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Cover Page Footnote

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How Can Rural-Based Universities Harness the Fourth Industrial Revolution to Strengthen Community Engagement Beyond National Borders?

Joseph Francis, Pertina Nyamukondiwa, and
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Abstract

Increasingly, universities are being called upon to leverage the opportunities that the Fourth Industrial Revolution affords them and mount relevant initiatives that yield better livelihoods in local and international communities. Yet most rural-based universities and campuses, especially in sub-Saharan Africa, have limited resources. This makes it difficult for them to effectively engage the communities they are supposed to serve. In this paper, we share the results of an exploratory study carried out to unlock the perspectives of academics and postgraduate students on (a) how opportunities from the Fourth Industrial Revolution can be used to strengthen community engagement initiatives and yield better local and international impact, (b) the potential challenges associated with the latter, and (c) how prospects associated with the Fourth Industrial Revolution can be used to make an impact on the experiences and lessons learned through community engagement at the international level. A semi-structured interview guide with open-ended questions was emailed to professors, senior lecturers, and postgraduate students at a rural-based university in South Africa. The same questionnaire was emailed to development practitioners operating in various parts of South Africa. Data were analyzed using thematic content analysis from Atlas.ti version 8.4. Resistance to change was found to be the major hindrance to the uptake of the Fourth Industrial Revolution-related opportunities. Providing multi-stakeholder facilitation, training, and infrastructural support for relevant technology to grassroots communities were suggested as interventions worth pursuing to address the resistance to change.

Introduction

Rapid advances in digital technology and the use of artificial intelligence have become topical issues in recent years. These advances are part of the Fourth Industrial Revolution (4IR), which is believed to bring with them a cocktail of both opportunities and challenges. Although difficult to define, the 4IR can be understood through its characteristics such as automation, artificial intelligence, and cyber-physical systems (Xing & Marwala, 2017). Latter scholars characterize the 4IR in terms of rapid changes in physical (e.g., intelligent robots, autonomous drones, driverless cars, 3D printing, and smart sensors), digital (e.g., the internet of things, services, data, and even people), and biological (e.g., synthetic biology, individual genetic makeup, and bio-printing) technologies (Xing & Marwala, 2017). All of these will significantly change the way people live and work. This advanced technological revolution presents opportunities to empower universities, especially those in rural areas, to become more meaningful and competent catalysts that connect rural communities and global stakeholders through mutually beneficial and reciprocal processes. A

prerequisite to the universities taking up this role effectively is rural communities' deep insight and understanding of the opportunities that the 4IR provides.

Advancing the public good, especially in rural communities, is increasingly prominent among internationalization practices. The contemporary definition of internationalization is "the intentional process of integrating an international, intercultural or global dimension into the purpose, functions and delivery of post-secondary education, in order to enhance the quality of education and research for all students and staff, and to make a meaningful contribution to society" (De Wit et al., 2015, p. 2). This definition underscores the need to focus on or include a common good in the internationalization process within higher education. Rumbley & Altbach (2016) highlight the notion that internationalization must connect the local and the global geographical spheres as a central tenet of the contemporary discourse. Moreover, Jones et al. (2016) propose that internationalization should intentionally and purposefully seek to provide benefit to the wider community.

In 2017, the University of Venda in South Africa launched a project to develop the idea that internationalization should extend through a mutual process to local grassroots communities. The idea was pilot tested in the Limpopo and Mpumalanga provinces through a master's and doctoral student training project. The 2017 internationalization project is one of the many community engagement initiatives the university is relying on to generate novel approaches for how to operationalize its new vision statement, adopted in 2020, to become "a university leading in engaged scholarship." (University of Venda, 2020)

We contend that internationalization is a purposeful process of infusing international and local perspectives via higher education for the benefit of society. In the past, higher education reached out to communities using an expert, top-down model of knowledge delivery. That connection with communities has transitioned over the years to a more engaged model in which community and university partners co-create solutions (Fitzgerald et al., 2016). The new approach to engagement acknowledges that not all knowledge and expertise reside in the academy, and that both expertise and significant learning opportunities in teaching and scholarship reside in non-academic settings as well (Nicotera et al., 2011; Fitzgerald et al., 2016). Although community engagement is important when running people-centered programs, there is still no universally adopted definition. Weerts & Sandman (2008) define community engagement as a two-way approach of interacting between partners to address societal needs. Considering the preceding arguments and other definitions (Driscoll, 2008; Hart et al., 2007; Head, 2007; Maddison & Laing, 2007), the most common features of community engagement include beneficial exchange, active participation of communities, inclusion of communities, and mutually beneficial and respectful collaboration. In the current study, community engagement refers to active participation of residents from specific geographical areas in the exchange, exploration, and application of information, knowledge, and resources that enhance their and other stakeholders' well-being.

Higher education institutions have the potential to facilitate societal responses to existing socio-economic challenges that grassroots communities face throughout the world. Stephens et al. (2008) view institutions of higher learning as agents of change in advancing more sustainable practices in diverse cultures and contexts. They are important sites of knowledge production,

perpetuation, and dissemination. In addition, higher education institutions have the unique ability to facilitate the synthesis and integration of different types of knowledge and enhance the application of knowledge to social change (Stephens et al., 2008). It is possible for institutions to contribute to community development by conducting real-world, problem-based research designed to address the urgent sustainability challenges facing society. Higher education institutions can also enhance engagement between individuals and organizations both within and outside their boundaries. This may help reposition universities, for example, as agents of transdisciplinary work, highly integrated with and interwoven into other societal spheres. Thus, higher education institutions hold a unique position that enables them to catalyze positive societal transition for the benefit of communities in need.

This unique position of higher education institutions in society underscores the potential to harness the 4IR and deploy it to strengthen community engagement beyond national borders. Gleason (2018) contends that the 4IR is an opportunity for higher education institutions to collaborate with governments and industry to support lifelong learning. Gleason singles out micro-credentials, nanodegrees, adaptive learning, micro-learning, upskilling and preparing for just-in-time learning as important features of the 4IR. Penprase (2018) believes that higher education should urgently respond to the power of the 4IR technologies, which are expected to bring both positive and negative social, economic, and environmental impact to society. This implies that any strategy should consider the human condition, how new technologies and shifting economic power affect a wide range of socio-economic groups, and possible threats that exist within an increasingly interconnected world. It is imperative to do this in a manner that fosters deeper intercultural understanding and an abiding respect for freedom and human rights. Universities are employing such approaches, many of which are interdisciplinary and have global relevance even though they remain locally contextualized. For this reason, universities are critical players in connecting the 4IR with engaged work involving communities within their catchment areas.

Despite universities' potential to play a central role in creating platforms for knowledge exchange, dissemination, collaboration, and research among others, literature focusing on their relevance in harnessing the 4IR to strengthen community

engagement is rare. In response to this lacuna, an exploratory study that solicited the views of senior academics, postgraduate students, and development practitioners in South Africa was carried out.

Methodology

Study Area and Sampling Procedures

An exploratory qualitative study was carried out at the University of Venda, based in the Limpopo province in northern South Africa. Purposive, convenience, and cluster sampling was used to select respondents. Etikan et al. (2016) explain purposive sampling as deliberately selecting participants based on certain inherent qualities. It is a nonrandom technique that does not need underlying theories or a set number of participants to generate authentic data. As Bernard (2002) reveals, the researcher decides what should be known and identifies people who are knowledgeable about the research issue and are willing to participate. In the current study, postgraduate students, academic staff, and development practitioners who were willing to serve as respondents constituted the population. The postgraduate students were sub-categorized into those registered for master's and PhD degrees. None of the postgraduate students participated in the 2017 pilot study.

Data Collection

A semi-structured interview guide with three open-ended questions was emailed to 21 senior academics ranking from senior lecturer to professorial levels, 17 development practitioners and postgraduate students pursuing master's (31) and doctoral degrees (27). The same set of interview questions were emailed to all the respondents. The questions were:

1. How can the major features of the 4IR be taken advantage of in order to improve how community engagement is carried out?
2. What might make it difficult to apply the key features of the 4IR to improve community engagement?
3. How can the 4IR be used to ensure that the experiences and lessons learned through community engagement have impact at an international level?

The interview guide explained the purpose of the study and highlighted that participants were free to withdraw at any point during the study. It also stated that only their participants' knowledge and views on the subject were being sought; they

were not judged on the correctness of the answers. Participants were requested to send back their responses within two weeks. Reminders were sent to all target respondents twice: a week before the due date and one day prior to the deadline. Those respondents who requested extension were afforded an extra week.

Data Analysis

Data were stored in the Microsoft Office Word Processor before being exported to Atlas.ti version 8.4., a qualitative data analysis software package. Within the software, document groups were created, showing master's and PhD candidates, academic staff, and development practitioners as the interest groups. Open and list coding were carried out at the same time. During coding, memos and comments recorded any interesting or contradictory observations. These were used during data analysis and discussion. Related codes were eventually merged.

Code groups were then created to cluster related subthemes. The subthemes were then grouped into broad themes. Three types of outputs were generated, namely code document tables, network diagrams, and textual reports. Code document tables were used to show the data sources, broad themes, subthemes, and number of associated quotations. To show the relationships between themes, we created network diagrams that presented an overview of themes, subthemes, and relevant quotations. Finally, textual output was used to retrieve relevant verbatim quotations.

Results

Thirty-three persons returned their responses to the three study questions: 8 master's students (25% response rate), 13 PhD candidates (48%), 7 academic staff (33%), and 5 development practitioners (29%). In the following sections, the obtained responses are presented for each research question, taking into account the views of the four interest groups that participated in the study.

Question 1: How can the Fourth Industrial Revolution be taken advantage of in order to improve the way community engagement is practiced? Sixteen subthemes were distilled out of the 57 quotations drawn from the responses to this question (Table 1). The 16 subthemes were further categorized into seven higher-level themes, namely "Facilitation and training," "Communication," "Scientific research," "Infrastructure," "Curriculum review," "Monitoring and evaluation," and "Others"

Table 1. Question 1: How can the Fourth Industrial Revolution be taken advantage of in order to improve the way community engagement is practiced?
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Responses	Academics	Masters Students	PhD Students	Development Practitioners	Totals
Facilitation and training					
A) Capacity building such as technological training	2	3	2	3	10
B) Harnessing technology/ innovation in production and consumption	3	0	0	2	5
C) Encouraging/facilitating communities to develop own solutions	2	0	1	1	4
D) Encouraging communities to be receptive of change	1	0	1	0	2
Communication					
A) Taking advantage of improved ways of communication	1	7	7	4	19
Scientific research					
A) Using digital data collection tools	0	2	2	0	4
B) Community participation in 4IR research	2	0	1	0	3
C) Using artificial intelligence to enhance translation of different languages	0	1	0	0	1
D) Inclusion of data analysis tools with AI	0	0	1	0	1
Infrastructure					
A) Investment in ICT infrastructure	0	1	0	1	2
B) Using 3D printers to package community-developed prototypes	0	0	1	0	1
Curriculum review					
A) Curriculum assessment	0	1	0	0	1
B) Accessing education through virtual reality platforms	0	0	0	1	1
Monitoring and evaluation					
A) Remotely tracking progress of interventions	0	0	0	1	1
Other					
A) Eradication of energy poverty	0	1	0	0	1
B) Need more time to understand 4IR	0	0	1	0	1
Totals	11	16	17	13	57

(Figure 1). The “Facilitating and training” and “Scientific research” themes had the most diverse responses. All the interest groups expressed views that related to “Taking advantage of improved ways of communication” and “Capacity building such as training.” The quotation distribution varied among the interest groups for subthemes such as “Use of 3D printers to package community-developed prototypes,” “Need more time to understand the Fourth Industrial Revolution,” and “Use of artificial intelligence to enhance translation of different languages.” Below are some of the quotations that present the respondents’ views on the subtheme, “Taking advantage of improved ways of communication”:

We can make use of our internet using smartphones, emails...in order to facilitate our communications so that we are able to share information with communities from remote areas. [Master’s student]

Using innovative communication with communities for example, cellphone messages, Facebook communications... tailored community mobile applications for data collection and reporting. [PhD candidate]

We have better and more efficient ways of communicating. We can be able to reach a broader spectrum of community members regarding community engagement programs. [Academic staff member]

Effective use and management of data and improved communication. [Development Practitioner]

As revealed in Figure 1, improved communication methods such as the internet and the use of smart phones, email, and social media, among others, could be taken advantage of to access education through virtual reality platforms as well as enhancing language translation. Another popular view was the need for “Capacity building such as through training” among grassroots communities, young people, and academics in the 4IR’s key domains. This would help these groups to take advantage of the 4IR features while facilitating community-engaged work. This perspective is reflected upon by one development practitioner:

We have always said that the world belongs to the youth. We now have an opportunity to convert that statement into reality by focusing our efforts on the young generation. We must develop youth-driven programs and ensure that they are ready to embrace technology for development.

Capacity building was linked to many other themes, as illustrated in Figure 1. Through encouraging grassroots communities to develop their own solutions, nurturing a culture of innovation in production and consumption, taking advantage of virtual reality platforms for education, and understanding how their lives would improve, communities could become receptive to the 4IR’s possible changes. It was thus unsurprising that a suggestion was made that more time should be invested in ascertaining the understanding of the 4IR among grassroots communities. The following excerpt from a PhD candidate sheds some light on the need for educating communities about the 4IR before they can benefit from it:

I feel like a lot of us are still getting used to the Third Industrial Revolution. So for us to be pushed towards the Fourth already feels premature. I don’t undermine how knowledgeable communities might be on technologies in general, but I worry there might be too much time (which is what is needed) spent on ironing out what this revolution means for people currently.

Question 2: What might make it difficult to apply the key features of the Fourth Industrial Revolution to improve community engagement?

Figure 2 shows the 16 subthemes distilled from the 85 quotations on the possible challenges to applying the 4IR’s key features to improve community engagement praxis. The 16 subthemes were further clustered into seven broader themes, namely “Resistance,” “Accessibility,” “Skills,” “Funding,” “Infrastructure,” “Security,” and “Political climate.” “Resistance to change” and “Lack of funding” were the most popular subthemes (Table 2). Below are some verbatim quotes that confirmed that resistance to change was of major concern to the respondents.

The fact that people resist change: not everybody will embrace it. It is important to understand that change has both

Figure 1. Network of Community Engagement and Scholarship, Vol 13, Iss 2 (2021), Art 15 (appearing in the middle of the figure) and associated subthemes that were developed from the 57 quotations explaining ways in which the Fourth Industrial Revolution could be taken advantage of to improve community engagement. A lighter background color depicts subthemes with the highest number of quotations.

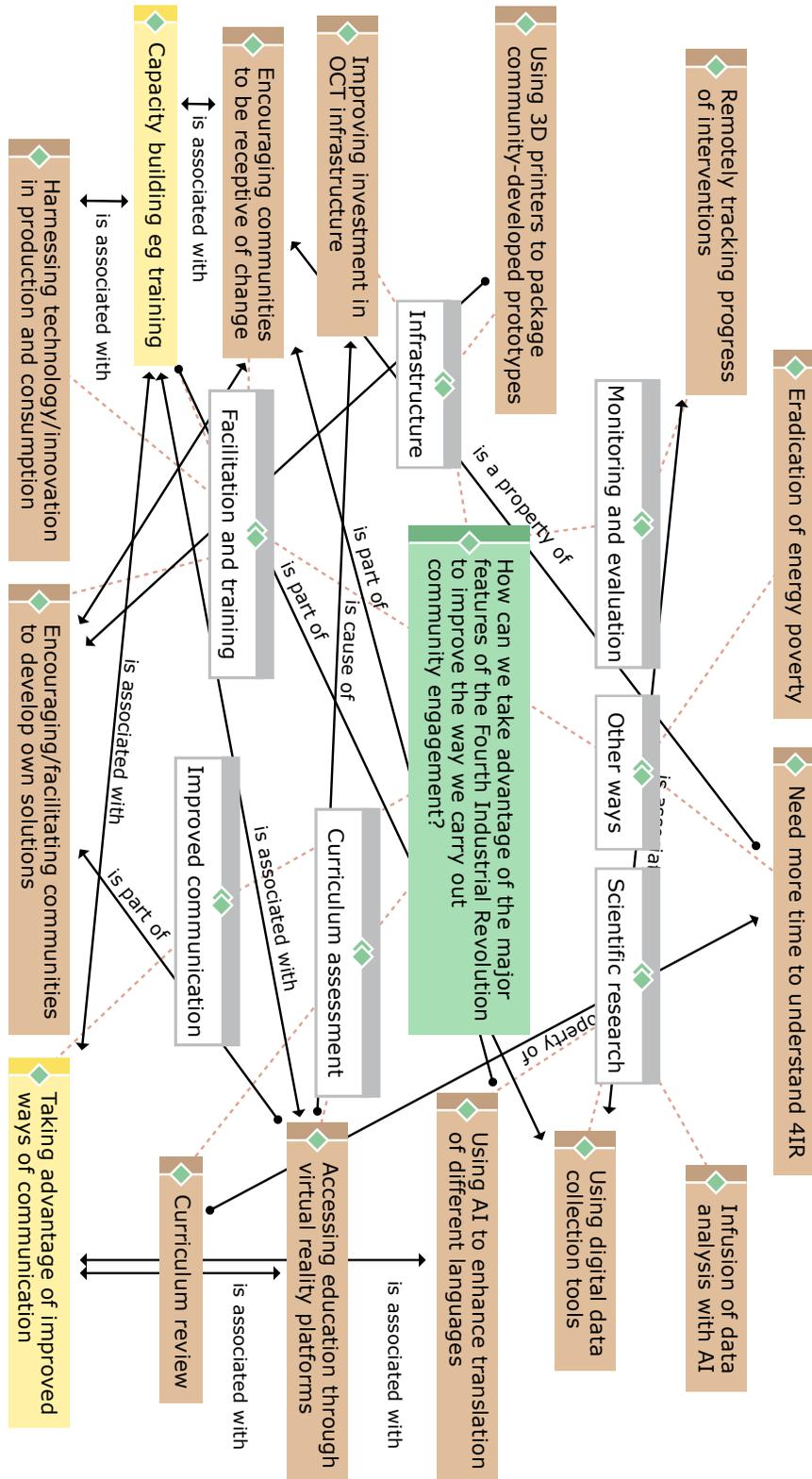


Table 2. Questionnaire results on the key barriers to applying 4IR to improve community engagement?

Responses	Academics	Masters Students	PhD Students	Development Practitioners	Totals
Resistance					
A) Resistance to change	4	6	9	3	22
B) Reluctance of companies and institutions to partner with grassroots communities	0	0	2	0	2
Accessibility					
A) Accessibility	2	0	4	1	7
B) Lack of understanding of 4IR	3	1	1	2	7
C) Exclusion of illiterate people	0	2	1	2	5
D) Poor communication among relevant stakeholders	0	1	0	0	1
Skills					
A) Lack of skills to operate technology devices	0	3	4	1	8
B) Affects current competencies/unemployment	1	3	2	0	6
Funding					
A) Lack of funding	4	3	4	0	11
Infrastructure					
A) Lack of relevant technological infrastructure	1	1	4	1	7
B) Unreliable internet/wireless connection	0	0	1	0	1
Security					
A) Security issues	2	0	1	0	3
B) Violation of codes of ethics and morals	0	0	2	0	2
C) Some features of 4IR are not environmentally friendly	0	0	1	0	1
Political climate					
A) Bureaucratic structures and red tape in organizations and institutions	0	1	0	0	1
B) Inadequate political will	0	1	0	0	1
Total	17	22	36	10	85

advantages and disadvantages. [Academic staff member]

Resistance to technology by the rural communities and this could be as a result of social, cultural, religious and political reasons. [Development Practitioner]

Resistance to change due to fear of the unknown and real threats such as sophisticated, organized crime. [Masters student]

The unwillingness of individuals to make use of these key features of the Fourth Industrial Revolution to make their tasks easier. [PhD candidate]

“Resistance to change” was most popular and linked to most subthemes (Figure 2). Security issues, violation of codes of ethics and morals, environmental unfriendliness of some features of the 4IR, poor communication, lack of understanding, and lack of skills among others were understood to potentially discourage grassroots community members from adopting technological innovation. Lack of funding was attributed to inadequate political will, limited access to technological resources, and unreliable internet connectivity.

Academic staff and postgraduate students cited “Lack of funding” as a major challenge. Resource limitations (i.e., funding in particular) were noted as the principal bottlenecks to new technological development and maintenance. Students and development practitioners indicated that “Lack of skills to operate technological devices” would also make it difficult to take advantage of the 4IR in the quest for improved community engagement (Table 2). Moreover, it was noted that most rural citizens and their leaders were often not computer literate. This made it difficult for them to harness the 4IR actively. “Inadequate political will,” “Poor communication among relevant stakeholders,” “Bureaucratic structures and red tape in organizations and institutions,” “Environmental unfriendliness of some features of the Fourth Industrial Revolution,” and “Unreliable internet/wireless connectivity” contributed the least number of quotations.

Question 3: How can the Fourth Industrial Revolution be used to ensure that experiences and lessons learned through community engagement have impact at international level?

The 62 quotations that were obtained from the participants’ responses are presented in Table 3, from which 16 subthemes were formulated. In Figure 3, the subthemes are categorized into six broader themes, namely “Communication,” “Scientific Research,” “Exposure visits,” “Collaboration,” “Training,” and “Others.” Furthermore, Table 3 reveals that “Communication” and “Scientific research” were the most popular responses, with “Collaboration” and “Others” yielding the least quotations. Information disseminated via “Scholarly publications through websites,” “Organizing scientific conferences,” and “Providing awareness and technological training for members of rural communities” were cited unanimously. Across the six themes, “Use of various media to connect diverse communities with the world,” “Scholarly publications through websites,” and “Providing awareness and technological training for members of rural communities” were most common.

With respect to the “Use of various media to connect diverse communities with the world,” some respondents suggested that information should be disseminated through online media. Among the suggested media or channels were magazine articles, journals articles, and policy briefs. Universities should facilitate the dissemination of these among the grassroots communities.

Other views that the interest groups expressed regarding “Providing awareness and technological training to members of rural communities” were:

Community members should be trained about the features, opportunities, and application of the Fourth Industrial Revolution. [Master's student]

We should start by identifying existing challenges and develop devices to close the gaps and then chart the way forward. We need to make sure that we do not continue to divide our communities into rural and urban in terms of the approach we use to provide awareness of the Fourth Industrial Revolution. Most communities are in rural areas across Africa. [Development Practitioner]

Table 3. Question 3: How can the Fourth Industrial Revolution be used to ensure that experiences and lessons learned through community engagement have impact at international level?

Responses	Academics	Masters Students	PhD Students	Development Practitioners	Totals
Communication					
A) Use of various media to connect diverse communities with the world	1	5	7	0	13
B) Use of social media platforms	0	1	3	1	5
C) Effective communication	2	0	0	1	3
Scientific research					
A) Scholarly publications through websites	3	3	3	2	11
B) Use of Artificial Intelligence in research	1	2	0	0	3
C) Organizing scientific conferences	1	1	2	1	5
Exposure visits					
A) Benchmarking	0	0	1	1	2
B) Organizing Homestays and Exchange programs	0	1	1	0	2
C) Participating in International awards	0	0	1	0	1
Collaboration					
A) Open innovation model (quad helix)	1	0	0	0	1
B) Collaboration of diverse stakeholders	1	0	1	0	2
C) Collaboration of researchers	1	0	0	0	1
Training					
A) Providing awareness and technological training to members of rural communities	4	2	2	2	10
Other					
A) Establishing dedicated municipalities	0	0	1	0	1
B) Having the right leaders	1	0	0	0	1
C) Not sure	0	0	1	0	1
Totals	15	15	23	8	62

Figure 2. Network of Community Engagement and Scholarship, Vol. 13, Iss. 2 (2023), Art. 15
 possible challenges to applying the 4IR's key features to improve community engagement praxis. Seven broader themes (e.g., "Resistance") appear in the middle of the figure.

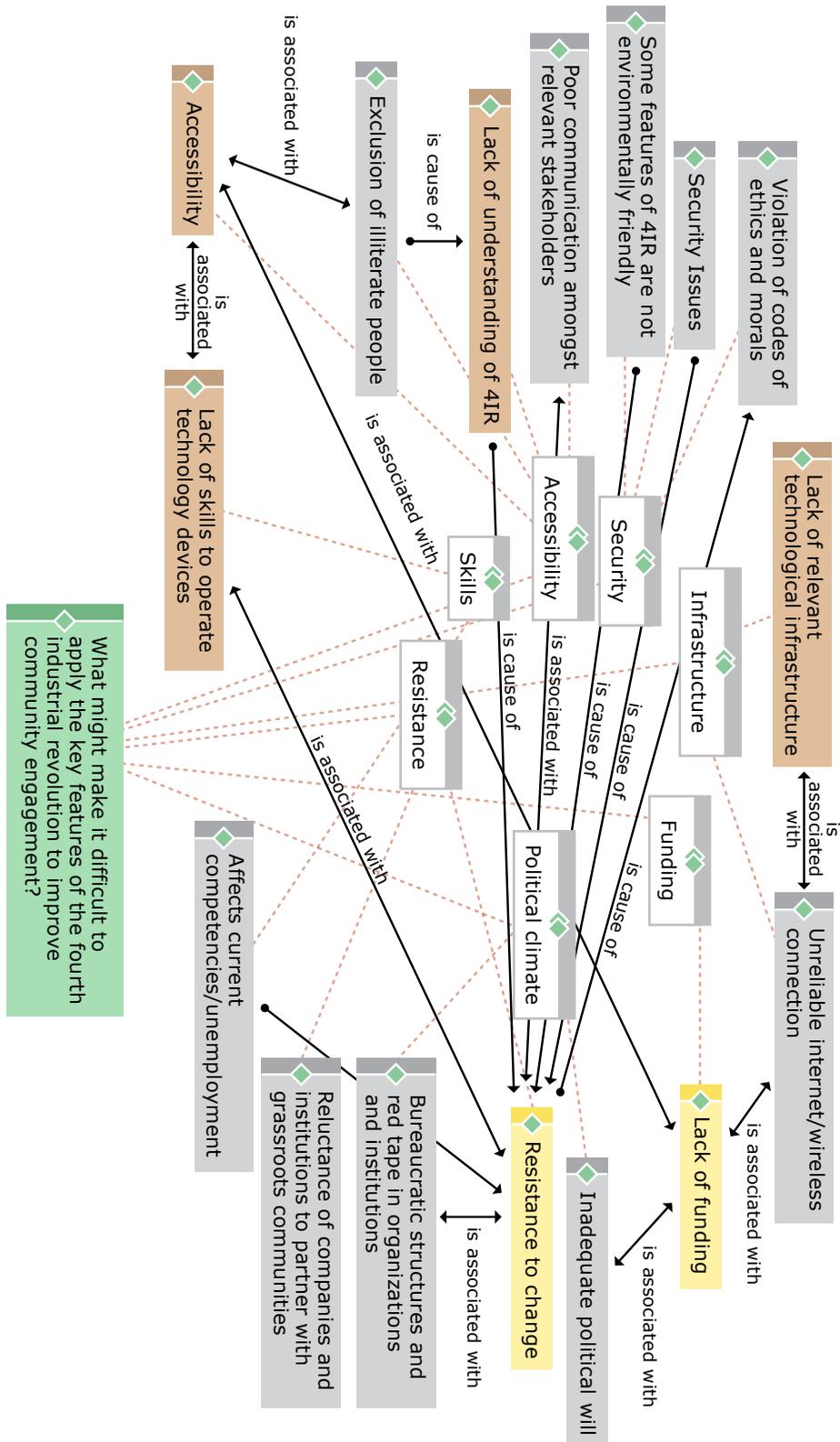
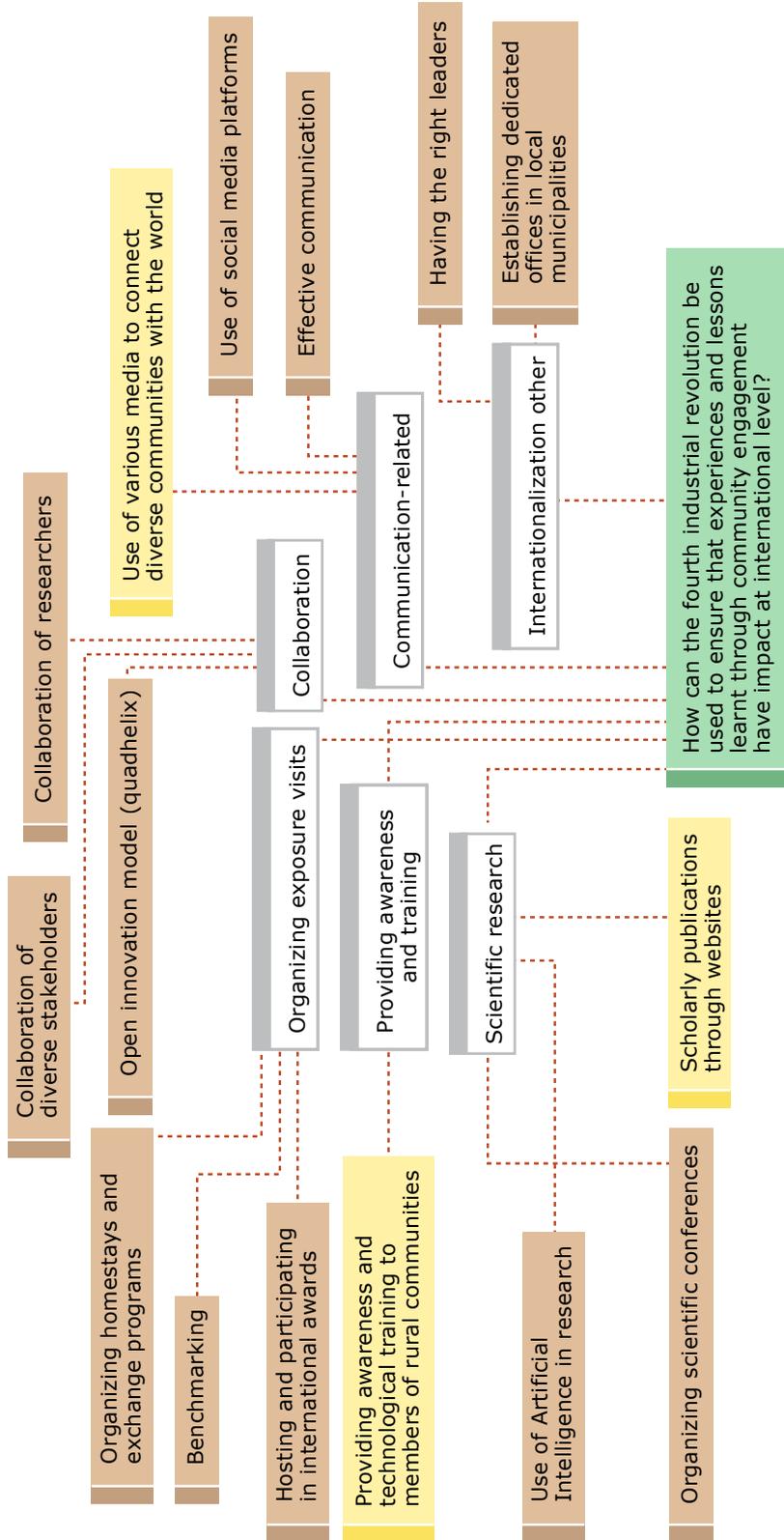


Figure 3. Network diagram of Responses to Question 4: How can the 4IR be used to ensure greater impact of the experiences and lessons learnt through community engagement. Six broader themes (e.g., "Organizing exposure visits") appear in the middle of the Figure. The most common subthemes are shaded with the brightest color.



That could be done through sharing the vision and the desired expectations for change. That may result in communities developing greater commitment to the new process. They should then be invited to create goals. People are committed to their own goals rather than those set by other people. [Academic staff member]

By encouraging and training communities to create their own technologies and local products and then patenting them. [PhD candidate]

Discussion

Facilitating access to relevant information and training residents from specific geographical areas were perceived to be the most important ways to improve community engagement practice through the 4IR. This observation might imply that grassroots communities are, in general, not ready for this innovation and technological advancement. It is therefore necessary to build awareness and educational campaigns focusing on the key tenets of the 4IR in general and their applicability in rural areas in particular. Various scholars (Townsend et al., 2013; Bloem et al., 2014; Makhmari, 2018) highlight the importance of training to enable adoption, in general. The benefits and negative impacts of the 4IR, and how to take advantage of the opportunities that it offers, should be embedded within training programs, particularly with respect to rural areas. Townsend et al. (2013) explain this within the Swedish context and recommend investment in a broadband delivery plan together with local training hubs that also provide support to geographical communities. Facilitating access to information and training communities (Townsend et al., 2013; Bloem et al., 2014; Makhmari, 2018), coupled with affordable technological infrastructure provision, would thus address most of these issues. This would presumably work in African contexts, especially if the necessary knowledge is accorded to the rurality that is dominant in Africa.

Makhmari (2018) advances the view that the middle class should receive skills training relevant to any future jobs. However, Ayentimi and Burgess (2019) raise concerns for emerging and developing economies across Africa where the middle class is small. In many African countries that are dominated by rurality (South Africa included),

the informal economy is the main source of employment for the youth and women. Thus, the 4IR's impact on the informal economy in Africa depends on the pace of technological adoption to re-organize small and micro enterprises and agro-processing businesses. According to Amankwah-Amoah (2018), lack of human resource capabilities, the lack of supporting infrastructure such as transportation and communication, and the low innovative and entrepreneurial culture within the business environment across the region may constrain this reorganization.

Students should acquire appropriate skills to enhance their employability. This recommendation demands that the curricula of universities and other tertiary institutions in general, especially those located in rural settings, be reconfigured such that they include designing, computer programming, and basic economics (Bloem et al., 2014). Ayentimi and Burgess (2019) acknowledge that African countries' lack of prioritization of innovation and technology in national development policy frameworks threatens their readiness to fully embrace the 4IR. This means that governments should first invest in infrastructure for technology adoption before embarking on training. Besides its availability, such infrastructure must be easily accessible and affordable to enable grassroots communities to participate in the training. Moreover, the training should ideally be multidisciplinary in nature and help facilitate patent development, knowledge transfer, and technological application commercialization (Lee et al., 2018). Consequently, people from all walks of life will be able to prepare themselves for the new era of digitization.

Resistance to change was cited as the major challenge in harnessing the 4IR to popularize and enhance community engagement. It was revealed that this emanated from a perceived lack of understanding of what the 4IR entailed, predicted unemployment due to a lack of relevant skills, unresolved questions regarding security matters, and an inaccessibility of technological resources, among others. Longworth (2019) notes the possible utilization of technology and innovation to enhance capacity development and lifelong learning in geographical communities. This means that acquiring technological and innovation skills should be a continuous process. When this happens, grassroots communities and universities remain abreast of technological revolution. Lee et al. (2018) emphasize the importance of collaboration between firms and start-ups. The

same scholars add that established firms may act too slowly, thereby disadvantaging grassroots communities from benefiting from collaborations with large companies. However, corporate social responsibility initiatives should include training and mentoring of grassroots communities as top priorities.

There is an obvious urgency to initiating genuine and comprehensive conversations regarding how the 4IR can be used to ensure that the experiences and lessons learned through community engagement have impact at international level. There is currently a dearth of literature on this aspect. However, in an era where data is the new key currency (Evans & Annunziata, 2012), coupled with the considerable transformation and disruption expected from the digital age (Noor, 2015), it is crucial to plan ahead for a world in which more people, information, and other features of life will be better connected. That positioning should occur at the individual and institutional levels. For this to be meaningful and long-lasting, deliberations should go beyond benefits and spell out how society contributes to the big data revolution. The 4IR has brought with it various cheap and convenient ways of communicating through the internet. Among these are formal platforms such as email or digital fax, along with social media platforms such as Facebook, LinkedIn, WhatsApp, YouTube, Instagram, Pinterest, and Blogs.

The diverse means of communicating listed above are currently not well-harnessed to disseminate lessons learned through community engagement, including the practice itself. Platforms used to disseminate scientific research such as conferences, peer-reviewed journals, policy briefs, magazines, and newsletters are readily available for use in internationalizing community-engaged work. Research collaboration and exposure visits for both scholars and members of grassroots communities with whom studies are conducted can be organized for the same purpose. If preparations are made now with serious intent and conviction, geographical communities will be able to adapt to the 4IR with ease.

Conclusion and Future Studies

This study explored how rural-based universities can harness the 4IR to strengthen community engagement beyond national borders. Facilitating and training grassroots communities were cited as crucial in equipping their citizens with the knowledge and skills relevant for the 4IR.

The study reconfirmed the need for higher learning institutions to reconfigure their curricula in line with the demands of the 4IR. Although the interviewed interest groups acknowledged the benefits of the digital era (e.g., reduction in the costs of goods and services, improved production and productivity, and convenience), they expressed concern over the increased unemployment precipitated by these factors. Resistance to change was regarded as the major hindrance to the uptake of the 4IR. However, respondents also indicated that facilitating multi-stakeholder platforms and providing training and infrastructural support for relevant technology to grassroots communities were worth pursuing. Finally, to help internationalize community engagement, participants suggested utilizing improved communication platforms and tools, intensive participation in scientific research and collaboration, and exposure visits. Such measures have the potential to contribute to the considerable extension of internationalization to local grassroots communities.

A notable limitation of the current study is that the perspectives of grassroots communities and business were not captured. Nevertheless, it should be emphasized that this is the first step toward a more inclusive study. Engaging postgraduate students, academic staff, and development practitioners contributes to a body of knowledge that unpacks novel ways of strengthening community engagement. In addition, this paper has broadened the discourse on the community engagement–technology nexus by unpacking understanding of the 4IR. In the course of the investigation, the limitations and opportunities associated with harnessing the 4IR have been unraveled. Ways of exploring how to leverage the benefits of the 4IR for grassroots communities in particular have been suggested. In light of the above, future work should focus on comparative studies that examine the perspectives of a broader range of stakeholders, including grassroots communities and businesses.

References

- Amankwah-Amoah, J. (2018). Revitalising serial entrepreneurship in sub-Saharan Africa: insights from a newly emerging economy. *Technology Analysis & Strategic Management*, 30(5), 499–511.
- Ayentimi, D.T., & Burgess, J. (2019). Is the fourth industrial revolution relevant to sub-Saharan Africa? *Technology Analysis & Strategic Management*, 31(6), 641–652.

- Bernard, H.R. 2002. *Research methods in anthropology: Qualitative and quantitative approaches* (3rd ed). Walnut Creek, CA: AltaMira Press.
- Bloem, J., van Doorn, M., Duivesteyn, S., Excoffier, D., Maas, R., & van Ommeren, E. (2014). *The Fourth Industrial Revolution: Things to tighten the link between IT and OT*. Sogeti VINT. <https://www.fr.sogeti.com/globalassets/global/downloads/reports/vint-research-3-the-fourth-industrial-revolution>
- De Wit, H., Hunter, F., Howard, L. & Egron-Polak, E. (2015). *Internationalization of higher education: Study*. European Parliament Directorate-General for Internal Policies. Policy Department B: Structural and Cohesion Policies, Culture and Education Study. [https://www.europarl.europa.eu/RegData/etudes/STUD/2015/540370/IPOL_STU\(2015\)540370_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2015/540370/IPOL_STU(2015)540370_EN.pdf)
- Driscoll, A. (2008). Carnegie's community-engagement classification: Intentions and insights. *Change: The Magazine of Higher Learning*, 40(1), 38–41. <https://doi.org/10.3200/chng.40.1.38-41>
- Etikan, I., Musa, S.A., & Alkassim, R.S. (2016). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics*, 5(1), 1–4.
- Evans, P.C., & Annunziata, M. (2012). Industrial internet: Pushing the boundaries of minds and machines. *General Electric Reports*, 488-508
- Fitzgerald, H.E., Bruns, K., Sonka, S.T., Furco, A., & Swanson, L. (2016). The centrality of engagement in higher education. *Journal of Higher Education Outreach and Engagement*, 16(3), 7–28.
- Gleason, N.W. (2018). *Higher education in the era of the fourth industrial revolution* (p. 229). Springer Nature. Singapore
- Hart, D., Donnelly, T.M., Youniss, J., & Atkins, R. (2007). High school community service as a predictor of adult voting and volunteering. *American Educational Research Journal*, 44(1), 197-219. <https://doi.org/10.3102/0002831206298173>
- Head, B.W. (2007). Community engagement: Participation on whose terms? *Australian Journal of Political Science*, 42(3), 441–454. <https://doi.org/10.1080/10361140701513570>
- Jones, E., Coelen, R., Beelen, J. & de Wit, H. (2016). Global and local internationalization. *Global and Local Internationalization*, Sense Publishers, The Netherlands. <https://doi.org/10.1007/978-94-6300-301-8>
- Lee, M.H., Yun, J.H.J., Pyka, A., Won, D.K., Kodama, F., Schiuma, G., Park, H., Jeon, J., Park, K., Jung, K., Yan, M.R., Lee, S.Y., & Zhao, X. (2018). How to respond to the Fourth Industrial Revolution, or the second information technology revolution? Dynamic new combinations between technology, market, and society through open innovation. *Journal of Open Innovation: Technology, Market, and Complexity*, 4(3). <https://doi.org/10.3390/joitmc4030021>
- Longworth, N. (2019). *Making lifelong learning work*. Routledge
- Maddison, E. & Laing, S. (2007). The CUPP model in context. In A. Hart, E. Maddison, & D. Wolf (Eds.). *Community-university partnerships in practice* (pp. 8–20). National Institute of Adult Continuing Education.
- Makhmari, T. Al. (2018). Are we ready for the 4th industrial revolution? *Muscat Daily*, 3–4. <https://ithraa.om/Media-Hub/Press-Releases/ArticleID/1137/Are-We-Ready-for-the-4th-Industrial-Revolution-2018-Inside-Stories-Season-Launches>
- Nicotera, N., Cutforth, N., Fretz, E., & Thompson, S.S. (2011). Dedication to community engagement: A higher education conundrum? *Journal of Community Engagement and Scholarship*, 4(1), 1–13. <http://jces.ua.edu/dedication-to-community-engagement-a-higher-education-conundrum/>
- Noor, B. (2015). The internet of everything: Coming to a building near you. *Mechanical Engineering* 137(09), 36–41. <https://doi.org/10.1115/1.2015-Sep-2>
- Penprase, B.E. (2018). The fourth industrial revolution and higher education. In N.W. Gleason (Ed.). *Higher education in the era of the fourth industrial revolution* (pp. 207–229). Palgrave Macmillan. <https://doi.org/10.1007/978-981-13-0194-0>
- Rumbley, L.E., & Altbach, P.G. (2016). The local and the global in higher education internationalization: A crucial nexus. In E. Jones, R. Coelen, J. Beelen, & H. de Wit (Eds.). *Global and local internationalization* (pp. 7–13). Brill Sense.
- Stephens, J.C., Hernandez, M.E., Román, M., Graham, A.C., & Scholz, R.W. (2008). Higher education as a change agent for sustainability in different cultures and contexts. *International Journal of Sustainability in Higher Education* 9(3), 317–338. <https://doi.org/10.1108/14676370810885916>

Townsend, L., Sathiaseelan, A., Fairhurst, G., & Wallace, C. (2013). Enhanced broadband access as a solution to the social and economic problems of the rural digital divide. *Local Economy*, 28(6), 580–595. <https://doi.org/10.1177/0269094213496974>

University of Venda, (2020). Strategic Planning Framework 2021-2025: Positioning the University of Venda for impact and relevance, Thohoyandou, South Africa.

Weerts, D.J., & Sandmann, L.R. (2008). Building a two-way street: Challenges and opportunities for community engagement at research universities. *The Review of Higher Education*, 32(1), 73–106. <https://doi.org/10.1353/rhe.0.0027>

Xing, B., & Marwala, T. (2017). Implications of the fourth industrial age for higher education. *The Thinker*, 73(Third Quarter), 12–18.

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