws, *IBW* Bandwidth, *TRF* ICT cost, *ICT* skills, *GNI* Income, *DEV* Development status, *INU* Internet use, *FBB* Fixed broadband subscription, *MPS* Mobile phone subscription

[a]Logarithmically transformed

***$p < 0.001$; **$p < 0.01$; *$p < 0.05$; #$p < 0.10$ (Two-tailed)

4.4 Post-hoc Analysis

4.4.1 Comparison between developed and developing countries

As can be seen in Fig. 2, higher quantiles of social media diffusion mainly consist of developing countries, whereas the lower quantiles primarily consist of developing or less-developed countries. Therefore, it is academically appropriate to explore how the relationships between the predictors and social media diffusion are different in developed and developing countries. Our study also heeds to the call by Krishnan and Lymm (2016) for "improving the empirical analysis" by comparing "developed and developing countries." Accordingly, we included development status as a moderator (with a higher value as developed and lower value as developing countries) to each predictor variable and re-analyzed the model. The results are presented in Table 5.

First, the estimated coefficient of the interaction between 'ICT in government's vision' and 'development status' was statistically significant in all quantiles, indicating a positive moderation. In other words, the results indicate the effect of 'ICT in government's vision' in increasing social media diffusion is more prominent in developed countries than in developing countries. Second, the estimated coefficient of the interaction between 'ICT laws maturity' and 'development status' was positive and statistically significant in most quantiles, indicating a positive moderation. This indicates the effect of maturity of ICT laws in increasing social media diffusion is more prominent in developed countries than in developing countries. Third, the estimated coefficient of the interaction between 'Internet bandwidth' and 'development status' was positive and statistically significant in most quantiles, indicating a positive moderation. This shows that the effect of Internet bandwidth in increasing social media diffusion is more prominent in developed

Table 5 Post-hoc analysis for comparing developed and developing countries (quantile panel regression results)

Independent variable	Estimated coefficients for different quantiles (dependent variable: SMD)								
	10th	20th	30th	40th	50th	60th	70th	80th	90th
GIV	-0.027	0.024***	0.003	0.004	-0.009	-0.022	0.015	0.004	-0.048***
ICL	0.353***	0.164***	0.204***	0.198***	0.227***	0.186**	0.148***	0.110***	0.154**
IBW[a]	0.399***	0.214***	0.148***	0.183***	0.169***	0.138***	0.066***	0.062***	0.001
TRF	0.072***	0.009	0.032***	0.044***	0.013***	0.024***	0.049***	0.006	-0.051***
SKL	-0.600***	-0.325**	-0.236***	-0.052***	-0.113***	-0.136***	-0.007***	0.010***	0.127***
GNI[a]	0.081**	0.194***	0.193***	0.060***	-0.025***	0.035***	0.020***	-0.070***	0.015***
Moderating variable									
DEV	0.304	-0.425***	-0.550***	0.294***	-0.400***	-0.296***	-0.421***	-0.416***	-0.613***
Moderation effects									
GIV * DEV	0.481***	0.313***	0.179***	0.130***	0.196***	0.230***	0.135***	0.292***	0.358***
ICL * DEV	-0.176***	-0.025	0.133***	0.154***	0.059***	0.092***	0.143***	-0.010	-0.086***
IBW[a] * DEV	-0.164***	-0.001	0.062***	0.018	0.039***	0.004	0.062***	0.119***	0.150***
TRF * DEV	0.070***	-0.001	-0.013	0.010	0.000	-0.113***	-0.190***	-0.164***	-0.176***
SKL * DEV	1.299***	0.763***	0.574***	0.250***	0.263***	0.204***	-0.022**	0.329***	-0.161***
GNI[a] * DEV	-0.407***	-0.261***	-0.343***	-0.107***	-0.058***	-0.053***	-0.005	0.115***	0.116***
Controls									
INU[a]	0.492***	0.381***	0.491***	0.480***	0.467***	0.467***	0.404***	0.371***	0.345***
FBB[a]	0.157***	0.202***	-0.022*	-0.104***	0.010	0.050***	0.068***	0.125***	0.034***
MBS[a]	0.131***	0.108***	0.134***	0.170***	0.194***	0.155***	0.111***	0.093***	0.046***
Year dummies	yes	yes	yes	yes	y es	yes	yes	yes	yes

SMD Social media diffusion, *GIV* ICT in government's vision, *ICL* ICT Laws, *IBW* Bandwidth, *TRF* ICT cost, *ICT* skills, *GNI* Income, *DEV* Development status, *INU* Internet use, *FBB* Fixed broadband subscription, *MBS* Mobile phone subscription

Panel data from 2012 to 2016; [a]Logarithmically transformed

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$ (Two-tailed)

countries than in developing countries. This counter-intuitive finding maybe because for social media diffusion to happen, other factors in addition to bandwidth should also be present. For instance, if people do not have enough ICT skills, they may not be able to use social media even when bandwidth in a country is high. Further, people should have sufficient income to buy ICT devices for using social media. With better socio-economic factors, developed countries are favorably positioned to present such positive factors that can increase social media diffusion. Fourth, the estimated coefficient of the interaction between 'ICT cost' and 'development status' was negative and statistically significant in middle and higher quantiles. That is, it is further strengthening the negative relationship hypothesized between ICT cost and social media diffusion, indicating a positive moderation. This indicates that the negative effect of ICT cost on social media diffusion is more prominent in developed countries than in developing countries. Fifth, the estimated coefficient of the interaction between 'ICT skills' and 'development status' was positive and statistically significant in the lower and middle quantiles, while the result is inconclusive in the higher quantiles. This shows that ICT skills influence social media diffusion in developed countries more than in developing countries, although this relationship holds only in countries where the current level of social media diffusion is not high. Lastly, the estimated coefficient of the interaction between 'capacity to own ICT' and 'development status' was negative and statistically significant in most quantiles, indicating a negative moderation. In other words, as compared to developing countries, the positive association between 'capacity to own ICT' and social media diffusion is weak in developed countries. In sum, the post-hoc analysis results highlight how a country's development status influences the relationships between predictors and social media diffusion.

To summarize, these findings indicate that both the government sub-dimensions (i.e., enabling and regulatory interventions) play critical roles in improving social media diffusion. However, this effect is more prominent in developed countries than in developing countries. Further, the ICT supportive infrastructure sub-dimension of the technology dimension and ICT skills sub-dimension

of the people dimension were also found to have more effect in developed countries than in developing countries. However, the effect of the capacity to own the ICT sub-dimension of the people dimension was more prominent in developing countries rather than developed countries.

5 Discussion

Using a panel data analysis, in this study, we explored the effect of various factors categorized into three dimensions, namely, government, people, and technology, on social media diffusion at a country-level. Our results reveal that ICT in the government's vision, ICT law maturity, Internet bandwidth, and capacity to own ICT were positively associated with social media diffusion. In contrast, ICT cost was negatively associated with it. The finding aligns with a study by Krishnan and Lymm (2016), who found that information infrastructure and human capital were positively associated with social media diffusion. However, our study extends the study by Krishnan and Lymm (2016) in two ways. First, our study is broader as our GTP framework captures more country-level determinants of social media diffusion. And second, our study employs longitudinal analysis instead of cross-sectional to test the model, thereby providing a better understanding of the phenomenon.

H1 (Importance of ICTs to government's vision is positively related to social media diffusion) was only partially supported. To elaborate, while the results held for countries at higher quantiles of social media diffusion (e.g., Sweden and Estonia), there was no evidence for the effect in countries, such as Ethiopia and Lebanon, with lower and moderate levels of social media diffusion. This is an important insight as it shows that the emphasis given by the government in incorporating ICT into its national visions and plans plays a crucial role in increasing social media diffusion only when the level of social media reaches an upper threshold. Similarly, H4 (Cost of ICT is positively related to social media diffusion) was only partially supported. To elaborate, while the results held for countries at higher quantiles of social media diffusion (e.g., Sweden), there was no evidence for the effect in countries with low levels of social media diffusion. This is an exciting finding as it shows that the cost of ICT affects social media diffusion only after a point. This finding further points to the non-linear relationship between ICT cost and demand. This insight is also in line with Bagchi et al. (2008), who observed that reducing ICT prices alone would not guarantee technology diffusion. They noted that "countries that have well-established social and institutional infrastructures are most likely to take advantage of price reductions" (p. 192). It is worthy to note that countries in higher quantiles of social media diffusion (e.g., Sweden and Belgium) also enjoy well-developed social and institutional infrastructures, indicating why the relationship may be holding only in middle and higher quantiles. Further, H6 (Capacity of people to own ICT is positively related to social media diffusion) was only partially supported. To elaborate, the relationship was positive and statistically significant in middle and higher quantiles, while it was not statistically significant in lower quantiles. The reason for this could be that most of the countries in lower quantiles (e.g., Cameron) are also low in socio-development indices, due to which the priorities of people in such countries are towards meeting basic needs rather than using hedonic technologies, such as social media (van de Ven, G et al., 2020). Further, countries in higher quantiles of social media diffusion (e.g., Sweden and Belgium) are also high-income countries, and thus, most people in such countries will be able to afford the devices to access social media. The lack of support for H5 (i.e., ICT skill is positively related to social media diffusion) may be because social media platforms are becoming more user-friendly every day, rendering the need for sophisticated ICT skills irrelevant to use social media. There is evidence that platforms such as YouTube are breaking the language barrier by adding many languages in addition to English (Kessler, 2007), making it easy for people with limited skillsets to use social media.

This study makes critical contributions to the knowledge base of social media and offers several vital recommendations from a practical standpoint (see Table 6 for a summary), the details of which are discussed in the following sub-sections.

5.1 Theoretical Contributions and Implications for Future Research

Our study contributes to the knowledge base of social media in the following key ways. First, taking a cue from the past studies on technology diffusion (e.g., Bajaj & Leonard, 2004; Durbhakula and Kim (2011); Tornatzky & Fleischer, 1990), we have created a new framework (GTP framework) to understand the country-level determinants of social media diffusion. In the framework, the government dimension has two aspects, namely, influential and regulatory intervention, the people dimension has two aspects, namely, skills and capacity to own ICT, and the technology dimension has two aspects, supportive ICT infrastructure and cost of it, to influence social media diffusion. Thus, by offering a new framework, we contribute to the technology diffusion literature by emphasizing the role of government, people, and supportive technologies in driving ICT diffusion at the country level.

Second, our study shows that the importance of ICT in the government's vision and the maturity of ICT laws

Table 6 A summary of study contributions

Contribution	State of the literature	Theory	Practice
Contributes to the technology diffusion literature by offering a new framework (GTP framework) for social media diffusion and emphasizing the role of government, people, and supportive technologies in driving social media diffusion at the country level	While past country-level studies (e.g., Bajaj & Leonard, 2004; Tornatzky & Fleischer, 1990) have investigated ICT diffusion using frameworks such as TOE (Tornatzky & Fleischer, 1990) and CPT (e.g., Bajaj & Leonard, 2004), these frameworks are not exhaustive and need to be adapted	✓	
Contributes to the social media literature by establishing the importance of enabling interventions from the government in increasing social media diffusion	Evidence indicates that if the government, through their actions, shows social proof of the benefits of technology, such actions can nudge people to adopt technologies (Schneider et al., 2020)	✓	✓
Contributes to the social media literature by establishing the importance of regulatory interventions from the government in increasing social media diffusion	The presence of mature ICT laws reduces people's perceived risk of using ICTs by reducing data protection risks (Khan et al., 2020)	✓	✓
Contributes to the social media literature by proving the critical role of supportive ICT infrastructure in increasing social media diffusion	Accessing multimedia content over the Internet requires high bandwidth (Jedari et al., 2020)	✓	✓
Adds to the social media literature by showing that the ICT cost, a sub-dimension of the technology dimension, will influence social media diffusion only in countries with already higher levels of diffusion	Past studies (e.g., Alam & Noor, 2009) have indicated that ICT costs do not directly impact ICT diffusion. However, these studies did not provide a quantile level analysis. Further, Bagchi et al. (2008) have observed that reducing ICT costs alone will not guarantee technology diffusion. They noted that countries also need to have well-established social and institutional infrastructures	✓	✓
Contributes to the social media literature by establishing that people's capacity to own ICT, an essential people dimension, will influence social media diffusion in a country	Past studies (e.g., Beilock & Dimitrova, 2003; Kiiski & Pohjola, 2002) show that income, which determines a person's capacity to own ICT, has a positive relationship with the Internet diffusion. However, its effects on social media diffusion are less investigated	✓	✓
Recommends policymakers to give importance to ICT in government's national plans and visions as such actions positively influence public behavior towards using ICTs, creating a facilitative environment for social media diffusion	The UN has recommended using ICT and its tools by the governments in policymaking (Lallana, 2014)		✓
Recommends policymakers establish sound ICT laws as it creates safe and predictable cyberspace, increasing social media diffusion	A sound ICT regulatory environment is essential in improving ICT diffusion through peoples' trust (Khan et al., 2020)		✓
Recommends policymakers take steps to increase the Internet bandwidth as people will be able to access more multimedia content on social media, increasing its diffusion	According to UNESCAP (2014), a higher Internet bandwidth provides supportive technology for communication technologies while also boosting economic development, social equality, and social integration		✓
Suggests policymakers that reducing ICT costs may not be an effective policy tool to increase social media diffusion as the findings show that it works only in countries with already higher levels of diffusion	According to Bagchi et al. (2008), countries also need to have well-established social and institutional infrastructures to effectively utilize the reduced cost of ICT		✓
Recommends policymakers take measures to increase the capacity of people to buy ICT devices by increasing their disposable income	According to UNCTAD (2021), reducing income inequality is necessary for harnessing technology and its diffusion		✓
As the effect of the three dimensions on social media diffusion varies in developed and developing countries, our study recommends that policymakers focus on specific dimensions while devising policy measures. Specifically, while in developing countries, the focus should be on improving people's capacity to own ICT, the focus should be on influential and regulatory interventions in developed countries	Past studies (e.g., Krishnan & Lymm, 2016) have suggested a possible difference in social media diffusion between developed and developing countries		✓

will drive social media diffusion in a country. In other words, the study highlights that when the government gives importance to ICT and uses it in its national plans and visions, it positively influences the public behavior towards using ICTs, creating a facilitative environment for social media diffusion. The positive effect of such influential interventions from the government in technology diffusion has been observed in past studies. For instance, Schneider et al. (2020) found that when the government's actions become social proof of the benefits of ICT, it indirectly nudges people to use ICT themselves. Therefore, our study shows that when the government gives importance to ICT and uses it in its national plans and visions, it nudges people to see the positive and safe digital ecosystem in the country, driving people to use social media.

Third, our study indicates that the maturity of ICT laws positively influences social media diffusion. To elaborate, when the ICT penetration increases, there can be cybersecurity, cybercrimes, and privacy problems. Therefore, the government can create cyberspace free from the aforementioned issues by establishing a sound and mature ICT legal system using its regulatory powers. Such regulatory interventions from the government give assurances to the people about safe cyberspace for using social media. This finding is in line with Khan et al. (2020), who found that the presence of sound and mature ICT laws is vital for ICT diffusion. Thus, we contribute to the social media literature by establishing how governments can influence social media diffusion through two interventions, namely, influential and regulatory.

Fourth, the study establishes that Internet bandwidth increases social media diffusion. To elaborate, the Internet is a basic supportive infrastructure for accessing social media. As new-age social media platforms are multimedia intensive, a higher Internet bandwidth allows accessing these platforms seamlessly, thereby increasing their use. The need for high bandwidth Internet for multimedia content has been established in past studies (Jedari et al., 2020). Accordingly, we contribute to the social media literature by underscoring the importance of supportive infrastructure in determining social media diffusion.

Fifth, our study indicates a negative relationship between the ICT cost and social media diffusion in countries in high quantiles where social media diffusion is already high. People access the Internet using mobile phones and fixed lines. When the tariffs of these services are low, people will have better access to the Internet, increasing social media use. However, this influence was visible only in countries with high social media diffusion. Accordingly, we contribute to the social media literature by underscoring the importance of supportive infrastructure and its cost in determining social media diffusion.

Sixth, our study indicates that people's capacity to own ICT will influence social media diffusion in a country. In other words, people need to have the financial means to own ICT devices to use social media. This finding is in line with the past studies (e.g., Beilock & Dimitrova, 2003); Kiiski & Pohjola, 2002) that show that income, which determines a person's capacity to own ICT, positively influences the Internet diffusion. Through this finding, we contribute to social media by establishing that the capacity to own ICT is an essential people dimension in influencing social media adoption.

And lastly, although not hypothesized formally, our post-hoc analysis indicates that the relationship between the variables of interest and social media diffusion varied significantly based on a country's development status. For instance, our study shows that the maturity of ICT laws plays a crucial role in increasing social media diffusion in developing countries than in developed countries. This is an important finding as it stresses the need to develop studies explicitly focusing on developed or developing countries.

Our study lays down many paths for future exploration. First, while testing the GTP framework, we have included only six country-level determinants for want of parsimony. It is possible more aspects of these dimensions can affect social media diffusion. Therefore, future studies may use the GTP framework as a base and explore more country-level antecedents of social media diffusion. Second, as our focus in this study was on determinants, we did not explore the moderating effects of various country-level factors. However, we do not deny the possibility of such effects. For instance, as Krishnan and Lymm (2016) found, various cultural dimensions could interact with the antecedents of social media diffusion. Similarly, a study by Stump and Gong (2020) also indicates the influence of cultural dimensions. Such exploration in future studies will be a notable extension of the present study. And lastly, while our study threw light on the direct relationships between various factors and social media diffusion, other underlying processes could drive these associations. Therefore, understanding what mediating factors intervene in the relationship between the predictors and social media diffusion may throw more light on the mechanisms through which social media diffusion happens at a country-level.

5.2 Policy Implications

Several insights emerge from our study for policymakers. First, while there is an understanding of the drivers of social media diffusion at an individual and organizational level, country-level studies are scarce. Such scarcity is glaring despite a broad consensus on social media as a powerful

socio-technical platform for achieving many country-level objectives related to development (Jones et al., 2012; Li & Liu, 2020; Nam, 2021; Rice, 2010). Therefore, understanding the determinants of social media diffusion can inform policymakers on improving social media use in a country. Second, the GTP framework delineates critical dimensions of ICT and social media diffusion in a country. It informs policymakers to be mindful of the three dimensions of determinants: government, people, and technology, while making policy and strategic decisions to increase social media diffusion. Third, they need to note that the government's importance for ICT in its plans and visions indirectly nudges people to use social media. Fourth, policymakers need to establish sound ICT laws as it creates safe and predictable cyberspace, increasing social media diffusion. Past studies indicate that a sound ICT regulatory environment is essential in increasing ICT diffusion as predictable cyberspace increases peoples' trust (Khan et al., 2020). Fifth, policymakers need to increase Internet bandwidth, which is a supportive technology for social media, as people will be able to access more multimedia content on social media, increasing its diffusion. UNESCAP (2014) has noted that a higher Internet bandwidth provides supportive technology for communication technologies while also boosting economic development, social equality, and social integration. This may be achieved by reducing the cost of high-speed Internet subscriptions or by subsidizing them. Also, as the capacity to own ICT is an important determinant of social media diffusion, policymakers can focus on improving the disposable income of people so that they will be able to own the necessary devices to use social media. This suggestion is also in line with UNCTAD (2021), according to which reducing income inequality is critical for harnessing technology and its diffusion.

5.3 Limitations

It is important to note some of the limitations of this study. First, the data used in our analyses is only from 2012 to 2016. Although the data availability mainly drove the choice of periods, we do not deny that analysis with more recent data would have given better insights. However, we believe that our study can be a starting point, and future studies may improve upon it when more data becomes available. Second, we removed some of the poorest countries, such as North Korea, due to a lack of data availability. Although we acknowledge this as a limitation, we believe that our coverage of the remaining countries is comprehensive. Therefore, we suggest future studies replicate the study with a bigger sample.

6 Concluding Remarks

To conclude, while there is a growing understanding of the factors that drive social media use at individual and organizational levels, our understanding at the country level is still at a nascent stage. With the growing importance of social media in achieving various policy objectives, such an understanding is vital for both researchers and policymakers. To this end, by grounding the discussion on the framework (GTP framework) we constructed, our study investigated and empirically established the direct effect of (1) the importance of ICT in government's vision, (2) ICT law maturity, (3) Internet bandwidth, (4) ICT cost, and (5) capacity to own ICT, on social media diffusion. Findings underscore the need to focus on three dimensions of social media determinants: government, people, and technology, to improve social media diffusion.

Appendix A

Table 7 List of Countries included in data analysis

Albania, Algeria, Armenia, Australia, Austria, Azerbaijan, Bangladesh, Belgium, Bolivia, Botswana, Bulgaria, Cambodia, Cameroon, Cape Verde, Chile, China, Colombia, Costa Rica, Croatia, Cyprus, Czech Republic, Dominican Republic, Egypt, El Salvador, Estonia, Ethiopia, Finland, France, Gambia, Georgia, Ghana, Greece, Guatemala, Honduras, Hong Kong, Hungary, Iceland, India, Indonesia, Iran, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Kuwait, Kyrgyz Republic, Latvia, Lebanon, Lesotho, Lithuania, Luxembourg, Macedonia, Madagascar, Malawi, Malaysia, Mali, Malta, Mauritania, Mauritius, Mexico, Moldova, Mongolia, Montenegro, Morocco, Namibia, Nepal, Netherlands, New Zealand, Nicaragua, Nigeria, Oman, Pakistan, Panama, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, Romania, Russian Federation, Rwanda, Saudi Arabia, Senegal, Serbia, Singapore, Slovak Republic, Slovenia, South Africa, Spain, Sri Lanka, South Korea, Sweden, Switzerland, Thailand, Trinidad and Tobago, Turkey, Uganda, Ukraine, United Kingdom, United States, Uruguay, and Vietnam; $N = 107$

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Declarations

Conflict of interest The authors declare that they have no conflict of interest.

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