

# Inclusive Development Using a Micro-Tasking Approach for Building Smart Communities

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**Abstract:** African communities suffer a series of socio-economic challenges that seem difficult to eradicate. The challenges include lack of access to essential services and infrastructure; high levels of poverty, and unemployment, especially amongst the youth. The advent and adoption of Information and Communication Technologies (ICTs), particularly mobile technologies in Africa has led to a number of initiatives that attempt to eradicate some of these challenges. This has also led to young people, a majority in Africa, to play a critical role in contributing towards addressing African challenges with African solutions. At the same time, ICTs are changing the conditions of living in communities; how people communicate, work, produce and distribute knowledge. Businesses and governments are exploiting ICTs to create employment, stimulate economic growth, and solve problems in innovative ways. However, it is worth noting that although some technology-centric solutions have enjoyed successes, ICTs have not always achieved the desired and envisaged impact in communities. In most cases where technology has made inroads, the human factor has been a key differentiator, indicating that technology alone is not a solution. This paper explores a smart community approach that motivates for the impactful transformation, adoption and use of technology in digital villages to achieve the desired outcome in an ICT inclusive participatory development approach to benefit the entire community. In this descriptive research, authors share some of their research experiences from direct involvement in a number of Information and Communication Technology for Development (ICT4D) projects that had objectives of addressing our local social challenges. The main contribution from this paper is the proposal of a micro-tasking approach for building smart communities that perceive citizens as problem identifiers and solvers, producers and consumers of local solutions, leaders and followers, and owners as well as beneficiaries of any intervention in their communities whether addressed using technology or other traditional means.

**Keywords:** Digital village, Inclusive-development, Micro-tasking, Smart communities

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## 1. Introduction

It is a common fact that African countries are lagging behind compared to first world countries in terms of socio-economic development. For instance, unemployment is increasingly growing in countries such as Swaziland, Lesotho, South Africa and Namibia with unemployment rates ranging between 22 and 33 percent, compared to developed countries like the United Kingdom and United States at 3.5 percent respectively (Trading Economics, 2020). Statistics South Africa (STATSSA, 2020) recorded 52% of the unemployed youth for the April-June period. However, Information and Communication Technologies (ICTs) have transformed almost every aspect of our lives as citizens, employees, parents, politicians, businesses, leaders and as members of any type of a community. ICTs have demonstrated across the world the different possibilities on how

the technological advancement can influence and transform local communities, governments, and ordinary citizens through increased quality of life, information and education access, and economic opportunities (Zheng, 2009).

ICTs have also brought forth a period of great change and equalizer in developed and under-developed communities. The new wave of technology has also transformed the digital divide into digital difference, where virtually anyone and anywhere can have access to some form of technology, albeit with its own limitations and access channels. Today, technology is increasingly taking hold and reshaping the way people live, communicate and work. This is a step in the right direction and provides some great impetus when introducing technology for modernizing and transforming local communities. As already noted, some ICTs have enjoyed successes

and others have failed dismally. For instance, the mobile payment or cash transfer solution such as M-PESA has enjoyed considerable success in countries such as Kenya and Mozambique, but failed to make an impact in South Africa. It is on this background that as we venture into building smart communities, we emphasize that technology must not take the centre stage, but the human-element. This is because people are the ones that must benefit from any intervention introduced via technology. This paper starts by discussing the research methodology, in section two, used in addressing the research topic. Section three provides the background into the research and definitions of concepts applied. Section four describes a smart community and how it can be built. This is followed by section five, which discusses various approaches that can be used in building a smart community. Section six provides the contribution of the paper and the paper is summarised and concluded in section seven.

## 2. Research Methodology

Leedy and Ormrod (2005:46) succinctly define research methodology as the "specific procedures, instruments, methods or techniques used to identify, select, process, and analyse information about a research topic". In essence, this research methodology section provides a narrative that may enable the reader to evaluate the validity and reliability of the results presented in this paper. In order to demonstrate how data was collected and analysed to reach the conclusions in this paper, a multi-method approach is adopted for data collection, analysis, and reporting. Firstly, a comprehensive literature review approach was adopted to study related work and analyse the state of the art with regards to socio-economic challenges in South Africa, smart communities and villages, ICT4D, hackathons and crowdsourcing. In complementing the literature reviews, qualitative content analysis (Wilkinson & Birmingham, 2003) was adopted to identify patterns and themes that led to the development of the elements composing the micro-tasking approach for building smart communities.

In addition, the activity theory (Hashim & Jones, 2014) as a conceptual framework for qualitative analysis was relied upon to understand human interactions with tools (e.g. technology) and artefacts in building smart communities. Activity theory is an effective approach for understanding interactions in smart communities with significant historical and cultural

context. This theory is core to this study as it enables the researchers to break down activities that may be involved in the creation of smart communities into subjects, tools, objects, division of labour, rules and community (Hashim & Jones, 2014).

## 3. Defining a Smart Community

African countries have had an opportunity to leapfrog from fixed telephone lines to mobile phones. Some of the countries are expected to further leapfrog from 2G services to 5G as technology advances. The wide presence of various technologies has also emphasised the concept of being smart where ICT devices and services' efficiencies can be measured or tested. ICTs are capable of influencing the manifestation of "smartness", however, the way we interact with various technologies around us may reveal how advanced and smart communities can be. Therefore, smartness is experienced in society, environment, business, and politics in different ways through different modalities. The smartness of communities can further be identified by a horizontal collaboration of both humans and artefacts that are readily available to them. These could be things like the Internet, mobile devices, natural, social and financial resources. This interaction does not only benefit one party, but a number of people in a society. There are different interpretations on what is meant by smart communities or smart cities or smart villages. There are also different debates on the origins on the term smart community or cities. This is not the primary focus in this paper, however, in order to set some context on what we mean where we refer to smart communities, it is worth to put some perspectives forward.

In our approach to the smart community concept, we embrace elements that focus on the community and humans, but we also appreciate the fact that in as much as smart communities or cities are about the technologies and architectures, smartness cannot only be upheld in areas that have upmarket facilities. For instance, some of the definitions accentuate the factors of interconnectedness, interoperability and intelligence (Nam & Pardo, 2011). A smart community involves various stakeholders in a certain geographic region who are using ICTs and various infrastructures to stay connected, and create a sustainable community (Lindskog, 2004). According to Lindskog (2004), there is collaboration, cooperation, and partnership between the citizens, private, public and voluntary sectors to ensure an efficient smart

community. Westraadt and Calitz (2018) include aspects of sustainable energy as well as the environment in their definition. A number of important elements on both technology and human factors have been well addressed in the aforementioned definition and it forms the basis of our understanding on smart communities. However, most definitions are not context-aware. The human factor should always be deemed necessary, even though it may be relegated to the background in the absence of infrastructure and IT services in some communities (Nishi, 2018). In this light, we have looked into the critical elements brought forward and contextualised them to suit the African milieu and align to a digital village, which is in essence different from a smart community that may have the good infrastructure and associated resources (Chan, 2018).

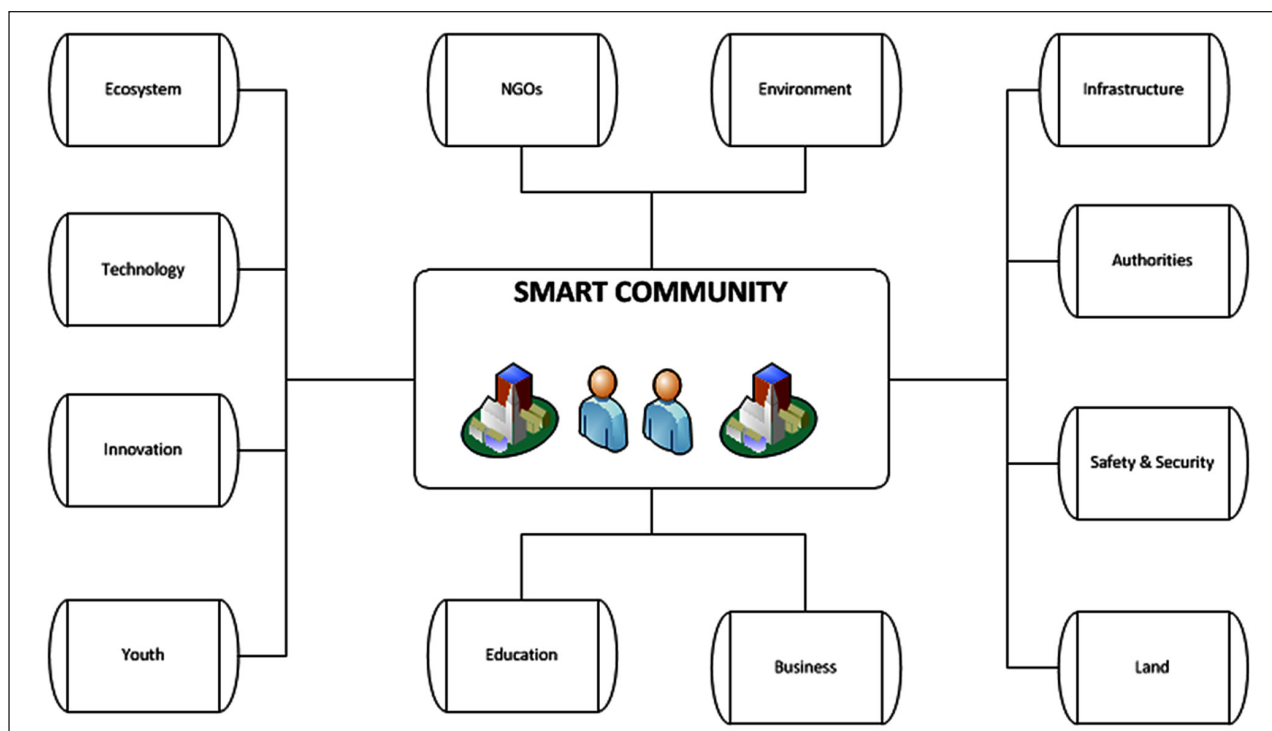
### 3.1 Contextualising a Smart Community

Smart communities call for the use of innovative technologies and approaches to inform, empower and connect. At the same time, a smart community is not only interconnected, but is also information-rich, inclusive, collaborative, cooperative, social, and enabling – expressing the spirit of Ubuntu in all its activities and providing opportunities to all citizens. This in our view cannot be realized by

following traditional communities' approaches where everything is top-down; that is, contributions, solutions, impact and influence only come from those with financial or leadership power. As we enter into the fourth industrial revolution, technology is becoming central and the creation of smart communities for the benefit of everyone becomes paramount.

Figure 1 below shows the context of smart community used in this paper. In our view, shared also by other authors in this field, a smart community can be considered an essential component to realise a sustainable, self-sufficient, environmental-friendly and disaster-tolerant society, thereby providing citizens the opportunity to lead a simple, healthy, and energy-saving way of life as well as ensuring safety, security, and a high quality-of-life in the community (Lindskog, 2014; Nishi, 2018; Mtsweni, Ngassam & Burge, 2016, 2018; Westraadt & Calitz, 2018). In this regard, a smart community is inclusive in that it always involves and combines the efforts of everyone in order to achieve transformative impact, and this is attained in collaboration and cooperation with all stakeholders as depicted in Figure 1. Realisation of smart communities requires leaders to invest in the people, tools, digital skills, and pave the way for transformation, because communities

**Figure 1: Smart Community**



Source: Authors (2020)

do not become smarter just because they are using advanced technologies. They become smart communities in addition to the use of innovative technologies by sharing the same vision and mission, and when everyone contributes and shares in the benefits, it leads to visible transformation.

### 3.2 Benefits of Smart Communities

Smart communities when in place could play an important role of foregrounding infrastructural needs of a community. They could further assist in training opportunities to enable community members enhance their skills. The built skill sets can be recorded and mapped to a community skills database (Modiba, 2016:248), which would enable the municipalities to know of the capabilities that exist in their area. This is a beneficial role for the smart village as each community skill metrics can then be advertised regionally and nationally for employment and entrepreneurial opportunities.

This linkage of skills from a rural community to the municipality to regional and national pools contributes to building quality life, which is aligned to the concept of smart communities. In addition, a village where the people and leadership are conjoined by effective technology, a better service delivery and management of municipalities is plausible. Smart communities can assist in building a citizen-leadership connection through open communication relationships to easily discuss issues and opportunities from both sides. Such a relationship is necessary in ensuring that smart community needs are met. Additional benefits relate to accountability of leadership both at the local and national levels. Issues of service delivery can be easily noted with the citizens' inputs. This bottom-up transparency has the potential to influence provincial leadership to adequately support the provision of services or communicate with the impacted communities in time to avoid service delivery protests.

## 4. Approaches Used for Smart Communities

Building smart communities, especially in digital villages faced with various challenges requires careful consideration of value-driven approaches. Over the years, we have been involved in different interventions trying to infuse technology into communities, but these have not gone without

resistance, confusion, and challenges. In this section, we briefly touch on some of these approaches, some of which are well-fused in various businesses, communities and governments for sourcing solutions from local citizens.

### 4.1 Hackathons

Hackathons are platforms for all demographics where the novice and experts come together to identify local problems, share knowledge, network and try out new technologies towards addressing identified socio-economic problems. The emergence of hackathons date back to the 60's. Mtsweni and Abdulla (2015) state that these marathon-coding events are used to build quick and yet fully operational prototypes that address technological challenges within a particular domain. Moreover, their extensive use within the software development domain started to emerge in the 90's when the use of computer software became significant.

Today, hackathons are a norm in large organizations such as Facebook, Yahoo, Google, and Microsoft. The events are strategically hosted in these large organizations to build new solutions, empower a community of developers, entice developers to embrace latest technologies, and to recruit bright software developers into these organisations. For instance, in 2011 over 200 hackathons were hosted in different cities across the globe (Mtsweni & Abdulla, 2014). These events addressed issues around education, disaster responses, corruption, health, water, climate change, government elections, politics, food security, transport, mobility, and many other local issues. In South Africa, different communities have adopted such an approach in coming up with technological solutions to address social problems.

### 4.2 Crowdsourcing

Mtsweni and Burge (2014) describe crowdsourcing as a phenomenon that has been used widely in developed countries and has potential in developing countries, especially in application domains. Howe (2006) defines crowdsourcing as a "distributed problem-solving model" that encourages tapping into the intelligence of the crowd in order to address unique, large and/or complex problems. Mtsweni and Burge (2014) argue that there are complex problems, which computers may not be able to process swiftly like humans, e.g. image tagging.

They further maintain that crowdsourcing is sometimes referred to as human computation, although there are some subtle differences between these terms. Crowdsourcing uses the wider community (i.e. crowds or smart citizens) in solving certain problems other than relying on one entity to complete a task (Mtsweni & Burge, 2014). Platforms such as Wikipedia, YouTube, and Ushahidi have successfully used this phenomenon in building their businesses.

### **4.3 Living Labs**

Living Labs (LLs) are another form of technology deployment approaches in smart communities. The LLs are regarded as user-centric, involves stakeholders and research institutions, and follows an open-innovation ecosystem in addressing community problems. The approach is contextual and promotes addressing problems in real-life settings with the participants that are directly affected by the identified problems. The application of Living Labs in smart cities is mostly for lifestyles, innovation and urban growth, mobility and sustainable development (Vale, Carvalho, Souza, Raimundo, Faria, Spinola & Elberzhager, 2018). When applying the living lab approach, the main objective is not about technical experts coming up with technological solutions, but it encourages the involvement of communities as a source of alternative solutions leading the process of systematic user co-creation and innovation (Santoro & Conte, 2009). The intention of a living lab methodology is to push technology and its application into a community through crowdsourcing where the views of the community are integrated into the early stages of problem identification and technology development.

## **5. Building a Smart Community**

A smart community can be recognised by three components, namely: connectedness, supportive infrastructure, and a sense of ownership. The teams engaged in various community building projects have a choice and urgency to adopt technologies that will contribute towards effective project activities. Moreover, they are not dictated as to how they should use any form of technology but rather advised on pros and cons of such artefacts. However, they are aware that some technologies are a part of a broader reality that is inevitable (Daly, Magmanus & Regan, 2016:274). They can also willingly buy into using innovations brought into their communities by external people. Equally, they are

able to reject an innovative technology brought into their communities should they feel it does not serve them fully.

In our anecdotal and research experience, a mobile phone based e-procurement application (Ngassam, Ntawanga & Eloff, 2013) could not succeed in Sekhukhune, Limpopo. The app was introduced to spaza shop owners who were members of the LL in efforts to help them save travelling costs, and lost business time associated to them having to travel to a nearest city of about ±40Km to buy stock. Part of the reasons for non-usage was that spaza owners preferred travelling to town to buy stock as it afforded them time out from the village. The reason for technology rejection was not technical, but social.

### **5.1 Infrastructure and Connectivity**

The infrastructure plays a complimentary and important role in that it may enable easy access amongst communities working together. For instance, it will be imperative for a community to have well-functioning network towers for them to use devices such as mobile phones to manage their daily activities. Good infrastructure is also important, because, with poor connectivity, communities run a risk of incurring high costs to access services like the Internet. Intermittent access to the network means that for one to load a webpage or open an application that requires Internet access one will have to pay more. In these cases, rural based smart-communities may not experience the full benefits compared to other smart communities where network infrastructure is reliable. As such, reliable, resilient, and robust infrastructure (Chan, 2018) is a requirement to ensure that access inequalities do not dampen the digital revolution in smart communities.

These smart community members are therefore able to find innovative ways to deal with technologies they are exposed to. Mobile phones have, for instance, enabled some communities to identify ways to use them in a manner that supports their social needs. For instance, in a research conducted in Phake Rebone, Mpumalanga, mobile phone owners used them to stay connected to their loved ones (Modiba, 2016).

According to Modiba (2016), users devised a means to work around the cost issue of making calls. They used multiple SIM cards to recharge and request

airtime advance from service providers. This shows how this community maximised the use of mobile phone services and managing service provider costs. This device of choice was also used to source knowledge on matters ranging from fertility issues, crime management to seeking employment opportunities. The gaps of usage were also identified where this device was not used effectively for job opportunities; political activities like lobbying; and for educational purposes.

### 5.2 Awareness and Empowerment

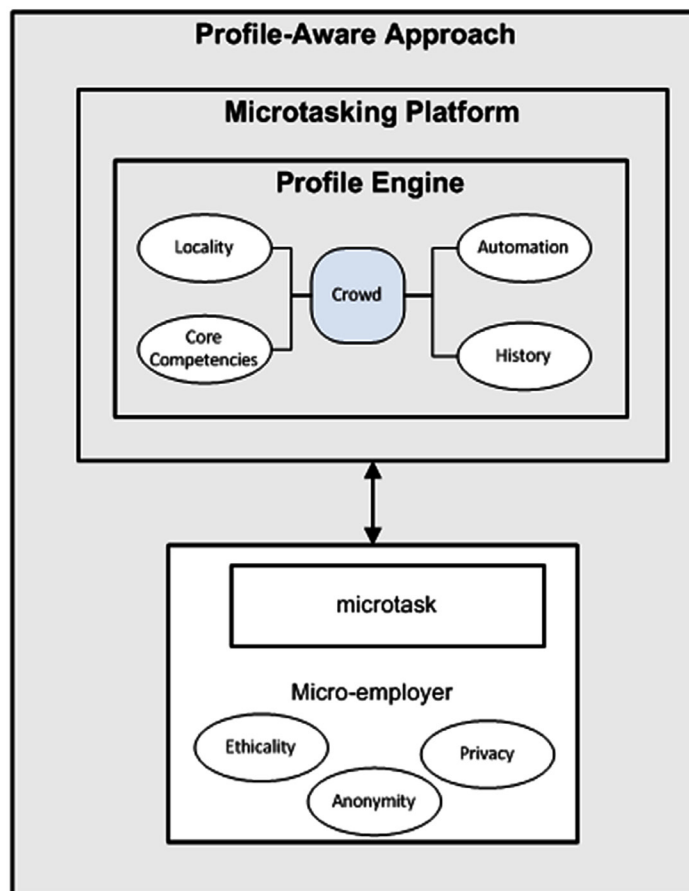
The exposure to all the technological advancement further prompts smart communities to create an environment where both innovators and users become conscious of the artefacts at their disposal. Lack of awareness on cyber issues increases the potential harms to users and may also hamper the positive impact intended by a smart community. In a research conducted in Soshanguve, Gauteng on the adoption and use of mobile payment solutions, it emerged that many citizens do not use mobile

payment solutions because of the misconceptions or fears that such solutions are meant to steal their monies or will open them up to criminals (Mhlongo, Mtsweni & Modiba, 2017). In this study, it was determined that lack of awareness and empowerment of users by the service providers on these solutions is the biggest challenge. It is then understandable why many technologies that are meant to empower communities can sometimes achieve the opposite. This confirms that the smart community is not only dependent in itself but on other stakeholders not only to empower them, but also to make them aware of the recent trends to ensure that they are safe when using different technologies (Modiba, 2016).

### 6. Micro-Tasking

Micro-tasking is proposed in this paper for building smart communities (see Figure 2). According to Mtsweni, Ngassam and Burge (2016), this approach has been used for solving a myriad of social and business challenges in some developed countries by tapping into the diversity of the local citizens who

Figure 2: Micro-Tasking Approach for Smart Communities



Source: Authors (2020)

by the nature of their experiences have knowledge that could contribute towards building a sustainable smart community. Mtsweni, Ngassam and Burge (2016) further posit that micro-tasking takes a bottom-up approach in addressing local challenges using different interventions including technology, but also does not ignore what already exists in the community. Moreover, it promotes the completion of digital and physical tasks by dividing a complex task (e.g. translation of a book) into simple and smaller tasks that can be completed by diverse skilled micro-workers located across various locations, thereby including as many community members based on skills. The micro-tasks could be generated from a large task owned by the community (or associated stakeholders) called micro-employer.

Mtsweni and Burge (2014) argue that micro-tasks do not require extensive skills or training because humans are intrinsically better at traditional and physical tasks than machines, such as sentiment analysis of social media posts of a particular product or image tagging for better search on the web. Therefore, the micro-worker could be any person who is part of a community who has the interest and profile to complete the required task, and consequently the micro-employer could be anyone who has a digital or physical task that could be completed by the crowd or individuals within a crowd.

Micro-workers might also gain valuable working experience through their participation in diverse micro tasks of different complexities. Micro-employers also have opportunities to tap into the intelligence of the crowd for value co-creation and novel solutions. We believe that such benefits are relevant for the success and impact of smart communities. When the unemployed are constantly involved in performing tasks made available in a smart community, this would not only assist them in making a living through minimal financial gains, but micro-workers would also have opportunities to build their work profiles (i.e. resumes), which could be useful for long-term job employment.

According to Mtsweni and Burge (2015), micro-work services have an indirect value to citizens in developing nations like an opportunity for the unemployed to have equitable access to various job opportunities where their contributions could be recognised and rewarded. Additional benefits that are commonly cited for micro-tasking include: innovation and entrepreneurship stimulation, equitable access

to employment opportunities, skills and work-profile development, diverse participation leading to diverse contributions, increased productivity and value co-creation. All of these benefits are directly relevant towards building sustainable digitized smart communities.

## **7. Conclusion and Recommendations**

The socio-economic challenges in Africa continue to rise, and unemployment of young people is also reaching higher levels impacting on the stability, safety and security of countries. Although, technology always comes with promises of having a positive impact on the lives of ordinary people, in most cases, ICTs when deployed in isolation without considering context and history of the communities, they will never be effective. In this paper, we focus on the involvement of communities in tapping into the emerging technologies directly focusing on the use of ICTs to address socio-economic challenges. The paper proposes a micro-tasking approach that ensures that in building smart communities, all individuals benefit financially and socially through the use of ICTs. The approach also promotes the prosumers philosophy where the smart communities are also part of the value chain of creating new solutions and products so as to create employment opportunities for their own communities.

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