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Article

Global Digital Peripheries: The Social Capital Profile of Low-Adopter Countries

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Abstract
As digital transformations have the potential to reinforce longstanding inequalities and create novel ones within and among societies, it is vital to understand how this process is socially embedded. This article contributes to the study of macro-level patterns of cross-country differences in digitalization by providing a global comparative analysis of 76 countries in three different clusters, with a focus on the almost 30 countries with the lowest rates of adoption. Going beyond the "access, use, outcome" perspective of the digital divide approach, this empirical analysis addresses the social embeddedness of digitalization in the framework of the three types of social capital. In contrast to the digitalized and the digitalizing country clusters, the findings on the social capital profile of low-adopter societies reveal their consistently low status on bridging and linking social capital, as well as their strengths in the trust and ties dimensions of bonding social capital. These results have alarming implications for digital inclusion in low-adopter societies.

Keywords
bonding social capital; bridging social capital; cross-country analysis; digital divide; digital transformation; linking social capital; low-adopter; social embeddedness; trust

Issue
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1. Introduction

Digitalization is gradually transforming societies around the globe: The widespread diffusion of digital technologies has turned the digital transformation into a pressure point in a broad spectrum of everyday activities, from Industry 4.0 to public services, healthcare, schools, entertainment, and family life. Currently, all major international cooperation organizations and development agencies have priority actions in place to advise their stakeholders on how to reap the benefits and avoid the pitfalls of digitalization, including the United Nations (2020, 2023), the United Nations Development Programme (UNDP, 2021), the International Telecommunications Union (ITU, 2022a), the World Bank (2021), OECD (2020), the World Economic Forum (2023a), the European Commission (2021), and the BRICS (Brazil, Russia, India, China, and South Africa; see International Trade Centre, 2022). Their policy efforts extend to collecting and sharing global metrics on digital transformations: The ITU (2022b, 2023) has devised a digital development dashboard; OECD (2022) has published the *Going Digital Integrated Policy Framework*; the European Commission launched the Digital Economy and Society Index, followed by the International Digital Economy and Society Index (European Commission & Tech4i2, 2020); the World Bank (2016) set up the Digital Adoption Index; the UNDP (2023) offers its clients a digital readiness assessment tool; and the World Economic Forum (2023b) works with its stakeholders in the framework of its digital transformation initiative.

Global-scale evidence made available by these organizations provides valuable macro-level insight into the technology-diffusion aspects of digitalization but largely falls short of grasping how digitalization transforms societies in more complex ways. Moreover, the focus of evidence-based policy-making has been chiefly on core economies, as they have experienced both digital disruption and digital dividends most powerfully. The ongoing digital transformation of societies on the peripheries, therefore, remains understudied. The same holds for conventional approaches in the academic literature on cross-country analyses of the digital divides. Most macro-level comparative research on the access to, use of, and benefits of digital affordances has sought to identify the economic, social, cultural, institutional, and regulatory predictors of technology diffusion. Focusing on core countries and policy implications, these studies have found that wealth, income, education, urbanization, trust, and the institutional environment are the main drivers of this process (Ayanso et al., 2010; Billon et al., 2009; Billon et al., 2010, 2016; Chinn & Fairlie, 2010; Corrocher & Ordanini, 2002; Cruz-Jesus et al., 2012, 2018; Cruz-Jesus, Oliveira, et al., 2016; Cryz-Jesus, Vicente, et al., 2016; Doong & Ho, 2012; Kraemer et al., 2005; Mardikyan et al., 2015; Skaletsky et al., 2016; Pick & Nishida, 2015; Serrano-Cinca et al., 2018; Zhang, 2013).

As a counterpart to analyses centered on technology and public policy, another segment of academic literature on the digital divide has offered a wealth of perspectives and empirical evidence on the social embeddedness of digitalization. For more than a quarter of a century (since Irving et al., 1995), scholars have studied the paradoxical potential of digital transformations to either reinforce or mitigate existing inequalities within and among societies. Besides investigating the aspect of access to transformative digital technologies, these studies have covered both the benefits and risks of various modalities of technology use (Chen & Wellman, 2004; Cotter & Reisdorf, 2020; Hargittai, 2002; Loh & Chib, 2021; Lutz, 2019; Ragnedda, 2017; van Deursen & Helsper, 2015; van Deursen & van Dijk, 2015, 2019; van Dijk, 2020), as well as the associated prospects for digital inclusion (Ragnedda, 2020; Robinson, Schulz, Blank, et al., 2020; Robinson, Schulz, Dodel, et al., 2020; Robinson, Schulz, Dunn, et al., 2020; van Dijk, 2020). A number of scholars in the digital divide literature who seek to capture digitalization as a complex process of social transformation do so by drawing on the theory of social capital. Some of these studies have focused on how the key dimensions in social capital research, i.e. networks, trust, and cooperative interactions (Dasgupta & Serageldin, 1999; Fukuyama, 1995, 1999; Portes, 2000; Putnam, 2000; Putnam et al., 1993) are related to the access, use, and benefits aspects of digital activities (Antoci et al., 2011; Chen, 2013; DiMaggio et al., 2004; Neves, 2013, 2015; Nguyen et al., 2021; Pénard & Poussing, 2010; Rainie & Wellman, 2012; Robinson et al., 2015; Sabatini & Sarracino, 2014). Others have investigated how these basic dimensions relate to digital capital, conceptualized as an additional form of capital, thereby broadening Pierre Bourdieu's scheme of economic, cultural and social capital (Calderon Gomez, 2021; Park, 2017; Ragnedda, 2018; Ragnedda & Ruiu, 2020; Ragnedda, Addeo, et al., 2022; Ragnedda et al., 2019; Ragnedda, Ruiu, et al., 2022; Ruiu & Ragnedda, 2020). Part of this scholarship has found not only an empirical but also a strong conceptual association between social capital and digital practices, resulting in a growing literature on how social capital has absorbed the digital dimension (DiMaggio et al., 2001; Hargittai & Hsieh, 2013; Nguyen et al., 2021; Ragnedda & Ruiu, 2017; Wellman & Haythornthwaite, 2002). Our study builds on these efforts by providing an analysis of the macro-level social embeddedness of digitalization in the framework of the three types of social capital, in order to highlight how various technological and digital affordances combine with bonding, bridging, and linking social ties and interactions.

The delineation of three distinct types of social capital was already introduced around the turn of the millennium (Field, 2003; Fukuyama, 1999; Halpern, 2005; Putnam, 2000; Woolcock, 1998, 2001, 2010, 2021) to overcome an excessively compact version of social capital (Portes, 2000), operationalized either by social networks alone, solely as a matter of trust patterns, or merely in terms of cooperative norms. The theory of the three types of social capital rests on the insight that the various types of trust, the diversity in norms of cooperation, and the many kinds of social networks are intertwined into analytically distinct social phenomena. Our analysis is based on the understanding that there is not only conceptual room but an increasing need as well for adding the dimension of technology use to all three types of social capital.

Bonding social capital rests on narrow-radius interpersonal trust among social actors who are in frequent face-to-face (potentially technology-mediated) contact, where cooperation is regulated by demanding norms of loyalty or altruism in social networks involving family, kin, or friends. Examples of bonding interactions would be family members supporting each other emotionally via voice/video calls, or elderly care provided by family members with the assistance of smartwatch communication and health apps. Bridging social capital is predicated upon less intensive, broad-radius, generalized interpersonal trust among actors who interact in formally or informally regulated social settings, such as schools, civil organizations, neighborhoods, or start-ups, where interactions occur ever more frequently online. Examples of bridging interactions would be social media-assisted crowdfunding for product innovation by a start-up, or practical support received on online self-help discussion forums. Linking social capital requires institutional trust among actors in various highly regulated, large-scale institutional settings, such as public transportation, banking, the judicial system, representative political institutions, or multinational corporations, where actors differ greatly in terms of their power and level of expertise vis-à-vis institutional processes, but typically use the same digital platforms. An everyday example of linking interactions would be claiming a refund for a product purchased on an e-commerce platform.

The aim of this empirical investigation is to provide a global-scope analysis of macro-level bonding, bridging and linking social capital. Such a perspective allows us to focus on the global peripheries, which are often understudied in the literature on both digitalization and social capital. We are thus contributing to a distinct line of social capital scholarship that investigates macro-level social capital by using country- (or regional-) level data as proxies (Dulal et al., 2011; Halpern, 2005, pp. 13–19, 26–27, 65–71) for studying macro-level phenomena, such as national (or regional) democracy and public policy (Putnam, 2000; Putnam et al., 1993; Szreter & Woolcock, 2004), economic prosperity (Fukuyama, 1995; Füzér et al., 2020), development programs (Woolcock, 1998, 2001, 2010; Woolcock & Narayan, 2000), or innovation ecosystems (Doh & Acs, 2010). To account for the multidimensional character of social capital, several scholars have constructed comprehensive measures for cross-country analysis based on various techniques (Christoforou, 2011; Lee et al., 2017; Sarracino & Mikucka, 2017; van Oorschot et al., 2006). However, a metric that systematically recognizes the dimensions of trust, norms and networks and also incorporates the aspect of technology use in all three types of social capital is missing.

2. Research Questions and Methods

Three research questions follow from our exploratory research agenda:

> RQ1: What do the social capital-based digital profiles of countries around the world look like? To what extent can countries rely on bonding, bridging, and linking social capital?
>
> RQ2: Can we identify typical groups in terms of countries' social capital-based digital profiles?
>
> RQ3: In what ways is the social embeddedness of digitalization in the digital peripheries different from the digitalized core?

We apply the method of building composite indicators for the three types of social capital, following a standard procedure (OECD, 2008) and using a wide array of global datasets, all curated and made accessible online by international organizations as recognized data stewards. The pillars of our social capital indexes (SCIs) capture the three dimensions of trust and norms, ties, and connections, and the technology-mediated aspects of social interaction. Our three composite indicators reflect the intensity of bonding, bridging, and linking social capital available in all societies, while at the same time drawing their respective profiles. The guiding principles in selecting our proxy variables for each of the three dimensions of social capital were the following: The interpretation and categorization of the applied indicators should be as clear as possible and rest on precedents in the literature; the data should be as globally comprehensive as possible; the number of cases should be as high as possible; and the basic variables should correlate as much as possible within the subset of each pillar. The logic of index-building is summarized in Table 1, while a list of all variables used for the pillars of the three SCIs, their description, and the links to the data steward organizations are listed in Tables 1–3 of Supplementary File 1.

The variables for bonding social capital were selected to reflect the significance of strong ties, especially those of marriage and family. The average singulate age at marriage and the crude divorce rate indicate global differences in the significance of marriage, a prime vehicle of particular interpersonal trust, and the norm of loyalty (Brinig, 2011; Fukuyama, 1999, pp. 43–45, 108–110; Miladinov, 2022; Prandini, 2014). The capacity of family in providing immediate bonding social ties is assessed by the total fertility rate and household size (Fukuyama, 1999, pp. 45–46, 110–113; Halpern, 2005, p. 224). In addition, it is also measured by a negative indicator, namely the adolescent birth rate, which denotes the dysfunctional emergence of parent-child relations (Denner et al., 2001; Gold et al., 2002; Gyan et al., 2017). To approximate one aspect of financial responsibility within the family, we use data for personal remittances, as these denote strong bonding social connections among family and kin in a globalized context (Böröcz, 2014; Eckstein, 2006; Wu et al., 2023). One of the technologies that is of prime importance in managing bonding social ties is voice calling via telephone, which we measure by means of two variables indicating the type of device available to households (fixed lines, mobile phones), and one for the total population (cellphone subscription rate), both reflecting crucial elements in the access dimension of the digital divide in the context of bonding ties (Chan, 2015; Gubernskaya & Treas, 2016; Shema & Garcia-Murillo, 2020).

In the case of bridging social capital, the variables for the trust, norms, ties, and connections pillars were selected according to standard research practice. The measurement of generalized interpersonal trust, on the one hand, has its own history and associated inertia, making it indispensable for the trust and norms pillar of bridging social capital (Bauer & Freitag, 2018; Freitag & Traunmüller, 2009; Lundmark et al., 2015; Uslaner, 2012). Spontaneous sociability, on the other hand, manifests itself in active participation in various social settings, prominent among which are civil society (Dulal et al.,

Table 1. The logic of index-building.

Index	Pillar	Description
Bonding	Trust and norms	Narrow radius of interpersonal trust Bonding ties typically rest on mutual loyalty
	Ties and connections	The primary setting of social interaction are partnerships, family and kinship ties, and friendships (strong ties)
	Devices and technology	Information and communication technology (ICT) and devices assist in managing the needs and responsibilities arising from bonding social ties
Bridging	Trust and norms	Broad radius of interpersonal trust and spontaneous sociability Bridging ties typically rest on civility, honesty and trustworthiness
	Ties and connections	The primary setting of social interaction is the professional, educational and civil life (weak ties)
	Devices and technology	ICT and technological devices assist in managing the tasks and opportunities arising from bridging social ties
Linking	Trust and norms	Institutional trust and institutionalized interpersonal trust Linking ties rest on expertise, (self)-competence and integrity
	Ties and connections	Social interaction is framed by various highly institutionalized settings (institutional ties)
	Devices and technology	ICT and technological devices assist in managing the institutional interactions of lay actors and experts with varying degrees of power and types of expertise

2011; Putnam, 2000; Putnam et al., 1993), learning environments and social media, the latter reflecting the use dimension of the digital divide in the context of bridging ties (Nieminen et al., 2007; Saukani & Ismail, 2019; Stolle & Hooghe, 2003). While the general transportation and communications infrastructure continues to be highly relevant in facilitating social interaction (Bradbury, 2006; Gray et al., 2006; Wellman, 1999), the crucial technology in the domain of bridging social ties nowadays is the internet. We, therefore, selected variables that depict internet availability to households and individuals, capturing a vital element in the access dimension of the digital divide (Alessandrini, 2006; Wellman & Haythornthwaite, 2002).

The large-scale institutional settings that frame the interactions of linking social capital are also well-established in research practice, both in terms of confidence in institutions and participation in institutional processes (Dulal et al., 2011; Huff & Kelley, 2003; Tsai et al., 2011; Wang & Gordon, 2011). Besides variables of confidence and participation in comprehensive institutions, we also selected survey items covering the processes of linking social interactions. The perceptions of the effectiveness and fairness of institutional processes (e.g., corruption, rule of law, law enforcement) feed into confidence and participation, thereby creating positive or negative reinforcement mechanisms (Rothstein, 2003; Rothstein & Stolle, 2008). The primary technology supporting interaction among actors linked by large-scale institutional settings are internet platforms that create new opportunities to connect (as in e-commerce; see Doh & Acs, 2010; Sussan & Acs, 2017). These platforms can also boost conventional forms of transactions and interactions, such as e-public participation (Naranjo-Zolotov et al., 2019) or e-learning environments (Lu et al., 2013), and thus capture constitutive elements of the outcome dimension of the digital divide in the context of institutional ties.

Our datasets allowed us to calculate the pillar and index scores of 32 indicators for a total of 76 countries worldwide, using the standard composite indicator technique (OECD, 2008) and the calculation methodology advanced by Acs et al. (2014). The World Value Survey data proved to be the bottleneck in country selection: There are several countries where the rate of missing data is high—25% for Belarus and Qatar, 19% for Iran, Libya, and Uzbekistan, and 16% in the case of Iraq, Korea, and Kuwait. Consequently, the results should be viewed with caution for the eight countries in question.

First, the 32 selected indicators were normalized by means of the standard min-max methodology:

$$\mathrm{Ind(norm)}_{i,j} = \frac{\mathrm{Ind}_{i,j} - \min \mathrm{Ind}_{i,j}}{\max \mathrm{Ind}_{i,j} - \min \mathrm{Ind}_{i,j}} \quad (1)$$

where $\mathrm{Ind(norm)}_{i,j}$ is the normalized indicator score value for country *i*, indicator *j*, $\min \mathrm{Ind}_{i,j}$ is the minimum value of indicator *j* for country *i*, and $\max \mathrm{Ind}_{i,j}$ is the maximum.

Second, the three indexes of social capital are made up of three pillars: trust and norms (TN), ties and connections (TC), and devices (DE); thus we calculated the scores for all nine pillars by averaging (arithmetic mean) the previously normalized indicators *j* belonging to each pillar for each country i:

$$\text{Social Capital Index (Pillar)}_i = = \text{mean}\left(\text{Ind(norm)}_{i,j}, \dots\dots, \text{Ind(norm)}_{i,j}\right) \quad (2)$$

For each normalized indicator, any missing data were replaced by the averages of other normalized indicators belonging to the same pillar. The different averages of the normalized values of the indicators imply that reaching the same indicator value requires different efforts and resources. However, the additional resources needed to achieve the same marginal improvement of the pillar values should be the same for all pillars. The marginal effects could differ, depending on the level of the pillar values. Country variations in the marginal effects are also possible. As calculating all the marginal effects for all countries would be a cumbersome task, we propose a simpler solution, namely to equalize the marginal effects of the components only for the average pillar values of all countries. This technique reduces but does not eliminate the distortion in calculating the marginal effects. Equation 3 shows the calculation of the average value of pillar j:

$$\overline{\text{pillar}_j} = \frac{\sum_{i=1}^{n} \text{pillar}_{i,j}}{n} \text{ for all } j \quad (3)$$

We want to transform the $\text{pillar}_{i,j}$ values such that the potential values will be in the [0,1] range:

$$\text{meanpillar}_{i,j} = \text{pillar}^k_{i,j} \quad (4)$$

where k is the "strength of adjustment," and the k-th moment of pillar_j is exactly the required average, $\overline{\text{meanpillar}_j}$

For this, we have to determine the root of the following equation for k:

$$\sum_{i=1}^{n} \text{pillar}^k_{i,j} - n \times \overline{\text{meanpillar}_j} = 0 \quad (5)$$

It is easy to see, based on previous conditions and derivatives, that the function is decreasing and convex, which means it can be quickly solved using the well-known Newton-Raphson method, with an initial guess of 0. After obtaining k, the computations are straightforward.

As a result, is k to be thought of as the strength (and direction) of adjustment.

The average marginal rate of compensation (AMRC) for any two average pillars i and j is the same:

$$\text{AMRC}_{i,j} = \frac{d\bar{y}_i}{d\bar{y}_j} \quad (6)$$

More concretely, the nine pillars of the three indexes were calculated as follows:

$$\text{Bonding(TN)}_i = \text{mean}\left(\text{Ind (norm)}_{i,1}, \dots\dots, \text{Ind(norm)}_{i,3}\right) \quad (7a)$$

$$\text{Bonding(TC)}_i = \text{mean}\left(\text{Ind (norm)}_{i,4}, \dots\dots, \text{Ind(norm)}_{i,6}\right) \quad (7b)$$

$$\text{Bonding(DE)}_i = \text{mean}\left(\text{Ind (norm)}_{i,7}, \dots\dots, \text{Ind(norm)}_{i,9}\right) \quad (7c)$$

$$\text{Bridging(TN)}_i = \text{mean}\left(\text{Ind (norm)}_{i,10}, \text{Ind(norm)}_{i,11}\right) \quad (7d)$$

$$\text{Bridging(TC)}_i = \text{mean}\left(\text{Ind (norm)}_{i,12}, \text{Ind(norm)}_{i,13}\right) \quad (7e)$$

$$\text{Bridging(DE)}_i = \text{mean}\left(\text{Ind (norm)}_{i,14}, \dots\dots, \text{Ind(norm)}_{i,18}\right) \quad (7f)$$

$$\text{Linking(TN)}_i = \text{mean}\left(\text{Ind (norm)}_{i,19}, \dots\dots, \text{Ind(norm)}_{i,23}\right) \quad (7g)$$

$$\text{Linking(TC)}_i = \text{mean}\left(\text{Ind (norm)}_{i,24}, \dots\dots, \text{Ind(norm)}_{i,29}\right) \quad (7h)$$

$$\text{Linking(TN)}_i = \text{mean}\left(\text{Ind (norm)}_{i,30}, \dots\dots, \text{Ind(norm)}_{i,32}\right) \quad (7i)$$

where, for example, $\text{Ind(norm)}_{i,1}$ represents the first of the 32 normalized indicators for country i.

Third, we normalized the nine pillar scores (7b–7j) by the distance methodology, which is based on dividing the pillar scores by their maximum value:

$$x_{i,j} = \frac{z_{i,j}}{\max z_{i,j}} \quad (8)$$

where j denotes the pillar of country i, $\max z_{i,j}$ is the maximum value for pillar j for country i, and $x_{i,j}$ is the normalized score value for a given pillar and country.

Fourth, as the different averages of the normalized pillar values imply that achieving the same pillar values requires different efforts and resources, it also causes problems in calculating the marginal improvement effects. In order to equalize the marginal effects over the nine pillars, we applied the equalization of averages technique developed by Acs et al. (2014).

Finally, we calculated the three SCI scores by using a simple arithmetic average of the previously calculated three pillars: trust and norms, ties and connections, and devices. We also transferred the range [0,1] resulting from step four to the [0,100] scale by simply multiplying it by 100:

$$\text{BONDING}_i = 100 \sum_{j=1}^{3} \frac{y_j}{3} \quad (9a)$$

$$\text{BRIDGING}_i = 100 \sum_{j=4}^{6} \frac{y_j}{3} \quad (9b)$$

$$\text{LINKING}_i = 100 \sum_{j=7}^{9} \frac{y_j}{3} \quad (9c)$$

For analytical purposes, we also calculated a composite SCI score using the geometric average of the scores of the three SCIs:

$$SCI_i = \Pi\,(BONDING_i,\ BRIDGING_i,\ LINKING_i) \qquad (10)$$

where SCI_i is the composite SCI score for country *i*.

The three SCIs for bonding, bridging and linking social capital provide the social capital profile of the selected 76 countries. Profiling proved to be a better way to capture social capital endowments at country level than concentrating information into a composite SCI: Statistical robustness tests revealed that this overall SCI is very sensitive to different weighting scenarios (detailed calculations are available in Supplementary File 2). The geometric average provides a conservative estimate of the overall SCI score of a particular country. Since no available theory is able to account for the compensability effects of the different pillars, utilizing the nine-pillar social capital profile of the three SCIs is more reliable than using the composite SCI score.

In order to group countries according to typical social capital profiles, we applied two alternative methods while identifying statistically distinct categories based on index scores: k-means cluster analysis (Hennig & Meila, 2015; Kassambara, 2017; Mirkin, 2015) and latent profile analysis (Williams & Kibowski, 2016).

3. Results and Discussion

As regards our first research question, we introduce our basic research results, the raw scores for the three SCIs and the index pillars for all 76 countries in Tables 1–3 in Supplementary File 3. In the course of answering our second research question, the simple *k*-means cluster analysis of the SCIs revealed that there are three distinct groups of countries in terms of social capital profile. The three groups were chosen according to the elbow method, where we calculated the total within-cluster sum of squares for cluster solutions ranging from 1 to 10, and chose the cluster number after which an additional cluster did not improve the clustering solution (Kassambara, 2017; Mirkin, 2015). This finding was also corroborated by latent profile analysis (LPA; Spurk et al., 2020; Williams & Kibowski, 2016). Compared to k-means, LPA is a soft clustering method where individuals belong to each identified group (profile) with a certain probability. Comparing LPA solutions relies on the Akaike information criterion (AIC) and Bayesian information criterion (BIC), where the model with the lowest AIC and BIC values indicates the best model. A solution with three profiles (entropy = 0.85), which qualitatively matches the $k = 3$ solution of the *k*-means approach, was found to be the most appropriate.

The cluster score means of digitalized, digitalizing and low-adopter countries are presented in Table 2, and the clusters are visualized in Figures 1 and 2.

Our third research question probes the differences in the social embeddedness of digitalization across the groups of countries. We found that out of the 76 countries in our dataset, 16 belong to the digitalized cluster, meaning they rely on a wide array of device-mediated social interactions, have strong bridging and linking ties, reinforced by high levels of generalized interpersonal trust and confidence in a broad range of institutions, and exhibit intensive participation in institutional processes (see Table 3 in Supplementary File 3). Bonding social capital does not play a significant role in digitalized countries. In sharp contrast, the 28 low-adopter countries are characterized by strong, particularized interpersonal trust, which makes them predominantly dependent on bonding ties and hardly at all on device-mediated social interactions (see Table 1 in Supplementary File 3). Low-adopter societies are exceptionally weak in all aspects of bridging and linking social capital. The 32 digitalizing countries are similar to low-adopter societies in that bonding social capital is vital to them but, at the same time, they also rely on bridging and linking social capital, albeit to a lesser degree than digitalized societies (see Table 2 in Supplementary File 3). Device-mediated social interactions play an important role in digitalizing countries but are not as vital to their workings as in digitalized countries.

Our focus on low-adopter societies reveals that their social embedding of digitalization is marked by a combination of two factors. Their modest reliance on device-mediated social interactions in all walks of life is coupled with excessive family bonds and a narrow range of social or institutional ties beyond the family.

Looking at the visualization of our results in Figure 1, a narrow focus on the technology use profile of digitalized, digitalizing and low-adopter societies would reveal differences that are seemingly a matter of degree only: Low-adopter countries have the lowest technology use capacities (their bonding device, bridging device, and linking device data points form a very small triangle), while those of digitalized countries are the highest (their data points form a very large triangle), with digitalizing countries in between. The strength of our analysis is that

Table 2. K-mean cluster average index scores.

SCIs	Digitalized	Digitalizing	Low-adopter
Bonding SCI	41.0	50.6	51.2
Bridging SCI	74.4	49.6	33.4
Linking SCI	78.2	47.9	33.1
Number of cases	16	32	28

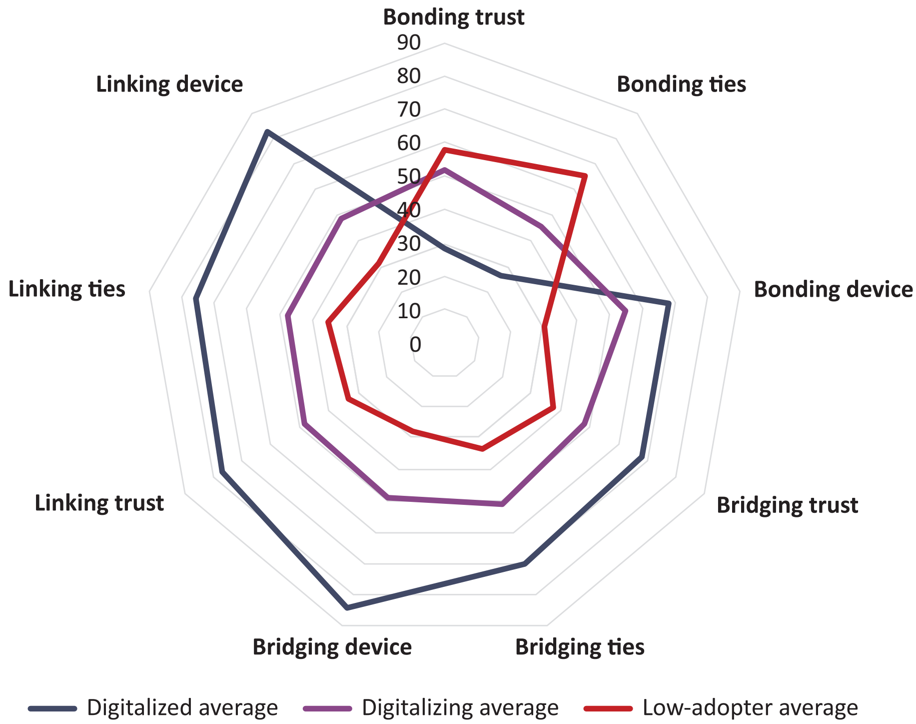

Figure 1. Profiling country clusters.

we can portray the social embeddedness of technology use by showing that the "shape" of the periphery (the low-adopter cluster) follows a very similar "matter of lesser degree" pattern concerning the social embeddedness dimensions of both bridging and linking trust and ties, but is markedly different in terms of bonding trust and ties. Low technology adoption on the digital periphery is coupled with excessively narrow social trust and

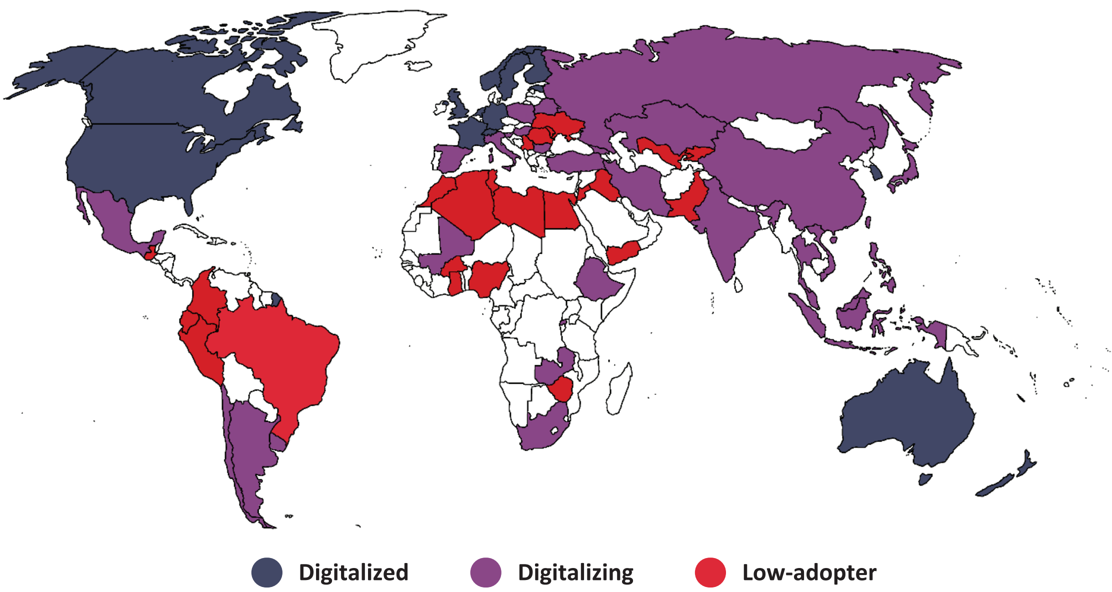

Figure 2. Country clusters on the map. Notes: DIGITALIZED countries: Australia, Canada, Estonia, Finland, France, Germany, Netherlands, New Zealand, Norway, Qatar, Singapore, South Korea, Sweden, Switzerland, United Kingdom, United States; DIGITALIZING countries: Argentina, Belarus, Bulgaria, Chile, China, Cyprus, Ethiopia, Georgia, Hungary, India, Indonesia, Iran, Italy, Japan, Kazakhstan, Kuwait, Malaysia, Mali, Mexico, Philippines, Poland, Russian Federation, Rwanda, Slovenia, South Africa, Spain, Thailand, Trinidad and Tobago, Turkey, Uruguay, Vietnam, Zambia; LOW-ADOPTER countries: Algeria, Armenia, Azerbaijan, Brazil, Burkina Faso, Colombia, Ecuador, Egypt, Ghana, Guatemala, Iraq, Jordan, Haiti, Kyrgyzstan, Lebanon, Libya, Moldova, Morocco, Nigeria, Pakistan, Peru, Romania, Serbia, Tunisia, Ukraine, Uzbekistan, Yemen, Zimbabwe.

tie patterns, a finding that, on the one hand, points to further research questions about the social conditions and consequences of technology use, and at the same time cautions against expectations rooted in technological determinism.

4. Conclusions

The three clusters of countries identified in our study, namely digitalized, digitalizing, and low-adopter, offer very different settings for bridging the digital divides and highlight the complexity of the social circumstances of technology use worldwide. This evidence-based argument on the social embeddedness of the digital transformation in the pre-Covid-19 world can enrich the reflections on policies, programs, and interventions aimed at managing the tide of digitalization triggered by the global pandemic. As such, it can act as a standard against which to measure the impact of the current, intensified phase of digitalization.

The social capital posture of low adopter societies calls into question any overly optimistic readings suggesting that the second or even the first digital divide has become obsolete worldwide. In fact, even the very access to those digital affordances that could invigorate social interactions with potential benefits is limited in vast parts of the world. At the same time, it is not simply access to technology and a fitting habitus in its use, but rather the development of a complex set of public and private institutions and practices that poses the greatest challenge to low adopter societies given their limited social and political activity and low institutional and generalized interpersonal trust. While this is something that policy interventions may be able to rectify to some extent, these countries still have to reckon with a social setting marked by overwhelmingly low levels of trust.

The social capital profile of digitalizing countries confirms that they are already in a position to reap the advantages of having access to and making use of a wide array of technologies. However, to improve their situation, they most likely have to reinforce their institutions in general, while at the same time enabling and promoting (and by no means hampering) cooperation among their citizens in settings normally not in the limelight of public policy, such as workplaces, civil society, and learning environments. As investments exclusively in technology might not suffice, these countries also need to pay attention to social embeddedness when designing digital inclusion interventions.

The social capital profiles of digitalized countries suggest that their intensive use of technologies is predicated upon a whole range of social and institutional conditions whose cultivation is not merely a matter of employing more technology but they have to sustain social and institutional processes with logics of their own, such as the reproduction of high levels of generalized interpersonal trust and institutional confidence. It is an entirely open question how the trust patterns in these countries have been affected by the Covid-19 pandemic (Delhey et al., 2021). The trust response can cut both ways: It can either reinforce or deplete confidence in expertise and the institutional processes most involved in creating measures to combat the pandemic, namely state capacities and scientific discovery feeding into technological innovation. Likewise, the pandemic has also put a strain on generalized interpersonal trust, as individual-level compliance and cooperation have been central to the success of anti-pandemic measures and continue to be vital to programs for recovery.

As opposed to academia, where attempts at blending the agendas of social capital and digital practices are already apparent, the policy world has only just begun to combine the goals of strengthening social capital and closing digital gaps in development and intervention programs (e.g., UNDP, 2023). Our study offers a framework for reflection on how closely intertwined these two aspects are and supplies empirical evidence of the structural conditions that have to be taken into account when devising targeted interventions. It is not simply technology rollout, but also the social and institutional embedding of technology use that is essential to achieving positive business, educational, health, and other outcomes (Chen, 2013; Stilinovic & Hutchinson, 2021).

As the world enters a new area of unprecedented, Covid-19-induced improvements in access to and use of digital technology worldwide, the social embedding of these processes, we argue, takes place in three very different types of social contexts. The structural factors captured by the social capital profiles of digitalized, digitalizing, and low-adopter societies are likely to shape the outcomes of digital practices performed by businesses, public and nonprofit organizations, as well as citizens more broadly. Low-adopter societies, in particular, are in a challenging situation, as the resources available to their social and institutional infrastructure have thus far not combined well with digitalization. Whether the strength of strong ties, manifest in low-adopter societies' bonding social capital assets, could invigorate a new variety of digital transformation remains to be seen. The social capital perspective promoted by this article can inform the design of inclusion policies aimed at tackling the vast digital inequality gaps exposed by the Covid-19 pandemic (Nguyen et al., 2021; Robinson, Schulz, Blank, et al., 2020; Robinson, Schulz, Dunn, et al., 2020; van Deursen, 2020).

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Conflict of Interests

The authors declare no conflict of interests.

Supplementary Material

Supplementary materials for this article are available online in the format provided by the author (unedited).

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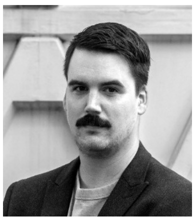

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