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The relationship between inequality and poverty in developing countries: mitigating role of virtual social network and internet access in schools

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Abstract

Purpose – This research complements the extant literature on poverty and inequality by assessing the role of "virtual social networks" and "internet access in schools" in mitigating the incidence of inequality on poverty.

Design/methodology/approach – Using secondary data, the focus of the study is on developing countries and the empirical evidence is based on Tobit regressions.

Findings – The study shows that inequality unconditionally increases poverty while "virtual social networks" and "internet access in schools" negatively moderate the effect of inequality on poverty. An extended analysis provides thresholds of "virtual social networks" and "internet access in schools" at which, the unconditional positive effect of inequality on poverty is completely dampened and above which, negative incidences on poverty are apparent. These attendant information technology thresholds are below average levels in the sampled countries.

Originality/value – The study complements that extant literature by assessing the role of virtual social networks and internet access in schools in mitigating the incidence of inequality on poverty in developing countries. Policy implications are discussed in the light of Sustainable Development Goals.

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Keywords Information technology, Inequality, Poverty

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1. Introduction

This inquiry into the role of virtual social networks and internet access in schools in mitigating the incidence of inequality on poverty in developing countries is premised on three main factors, notably: (1) the challenging policy syndromes of poverty and inequality in the light of sustainable development goals (SDGs); (2) the growing importance of information technology in addressing the attendant policy syndromes and (3) gaps in the extant contemporary literature. These motivational elements are put in more perspective in the following passages.

First, mitigating poverty in all its forms to a threshold of below 3%, including extreme poverty, represents one of the most important challenges to SDGs in the post-2015

development agenda (Bicaba *et al.*, 2017; Moyer and Bohl, 2019). Moreover, most studies are also consistent on the position that reducing poverty should be contingent on reducing income inequality because the response of poverty to economic prosperity decreases with growing levels of inequality (Nguyen *et al.*, 2020). It follows that two main factors/variables of interest in this study are substantial policy syndromes that need to be tackled in order to meet most poverty- and inequality-related SDGs. These underlying policy concerns can be addressed by a third factor (i.e. information technology) which has been documented to promote inclusive development in developing countries.

Second, there is an evolving strand of literature on the relevance of information technology in addressing challenges to SDGs such as poverty and inequality in developing countries (Tchamyou *et al.*, 2019a) and building knowledge economies for sustainable development (Tchamyou, 2017; Tchamyou *et al.*, 2019b; Karakara and Osabuohien, 2019; Ejemeyovwi and Osabuohien, 2020; Kuada and Mensah, 2020; Avom *et al.*, 2020). Unfortunately, most of the attendant literature to the best of our knowledge has leveraged information technology indicators from the World Bank Development Indicators such as the number of personal computer users, internet penetration, mobile phone penetration and fixed broadband subscriptions. By extension, owing to data availability constraints, more contemporary information technology indicators such as use of virtual social networks (VSN) and internet at schools (IAS) have not been given the relevant scholarly attention they deserve, especially as it pertains to their importance in addressing the policy syndromes of poverty and inequality articulated in the previous paragraph. This study therefore contributes to the extant literature by using two novel variables (i.e. use of VSN and IAS) from the Global Information Technology Report (GTIR) to assess how they moderate the effect of inequality on poverty. The focus on these unexploited information technology dynamics is further informed by the need to depart from the extant literature on blanket nexuses between information technology and development outcomes, by providing specific information technology critical masses that are worthwhile in mitigating the corresponding policy syndromes for favorable inclusive human development outcomes.

Third, a substantial body of the literature on nexuses between information technology and development outcomes is concerned with direct linkages between the former and the latter (Karakara and Osabuohien, 2019; Ejemeyovwi and Osabuohien, 2020; Lechman and Popowska, 2022; Afzal *et al.*, 2022). However, in order to produce findings that are more relevant to policy makers in view of the SDGs challenges highlighted above, it is worthwhile to provide policy makers with actionable critical points of the policy variables relevant to addressing the policy syndromes of inequality and poverty. This is essentially because, information technology is proxied in this study as a policy variable, partially due to its documented higher penetration potential in developing countries, compared to their more developed counterparts (Efobi *et al.*, 2018; Karakara and Osabuohien, 2019).

In the light of the above, the question this research attempts to answer is the following: what are minimum levels of information technology or thresholds (i.e. in terms of the use virtual social networks and internet access in schools) needed to dampen the positive effect of inequality on poverty in developing countries? The closest study in the literature to the present study is Asongu and Odhiambo (2020) which has examined information and communication technology (ICT) thresholds that reduce inequality for female economic participation in Sub-Saharan Africa. The following distinctive features are therefore obviously apparent between the two studies. (1) The outcome variable of this study is poverty instead of female economic participation. (2) This research is focusing on developing countries as opposed to countries south of the Sahara. (3) The periodicities of both studies are different. (4) While Asongu and Odhiambo (2020) employ the Generalized Method of Moments, this study employs Tobit regressions in the light of specific constraints pertaining to the outcome variables. (5) While the ICT dynamics considered in the underlying study are

mobile phone penetration, internet penetration and fixed broadband subscriptions, in this study, the use of virtual social network and internet access in schools are taken on board because of their sparse usage in the literature.

In order to address the problem statement, using secondary data and Tobit regressions, the study shows that inequality unconditionally increases poverty while "virtual social networks" and "internet access in schools" negatively moderate the effect of inequality on poverty. An extended analysis provides thresholds of "virtual social networks" and "internet access in schools' at which, the unconditional positive effect of inequality on poverty is completely dampened and above which, negative incidences on poverty are apparent. These attendant information technology thresholds are below average levels in the sampled countries.

The rest of the study is structured as follows. The theoretical underpinnings and attendant literature informing the testable hypothesis are covered in the second section while the third section discusses the data and methodology. The empirical results are disclosed in the fourth section whereas the fifth section concludes with implications and future research directions.

2. Theoretical underpinnings and testable hypothesis

This section is engaged in two main strands. The first discusses theoretical underpinnings surrounding the nexus between information technology and inclusive development whereas the second engages how information technology can dampen the potential association between inequality and inclusive development and by extension, develops a testable hypothesis based on the theoretically discussed nexuses between inequality, information technology and poverty.

The first strand can be discussed from three main theoretical perspectives, namely: the diffusion of innovation theory; the theory of perceived attributes and the theory of individual innovativeness. The attendant theories are expanded in what follows. First, according to the diffusion of innovation theory, diffusion changes in society (including inclusive development) are contingent on the manner in which information and innovation are created and diffused for the progress of society (Rogers, 1995; Hashim, 2008). According to Rogers (1995), there are four principal theories associated with information diffusion, notably: (1) "the theory of perceived attributes"; (2) "the rate of adoption theory"; (3) "the individual innovativeness theory" and (4) "the innovation-decision theory". The first (i.e. "the theory of perceived attributes") and third (i.e. "the individual innovativeness theory") are the closest to the focus of the present study. They are expanded in the same chronology as highlighted.

The theory of perceived attributes is based on the view that individuals are very much eager to select and adopt a particular technology-driven innovation in the light of perceived benefits associated with the adoption of the corresponding technologies, *amongst others*: (1) the relative importance of the innovation over existing information technology innovations; (2) compatibility of contemporary innovations with individuals' existing practices, existing values and previous experiences; (3) the nature of complexity in the innovation; (4) evidence of a trial period before adopting the technology and (5) observable features in terms of benefits upon the adoption of the innovation (Rogers, 1995; Hashim, 2008). The underlying features are broadly consistent with the focus of the present study in the light of the fact that before adopting a specific technology for perceived benefits to reducing poverty, individuals consider some or all the five characteristics, *inter alia*.

The theory of individual innovativeness is largely founded on the peculiarities of an individual who is adopting a specific innovation as well as the time at which the corresponding innovation is being adopted. In the context of our study, irrespective of the level of adoption in the theoretical literature (Rogers, 1995; Hashim, 2008), individuals can adopt a given information technology for the purpose of alleviating poverty. In other words, the factors of individual innovativeness are just a matter of time in the light of the levels of

adoption, namely: risk-takers or pioneers (first category of innovators); early adopters (second category); early majority, late majority and laggards (fifth and last categories).

In the second strand, to connect the discussed theoretical underpinnings with inclusive development in the perspective of poverty alleviation which is the context of this study, it is important to note that information technologies (such as "use of virtual networks" and "internet access in schools") can be used to reduce poverty if individuals are convinced in their perceived attributes (i.e. "theory of perceived attributes") and if individuals want to innovate out of poverty (i.e. "theory of individual innovativeness"). However, at the practical level, the suggested theoretical connections can be constrained by *inter alia*, existing levels of inequality, given that not all individuals can leverage information technology opportunities at the same rate. Hence, income levels can determine how the above theoretical underpinnings are practically relevant to individuals. This is consistent with the documented studies on the unfavorable role of inequality in the equal benefits of information technologies for socio-economic development outcomes (Efobi *et al.*, 2018; Tchamyou *et al.*, 2019a).

In the light of the above, in order to develop the testable hypothesis, it is relevant to articulate that: (1) inequality increases poverty; (2) information technology reduces inequality and (3) information technology can mitigate the positive inequality-poverty nexus. These are engaged in what follows. Accordingly, cross-country differences in poverty levels are substantially connected to inequality, because *inter alia*, in the era of globalization, initial levels of economic development in countries around the world influence the degree by which poverty is alleviated in the corresponding countries (Beaudoin, 2007; Dasandi, 2014). Moreover, contemporary literature has documented that ICT reduces inequality (Efobi *et al.*, 2018; Asongu and Odhiambo, 2018) and ICT is relevant in influencing the effect of inequality on inclusive development (Asongu and Odhiambo, 2020). Given these insights, the following testable hypothesis is examined in the empirical section of the study.

> *H1.* Information technology reduces the positive effect of inequality on poverty and by extension; some thresholds of information technology should be exceeded in order for information technology penetration to completely dampen the positive effect of inequality on poverty.

In spite of the highlighted testable hypothesis, it is relevant to note that the adoption of information technology is not exclusively designed to reduce poverty, not least, because a multitude of benefits are also linked to information technology adoption, notably: higher income and employment opportunities; a more fulfilled life and better coping frameworks (Laal, 2012; Dzator *et al.*, 2023; Gu *et al.*, 2023). How the adoption of technology affects poverty within the remit of the study is framed to be contingent on extant levels of income inequality. Hence, according to the problem statement, how technology adoption affects poverty depends on many factors, *inter alia*, income inequality which is considered in this study. Whether income inequality is a significant channel in addition to other documented factors in the extant literature is a subject of empirical validity which is the object of the empirical results section.

3. Data and methodology
3.1 Data
The focus of the research is on 57 developing nations using an unbalanced panel data from 2012 to 2016 [1]. Developing countries within the context of the study are non-OECD (the Organization for Economic Co-operation and Development) countries for which the relevant data are available. Non-OECD countries are characterized by comparatively more poverty relative to their OECD counterparts. Hence, the relevance of non-OECD countries in addressing concerns of poverty. The temporal and geographical scopes of the study are contingent on availability of data at the time of study, notably: there are constraints in access

to "virtual social network" and "internet access in schools" data from the GTIR. The motivation for employing these information technology variables has been discussed in the introduction, notably, to depart from the extant literature that has largely focused on information technology variables from the World Development Indicators (WDI) of the World Bank such as internet penetration, mobile phone penetration, number of personal computer users and fixed broadband subscriptions (Asongu and le Roux, 2017; Afutu-Kotey *et al.*, 2017; Asongu and Asongu, 2018; Abor *et al.*, 2018; Uduji and Okolo-Obasi, 2018a, 2018b; Asongu *et al.*, 2018; Gosavi, 2018; Issahaku *et al.*, 2018; Humbani and Wiese, 2018).

The outcome variable which is the poverty headcount ratio is obtained from WDI of the World Bank and denotes poverty at national poverty lines as a percentage of the population. The choice of the poverty indicator is consistent with contemporary poverty literature (Mahembe and Odhiambo, 2019a, b). The Gini coefficient which is from the Global Consumption and Income Product (GCIP) and measures the distribution of wealth across a given population, is informed by contemporary inequality literature (Tchamyou, 2019, 2020).

In order to take the concern of variable omission bias on board, the following variables in the conditioning information set are considered, namely: remittances inflows, population, inclusive education and adult literacy. The choice of these control variables is informed by contemporary inclusive human development literature (Asongu and Kodila-Tedika, 2017; Mlachila *et al.*, 2017; Asongu *et al.*, 2019). In what follows the expected signs are discussed.

First, the size of the population is expected to be positively associated with poverty because more citizens have to share the fruits of economic prosperity, *ceteris paribus*. However, it is also important to note that if an increasing population size is linked to more economic prosperity and that the fruits of economic prosperity are more equitably distributed across the attendant population, population size might be associated with decreasing poverty levels. Second, remittance inflows are anticipated to increase poverty levels in developing countries because most citizens migrating abroad have been documented to be from the wealthier fraction of the population and by extension; on average, rich households are further enriched at the expense of poor households when remittances are sent back to countries of origin. This narrative on the anticipated nexus between remittances and inclusive development outcomes is consistent with attendant inequality literature (Anyanwu, 2011; Meniago and Asongu, 2018). Third, on the contrary, gender parity inclusive education and adult literacy are expected to reduce poverty because they are associated with measures that offer more opportunities for social inclusion, safety nets and upward economic mobility. Appendixes 1–3 respectively, disclose the definitions and sources of variables, the summary statistics and correlation matrix.

3.2 Methodology
The estimation approach in this research is informed by documented studies on the relevance of motivating the choice of an empirical strategy with data behavior (Kou *et al.*, 2012; Asongu and Nwachukwu, 2016). With regard to the Tobit regressions adopted in this study, the outcome variable used is consistent with the attendant empirical approach because it is situated within a specific interval (i.e. from 0 to 100%). This is essentially because the poverty headcount ratio at the national poverty line is expressed as a percentage of the population. Moreover, the selection of the Tobit regression is in accordance with studies in which the dependent variable falls within a specified interval (Ajide *et al.*, 2019; Lashitew *et al.*, 2019).

It is worthwhile to note that non-contemporary Tobit-oriented literature maintains that Ordinary Least Squares (OLS) are inappropriate for estimating outcome variables that, by construction, are censored from 0% to 100%, notably: Kumbhakar and Lovell (2000), Koetter and Vins (2008), Kumbhakar and Lovell (2000), Ariss (2010) and Coccorese and Pellecchia (2010). Within the specific context of this study, from the summary statistics, the dependent variable ranges from 0.400 to 66.500% with respectively, theoretically minimum and

maximum values of 0 and 100%. It follows that the outcome variable is in percentage of the population which implies that by definition, it is censored between 0 and 100%. Hence, a double censored Tobit estimation technique is worthwhile as empirical strategy. Furthermore, an OLS technique is unlikely to generate consistent estimates in the light of the fact that the corresponding technique does not consider variations in the conditional probability of poverty for limited observations which is the case of countries that are characterized by 0% poverty rate or by 100% poverty rate (Amemiya, 1984).

Given the above consideration, a doubled censored Tobit regression strategy is adopted for this research because it is theoretically designed to censor the poverty rate of distribution at both ends of the corresponding distribution. The following equations therefore, denote the standard Tobit modeling approach (Tobin, 1958; Carson and Sun, 2007)

$$y_{i,t}^* = \alpha_0 + \beta X_{i,t} + \varepsilon_{i,t}, \tag{1}$$

where $y_{i,t}^*$ is a latent response variable, $X_{i,t}$ is an observed $1 \times k$ vector of explanatory variables and $\varepsilon_{i,t} \approx$ i.i.d. N(0, σ^2) and is independent of $X_{i,t}$. Contrary to observing $y_{i,t}^*$, we observe $y_{i,t}$:

$$y_{i,t} = \begin{cases} y_{i,t}^*, if\, y_{i,t}^* > \gamma \\ 0, if\, y_{i,t}^* \leq \gamma, \end{cases} \tag{2}$$

where γ is a non-stochastic constant. It follows that, the value of $y_{i,t}^*$ is missing when it is less than or equal to γ.

It is worth articulating that the Tobit model is characterized by the following underpinnings: (1) the normal distribution of residuals and (2) a latent outcome variable that is not bounded and which is a linear function of the predictors considered (Amemiya, 1984). Consistent with Lashitew *et al.* (2019), two main marginal effects are apparent from the predictors: (1) one reflects the marginal impact of the predictors on the latent, unobserved poverty rate whereas (2) the other shows the observed, censored poverty rate. In the next section of this study, contrary to Lashitew *et al.* (2019), both are presented because one can be used for a robustness check on the other given that in the light of engaged interactive regressions, the corresponding thresholds from the moderating variables should be the same.

4. Empirical results

The empirical findings are presented in this section in order to assess the validity of the testable hypothesis enunciated in Section 2, notably: that technology reduces the positive effect of inequality on poverty and by extension; some thresholds of information technology should be exceeded in order for information technology penetration to completely dampen the positive effect of inequality on poverty. It follows that for the attendant hypothesis to be valid, three conditions should be fulfilled: (1) the unconditional effect of inequality on poverty should be positive; (2) the conditional effect from the interaction between information technology and inequality (i.e. the Gini coefficient) should be negative and (3) corresponding information technology thresholds at which the unconditional positive effect of inequality on poverty is completely dampened should make economic sense and be policy relevant. This third condition is worth putting in greater perspective. Accordingly, just by computing a threshold from a moderating variable is not synonymous to policy relevance because the attendant threshold should be situated within the statistical range disclosed in the summary statistics.

In the light of above criterion, the following are apparent in Table 1 with respect to the hypothesis being tested: (1) the unconditional effects of inequality on poverty are consistently

	Model 1 Coefficient	Model 2 dy/dx	Model 3 Coefficient	Model 4 dy/dx	
Constant	−40.802 (0.339)	–	−45.955 (0.382)	–	
Social network	18.257*** (0.006)	17.767*** (0.003)	–	–	
Internet in schools	–	–	28.820** (0.022)	28.058** (0.014)	
The Gini coefficient (Gini)	118.022** (0.024)	114.855** (0.016)	132.410* (0.080)	128.906* (0.067)	
[Social Network] × Gini	−33.506*** (0.004)	−32.607*** (0.002)	–	–	
[Internet in Schools] × Gini	–	–	−54.278** (0.027)	−52.841** (0.018)	
Remittances	0.803** (0.011)	0.781*** (0.008)	0.867*** (0.003)	0.844*** (0.001)	
Population	−0.631 (0.844)	−0.614 (0.843)	−1.536 (0.647)	−1.496 (0.644)	
Inclusive education	16.893 (0.479)	16.439 (0.464)	22.499 (0.374)	21.904 (0.366)	
Adult literacy	−0.215* (0.085)	−0.209* (0.071)	−0.228** (0.032)	−0.222** (0.022)	
Information technology thresholds	3.5224	3.5224	2.4394	2.4394	
Fisher	3.87***		3.11**		
Observations	43	43	43	43	**Table 1.** Information technology, inequality and poverty

Note(s): ***,**,*significance levels at 1, 5 and 10% respectively
Source(s): Authors' own creation

positive across specifications. (2) The conditional or interactive effects between inequality and information technology dynamics (i.e. "virtual social network" and internet access in schools) are consistently negative. (3) The associated thresholds at which information technology dynamics completely dampen the positive relevance of inequality on poverty are within stated statistical ranges and hence, make economic sense and by extension, have policy relevance.

To substantiate the above insights, in Model 1 and Model 2 of Table 1 pertaining to the use of virtual social network, the corresponding virtual social network thresholds of 3.5224 (118.022/33.506) and 3.5224 (114.855/32.607) are within the statistical virtual social network range of 2.571–6.234 disclosed in the summary statistics. In the same vein, the thresholds for internet access at schools are also within the statistical range and hence, have both economic meaning and policy relevance. It follows that in order for the engaged information technology dynamics to completely dampen the unfavorable or positive effect of inequality on poverty, policy makers should ensure that penetration levels of the considered information technology dynamics are beyond the established thresholds. This is essentially because, above the corresponding thresholds, the net effect of inequality on the outcome variable (i.e. poverty) changes from positive to negative. For instance, still considering Model 1 and Model 2 of Table 1, at a virtual social network threshold of 3.5224: (1) the net effect on poverty in Model 1 is 0.000= ([−33.506 × 3.5224] + [118.022]) while (2) the net effect on poverty in Model 2 is 0.000= ([−32.607 × 3.5224] + [114.855]). Hence, it follows that if policy makers increase the likelihood of the engaged information technology threshold by one unit (i.e. 1 + 3.5224), the overall net effect on poverty becomes negative. Accordingly, with a use of virtual social network penetration level of 4.5224, the following net effects on poverty are apparent in

Model 1 and Model 2 of Table 1: (1) −33.505 = ([−33.506 × 4.5224] + [118.022]) for Model 1 and (2) −32.606 = ([−32.607 × 4.5224] + [114.855]) for Model 2. It follows that when the likelihood of the information technology dynamics is above the computed thresholds, the net effect on poverty becomes negative. Since, the likelihood values range from 2.571 to 6.234, and the threshold is 3.5224, it follows that the likelihood of virtual social network use can still be below average levels in sampled countries in order for the incidence of inequality on poverty to be completely mitigated. The narrative extends to the use of internet in schools in Model 3 and Model 4 because the computed threshold of 2.439 is within the corresponding range in the summary statistics (i.e. 1.339 to 5.050) as well as below the average.

It is important to mention that while the unconditional effects of the technology adoption variables are positive on poverty, in the light of the problem statement being considered, the corresponding unconditional effects are not relevant for the outcome of the study. This is because when the partial derivative of poverty with respect of income inequality is considered, the unconditional effects of the moderators become zero and hence, are not used in the computation of the thresholds of the moderators. This narrative is consistent with Brambor *et al.* (2006) on the pitfalls of interactive regressions.

The significant control variables have the anticipated signs discussed in the data section. Accordingly, as expected and justified in the data section, remittances increase the poverty gap because most of those migrating abroad are from richer fractions of the population and adult literacy reduces poverty because it is associated with favorable measures for social inclusion, safety nets and upward economic mobility.

5. Concluding implications and future research directions
This research complements the extant literature by assessing the role "virtual social networks" and "internet access in schools" in mitigating the incidence of inequality on poverty in 57 developing countries using data from 2012 to 2016. The empirical evidence is based on Tobit regressions. The study shows that inequality unconditionally increases poverty while "virtual social networks" and "internet access in schools" interact with inequality to reduce poverty. An extended analysis provides thresholds of "virtual social networks" and "internet access in schools' at which, the unconditional positive effect of inequality on poverty is completely dampened and above which, negative incidences on poverty are apparent. These attendant information technology thresholds are below average levels in the sampled countries. Policy implications are discussed in the light of Sustainable Development Goals with particular emphasis on information technology, inequality and poverty.

First, the criticality of information technology in addressing policy syndromes for development outcomes in the sustainable development era is particularly relevant for developing countries (compared to their developed counterparts) owing to the fact that these countries are characterized by a higher potential for information technology penetration. This high potential for penetration is an indication that policy makers can leverage it to address policy concerns/syndromes such as poverty and inequality. This study has provided actionable thresholds that policy makers in the sampled countries can use to fight inequality for poverty reduction. In other words, the empirical analysis informs policy makers on how they can enhance the penetration of the attendant information technology for the desired outcomes on inclusive development within the frameworks of poverty and inequality.

Second, inequality is a glaring policy syndrome in the contemporary era because the response of poverty to economic growth is a decreasing function of inequality (Nguyen *et al.*, 2020). It follows that externalities of information technology in reducing poverty by means of mitigating inequality can be broadened to other fronts of economic development. This is even more relevant in developing countries because despite enjoying economic growth over the

last 2 decades, most of them did not achieve the global development agenda of reducing extreme poverty by half from the mid-1990 levels (Asongu and le Roux, 2019).

Third, reducing extreme poverty to a threshold of below 3% is a target of SDGs (Bicaba *et al.*, 2017) and most SDGs are also related to the reduction of poverty. It follows that by mitigating extreme poverty, there are a plethora of externalities on other SDGs associated with poverty reduction.

The findings have shown that social networks and information technology are fundamental in driving inclusive development as apparent in the corresponding literature on the externalities of networks and information technology (Etzkowitz and Leydesdorff, 2000; Lechman and Popowsaka, 2022; Cántaro *et al.*, 2023; Gu *et al.*, 2023). Hence, the study underscores the relevance of collaborative nexuses, especially by means of information technology in addressing poverty- and inequality-related concerns that are standing on the path towards the achievement of SDGs. The findings also confirm the theoretical underpinnings surrounding collaborative innovation for inclusive development outcomes, especially as it pertains to the "innovation network theory" (Powell and Grodal, 2006; González-Moreno *et al.*, 2019). Hence, given that the attendant theoretical underpinnings are broadly confirmed within the remits of the nexus between income inequality and poverty, social networks should be given more consideration in the design of innovation policies that shape the creation and diffusion of information within knowledge-based economies for sustainable development prospects.

Future studies can improve the established findings by leveraging novel information technology proxies to assess the underlying linkages covered. Moreover, investigating the attendant nexuses within country-specific frameworks would obviously provide more targeted country-specific implications. However, such country-specific research prospects are only feasible with the unfolding of time as more data become available. At the time of the study, the corresponding data were sparse and thus, it is worthwhile for future studies to assess if the findings withstand empirical scrutiny when more updated data and number of sampled countries are employed. The corresponding future studies should adopt the relevant estimation techniques that take into account apparent concerns of cross-sectional dependence and reverse causality as well as unobserved country and time heterogeneities, which are shortcomings in the present study. The debated effects of some of the control variables on the outcome variable can also be the object of future studies.

Notes

1. The sampled countries are: Armenia; Bangladesh; Benin; Bhutan; Bolivia; Burkina Faso; Burundi; Cambodia; Cameroon; Cape Verde; Chad; Côte *d*'Ivoire; Egypt; El Salvador; Ethiopia; Gambia; Georgia; Ghana; Guatemala; Guinea; Guyana; Haiti; Honduras; India; Indonesia; Kenya; Kyrgyz Republic; Lao PDR; Lesotho; Liberia; Madagascar; Malawi; Mali; Mauritania; Moldova; Morocco; Mozambique; Myanmar; Nepal; Nicaragua; Nigeria; Pakistan; Philippines; Rwanda; Senegal; Sierra Leone; Sri Lanka; Swaziland; Syria; Tajikistan; Timor-leste; Uganda; Ukraine; Vietnam; Yemen; Zambia and Zimbabwe.

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Further reading

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Appendices

Variables	Signs	Definitions of variables (measurements)	Sources
Poverty head count	Poverty	Poverty headcount ratio at national poverty lines (% of population)	WDI
Social Network	SocialN	Use of virtual social network. In your country, how widely are virtual social networks used (e.g. Facebook, Twitter, LinkedIn)? [1 = not at all used; 7 = used extensively]	GTIR
Internet in School	InternetS	Internet access in schools. In your country, to what extent is the Internet used in schools for learning purposes? [1 = not at all; 7 = to a great extent]	GTIR
Inequality	Gini	The Gini index is a measurement of the income distribution of a country's residents	GCIP
Remittances	Remit	Remittances inflows to GDP (%)	WDI
Population	Pop	Logarithm of the total population	WDI
Inclusive education	IncluEdu	School enrollment, primary and secondary (gross), gender parity index (GPI)	WDI
Adult literacy	AdultL	Literacy rate, adult total (% of people ages 15 and above)	WDI

Note(s): WDI: World Development Indicators of the World Bank. GTIR: Global Information Technology Report. It important to note that while the values from the GTIR theoretically range from 1 to 7, when there is no official data, zero is assigned
Source(s): Authors' own creation

Table A1.
Definitions of variables

	Mean	SD	Minimum	Maximum	Observations
Poverty	28.241	15.765	0.400	66.500	84
Social network	4.828	0.674	2.571	6.234	264
Internet at school	3.240	0.843	1.339	5.050	264
Gini coefficient	0.501	0.088	0.257	0.635	217
Remittances	4.363	5.772	0.004	29.591	265
Population (log)	6.946	0.652	5.599	8.269	255
Inclusive education	0.966	0.081	0.692	1.095	181
Adult literacy	71.882	19.428	26.176	99.773	262

Note(s): S.D: Standard Deviation. It important to note that while the values from the GTIR theoretically range from 1 to 7, when there is no official data, zero is assigned
Source(s): Authors' own creation

Table A2.
Summary statistics
(2012–2016)

	Poverty	SocialN	InternetS	Gini	Remit	Pop	IncluEdu	AdultL
Poverty	1.000							
SocialN	0.079	1.000						
InternetN	−0.003	0.842	1.000					
Gini	0.091	0.136	−0.130	1.000				
Remit	0.306	0.267	0.223	−0.012	1.000			
Pop	−0.086	−0.081	−0.049	0.077	−0.187	1.000		
IncluEdu	0.048	0.183	0.294	−0.080	0.398	−0.083	1.000	
AdultL	−0.072	0.683	0.810	−0.189	0.264	0.006	0.398	1.000

Table A3.
Correlation matrix
(uniform sample
size: 43)

Note(s): SocialN: Social Network. InternetS: Internet at School. Gini: Gini Coefficient. Remit: Remittances. Pop: Population. IncluEdu: Inclusive Education. AdultL: Adult Literacy
Source(s): Authors' own creation

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