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USO DE REDES SOCIAIS PARA APOIAR ATIVIDADES DE GESTÃO POR PRODUTORES RURAIS: UMA ANÁLISE COM PARTICIPANTES DO ESTADO DE MINAS GERAIS, BRASIL

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ABSTRACT

In this study, we analyze the role of Information and Communication Technologies (ICTs) in supporting management activities in rural areas of Brazil. To do so, we used a dataset of responses from 113 farmers located in Minas Gerais State, which is a relevant area of the Brazilian agribusiness sector. Descriptive analysis indicated that WhatsApp was the application with the highest frequency of use during the week. Moreover, respondents perceive that they have the necessary resources to use ICTs, as well as an appropriate knowledge of these resources. This study reinforces the relevance of considering regional aspects when analyzing the adoption of new technologies, especially in Brazil, a country that has inequalities and cultural differences among internal regions.

Keywords: Diffusion of Innovations; Social Networks; Regional Issues; ICT4D; Information Technology; Information Poverty.

RESUMO

Neste estudo, analisamos o papel das Tecnologias de Informação e Comunicação (TICs) para suporte às atividades de gestão por produtores rurais do Brasil. Para tanto, utilizamos um conjunto de dados de respostas de 113 agricultores do estado de Minas Gerais, que é uma área relevante do setor do agronegócio brasileiro. A análise descritiva indicou que o WhatsApp foi o aplicativo com maior frequência de uso durante a semana. Além disso, os respondentes percebem que possuem os recursos necessários para utilizar as TICs, bem como um conhecimento adequado desses recursos. Este estudo reforça a relevância de considerar aspectos regionais na análise da adoção de novas tecnologias, especialmente no Brasil, um país que apresenta desigualdades e diferenças culturais entre as regiões internas.

Palavras-chave: Difusão de Inovações; Redes sociais; Questões Regionais; TIC4D; Tecnologia da Informação; Pobreza de Informação.

1. INTRODUCTION

1.1 Context and Objective

There are many advantages of Information and Communication Technologies (ICTs) in supporting management activities, and information technologies can provide better conditions of business management for rural producers. In this way, farm businesses can achieve better performance using Internet (Khanal; Mishra, 2016), social media (Morris; James, 2017) and smartphones (Michels *et al*., 2019) in management. Resources related to ICT reduce time spent by farmers with displacement, improve their communication, responsiveness and information access and optimize processes (Islam *et al*., 2018; Steinke *et al*., 2020). Mobile phones provide better opportunities to increase income and reduce vulnerabilities experienced by farmers (Msoffe; Lwoga, 2019). ICTs still help to identify market opportunities (Hoang, 2020) and agriculture services that can be extended with use of ICTs (Birke; Knierim, 2020), which is especially relevant in areas where digital inclusion is in progress.

Considering that information access can contribute to social inclusion (Mckeown, 2016), ICTs adoption can collaborate with the performance of farmers and benefit their communities in a social and economic perspective. Consequently, the use of ICTs can be positively associated with the economic growth of a country (Tripathi; Inani, 2020), and it plays a relevant role for development (Malaquias; Malaquias; Hwang, 2017). In this case, these technologies are also known as Information and Communication Technologies for Development (ICT4D). "The main focus of both research and practice in the [ICT4D] field is the so-called developing countries and, in particular, emphasis is often placed on the less materially advantaged members of those societies" (Walsham, 2017, p. 18).

Despite the advantages of ICTs and their contribution for development, Aldosari *et al*. (2019) verified that some farmers still have doubts about ICT4D usefulness. Access and adherence to ICT4D among different population layers involve challenges and barriers, related to social, cultural, institutional and political aspects of society (Zheng *et al*., 2018). Following this reasoning, practices of ICT4D are guided by different players, with social and economic differences; these players can also be inserted in diverse historical and cultural contexts (Dearden; Kleine, 2020). Therefore, these asymmetries should guide ICT4D-related research, since information and inferences from these studies can vary among regions and countries.

A dichotomy that exemplifies this situation is the differentiation in the use of technological resources, or the extent to which they are used, when comparing urban and rural managers. In the rural environment, managers may face barriers that are not frequently observed in the urban environment. As examples, we can mention training access to the use of technologies (Morris; James, 2017) and rural infrastructure (Chen *et al*., 2011; Adeleke, 2020). This perception is in line with the observation made by Cibangu (2020) about research related to the use of cellphones in rural areas, considering that these places are "characterized by specific things that could be misleading and indeed dangerous to human life if ignored, such as lack of electricity, police, Internet, road, bank, cash, house, hospital, toilet, store, government, safe drinking water, etc." (Cibangu, 2020, p. 20). This discussion also gain attention in the context of information divide, a distinction among societies based on resources and access of information (Goulding, 2001).

In this way, improvements in rural management considering new technological resources should be a permanent goal in a developing country where the agribusiness has a relevant participation on the economy. This is the case of Brazil, where agribusiness plays a relevant role for the economy (CNA, 2020), being responsible for the majority of exportation products (CNA, 2017). The use of ICTs is increasing among Brazilian farmers (ABMRA, 2017), so it is an interesting point to understand whether (and how) this use is applied to management. Thus, this paper aims to answer the following research question: What is the role of ICT tools to the management of Brazilian rural businesses? Following this research question, the main purpose of this paper is to understand the role of ICT tools to the management of rural businesses.

1.2 Relevance of the study

Brazil is a large country and it is important to mention that Brazil has differences at a regional level, so, even in the country, practices and barriers related to ICT4D are diverse and with different initiatives to achieve improvements. For example, based on the research conducted by the Brazilian Institute of Geography and Statistics (IBGE, 2018b), in the Southeast region of Brazil, 68.5% of the population living in rural areas had a mobile cellphone; this percentage varies among regions, being 76% in Midwest, 71.9% in South, 51.2% in North East and 40.4% in North region. While the Brazilian Southeast was the region with the higher levels of access of the population to the Internet

(81.1%), the North and North East registered lower percentages (64.7% and 64%, respectively). The main reasons related to the low levels of Internet use among rural inhabitants were lack of interest, the price of the service (considered as expensive) and the absence of the necessary knowledge to use it among the residents of the household (IBGE, 2018b).

In this context, the understanding of ICTs use in Brazil, as well as the proposals aimed at improving rural access to technology, must consider the features of each respective region. This factor reinforces the relevance of this research, which takes as a reference a prominent region in Brazilian agribusiness. The results related to research in this area can also provide useful information to support joint actions between Internet service companies and government programs, aimed at improving the quality of life of individuals who live in rural areas. Cost reduction of Internet access should be included in this agenda. These initiatives can also facilitate the democratic access to information, as well as the professional development of rural producers. The main results of this paper have the potential to encourage capitation and training activities designed to rural producers through government schools, telecommunication companies, financial institutions, cooperatives, and rural syndicates, which usually have a closer contact with the farmers.

The implementation of such actions requires the identification of characteristics related to the use of ICT by rural producers, allowing the identification of gaps that could be addressed and tools that could present a better adherence to the rural managers' reality. Thus, this research provides information that can support the implementation of actions mentioned in the previous paragraphs. Additionally, the identification of technological tools and social networks most used by rural producers can guide proposals aimed at optimizing the use or improvement of these technologies for rural management.

This paper also contributes to the debate on inequalities, since inequalities and poverty can generate other negative effects to the society, preventing, for example, developmental opportunities (Matli; Ngoepe, 2021). Information poverty "can be the result of no available information, it can also arise when information is available but people cannot understand it or apply value to it" (Mckeown, 2016, p. 3). Latin America, a region where Brazil is located, is marked by social and economic inequalities (Barja; Gigler, 2007), which indicates the relevance of studies related to resources that affect information access in the region.

Moreover, the results of the study can be discussed considering the context of information poverty and information divide, since the development of human freedom requires a better understanding of information and communication issues (Sen, 1999; Goulding, 2001; Barja; Gigler, 2007). Therefore, this paper can contribute to the literature addressing information poverty (Chen *et al*., 2011).

Previous research addressed the use of mobile devices in rural areas (Alam; Wagner, 2016; Steinke *et al*., 2020; Cibangu, 2020); this study expands previous research by analyzing mobile devices use and social networking platforms specifically in managerial practices of rural producers from Brazil. Moreover, we considered a perspective involving the use of Internet and social networking platforms (WhatsApp, Instagram and Facebook) in the managerial process of rural property. Although there are studies that analyzed the use of social networks on management (Ollington *et al*., 2013; Morris; James, 2017; Naeem, 2019a), this approach is not usually considered in the ICT4D optic with focus on a Latin America country, as explored in this research.

According to the literature review developed in this study, there are different kinds of research related to ICT4D use in rural areas. Some approaches employed in previous research involve aspects that could be associated to managerial activities done by rural producer (such as learning, training, and access to market information). This research contributes to the current literature since it considers management and its association with ICTs use. When this association is carried out effectively, it can boost economic and social development of rural producers and, therefore, the local and regional development of their communities. The paper also highlights the intensity and the presence of ICT resources, particularly social networks and mobile devices, in the context of rural management in Brazil.

1.3 Some Characteristics of Minas Gerais State, Brazil

The research was carried out in Minas Gerais, a state with the third largest participation in the formation of the Brazilian Gross Domestic Product (GDP). Located in the Southeast region of Brazil, Minas Gerais is the fourth Brazilian state in territorial extension. The local language is the Brazilian Portuguese, as it is in other regions of Brazil.

The history and culture of Minas Gerais are closely related to agriculture and cattle raising. The development of these activities in the region began at the end of the 18th century, with the

decline of the gold cycle. In the course of the 20th century, cattle raising became more relevant to the state's economy, especially after the coffee crisis in the 1930s (CED, 1969). Despite the increase in urbanization and industrial development, in the 21st century agriculture remains as a relevant activity in Minas Gerais, considering social and economic aspects.

The state concentrates 12% of the Brazilian agricultural establishments and is the main producer (or at least one of the main producers) of various items, such as: coffee (49.7% of national production); olives (21%); forestry (20.4%); milk (27%); beans (18.4%); and sugar cane (9.7%). In the year of 2020, Minas Gerais registered an increase in the revenue of grain harvest (SEAPA, 2021). The activities related to agriculture and cattle raising in Minas Gerais also enable the production of derivatives from animals and plants, that have economic and cultural relevance.

1.4 Organization of the Study

This study is organized in five sections, including this introduction. The second section contains a literature review related to ICT4D and information technology in rural areas, as well as the literature related to social networking platforms. Then, we describe the procedures to data collection and data analysis. The fourth section presents the results and discussion and the final section contains the conclusions and implications.

2. LITERATURE REVIEW

2.1 ICT4D in Rural Areas: Benefits, Perceptions and Challenges

There are many advantages of using ICTs in rural areas. For example, Cibangu (2020), using interviews, investigated how cell phones provide development in rural areas of Congo. According to the results of the research, "there is no question that the emphasis of cell phone research on topics such as social networks, business networks, market price, and information asymmetry can be beneficial to cell phone users and society at large" (Cibangu, 2020, p. 28). Moreover, farm businesses can achieve better performance using Internet (Khanal; Mishra, 2016); mobile phones help rural producers to reduce their vulnerabilities (Msoffe; Lwoga, 2019); and agricultural services can be extended through ICTs (Birke; Knierim, 2020).

However, different contexts and personal perceptions can influence the level of access and willingness to use ICT resources. In this way, when evaluated how ICT can contribute to sustainable development in rural communities in Nigeria, Okon (2015) concluded that cultural aspects are associated with the adoption of information and communication technologies, such as Internet, mobile devices, television and radio. Considering other important characteristics beyond the economics in the identification of factors that motivate the adoption of ICT4D in the managerial process, Alam and Wagner (2016) concluded that non-monetary aspects are more relevant for producers; many producers are not aware about the monetary benefits from ICTs use.

Panganiban (2019) developed a case study to analyze e-governance use for rural producers from Philippines. There are limitations commonly observed in relation to these technologies (restrict financing, absence of infrastructure, deficiency in human resources); however, the author highlighted that mobile devices and social media platforms, in the field of e-governance, contribute to producers so they can improve their managerial abilities and their decision making process. Thus, the restrictions observed should be mitigated to provide the development of policies related to e-governance; these policies can contribute to improvements in the agricultural sector (Panganiban, 2019).

Still as barriers to ICT adoption by farmers, there are also the lack of services that adapt to the context and needs in rural areas (Islam; Grönlud, 2011) as well as demographic variables that can affect ICT use. Besides that, Gollakota *et al*. (2020) identified that the factors associated to ICT use for development (information quality, relative advantage, self-efficacy, and availability of other services) differ from the factors associated to ICT use for personal purposes (effort expectancy and cost). Therefore, the strategies to increase ICT adoption among rural producers should vary according to the use purpose.

Based on the previous discussion, one can note several advantages that ICT resources can provide for the development of rural areas; however, some barriers still exist. One is the lack of adequate technological infrastructure, which can increase inequalities in access to information between urban and rural areas (Adeleke, 2020). For example: i) the acquisition of a computer can represent an impracticable investment for low income farmers (Chen *et al*., 2011); and ii) the telephone charge can be different when comparing rural and urban areas (Chen *et al*., 2011). It is

also necessary to develop the skills for rural populations to use and develop through ICT. Therefore, the necessary resources on ICT – skills, tools, infrastructure – can be a preponderant factor for the development of rural areas.

Wyche and Steinfield (2016) proposed that software developers should reconsider "the design of mobile phones, and developing innovative educational interventions" (Wyche; Steinfield, 2016, p.11). AlBar and Hoque (2019) also mentioned the relevance of providing farmers the necessary knowledge to use ICT in the context of rural small and medium enterprises in developing countries.

Digital divide is another issue that requires attention and is related to infrastructure and to the necessary resources to use ICTs. "Not all members of society have access to ICT or to the benefits they bring" and "those who lack access to them become further disadvantaged, since information and services are increasingly, or solely, provided via the new technologies" (Rooksby *et al*., 2002, p. 197-8). For Hossain and Samad (2020), mobile phones reduce communication barriers and digital divide in rural lagging regions, since these devices help farmers to improve their profits, and contribute to women's empowerment in rural areas. This view reinforces the comprehension of ICTs as elements for social and economic development.

According to previous research (Venkatesh *et al*., 2003), another element that may be a barrier to the use of ICT is the users' perception of the compatibility of these tools with their day-to-day activities, as well as the compatibility between the different technologies used. This reasoning can also be extended to the rural areas. For instance, difficulties to reading text in the screen when farmers are in the field on sunny days, lack of skills to input text, inadequate illumination at home, and the use of the same device for many years could discourage the use of mobile devices by farmers (Wyche; Steinfield, 2016) and, therefore, being seen as incompatible with their activities.

For Yoon *et al*. (2020, p.4) "if smart farming technologies are compatible with a farm's current work, the farming organization will be more likely to adopt it". Considering this perspective, the willingness of rural producers to use ICT devices can increase when they perceive compatibility together with the advantages that social networks or other applications bring to managerial activities. Thus, the rural producers could become more inclined to use ICT devices, such as cell phones or laptops, when they realize that WhatsApp or Facebook, for example, favors communication with customers

and suppliers, facilitate the sending and receiving of information or documents and speed up internal processes. This could increase access and dissemination of information, as well as improve management practices and increase the economic returns of rural families and their respective communities.

Age can also be a factor associated with the use of ICTs (Venkatesh *et al*., 2003; Islam; Grönlud; 2011). The different stages of life in which rural producers find themselves could require different strategies for training in the use of technologies. These approaches may be relevant to increase the elderly's access to information and technological resources, which could contribute to their personal and professional development, and to reduce inequalities arising from the age factor.

In this way, Soja and Soja (2020) highlighted that adoption of technology in organizational context needs cooperation between different generations involved, in order to reduce insecurities of older members. Lu and Chang (2016) identified connection difficulties, perception of being too old to learn, expensive access, and not having a device to connect to, such as barriers for senior or older farmers to use Internet. Besides this, some farmers declared they are afraid of computers, they are slow at typing or they are just not interested in using Internet. When analyzed challenges for diffusion of Internet of Things in Latin America, Malaquias and Albertin (2019) pointed out age as a factor related to the use of technologies. Some possible reasons are that it would be harder for old people to handle these resources or they could have a lower level of trust in new technologies.

In addition to age, gender can also be associated with ICT use. Men would be more likely to adhere to new technologies (Minton; Schneider, 1980; Venkatesh *et al*., 2003). Conversely, encouraging women to use ICT could provide them with greater independence and increase their access to information. This reasoning would be in line with Yeganehfar *et al*. (2018), since the authors concluded that there is a gender gap in ICTs use and, in order to increase the participation of women, the authors suggested to reinforce women knowledge and abilities, with equal educational opportunities.

Since ICT can bring many benefits to farmers that reflect socially and economically in the regions where they operate (Khanal; Mishra, 2016; Msoffe; Lwoga, 2019; Zhou *et al*., 2020), those barriers must be faced and solved to facilitate ICTs use ICTs by them.

2.2 Social Networks for Management

There are many advantages of using ICT to perform organizational tasks. For instance, management of human resources can be improved with the use of social networks. These tools mitigate communication barriers between bosses and subordinates, support process of recruiting, selecting, evaluation and engaging people, and reinforce workforce interaction (Yokoyama, 2016). In New Zeland, Ollington *et al*. (2013) highlighted, among other findings, the relevance of Facebook to attract and screen new human resources. The authors pointed out that "companies can also proactively engage with social networks by building their own" (Ollington *et al*., 2013, p. 262).

Furthermore, customers can search for references about a product or service in tools available in mobile devices, and on-line reviews of users can influence purchase intention. Naeem (2019b) identified Facebook, WhatsApp and YouTube as the most used platforms for this purpose in the context of an Islamic country, including the use, by customers, of discussion groups on Facebook and WhatsApp.

Therefore, firm managers, in general, should use information from these mechanisms to understand the perception of customers about services or products, as well as to provide feedback in relation to eventual complaints. The management of this information facilitates firms' responsiveness and can increase reliability and empathy of customers (Naeem, 2019a). Advantages of ICTs for communication with customers and business partners were also observed in the context of the Ghanaian micro-entrepreneurships (Asiedu *et al*., 2019).

Morris and James (2017) observed that social networking platforms, such as Facebook, have an important role for the strategic decision-making process of farmers. These platforms can facilitate the cooperation in agriculture sector, providing conditions to innovate the supply chain and aggregate value to products (Morris; James, 2017). Results of abovementioned studies indicate relevance of social networks, as well the devices associated with their use, to upgrade practices of management.

3. DATA AND METHODS

This research was conducted in the Minas Gerais State, one of the most relevant areas for agribusiness in Brazil. Through paper-and-pencil method, we collected 113 structured questionnaires answered by farmers, applied from December 2018 to April 2019. In this research, we considered as "farmers" those who control rural properties, regardless of size, and who develop agriculture or cattle raising on these properties. The profile of the participants was distinct and ranged from those who live in the city and work in rural production with the help of employees, to those who live on the farm and produce on it, involving also family farming.

Participants are producers of several farm products, such as milk, cattle, soy and corn. The contact with each potential respondent was done in places such as auctions, rural syndicates and agribusiness fairs, justifying the use of the paper-and-pencil method. After obtaining the confirmation that the potential respondent was a farmer, we explained the content of the research and presented the consent form, in which the respondent was informed that he/she could interrupt the participation at any time, that the participation was voluntary, and that we were interested in collecting perceptions (so there were not correct or incorrect answers).

In this research, we seek to reduce eventual limitations for the participation of potential participants. When some participants showed difficulty in reading or understanding some terms used in the questionnaire, we clarified them about the research, the kind of responses, the consent form and other questions related to the expressions used, in addition to reading the questionnaire. The development of a research in the ICT4D field, considering a critical approach, involves a dialogue with the participants, which helps in the development of the concepts of representation and subjectivity (De *et al*., 2018). In some cases, during data collection of this research, the respondents spontaneously told us stories related to their experience, related to their work in rural activities, or related to the use of technologies. These stories provided us with insights related to the use of technologies in the rural context. However, in the quantitative analysis, we only considered the data collected from questionnaires.

In relation to the concept of social media, Fuchs (2017, p.32) points out that it "depends on how one conceives the social"; so this response needs to consider sociological theories. In this

way, the platforms considered as social media in this study meet the definition criteria, since they cover aspects such as a sense of belonging, human cognition, communities and human cooperation. It includes WhatsApp, which allows interaction in groups (communities) with hundreds of members, and two other social networking platforms: Facebook and Instagram.

We analyzed four constructs in this research; Table 1 contains the items related to each construct.

Table 1 | Description of the items

	How many times per week do you use:
USE 1	... MOBILE PHONES for business management?
USE 2	... TABLETS for business management?
USE 3	... LAPTOPS for business management?
USE 4	... COMPUTERS for business management?
	How many times per week do you use:
SN 1	... INTERNET for business management?
SN 2	... WHATSAPP for business management?
SN 3	... FACEBOOK for business management?
SN 4	... INSTAGRAM for business management?
SN 5	Do you usually use social networks in your daily life, for personal purposes? (Yes/No)
	Please, indicate your perception about technology and technology management practices (from 1 to 5) ...
RES 1	... I have the necessary resources to use mobile devices.
RES 2	... I have the necessary knowledge to use mobile devices.
RES 3	... I have the necessary knowledge to use the Internet.
COMPAT 1	... mobile devices are compatible with other technologies that I use.
COMPAT 2	... mobile devices are compatible with my day-to-day activities.

Notes: these items were selected based on previous research, specifically: Adeleke (2020), Benard *et al*. (2019), Khanal and Mishra (2016), Koksal (2016), Malaquias and Albertin (2019), Mandari *et al*. (2017), Morris and James (2017), Ollington *et al*. (2013), Owusu *et al*. (2018), Venkatesh *et al* (2003), Yoon *et al*. (2020); USE represent items related to ICTs Use; SN represent items related to Social Networks; RES represent items related to Necessary Resources; COMPAT represent items related to Compatibility.

On one hand, two constructs (ICTs Use and Social Networks) are represented by the average of days per week in which farmers use the respective tool for management. On the other hand, the other two constructs (Necessary Resources and Compatibility) were obtained through the average of the answers, based in a Likert scale from 1 to 5, where 1 means "totally disagree" and 5 means "totally agree". Cronbach's

Alpha of constructs ranged from 0.69 to 0.77, indicating reliability of them. Age and Gender were also evaluated in the descriptive analysis, considering the importance of these variables to understand ICT use (Venkatesh *et al*., 2003; Koksal, 2016; Lu; Chang, 2016; Owusu *et al*., 2018).

In relation to the use of variables based on the frequency of days (ICTs Use and Social Networks), even indirectly, they indicate some characteristics inherent to the rural context. As previously mentioned, the use of technologies in rural areas can face barriers related to infrastructure (Adeleke, 2020), training (Morris; James, 2017), electricity (Cibangu, 2020), among others. A high frequency of days using a given technology can indicate that the producer has the necessary infrastructure to use it and that it is available for several days of the week (or every day). The daily use of some technological tools can also indicate that the producer is more familiar with such technology, being able to use that resource.

4. RESULTS

4.1 Summary Statistics

Table 2 presents the descriptive statistics of items used in quantitative analysis.

Table 2 | Descriptive statistics of the variables (at the Item level)

Items	N	Mean	S.D.	Min.	p25	p50	p75	Max.
USE 1	113	5.442	2.478	0	4	7	7	7
USE 2	113	0.442	1.586	0	0	0	0	7
USE 3	113	1.513	2.457	0	0	0	2	7
USE 4	113	1.319	2.505	0	0	0	1	7
SN 1	113	3.301	2.933	0	0	3	7	7
SN 2	113	5.035	2.847	0	3	7	7	7
SN 3	113	1.062	2.354	0	0	0	0	7
SN 4	113	0.805	2.125	0	0	0	0	7
SN 5	113	0.513	0.502	0	0	1	1	1
RES 1	113	4.372	0.898	2	4	5	5	5
RES 2	113	4.071	1.050	1	4	4	5	5
RES 3	113	3.823	1.234	1	3	4	5	5
COMPAT 1	113	3.876	1.135	1	3	4	5	5
COMPAT 2	113	4.212	0.839	2	4	4	5	5
AGE	113	52.6	15.2	21	40	53	63	85
GEN	113	0.938	0.242	0.000	1.000	1.000	1.000	1.000

Notes: the variable AGE represents the age of the respondent; GEN represents the variable gender, that receives 1 for males and 0 for females; USE represent items related to ICTs Use; SN represent items related to Social Networks; RES represent items related to Necessary Resources; COMPAT represent items related to Compatibility.

The average of USE was 2.18 days per week, showing that there is space to expand the use of ICTs for rural management among Brazilian farmers. Considering the items of this construct, we observed that the ICT resource used with more frequency is mobile phone (on average 5.44 days per week). This reinforces data by ABMRA (2017) about increase in use of mobile phone by Brazilian farmers. On the other hand, the less used devices were laptops (1.51), computers (1.32) and tablets (0.44). A possible reason for the low usage of these devices is related to size, when compared to mobile phones. When the farmer is in the field or handling production, he/she can find it difficult to use large devices or devices that usually need both hands for usage. Table 3 also contains the descriptive statistics, however, considering the average of the items by construct.

Table 3 | Descriptive statistics at the Construct level (an average of the respective items by construct)

Construct	n	Mean	S.D.	Min.	p25	p50	p75	Max.
ICTs Use	113	2.179	1.644	0.000	1.250	1.750	2.500	7.000
Social Networks	113	2.551	1.910	0.000	1.250	2.500	3.500	7.000
Necessary Resources	113	4.088	0.869	2.000	3.667	4.000	5.000	5.000
Compatibility	113	4.044	0.900	1.500	3.500	4.000	5.000	5.000

Notes: In this table, the average for the construct Social Networks considers the items from SN 1 to SN 4, since SN 5 is a dummy variable.

The average of the construct Social Networks was 2.55 days per week (Table 3), which indicates that farmers are underusing the Internet and social networking platforms for farm management purposes. Among the components of this construct, WhatsApp is the most used tool by the respondents of this research (see Table 2). Farmers use this app for management on average 5.03 days per week, and more than 50% of respondents (precisely 63% of them, consulting the database) use it every day of the week. We presume that an easy to use layout and gathering resources such as text massage, voice massage, video call, group discussions and possibility of make advertising through status are characteristics that can be related to this result. Internet was used on average 3.3 days per week (in this case, Internet is considered for a more comprehensive purpose, such as to seek information for products prices, weather information, e-government platforms among others).

Once there are many advantages that Internet can bring to management, positively affecting farm's performance (Khanal; Mishra, 2016; Msoffe; Lwoga, 2019), it is an interesting point its use by farmers. Facebook is the second less used platform (0.8 days per week), indicating that farmers can expand their perception regarding the benefits of this tool, as presented in previous research addressing social media (Morris; James, 2017). Considering that Instagram has become even more popular and many users have migrated from Facebook to it (Hou; Shiau, 2019), Instagram seems to have emerged as a relevant platform for business. However, it is the least used platform by farmers who answered the questionnaire – less than one day per week (75% of the respondents do not use it).

Farmers agreed they had necessary resources and appropriate knowledge to use ICTs. In the scale from 1 to 5, respondents answered 4, on average. We observed they had a higher perception in relation to having necessary resources and knowledge to use mobile devices (4.37 and 4.07, respectively) in comparison with knowledge to use Internet (3.82). In the same way, average of construct related to compatibility was 4.04. Therefore, on average, farmers agreed when questioned if mobile devices were compatible with other technologies and with their day-to-day activities.

The average age of participants was 52.6 years and 93.8% were males (this information is also available in Table 2). This discrepancy between males and females was also noted when analyzing previous research in Brazilian context, where women farmers are less common in studies (Bracht; Werlang, 2015; Ferreira *et al*., 2017; Almeida; Massarani, 2018; Maia *et al*., 2019; Richards *et al*., 2020). Additionally, the agriculture census of 2017 showed that 86% of Minas Gerais' farms are managed by males (IBGE, 2018a). Thus, the sample seems close to that observed in population.

4.2 Discussion of Findings

The main purpose of this study was to understand the role of ICT tools to the management of rural businesses. We characterize the role played by ICT through the tools and platforms used, as well as the frequency of use, and this frequency can be an indication of the impact of technology on the daily lives of rural producers.

According to the main results, ICT devices such as computers, tablets and laptops have been used by farmers with low frequency for the purpose of management practices. Moreover, a portion

of farmers (25% of the respondents use social networks for management during 3 or more days per week, on average – Table 3) seems to realize the advantages of using Internet and social networks for rural management. Internet is a basic resource to access social media platforms; however, through the Internet, farmers can access other types of information than facilitate their managerial activities, such as products prices, weather information, e-government platforms among others. Considering the various advantages that these mechanisms can provide (Ollington *et al*., 2013; Khanal; Mishra, 2016; Morris; James, 2017), it becomes relevant to expand their use in rural areas. ICT devices and resources can help rural producers to improve their management practices, increase their access to information and expand their forms of communication with suppliers, customers, rural cooperatives and public entities.

Regarding the construct Compatibility, respondents believe that mobile devices, in general, present a good adherence to their daily activities, as well as to other technologies that they use. According to previous studies (Mandari *et al*., 2017; Yoon *et al*., 2020), such perception about compatibility could affect the adoption of ICT resources and improve the use of technologies by farmers. In relation to the construct Necessary Resources, respondents also believe that they have the basic resources to use ICTs as well as the necessary knowledge.

Observing the low scores for many items of ICT use, compared to the average scores for the two previous constructs (Compatibility and Necessary Resources), these results highlight an important gap to increase the use of technology to help rural producers in the management of their businesses. The producers seem to perceive the compatibility of technological resources and believe that they have the basic resources to use them, however, the effective use supporting management activities seems to be low.

A possible reason for these results is that, despite farmers having necessary resources to use these tools in management, they are not necessarily willing to use them. If farmers think they have necessary resources when they actually do not have, this also could cause an indirect effect on ICT use, a relationship that could be tested in future research. In this case, precarious access to ICT resources could negatively affect ICTs use for management purposes, since the unavailability of a given resource can demotivate or decrease the confidence of the producer in using a technological resource for managerial purpose.

The results of this research can contribute to improve the understanding of ICT4D in rural areas, generating information that can support actions to improve the use of technologies by rural producers. By contributing to the managerial process of rural producers, ICTs can provide better performance, leading to efficiency and effectiveness of the business and to well-being of rural producers' families. In turn, the integrated development among rural communities expands local and regional development, generating benefits that also affect other actors of the production chain.

It is worth to consider that, according to a report developed by the United Nations Development Program in partnership with Brazilian research institutions (UNDP, 2017), rural inhabitants have fewer years of schooling, lower income, and lower life expectancy. Actions aimed at improving the quality of life and income of this population, including the use of technologies, contribute to a shared prosperity, reducing poverty and inequality. In this sense, projects aimed at this purpose can apply to get support from international organizations that deal with these issues, such as the World Bank, which invests in related actions in Latin America (World Bank, 2017).

Brazil is a country that has inequalities. Brazil has a value of 53.9 for the Gini index (World Bank, 2021), which is in the same range of other countries such as Mozambique, Botswana and Central African Republic. According to the United Nations Development Programme (UNDP, 2021), considering the Human Development Indicators, Brazil is in the 84º position with an index equals to 0.765. The Purchasing Power Parities of Brazil in 2020 was 2.311, a value closer to Turkey (2.133) and far from countries such as Greece (0.546) and Portugal (0.574) (OECD, 2021).

As presented by Avgerou (2017), the development generated by ICTs is not a relationship of cause and effect; for Qureshi (2017, p. 15), "while ICTs have in fact increased productivity and wealth in many countries of the world, they have also been the cause of income inequality". Despite the usual focus in ICTs as tools to make a better world, Qureshi (2015, p. 512) highlighted that "the key questions that enable academics to make contributions to their field and practitioners to use these contributions to enabling ICT implementations and policies that improve people's lives remain to be discovered".

Therefore, questions may arise about the effective contribution of ICTs to reduce social discrepancies, particularly in countries with a high level of inequality such as Brazil. Considering that inequality is an inherent factor in the capitalist society and that it cannot be completely eliminated,

but reduced, this issue is a key point to be considered in projects and actions aimed at encouraging the use of ICTs by the rural population. As previously mentioned, access to technology in rural areas can face additional barriers when compared to urban areas, such as infrastructure deficiencies and higher costs. We believe that regional analysis, such as the one developed in this study, contributes to actions that can reduce inequalities.

5. IMPLICATIONS AND FINAL REMARKS

This study analyzed the role of ICT tools to the management of Brazilian rural businesses, considering a relevant region for Brazilian agribusiness. We developed and applied a questionnaire to investigate factors that could influence that adoption. One hundred and thirteen (113) participants of study were producers of a range of products, such as milk, corn, cattle, soy and fruits.

We observed that farmers used ICT devices for management on average 2.18 days per week and the most used device was mobile phone. One possible reason pointed out to explain larger use of mobile phones was the facility to handle this device in comparison to laptops, computers and tablets. Social networks were used on average 2.55 days per week for the same purpose, while Internet was used 3.3 days per week. The most frequent of these tools used in management was WhatsApp. We proposed the aggregation of many resources in this app as a possible justification for this preference.

We believe that the results of this study can contribute to actions taken by government, cooperatives, universities and development agencies, addressing the individual and managerial development of rural producers. Projects developed through public-private partnerships, involving electricity, telecommunication and education companies, can expand the access to technology and increase the offer of training opportunities. In this regard, institutions can apply to get support from organizations such as the World Bank, which invests in initiatives aimed at shared prosperity. Therefore, farmers can improve their abilities related to ICTs use, with the potential to become disseminators of this knowledge among friends and relatives. Training can also contribute to the farmer realize the utility of Internet and mobile devices to facilitate the managerial process.

The advantages arising from such actions can increase the financial returns of rural producers, also generating benefits to the economic development of the region. In the social aspect, the development

provided by technology to rural producers can include a more democratic access to information, the possibility of obtaining education and other benefits that, over time, can collaborate to reduce the inequalities observed between the urban and rural areas (UNDP, 2017). It is also important to highlight the existence of opportunities to increase women empowerment in the rural context, offering resources for them to develop skills and competences in ICTs accordingly to their perspectives and specific needs.

Furthermore, this study can expand the literature because we observed characteristics of rural managerial behavior of Brazilian farmers considering the ICTs use perspective. Besides, we analyzed variables that, to the best of our knowledge, were not observed before in the Brazilian rural context, for example, the use of Instagram for rural management. Results presented can contribute to future studies in this area, including research related to ICT4D and the literature addressing technology and the digital divide (Rooksby *et al*., 2002; Hossain; Samad, 2020). Additionally, information divide is a concept that considers the separation among those who have access to a large amount of information and those who are not able to find/interpret/use information (Goulding, 2001); therefore, the results of this study can also advance the understanding of the resources that can facilitate the access of information in rural areas of Brazil.

There are some limitations related to this research that should be mentioned. The first limitation is naturally related to our research questionnaire. It represents a structured form to collect information and does not involve voice recording, for example. The use of interviews with voice recording followed by transcription and content analysis, would offer other directions for the results; however, extensive interviews could affect the number of participants and the number of concepts investigated. Therefore, we employed a structured questionnaire, allowing the participation of more than a hundred respondents. Another limitation is related to our decision of analyzing a Brazilian region in which rural activities are relevant; in other Brazilian regions, where agribusiness is not so representative, the use of information technologies for rural management may present particular characteristics that are not necessarily observed in the cities of Minas Gerais. Moreover, the sample is comprised of responses from a limited number of cities from Minas Gerais.

We recommend that further studies go deeper to identify elements that could expand the understanding about the results related to the constructs Compatibility and Necessary Resources (with large scores) in comparison to the results for the effective adoption of ICT devices for management purposes. Characteristics of farms, such as the complexity level of their products, could also be investigated and included in future research.

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REFERENCES

ABMRA - Associação Brasileira de Marketing Rural e Agronegócio [The Brazilian Association of Rural Marketing and Agribusiness]. **7ª Pesquisa Hábitos do Produtor Rural** [7th Survey on Rural Producer Habits]. Disponível em: http://abmra.org.br/agro-mais-jovem-e-conectado/

ADELEKE, R. Digital divide in Nigeria: The role of regional differentials. **African Journal of Science, Technology, Innovation and Development**, p. 1–14, 2020. DOI: https://doi.org/10.1080/20421338.2020.1748335

ALAM, Md. M.; WAGNER, C. The relative importance of monetary and non-monetary drivers for information and communication technology acceptance in rural agribusiness. **Information Technology for Development**, v. 22, n. 4, p. 654–671, 2016. https://doi.org/10.1080/02681102.2016.1155142

ALBAR, A. M.; HOQUE, Md. R. Factors affecting the adoption of information and communication technology in small and medium enterprises: A perspective from rural Saudi Arabia. **Information Technology for Development**, v. 25, n. 4, p. 715-738, 2019. https://doi.org/10.1080/02681102.2017.1390437

ALDOSARI, F.; AL SHUNAIFI, M. S.; ULLAH, M. A.; MUDDASSIR, M.; NOOR, M. A. Farmers' perceptions regarding the use of information and communication technology (ICT) in Khyber Pakhtunkhwa, Northern Pakistan. **Journal of the Saudi Society of Agricultural Sciences**, v. 18, n. 2, p. 211-217, 2019. DOI: https://doi.org/10.1016/j.jssas.2017.05.004

ALMEIDA, C.; MASSARANI, L. Farmers prevailing perception profiles regarding GM crops: A classification proposal. **Public Understanding of Science**, v. 27, n. 8, p. 952-966, 2018. DOI: https://doi.org/10.1177/0963662518766281

ASIEDU, E. M.; SHORTLAND, S.; NAWAR, Y. S.; JACKSON, P. J.; BAKER, L. Supporting Ghanaian micro-entrepreneurships: The role of mobile technology. **Journal of Entrepreneurship in Emerging Economies**, v. 11, n. 3, p. 306-327, 2019. DOI: https://doi.org/10.1108/JEEE-05-2018-0046

AVGEROU, C. Theoretical framing of ICT4D research. In: J. CHOUDRIE; M.S. ISLAM; F. WAHID; J.M. BASS; J. E. PRIYATMA (Eds.), **Information and Communication Technologies for Development**: 14th IFIP WG 9.4 International Conference on Social Implications of Computers in Developing Countries, ICT4D 2017, Yogyakarta, Indonesia, May 22-24, 2017 Proceedings (pp. 10-23). Springer. 2007.

BARJA, G.; GIGLER, B.-S. **The concept of information poverty and how to measure it in the Latin American context**. *MPRA Paper 48628*, University Library of Munich, Germany, 2007.

BENARD, R.; DULLE, F.; LAMTANE, H. Challenges associated with the use of information and communication technologies in information sharing by fish farmers in the Southern highlands of Tanzania. **Journal of Information, Communication and Ethics in Society**, v. 18, n. 1, p. 44-61, 2019. DOI: https://doi.org/10.1108/JICES-11-2018-0085

BIRKE, F. M.; KNIERIM, A. ICT for agriculture extension: Actor network theory for understanding the establishment of agricultural knowledge centers in South Wollo, Ethiopia. **Information Technology for Development**, p. 1-16, 2020. DOI: https://doi.org/10.1080/02681102.2020.1727826

BRACHT, D. E.; WERLANG, N. B. Competências empreendedoras: Uma investigação com produtores rurais catarinenses [Entrepreneurial skills: An investigation with Santa Catarina's rural producers]. **Revista de Empreendedorismo e Gestão de Pequenas Empresas**, v. 4, n. 1, p. 101–124, 2015. DOI: http://dx.doi.org/10.14211/regepe.v4i1.130

CED - Conselho Estadual do Desenvolvimento (MG) [State Development Council]. **O Espaço econômico de Minas Gerais** [The economic space of Minas Gerais]. Belo Horizonte, 1969. Disponível em: http://www.bibliotecadigital.mg.gov.br/consulta/consultaDetalheDocumento.php?iCodDocumento=75446

CHEN, Z.; LIU, C.; YANG, D. Information Poverty and Farmers' Information Right in China's Mountainous Rural Areas. **Procedia Engineering**, v. 15, p. 1277-1281, 2011. https://doi.org/10.1016/j.proeng.2011.08.236

CIBANGU, S. K. Marginalization of indigenous voices in the information age: A case study of cell phones in the rural Congo. **Information Technology for Development**, v. 26, n. 2, p. 234–267, 2020. DOI: https://doi.org/10.1080/02681102.2019.1647403

CNA - Confederação da Agricultura e Pecuária do Brasil [The Brazilian Agriculture and Livestock Confederation]. **PIB do agronegócio cresce 3,81% em 2019** [Agribusiness GDP grows 3.81% in 2019]. Confederação Da Agricultura e Pecuária Do Brasil (CNA), 2020. https://www.cnabrasil.org.br/noticias/pib-do-agronegocio-cresce-3-81-em-2019

CNA - Confederação da Agricultura e Pecuária do Brasil [The Brazilian Agriculture and Livestock Confederation]. **Agronegócio é responsável por 7 dos 10 principais produtos exportados pelo Brasil em 2017** [Agribusiness is responsible for 7 of the 10 main products exported by Brazil in 2017]. 2017. http://www.cnabrasil.org.br/noticias/agronegocio-e-responsavel-por-7-dos-10-principais-produtos-exportados-pelo-brasil-em-2017

DE, R.; PAL, A.; SETHI, R.; REDDY, S. K.; CHITRE, C. ICT4D research: A call for a strong critical approach. **Information Technology for Development**, v. 24, n. 1, p. 63-94, 2018. DOI: https://doi.org/10.1080/02681102.2017.1286284

DEARDEN, A.; KLEINE, D. Interdisciplinarity, self-governance and dialogue: The participatory process underpinning the minimum ethical standards for ICTD/ICT4D research. **Information Technology for Development**, v. 26, n. 1, p. 1-20, 2020. DOI: https://doi.org/10.1080/02681102.2020.1840321.

FERREIRA, J. B.; LASSO, S. V.; MAINARDES, E. Características empreendedoras do produtor rural capixaba [Entrepreneurial characteristics of the rural producer in Espírito Santo]. **Gestão & Regionalidade**, v. 33, n. 99, 2017. DOI: http://dx.doi.org/10.13037/gr.vol33n99.2943

FUCHS, C. **Social media**: A critical introduction (2nd ed.). Sage, 2017.
GOLLAKOTA, K.; PICK, J. B.; SINGH, M. Does purpose of use matter? Influences on developmental use versus personal use by low-income farmers. **Information Technology for Development**, p. 1-26, 2020. DOI: https://doi.org/10.1080/02681102.2020.1811944

GOULDING, A. Information Poverty or Overload? **Journal of Librarianship and Information Science**, v. 33, n. 3, p. 109-111, 2001. DOI: https://doi.org/10.1177/096100060103300301

HOANG, H. G. Determinants of the adoption of mobile phones for fruit marketing by Vietnamese farmers. **World Development Perspectives**, v. 17, p. 100178, 2020. DOI: https://doi.org/10.1016/j.wdp.2020.100178
HOSSAIN, M.; SAMAD, H. Mobile phones, household welfare, and women's empowerment: evidence from rural off-grid regions of Bangladesh. **Information Technology for Development**, v. 27, n. 2, 2020. DOI: https://doi.org/10.1080/0268

1102.2020.1818542

HOU, A. C. Y.; SHIAU, W.-L. Understanding Facebook to Instagram migration: A push-pull migration model perspective. **Information Technology & People**, v. 33, n. 1, p. 272-295, 2019. DOI: https://doi.org/10.1108/ITP-06-2017-0198

IBGE - Instituto Brasileiro de Geografia e Estatística [The Brazilian Institute of Geography and Statistics]. **Census of Agriculture**, 2017. 2018a. https://www.ibge.gov.br/en/statistics/economic/agriculture-forestry-and-fishing/21929-2017-2017-censo-agropecuario-en.html?%25C2%25BC=&t%25C2%25BCo-que-e.=&t=o-que-e

IBGE - Instituto Brasileiro de Geografia e Estatística [The Brazilian Institute of Geography and Statistics]. **Uso de Internet, televisão e celular no Brasil** [Internet, television and cell phone use in Brazil]. 2018b. https://educa.ibge.gov.br/jovens/materias-especiais/20787-uso-de-internet-televisao-e-celular-no-brasil.html

ISLAM, M. S.; GRÖNLUND, Å. Bangladesh calling: Farmers' technology use practices as a driver for development. **Information Technology for Development**, v. 17, n. 2, p. 95-111, 2011. DOI: https://doi.org/10.1080/02681102.2010.526093

ISLAM, Md. M.; HABES, E. M.; ALAM, Md. M. The usage and social capital of mobile phones and their effect on the performance of microenterprise: An empirical study. **Technological Forecasting and Social Change**, v. 132, p. 156-164, 2018. DOI: https://doi.org/10.1016/j.techfore.2018.01.029

KHANAL, A. R.; MISHRA, A. K. Financial performance of small farm business households: The role of Internet. **China Agricultural Economic Review**, v. 8, n. 4, p. 553-571, 2016. DOI: https://doi.org/10.1108/CAER-12-2014-0147

KOKSAL, M. H. The intentions of Lebanese consumers to adopt mobile banking. **International Journal of Bank Marketing**, v. 34, n. 3, p. 327-346, 2016. DOI: https://doi.org/10.1108/IJBM-03-2015-0025

LU, Y.-T.; CHANG, Y.-H. Investigation of the Internet adoption on senior farmers. **Engineering Computations**, v. 33, n. 6, p. 1853-1864, 2016. DOI: https://doi.org/10.1108/EC-08-2015-0259

MAIA, A. G.; EUSÉBIO, G. S.; SILVEIRA, R. L. F. Can credit help small family farming? Evidence from Brazil. **Agricultural Finance Review**, v. 80, n. 2, p. 212-230, 2019. DOI: https://doi.org/10.1108/AFR-10-2018-0087

MALAQUIAS, R. F.; ALBERTIN, A. L. Challenges for development and technological advancement: An analysis of Latin America. **Information Development**, v. 35, n. 3, p. 413-420, 2019. DOI: https://doi.org/10.1177/0266666918756170

MALAQUIAS, R. F.; MALAQUIAS, F. F. O.; HWANG, Y. The role of information and communication technology for development in Brazil. **Information Technology for Development**, v. 23, n. 1, p. 179-193, 2017. DOI: https://doi.org/10.1080/02681102.2016.1233854

MANDARI, H. E.; CHONG, Y.-L.; WYE, C.-K. The influence of government support and awareness on rural farmers' intention to adopt mobile government services in Tanzania. **Journal of Systems and Information Technology**, v. 19, n. 1/2, p. 42–64, 2017. DOI: https://doi.org/10.1108/JSIT-01-2017-0005

MATLI, W.; NGOEPE, M. Life situations and lived experiences of young people who are not in education, employment, or training in South Africa. **Education + Training**, v. 63, n. 9, p. 1242-1257, 2021. DOI: https://doi.org/10.1108/ET-10-2019-0231

MCKEOWN, A. Developing an understanding of what information poverty is. In: MCKEOWN, A. (Ed.). **Overcoming Information Poverty**, Chapter 3. Chandos Publishing, 2016, p. 37-61. DOI: https://doi.org/10.1016/B978-0-08-101110-2.00003-8

MICHELS, M.; BONKE, V.; MUSSHOFF, O. Understanding the adoption of smartphone apps in dairy herd management. **Journal of Dairy Science**, v. 102, n. 10, p. 9422-9434, 2019. DOI: https://doi.org/10.3168/jds.2019-16489

MINTON, H. L.; SCHNEIDER, F. W. **Differential Psychology**. Brooks/Cole, 1980.

MORRIS, W.; JAMES, P. Social media, an entrepreneurial opportunity for agriculture-based enterprises. **Journal of Small Business and Enterprise Development**, v. 24, n. 4, p. 1028-1045, 2017. DOI: https://doi.org/10.1108/JSBED-01-2017-0018

MSOFFE, G. E. P.; LWOGA, E. T. Contribution of mobile phones in expanding human capabilities in selected rural districts of Tanzania. **Global Knowledge, Memory and Communication**, v. 68, n. 6/7, p. 491-503, 2019. DOI: https://doi.org/10.1108/GKMC-10-2018-0084

NAEEM, M. Do social networking platforms promote service quality and purchase intention of customers of service-providing organizations? **Journal of Management Development**, v. 38, n. 7, p. 561-581, 2019a. DOI: https://doi.org/10.1108/JMD-11-2018-0327

NAEEM, M. Role of social networking platforms as tool for enhancing the service quality and purchase intention of customers in Islamic country. **Journal of Islamic Marketing**, v. 10, n. 3, p. 811-826, 2019. DOI: https://doi.org/10.1108/JIMA-11-2018-0214

OECD - Organisation for Economic Co-operation and Development. **Conversion rates - purchasing power parities (PPP)**. 2021. https://data.oecd.org/conversion/purchasing-power-parities-ppp.htm

OKON, U. ICT for rural community development: implementing the communicative ecology framework in the Niger Delta region of Nigeria. **Information Technology for Development**, v. 21, n. 2, p. 297-321, 2015. DOI: https://doi.org/10.1080/02681102.2015.1007819

OLLINGTON, N.; GIBB, J.; HARCOURT, M. Online social networks: An emergent recruiter tool for attracting and screening. **Personnel Review**, v. 42, n. 3, p. 248-265, 2013. DOI: https://doi.org/10.1108/00483481311320390

OWUSU, A. B.; YANKSON, P. W. K.; FRIMPONG, S. Smallholder farmers' knowledge of mobile telephone use: Gender perspectives and implications for agricultural market development. **Progress in Development Studies**, v. 18, n. 1, p. 36-51, 2018. DOI: https://doi.org/10.1177/1464993417735389

PANGANIBAN, G. G. F. E-governance in agriculture: Digital tools enabling Filipino farmers. **Journal of Asian Public Policy**, v. 12, n. 1, p. 51-70, 2019. DOI: https://doi.org/10.1080/17516234.2018.1499479

QURESHI, S. Are we making a better world with information and communication technology for development (ICT4D) research? Findings from the field and theory building. **Information Technology for Development**, v. 21, n. 4, p. 511-522, 2015. DOI: https://doi.org/10.1080/02681102.2015.1080428

QURESHI, S. The forgotten awaken: ICT's evolving role in the roots of mass discontent. **Information Technology for Development**, v. 23, n. 1, p. 1-17, 2017. DOI: https://doi.org/10.1080/02681102.2017.1293963

RICHARDS, R. C.; PETRIE, R.; CHRIST, B.; DITT, E.; KENNEDY, C. J. Farmer preferences for reforestation contracts in Brazil's Atlantic Forest. **Forest Policy and Economics**, v. 118, p. 102235, 2020. DOI: https://doi.org/10.1016/j.forpol.2020.102235

ROOKSBY, E.; WECKERT, J.; LUCAS, R. The rural digital divide. **Rural Society**, v. 12, n. 3, p. 197-210, 2002. DOI: https://doi.org/10.5172/rsj.12.3.197

SEAPA - Secretaria de Estado de Agricultura, Pecuária e Abastecimento [State Department of Agriculture, Livestock and Food Supply]. **Agropecuária mineira encerra 2020 com recordes de safra e faturamento** [Agriculture in Minas Gerais ends 2020 with records of harvest and billing]. 2020. http://www.agricultura.mg.gov.br/index.php/component/gmg/story/4133-agropecuaria-mineira-encerra-2020-com-recordes-de-safra-e-faturamento

SEN, A. **Development as freedom**. New York, NY: Anchor Books, 1999.

SOJA, E.; SOJA, P. Fostering ICT use by older workers: Lessons from perceptions of barriers to enterprise system adoption.

Journal of Enterprise Information Management, v. 33, n. 2, p. 407-434, 2020. DOI: https://doi.org/10.1108/JEIM-12-2018-0282

STEINKE, J.; ETTEN, J. van; MÜLLER, A.; ORTIZ-CRESPO, B.; GEVEL, J. van de; SILVESTRI, S.; PRIEBE, J. Tapping the full potential of the digital revolution for agricultural extension: An emerging innovation agenda. **International Journal of Agricultural Sustainability**, p. 1-17, 2020. DOI: https://doi.org/10.1080/14735903.2020.1738754

TRIPATHI, M.; INANI, S. K. Does information and communications technology affect economic growth? Empirical evidence from SAARC countries. **Information Technology for Development**, v. 26, n. 4, p. 773-787, 2020. DOI: https://doi.org/10.1080/02681102.2020.1785827

UNDP - United Nations Development Programme / PNUD - Programa das Nações Unidas para o Desenvolvimento. **Desenvolvimento humano para além das médias** [Human development beyond averages]. Brasília: PNUD Brasil. 2017. https://www.ipea.gov.br/portal/index.php?option=com_content&view=article&id=30025

UNDP - United Nations Development Programme. **Human Development Reports**. 2021. http://hdr.undp.org/en/countries/profiles/BRA

VENKATESH, V.; MORRIS, M. G.; DAVIS, G. B.; DAVIS, F. D. User acceptance of information technology: Toward a unified view. **MIS Quarterly**, v. 27, n. 3, p. 425-478, 2003. DOI: https://doi.org/10.2307/30036540

WALSHAM, G. ICT4D research: Reflections on history and future agenda. **Information Technology for Development**, v. 23, n. 1, p. 18-41, 2017. DOI: https://doi.org/10.1080/02681102.2016.1246406

World Bank. **Annual Report 2017**: End extreme poverty, boost shared prosperity. World Bank, 2017. https://documents.worldbank.org/en/publication/documents-reports/documentdetail/143021506909711004/world-bank-annual-report-2017

World Bank. **Gini index - Brazil**. World Bank, 2021. https://data.worldbank.org/indicator/SI.POV.GINI?locations=BR&most_recent_value_desc=false

WYCHE, S.; STEINFIELD, C. Why don't farmers use cell phones to access market prices? Technology affordances and barriers to market information services adoption in rural Kenya. **Information Technology for Development**, v. 22, n. 2, p. 320-333, 2016. DOI: https://doi.org/10.1080/02681102.2015.1048184

YEGANEHFAR, M.; ZAREI, A.; ISFANDYARI-MOGGHADAM, A. R.; FAMIL-ROUHANI, A. Justice in technology policy: A systematic review of gender divide literature and the marginal contribution of women on ICT. **Journal of Information, Communication and Ethics in Society**, v. 16, n. 2, p. 123-137, 2018. DOI: https://doi.org/10.1108/JICES-06-2017-0038

YOKOYAMA, M. H. How social network sites (SNS) have changed the employer–employee relationship and what are the next challenges for human resource (HR)? **REGE - Revista de Gestão**, v. 23, n. 1, p. 2-9, 2016. DOI: https://doi.org/10.1016/j.rege.2015.11.001

YOON, C.; LIM, D.; PARK, C. Factors affecting adoption of smart farms: The case of Korea. **Computers in Human Behavior**, v. 108, p. 106309, 2020. DOI: https://doi.org/10.1016/j.chb.2020.106309

ZHENG, Y.; HATAKKA, M.; SAHAY, S.; ANDERSSON, A. Conceptualizing development in information and communication technology for development (ICT4D). **Information Technology for Development**, v. 24, n. 1, p. 1-14, 2018. DOI: https://doi.org/10.1080/02681102.2017.1396020

ZHOU, X.; CUI, Y.; ZHANG, S. Internet use and rural residents' income growth. **China Agricultural Economic Review**, v. 12, n. 2, p. 315-327, 2020. DOI: https://doi.org/10.1108/CAER-06-2019-0094