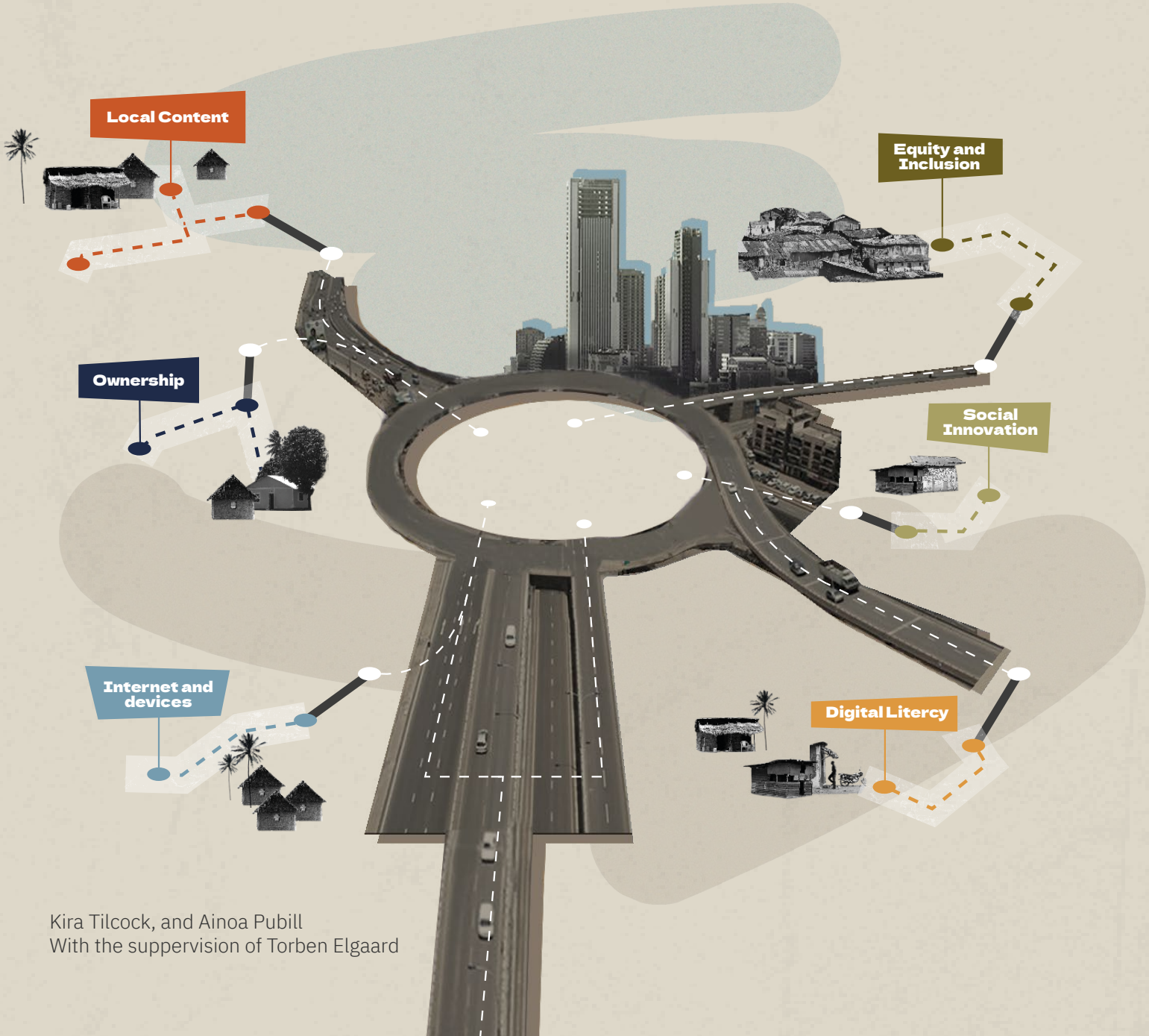
AALBORG
UNIVERSITY

10th Semester - Master Thesis
Techno-Anthropology
2nd of June 2023

# Beyond Access

An empirical exploration of how Kenyan Community Networks bring meaningful internet access to remote, marginalized and underserved communities.




Kira Tilcock, and Ainoa Pubill
With the suppervision of Torben Elgaard

# Preface

The motivation to dedicate our thesis to Kenyan Community Networks (CNs) stems from our personal experience and close involvement with Dunia Moja Community Network during our internship in the Fall of 2022. Through this internship, we had the privilege of witnessing the devotion, passion, and impact of Dunia Moja and several other CNs across Kenya. These experiences were profoundly transformative and inspired us to delve deeper into understanding CN's unique approach to addressing the digital divide.

We support and acknowledge the efforts of CNs in addressing human rights issues that affect underserved communities in Kenya. By recognising CNs' crucial role in bridging the digital divide, we aim to shed light on the challenges CNs are tackling and their successes. With this thesis, we aspire to provide a comprehensive analysis of CNs in Kenya that will inspire other organisations to adopt a culturally sensitive, locally guided approach to technology design; while encouraging and supporting CNs to remain authentic to their communities.

We extend our gratitude to all the CN members who have contributed to this study by sharing their real stories of the incredible work they are doing on the ground, enabling us to understand and engage with different perspectives. We also thank Mr Twahir, who hosted and guided us throughout our internship, Nicola Bidwell, who introduced us to the world of CNs, and our supervisor, Torben Elgaard, for his continuous positivity, guidance and support.

Group picture with some of the CNs members during a training week in Dunia Moja, Kilifi.

# Abstract

Kenya is undergoing a rapid digital transformation, with the government striving to strengthen its Information and Communications Technology (ICT) backbone, hoping to reap the socio-economic benefits of technology. Despite the increasing digitisation in Kenyans' everyday lives, from governmental and financial services to education, many Kenyans, especially those in remote, marginalised and underserved communities, lack affordable internet access. Community Networks (CNs) aim to bridge this digital divide by providing affordable internet and fostering digital literacy skills for meaningful and equitable digital inclusion. This research explores how seven CNs adopt *fluid*, *local* and *collaborative* approaches, drawing on De Leat and Mols' theoretical framework of multiplicity, which views technologies as fluid, and Donna Harwaway's Situated knowledge. CNs transcend their primary function as internet providers and embody fluid identities, adapting to local contexts, challenging dominant narratives surrounding technology, navigating societal challenges and empowering communities. They empower communities through hyper-local community-generated content, cultural preservation and knowledge production. CNs exhibit locality by addressing specific community needs and fostering community-driven solutions. Through engaging with their communities and collaborating with other CNs, they share resources and knowledge and support one another to tackle challenges and promote well-being. This research contributes with empirical data to broader socio-technical discourses by exemplifying how CNs 'work' as a fluid, contextually grounded and inclusive technological solution.

**Keywords: Community Networks, Kenya, Fluidity, Situated Knowledge, Digital Divide, Technological transformation.**

# Table of contents

# List of tables and Figures

# Acronyms

| | |
|---|---|
| **A.P.C** | Association for Progressive Communications |
| **CN/s** | Community Network/s |
| **CBO** | Community Based Organisation |
| **CoP** | Communities Of Practice |
| **ICT** | Information and Communications Technology |
| **ISOC** | Internet Society |
| **ISP** | Internet Service Provider |
| **KICTAnet** | Kenya ICT Action Network |
| **STS** | Science and Technology Studies |

# 1.0 Introduction

Kenya is undergoing a rapid digital transformation striving to position itself as the digital technology epicentre of Africa, often referred to as the Silicon Savannah (Poggiali, 2016, p.387). The Kenyan government recognises the importance of Information and Communication Technology (ICT) in enabling economic and social development (Atieno, 2014, p. 795). To strengthen the country's ICT backbone, initiatives such as the Digital Superhighway Project (henceforth 'Superhighway') aim to accelerate Kenya's digital transformation by expanding nationwide fibre network coverage and enhancing e-Government Services (International Trade Administration, 2023), thus facilitating economic opportunities, improved communication, and increased access to digital services (Kassouwi, 2023).

Kenya's digital transformation began in the early 2000s when the government developed new e-governance strategies (Ndung'u, 2019, p.2). Additionally, the telecommunications sector was deregulated, and the country's sole wireless provider, Safaricom, morphed from a state-owned subsidiary into a private company (Poggiali, 2016, p.389). "Safaricom became emblematic of technology's potential," and has been credited for providing "more to help Kenya than decades of aid" (Economist, 2008, as cited in Poggiali, 2016, p.388). New mobile financial services and state-corporate partnerships led the way to leverage digital technology in new ways (Ndung'u, 2019, p.2), turning ICT into a focal point in the country's political landscape (Poggiali, 2016, p.391).

While governmental, financial, and education systems become increasingly digitised, many Kenyans, especially those in remote, marginalised and underserved communities, are left unconnected due to the cost of internet access, lack of devices and language barriers (Odhiambo, 2023). Many of these communities face socio-economic challenges (Corrigan, 2022, as cited in Pubill & Tilcock, 2022, p.1); 67% of Kenya's population resides in rural areas with high poverty rates (Mbarika et al., 2009, p.9). In Kenya's capital city, Nairobi, it is estimated that around 70% of the population resides in informal settlements lacking basic needs and social amenities (Murisya et al., 2011, p.198; Wanjiru-Mwita, 2023). Socio-economic exclusion extends to the digital realm, as many Kenyans in these communities are excluded from government initiatives that aim to bring the internet. This exclusion further perpetuates socio-economic inequalities by limiting their access to technology adoption and its potential benefits, including the growing necessity to access governmental e-services.

In response to the 'digital divide,' grassroots non-profit organisations known as Community Networks (CNs) are filling the gap by setting up affordable internet access points in remote, marginalised and underserved communities. These CNs adopt community-led approaches to find solutions that align with their communities' socio-cultural beliefs, practices, and economy (Odhiambo, 2023). This paper explores how seven CNs across Kenya attempt to bring meaningful internet access

to their communities, drawing on empirical data collected during and after fieldwork experiences. The data is analysed using De Leat and Mols' theoretical framework of multiplicity; which views technologies as fluid (De Laet & Mol, 2000), and Donna Harwaway's concept of Situated knowledge (Haraway,1988); which understands knowledge as shaped by the specific context and experiences of those who produce it.

This case study showcases the transformative potential of these small but impactful organisations, moving beyond the notion of solely 'connecting the unconnected.' By presenting the fluid and contextually grounded approach of CNs, this research aims to contribute to the broader socio-technical discourse on collaborative and local strategies to address socio-economic inequality and promotion of inclusive technological solutions in bridging the digital divide. The findings provide valuable insights into how CNs transcend boundaries to: navigate socio-technical challenges, advocate for equitable access to technology, and become a local source for socio-economic development.

## 1.1 Problem Statement and Research Questions

Community Networks (CNs) are not only about connecting communities to the internet but also making it meaningful to their respective communities. Even those with some degree of access may not have meaningful access that could allow them to claim social, cultural, political, economic, and civil rights — the promises of what the Internet should offer (Brudvig, 2019). CNs attempt to make their organisation and programs meaningful but can struggle to engage community members and convince them of the potential of the internet and the possibilities for using ICT to innovate locally. A lack of engagement, in part, is due to a lack of relatability to the Western infrastructures and systems that have been brought along with the internet. The predominance of Western systems and perspectives on how digital technologies are designed can limit the potential benefits of technology for local communities. CNs hold a space in mobilising local social innovation to empower the community and promote digital inclusion and ownership.

The concept of multiplicity from science and technology studies (STS) serves as an analytical framework to view CNs as a fluid technology by adapting and appropriating themselves and their programs to their local settings (De Laet, M., & Mol, A., 2000). Combined with the conceptual framework of situated knowledge, CNs can be analysed from the perspective that they are built on knowledge grounded in specific cultural, social, and geographical contexts and exist in tension with the larger social and political structures that shape and influence them (Haraway, 1988). By acknowledging this tension, CNs can be seen as a technology that embodies a more inclusive and equitable distribution of knowledge and power.

The following research questions were developed in an attempt to glean a deeper understanding of the CN phenomenon in Kenya:

- **How are Kenyan Community Networks addressing the digital divide to promote meaningful digital inclusion and equity?**
- **What are CNs potential role in Kenya's digital transformation?**

# 2.0 Literature Review

The resulting literature summarises discourses amongst scholars on; the tensions within the digital divide and the role of Community Networks' (CNs) in Kenya's digital transformation. It highlights the complex dynamics involved related to socio-economic factors, post-colonial power relations, knowledge production, and technology development. The following section serves as a foundation to; contextualise the existence of CNs and the discourses that surround them, provide an academic perspective on the researcher's experience within CNs and support with empirical evidence the theoretical framework.

## 2.1 Globalisation and the Digital Divide

The tensions arising in Kenya's digital landscape can not be separated from the rest of the world. Information and communication technology (ICT) has and continues to revolutionise the world since its emergence, launching the world into what is dubbed as the '3rd Industrial Revolution' (Rifkin, 2011). Since then, various economic and cultural factors have shaped ICT development and adoption. While ICT has been recognised as a significant driver for economic growth and global interconnectedness, its impact has been considered as "variable, based on national resources, internet access and corporate and national leadership. It is taking place primarily in a capitalist and neo-liberal environment of traditional 'Globalisation from Above'" (Dunn, 2021, p. 33). Globalisation and structural inequalities inherent in global capitalism seem to perpetuate differences, heterogeneities, and boundaries (Nyamnjoh, 2002, p. 1).

It is crucial to acknowledge that the diffusion of ICT has not occurred equally across societies, contributing to what is known as the digital divide. The digital divide has been referred to as the gap between people with adequate access to and use of ICT and those without (Van Dijk, 2020, Chapter 1). In this definition, 'access' refers to the physical and material aspects, such as devices, broadband penetration rates by region, application, quality and speed of internet service, and availability of infrastructure (Wildermuth, 2018, p. 187). The concept of 'use' was subsequently introduced in the discourse, pointing out that access alone does not bridge the divide and help individuals appropriate technology; individuals must develop several necessary skills to use the medium concerned (Van Dijk, 2020). Furthermore, the digital divide has been discussed as a critical topic for social justice in the twenty-first century as it has "expanded to include inequalities in technology skills and how it is used" (Rogers, 2016, p. 1).

## 2.2 Beyond Access and Use

Several scholars have pointed out that oversimplifying the digital divide as a dichotomy of 'haves' and 'haves-nots' might overlook deeper intersections between technology, culture, identity, power, knowledge and social exclusion. Instead, it is important to look at the deeper nuances that shape the complex dynamics surrounding technology adoption in particular contexts (Van Dijk, 2020, Chapter 1). While understanding these nuances applies universally, several studies aim to shed light on these complex dynamics that affect the African context.

One issue discussed among scholars is the 'universal paradigm of technology' (Bidwell, 2021, p. 100), which is rooted in Western ideas of modernity (Ndlovu-Gatsheni, 2022, p. 7) and the notion of 'progress'. This paradigm shapes the understanding of creating, designing and innovating in an African context. This narrative also contributes to the African continent focusing on ways to 'catch up' with the Global North (Wasserman & Herman, 2021, p. 20), particularly in fields like Human Computer-Interaction for Development (HCI4D), which often emphasises addressing Africa's 'lacks' or 'gaps' (Adamu, 2023, p. 1). However, the introduction of digital media does not automatically democratise or empower; techno-deterministic assumptions can amplify existing power imbalances, political conflicts or social polarisations. (Wasserman & Herman, 2021, p. 24).

Post-colonial power relations have been discussed as a significant influence on the dynamics of technology adoption in Africa. (Dourish & Mainwaring 2012; Irani et al. 2010, as cited in Bidwell, 2021, p. 100). Bidwell argues that the legacy of colonialism has shaped not only the economic and political landscapes but also the socio-technological landscape of the continent (2021). The remains of colonialism referred to as coloniality, create an invisible power structure that sustains colonial relations of exploitation and domination long after the end of direct colonialism (Ndlovu-Gatsheni, 2012, p. 48).

Research has discussed how scholarly and industrial interest in African digital cultures has focused on the country's potential to "catch up" with the Global North, driven by Western-centric perspectives of progress and development (Appadurai 2016 as mentioned in Wasserman & Herman, 2021, p. 20). Technological development coming from abroad may overlook the local settings, cultural and social nuances, and indigenous knowledge systems that should be integrated into the design and implementation of technologies (Csikszentmihalyi et al. 2018 as mentioned in Bidwell, 2021, p.101), which could also perpetuate the narrative that African countries can not develop without foreign support (Irani et al. 2010 as mentioned in Bidwell, 2021, p.101). Additionally, it is important to consider the implications of digital content produced elsewhere, which often does not represent the realities of those who consume it. Consequently, this contributes to an implicit statement that local culture is dispensable, resulting in self-denial, self-evacuation, or self-devaluation and the glorification of the creative output of others. (Nyamnjoh, 2002, p. 2).

Examining digital media through the lens of culture should not be mistaken for an

apolitical stance or a return to nativism that uncritically celebrates an essentialist 'African culture' while rejecting other epistemologies developed elsewhere. Rather, it means understanding digital media within local contexts, social dynamics, and political power relations while recognising broader patterns of global change and cultural flows (Wasserman & Herman, 2021, p. 24).

Some scholars have highlighted the need to acknowledge the diverse ways knowledge is produced, accessed, and shared. As Bidwell, Winschiers-Theophilus, Kapuire, and Rehm (2011) state: "Beyond inequalities in the technical abilities of groups lie deeper tensions within the social, technical and literary strategies that different knowledge traditions apply in organising and sharing information" (p. 2).

This perspective shows that dilemmas in designing technologies and media for marginalised knowledge traditions go beyond the superficial preservation of local knowledge. Instead, it raises the question of what values, logics, and literacies may be lost in the transformation process (Bidwell et al., 2011). Recognising these tensions is essential for developing inclusive technological solutions that respect and integrate diverse knowledge systems.

Furthermore, some studies advocate for focusing on situated alternatives that include other dimensions of African Identities in technology rather than developing alternative approaches to design thinking and making (Adamu, 2023, p. 3). This approach would involve "creating a reflexive narrative about the place of technology in restructuring social life in Africa; in understanding how to design, evaluate, and deploy interventions that are diagnostic, participatory, and emancipatory" (Adamu, 2023, p. 3).

## 2.3 Community Networks Filling the Digital Divide

Despite the mobile revolution and rapid digital transition, many communities remain unconnected (Nyabuga et al., 2013). Current client-server market models are unable to provide affordable communication access to marginalised communities, resulting in further social inequalities (Rey-Moreno, 2014). Urban-rural divisions and insufficient infrastructure in certain regions hinder connectivity, impeding digital technology adoption. CNs have emerged as decentralised solutions to bridge the divide, addressing gaps in internet and electricity connectivity caused by monopolistic companies (Rey-Moreno, 2014; Bidwell, 2021, p. 109).

Gaps in education and accessibility are evident, as exemplified by the 'Laptop Program' which aimed to provide laptops to all primary schools while also including "infrastructure (energy, security, and connectivity), devices, content, and building of teachers' capacity" (Kenya Vision 2030, n.d.). By 2018, 80% of public primary schools have received a laptop or tablet, but 80% of teachers still lack the necessary ICT skills (Wanzala & Nyamai, 2018). Previous empirical research in Mtondia (Pubill & Tilcock, 2022) showed additional deficits in the laptop program; in primary schools with devices, many devices are broken due to poor quality, unused or non-functional, and many teachers lack basic ICT skills.

The power dynamics of post/neocolonialism that dictate the identities of African innovation are undermined by the gaps created by electric and telecommunications capitalisms and the dominant 'universal' paradigm. (Bidwell, 2021, p. 107) However, studies have indicated the potential for CNs to redefine the concept of innovation by addressing those gaps (Adamu, 2023, p. 3; Bidwell, 2021, p. 109). Although "the technologies and models to sustain African CNs are already embedded with Western Logics" (Bidwell, 2021, p. 108), CNs can provide a space to examine and discuss conversations about taken-for-granted perspectives on technology innovation. CNs hold the potential to decolonise innovation by embedding local values and embracing a relational ontology (Bidwell, 2021, p. 109).

## 2.4 CNs as a Social Innovation

Social innovation is defined in various ways but centred around the intentionality to drive a social mission (Onsongo, 2017, p. 371). For the purpose of this research, and within the content of CNs in Kenya, social innovation "highlights a change in or new interpretations of institutional elements such as roles, relations, expectations, practices, norms and values" while involving "actions intended to disrupt or transform prevailing institutions that have stabilised around social problems" (Onsongo, 2017, p. 371). Those who engage in social innovations can be perceived as actors who mobilise resources to create new institutions or to transform existing ones to realise interests they value highly (DiMaggio, 1988).

The work and activities that CNs initiate and participate in are innovative in nature, as they present novel processes (Carr et al., 2016) to address the wicked social-technical problem of inequality of internet access in Kenya. CNs are attempting to innovate for a social cause; thus, this research frames CNs as a social innovation based on their intentional social mission: to empower and increase prosperity through the internet. CNs are also a potential site for social innovation based on their planned innovation processes and outcomes. This definition and frame of social innovation will be used in this research to frame the 'innovation' that CNs are and facilitate.

## 2.5 Literature Review Conclusion

While it is impossible to address all the tensions and nuances surrounding the digital divide, recognising some of the scholarly discussions outlined in the previous paragraphs is essential for understanding the emergence and significance of Community Networks (CNs) in Kenya. This section provided a starting point to acknowledge the complex landscape of the digital divide and the role of CNs.

This literature review presented how the diffusion of ICT globally has not been equitable, leading to the digital divide phenomenon. This issue goes beyond access and use and is intertwined with complex dynamics between technology,

society, culture, economics, power and knowledge. It points out how a ‘universal paradigm’ and ideas of progress rooted in Western ideas and development discourses can overshadow local contexts and cultural nuances, emphasising the need for more inclusive technological solutions that integrate diverse knowledge traditions. It contextualises the rise of CN as a decentralised solution to address the divide and acknowledges their potential to redefine the meaning of innovation because of their existence within ICT development gaps. Finally, it presents a description of social innovation, which will frame the innovation that CNs facilitate and embody throughout this research.

# 3.0 Case Study of Kenyan Community Networks

Community Networks (CNs) are bottom-up, citizen-driven, and primarily non-profit Community-Based Organisations (CBOs) that provide affordable internet access to their communities. A CN may be "created in areas where traditional operators do not provide access services owing to the low economic appeal of these areas" (Siyam & Rey-Moreno, 2022. p.20) or because of the unattainably high cost of internet service. CNs intend to deploy and operate their own communication infrastructure designed to meet the specific needs of the community it serves (Rey-Moreno, 2014). Research done about CNs in Africa states that CNs are often:

> initiated by a champion who can be from the community or an external person collaborating with the community. Known institutional models bring together non-profit organisations, community-based organisations or cooperatives... This sense of community ownership has seen local community members and local authorities playing a key role in mobilisation and advocacy at local, national and regional levels. (Siyam & Rey-Moreno, 2022. p. 20)

The high upfront costs of the infrastructure components and salary to maintain the network means that only some CNs may initially have the resources and capacity to establish their own network. In parallel to providing internet access, most CNs within this case study also have a 'resource centre' or 'hub', which is a physical space where the community can access the internet and devices and where CNs provide free digital literacy education. CNs aim to empower the community by providing access and enabling practical and meaningful technology usage.

In the global context, 'the community' is defined as the shared interest in technological connectivity among people participating in the CN (Cho, 2008, as mentioned in Bidwell, 2021, p. 108). In the context of this research, which specifically examines Kenyan CNs, the term 'CN member/s' will be used to denote the former definition, whereas 'community' will refer to the established relationships within specific social and geographical locations (Bidwell, 2021, p. 108).

## 3.1 Institutions Supporting Kenyan CNs

National and international organisations often back CNs initiatives. Based on ethnographic data and interviews, the key organisations supporting these networks in Kenya include: the Internet Society (ISOC), a non-profit global organisation that "empowers people to keep the internet a force for good: open, globally-connected, secure, and trustworthy" (Internet Society, 2023), Kenya ICT Action Network (KICTANet), which is a multi-stakeholder platform that brings together individuals and organisations from the government, civil society, academia, and the private sector to engage in discussions and actions related to the development and use of information and communication technologies (ICTs) in Kenya (KICTANet, n.d.),

and the Association for Progressive Communications (APC) which is an international network of organisations that work to prompt access and use of ICT for social justice and sustainable development (Association for Progressive Communications, n.d.).

The Kenyan Communications Authority (CA), the regulatory body for communications in Kenya, does not directly support CNs. However, its role has been crucial in introducing the policies such as the Community Networks licence, which enables CNs to operate legally in the country. This licence legitimises the movement and creates opportunities to attract investors, stakeholders, and partnerships with local and national governmental institutions.

CN's affiliations with external organisations help promote the movement at a national and regional level, foster stakeholder engagement and provide direct input from the ground on the issues affecting their operations. Such partnerships enable CNs to leverage the expertise and resources of larger organisations while keeping their grassroots orientation and community-based mindset.

## 3.2 Basis for Case Study

This project focuses on seven CNs across Kenya, all of which participated in the Kenya National 'School' of CNs (KNSCN) in 2022 (henceforth, 'School'). The researchers engaged with representatives from each CN during two KNSCN events.

KNSCN, funded by APC and organised by Tanda, aims to support smaller or upcoming CNs. It provides monthly online training where three employees from each CN each complete training on one of the fundamental work packages: policy and sustainability (financial sustainability, not environmental sustainability), infrastructure, or content creation. Additionally, a week-long in-person training brings CNs members and experts together for cross-exchange learning and sharing of findings on each work package (Catherine, 2022). These initiatives foster discussions on challenges and collaborative solutions. At the end of the program, APC grants financial assistance to six CNs, facilitating the implementation of learned strategies and promoting their sustainability and growth.

### 3.2.1 Selected CNs


Figure 1. Map featuring the locations of each CN in the case study.

| Name of CN | Area | Type of Location | Year Established | Number of Employees | Number of Connections |
|---|---|---|---|---|---|
| **Tanda** | Kibera, Nairobi | Urban | 2023 (prev.2010) | 8 | 60 |
| **Oasis Mathare** | Mathare, Nairobi | Urban | 2013 | 7 | 4 |
| **Kijiji Yeetu** | Ugunja, Siaya County | Rural | 2019 | 3 | 4 |
| **Siaya** | Siaya, Siaya County | Rural | 2012 | 4 Employees 4 Volunteers | 4 |
| **Athi** | Maua, Meru County | Rural | 2020 | 3 | 1 |
| **OWNNET** | Kakuma Turkana | Refugee Camp | 2022 | 1 Employee 4 Volunteers | 3 |
| **Dunia Moja** | Mtondia, Kilifi | Rural | 2020 | 1 Employee 7 Interns | 10 |

Table 1. List of CNs with organisational specifications

### Tanda

Tanda is a community wireless network for Kibera in Nairobi, which is the largest informal settlement in Kenya and the third largest in the world. Tanda aims to "build a digital ecosystem to address digital inequalities for the socially and economically disadvantaged living in Kibera...[Tanda] addresses these inequalities by focusing on access to connectivity, building digital capacities, digital platforms and the creation of locally relevant content by, with and for the community" (Siyam & Rey-Moreno, 2022. p.25). Specifically, they wish to increase access to multimedia educational content and primarily target schools and other institutions that can benefit from educational content (Rey-Moreno et al., 2016). Tanda was previously a project called TunaPandaNet developed by TunaPanda in 2010.

### Dunia Moja

Dunia Moja and its sister organisation Lamuka Hub, are located in the rural village of Mtondia in Kilifi County. Their shared mission is to uplift the community by offering affordable internet access and digital literacy education. Youth employment is the primary concern in the area, so the CN's programs and activities are primarily shaped around the younger community members. To date, they have successfully installed WiFi in ten primary schools, benefiting approximately 10,000 children, as stated by Twahir Hussens, the organisation's owner (Pubill & Tilcock, 2023).

### Oasis Mathare

Oasis Mathare (OM) is a CBO based in Mathare, the second-largest informal settlement in Nairobi (Oasis Mathare, n.d.). OM's mission is to provide "practical solutions to the disadvantaged and marginalised youth and children of the Mathare slum" (Solidarités Jeunesses, 2022). They aim to Mathare youth and children:

> to take control of their own development through ICT and education, give youth the tools they need to champion environmental sustainability, health and wellbeing, and productive livelihoods. To reduce extreme poverty, crime rates and disease among the youth, [and] to improve the literacy level and reading culture among disadvantaged youth for their personal empowerment.(Solidarités Jeunesses, 2022)

OM is also a community space that provides; a safe space for youth and children, ICT training, mentorship opportunities, early childhood development activities and library services (Solidarités Jeunesses, 2022). Having a physical space allows children to do their studies away from home, where they may face challenges such as space and electricity (Oasis Mathare, n.d.).

## Athi

Athi Community Network (Athi) was formed in response to “expensive internet and [a] relatively impoverished population with a low digital literacy” (Athi Community Network, 2022). The area was once a dependable tea farming area but is no longer profitable due to environmental degradation. With “dwindling economic fortunes coupled with a low-skilled ever-expanding population has necessitated a rethink on how to empower the community” (Athi Community Network, 2022).

Athi has prioritised women’s involvement in decision-making as pregnant teens and women, as they have been neglected and do not enjoy the full benefits of the digital economy. Athi believes that the demand for digital skills is evident, from basic typesetting to structured network cabling and CCTV installation, app development, and everyday digital equipment, and that “imparting relevant digital skills will result in an empowered community” (Athi Community Network, 2022).

## Kijiji Yeetu

Kijiji Yeetu is based in Ugunja Village, Siaya County, but also has an additional office in Nairobi. Kijiji Yeetu aims to serve Kenya’s underserved villages and communities and describes itself as a “Smart Village Ecosystem for activating villages’ resources, sharing knowledge and community networks for devolution, governance, and development in Kenya” (Kijiji Yeetu, n.d.). Their initiatives revolve around digital Transformation, conversation and dialogue, and community Networks and learning (Kijiji Yeetu, 2020).

## Siaya Community Library

The Siaya Community Library (SCL) claims to be the first community library in the district and one of a kind across Kenya. It was established by the American Friends of Kenya (AFK) Inc., an organisation based in the USA that focuses on fostering Kenyan leadership in education and library development (Siaya Library, 2015). In July 2012, AFK donated and shipped a container of books, library shelving and supplies from the US (Siaya Library, 2015). The library is a physical space where community members, especially children, can access physical and online books. They also have installed Wifi in schools to ensure that the online books are accessible to all who may need them.

## OWNNET

OWNNET is a non-profit business located in Kakuma Refugee Camp. OWNNET is a branch of Winykal Computers (WC) that started in 2016. WC has three main areas of service; music production, mobile and computer repair and maintenance and internet services. In 2022 they started hotspot internet deployment. Their mission is to connect everyone in their area so their community can connect to the world and communicate with their friends and family to let them know where they are. They hope that bringing the internet will help the community

and generate new economic opportunities. Through music production, they aim to amplify the voices of emerging artists both locally and internationally (Ogul, 2023). The owner of OWNNET works with Action pour Le Progres (AP) as an IT consultant to help the organisation with network setup. AP also operates within the Kakuma refugee camp, focusing on uplifting young refugees through diverse developmental initiatives and empowering them to solve problems independently (Reframe, n.d.). The owner of OWNNET joined the ‘school’ with AP as their technical spokesperson, but this case study focuses on the work done by OWNNET.

# 4.0 Methodology

This section introduces the research's methodological approaches, including the overarching research design, methods for data collection, analytical strategy, and limitations and delimitations.

## 4.1 Positionality and Ethical Considerations

Throughout this research and our past interactions with Community Networks (CNs), we have been and continue to acknowledge our positionality. We recognise our position as outsiders and as people who have been given the opportunities afforded to us because of our backgrounds. We have embraced our experience with CNs from a place of respect, collaboration and mutual agreement. As outsiders to the CN community, we recognise that we are guests and must approach our work with humility and sensitivity and ensure this research gives visibility to the local voices from the CN movement.

All the work and support we do with and for CN has been consulted and discussed with CN members, ensuring our efforts align with their goals. For example, during our internship, we were asked to lecture on infographics in a peer-to-peer knowledge exchange. We were glad to share our expertise in design while providing some skills that give autonomy to CNs.

Thanks to our experience in Kenya, we have established proximity to the community and developed relationships. We recognise that our perspective is limited as outsiders, and we are not completely neutral in our interpretations. We strive to reflect and acknowledge our biases and assumptions continually. As Motari notes, our presumptions influence our observations in the field, which in turn affects the angle of what we hear and see (2015).

By choosing to analyse our data through specific theoretical lenses, we inevitably highlight certain discourses, stories, and opinions while leaving out others. We aim to conduct respectful, collaborative research that contributes to a deeper socio-technical understanding of CNs, remain allies of the CN members, and elevate the work of the CN movement in Kenya. We are grateful for the opportunity to learn from and work with CN members.

## 4.2 Research Design

The foundations of this research began in August 2022, when we completed a three-month internship with Dunia Moja. During our internship, We gained exposure to other Kenyan CNs but could not explore the broader CN movement due to time constrains. With ample thick ethnographic data, participation in two week-long national CN conferences and first-hand experience working with Dunia Moja and its respective community led us to want to expand on our own experience.

The research for this project began with a self-assessment of our questions that arose during and after the internship about the CN phenomena in Kenya. Subsequently, it formed the bases for this case study (see section 3.0). A cross-case single-case study approach (Yin, 2018) was chosen to conduct this exploratory study, which is based on Yin's description of a case study as "...an empirical method that investigates a contemporary phenomenon" (2018). Forming the research based on a case study allows us to understand a real-world case by involving important contextual conditions (Yin, 2018).

The overarching research design is encapsulated within a schematic diagram in Figure 2.

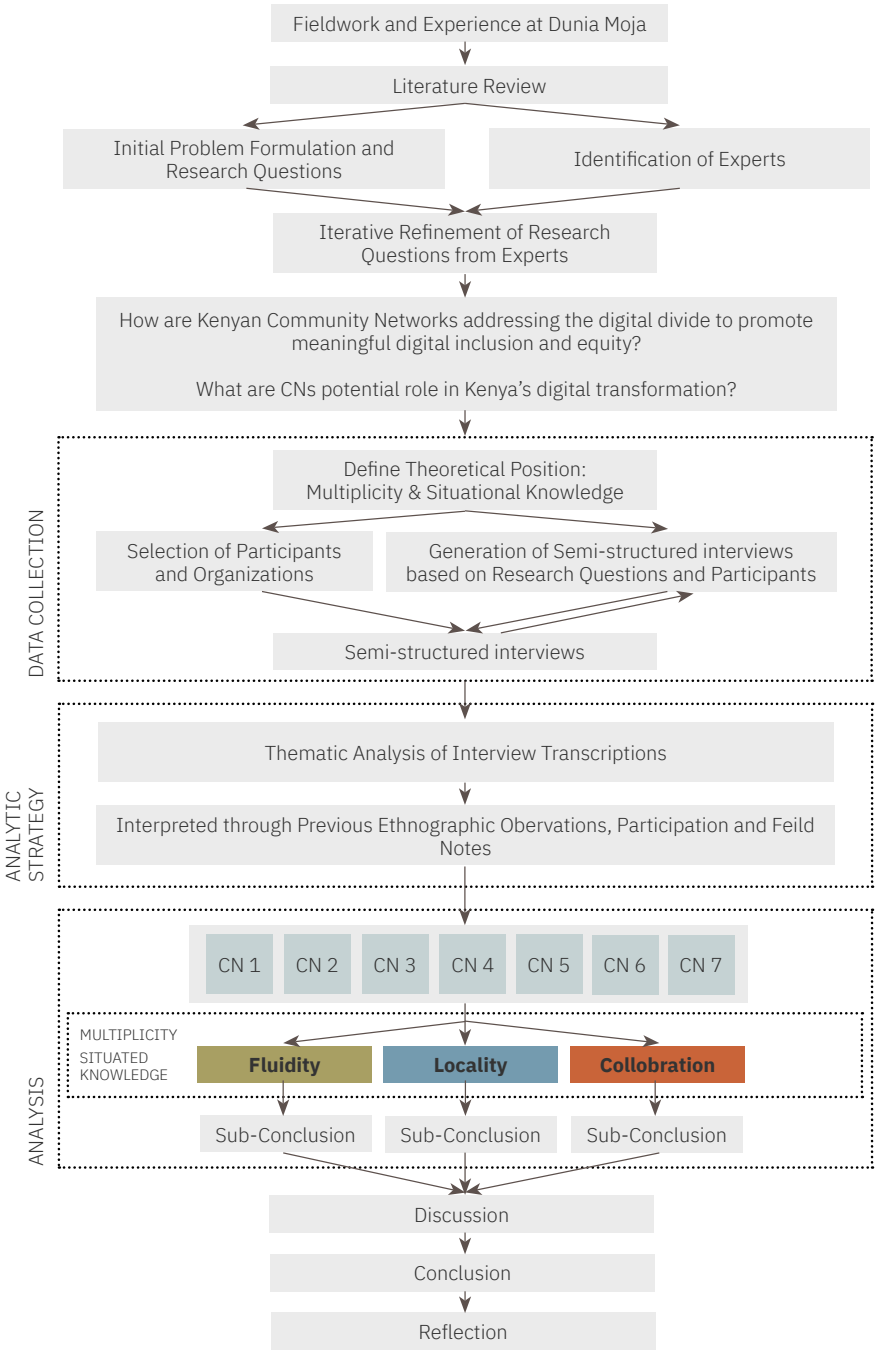



Figure 2- Research design diagram

## Literature Review

After brainstorming potential problem areas, we began a literature review focused on Community Networks (CNs) in Africa, particularly Kenya, and the tensions on the digital divide within Kenya's digital transformation. While there is a noticeable gap in academic articles specifically examining CNs in Kenya from a socio-technical standpoint, the available literature supports the value of local innovation for local needs. It also points to the potential of CNs in bridging the prevalent digital divide throughout Kenya. The literature review contextualises the discourses surrounding CNs, providing an academic basis for this research.

## Ethnographic Data

We focused on just one CN during our internship, as we were contractually and physically attached to Dunia Moja. Therefore, the majority of data collected during the internship predominantly focuses on fieldwork conducted in Dunia Moja and its corresponding community of Mtondia. However, for the purpose of this research, we extrapolated as much data from our interactions with other CNs in Kenya. This data mainly consists of; informal conversations, field notes, and participant observation (Spradley, J. P. 2016) in the two national CN conferences. These sources will serve as equal points of reference for our analysis. Throughout the internship, we used an open-ended ethnographically informed approach, which reflects the fundamentals of the ethnographic methodology of

> participating overtly or covertly, in people's daily lives for an extended period of time, watching what happens, listening to what is said, and/or asking questions through informal and formal interviews, collecting documents and artefacts – in fact, gathering whatever data are available to throw light on the issues that are the emerging focus of inquiry (Hammersley & Atkinson, 2007, p.3)

The resulting analysis is interpreted through a substantial amount of thick cultural and contextual data that we acquired through our ethnographic experiences.

## Analysis Methods

From our interview transcriptions, we used thematic coding to elicit the key themes (Given et al., 2008). First, separately we generated codes by using an inductive/open approach in Nvivo (See Appendix A). Subsequently, we conducted axial coding by grouping and rephrasing the recurring and significant codes using a Miro board (Figure 3). We interpreted these codes and themes through our previous ethnographic experience to further refine our analysis. After reviewing our codes, we looked for larger themes and arranged them to support our research questions and frameworks. We used the resulting themes to complete deductive/selective coding (Figure 4) within our transcriptions.

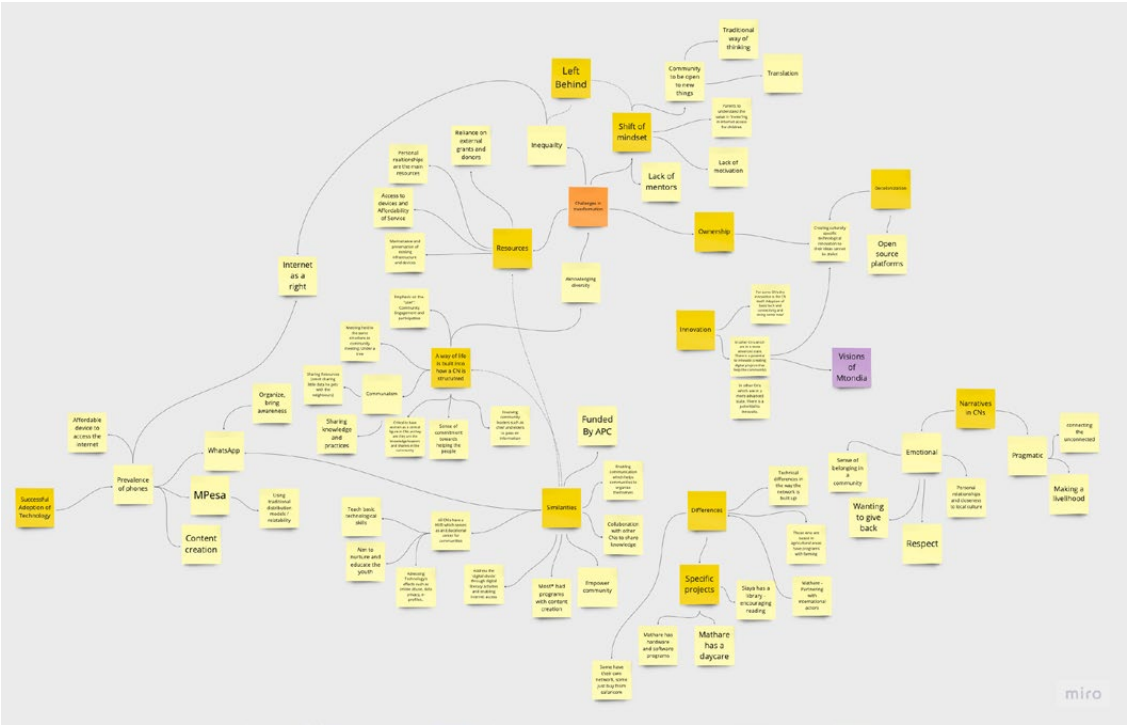



Figure 3 - Axial coding in Miro

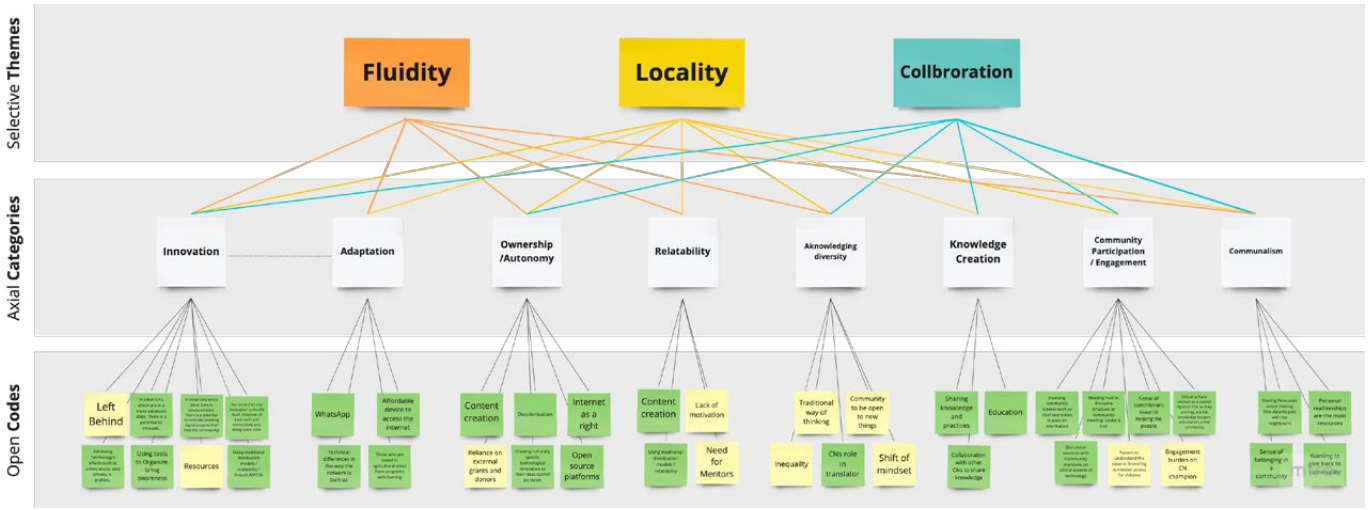



Figure 4 - Deductive/selective coding

Consent

Before each interview, every interviewee was informed about the research and consented that their interviews would be used in our thesis and made publicly accessible. Since all the interviews were conducted online, each interviewee was asked if their audio and video could be recorded. Additionally, they were asked if the audio could be transcribed using a third-party service called Otter.ai and if we could directly quote them in our thesis. We also informed them that their names would remain anonymous in the report unless they explicitly consented. When we brought up this component of anonymity, some of our interviewees brought up the issue that often, research done in Africa, not done by Africans, does not give credit to those whose stories and lives are involved in said research. We heard from them that it is important for them to have visibility and exposure of their contributions; therefore, all interviewees' names are visible, except for one whom we lost contact with after the first interview. Additionally, with their consent, we have added their images to Figure 1 (See section 3.2.1) and throughout the text to bring their faces to their names and make them more visible.

The interviewees have consented to the exact quotes and references used in this research. However, because they have been made explicitly visible, we have not included the transcripts of the interviews as they may include topics that are irrelevant to this research or contain personal conversations that should not be published.

Additionally, everyone captured in a picture within this paper has consented for their images to be placed here and published. If they are minors, we have avoided showing their faces even though we have also received consent from their parents or guardians.

Semi-Structured Interviews

We conducted nine semi-structured interviews (See Appendix B for interview question guidelines) and two informal conversations. We included the transcriptions from three semi-structured interviews and two informal conversations from our previous internship at Dunia Moja. All interviewees are either Community Networks employees or are involved with the movement and were all people we had developed a rapport with throughout our previous internship at Dunia Moja. We attempted to diversify our participants in hopes of obtaining varying perspectives.

- **Hawi Rapudo** - the Secretary-General of the Internet Society Kenya and member at Kijiji Yeetu
- **Risper Arose** - Digital Inclusion and Gender Justice employee at Tanda
- **Donatus Abwao** - ICT Lead at Siaya Community Network

1.If you are interested in seeing these transcripts, please contact the researchers.

- **Arleen Rackita** - Project manager at Oasis Mathare
- **Ali Hussein** - Tech Executive and Advisor to Boards of Technology in Kenya
- **Josie Philips** - Employee at Siaya Hub
- **Mrs C** - Administrative Officer Athi Community Network
- **Catherine Kyalo** - East Africa Coordinator for CNs at KICTANet through Association of Progressive Communications (A.P.C)
- **Omot Ogul** - Owner of OWNNET and Employee at Action Pour Le Progrès at Kakuma Refugee Camp

Informal Conversations:

- **Alphonce Odhiambo** - Network Team Lead at TANDA Community Network & President of the Internet Society Kenya
- **Josephine Miliza** - Co-founder of Tanda & Africa regional coordinator for the A.P.C

Previous interviews with:

- **Twahir Hussein** - The owner and founder of Dunia Moja/Lamuka Hub
- **Mr K** - Deputy headmaster from Kibarani school for the deaf and hard of hearing
- **Mr T** - Community member of Mtonida, whose children took part in a digital literacy camp at Dunja/Lamuka Hub

Previous informal Conversations with:

- **Dominic Lokuruka Losinyono -** ICT & PR officer at Ngikeyokok Community Network
- **Mrs M** - Kakuma Refugee Camp

## 4.3 Limitations and Delimitations

We recognise that this research only provides a snapshot of the CN movement in Kenya, as we selected only seven CNs, all of which are affiliated with the Kenya National School of CNs (KNSCN). We have personally interacted with representatives from all the CNs that are represented in this case study but were physically present in only three CNs: Dunia Moja, Oasis Mathare and Tanda. Dunia Moja informed the basis of our understanding since we were physically engaging with their work for three months. In Tanda and Oasis, we could only participate in one-day visits. By not being physically in the rest of the CNs, we acknowledge that we lose a more complete picture of their specific social and cultural context. Consequently, we heavily rely on the data gathered during interviews and personal interactions.

During the data-gathering process, almost all interviews were interrupted by the interviewee's unstable internet connection, which sometimes resulted in varying degrees of inaudibility. Consequently, this led to gaps in the transcriptions and required us to rely on guesswork to fill those gaps. Additionally, we faced challenges aligning work schedules due to different time zones, which led to demoting two of our semi-structured interviews to informal conversations. As a result, we had to rely on previous field notes where a new interview would have been preferred. We were also limited to only proficient English-speaking participants.

# 6.0 Theoretical and Conceptual Framework

The following section introduces in detail the two theoretical and conceptual frameworks that inform the analytical strategy of this study and help understand Community Networks (CNs) through a socio-technical lens. The dominant theory of multiplicity focuses on the concept of fluidity presented by Marianne de Laet and Annemarie Mol through their text: "The Zimbabwe bush pump: Mechanics of a fluid technology" (De Laet & Mol, 2000), which positions technology as fluid and relational. Additionally, this chapter expounds upon the main ideas of the feminist theory of technology with Donna Haraway's concept of situational knowledge (1988). Haraway's concept challenges the idea of objective and universal knowledge and argues for feminist objectivity, which provides a framework for understanding knowledge that is situated in specific social, cultural, and historical contexts.

The choice to combine multiplicity with the notion of situated knowledge stems from the two concepts' combined value in analysing CNs as a fluid technology and the potential for local knowledge to foster social innovation. Both theories are similar as they acknowledge the importance of the specific social context in technology while challenging universal solutions that fail to adapt to or respect diverse sociocultural contexts. Additionally, both theories address power dynamics, emphasising the importance of collaboration and community participation. The main difference is on the subject matter; Haraway engages in broader conversations about the nature of knowledge, feminist epistemology and the tensions arising from imposing a universal objective view. Where Mol and de Laet focus on a specific case to exemplify multiplicity, drawing empirical data examining a particular technology and its implications within a social environment.

## 6.1 Multiplicity

The theory of multiplicity was developed in the mid-1980s (Gad & Bruun Jensen, 2010, p.55) due to growing criticism towards actor-network theory (ANT). ANT was critiqued as being too managerialist, too functionalist and too focused on closure (Star, 1991; Law, 2004; Mol, 1999, 2002). Multiplicity emerged as a reaction to "...call for greater empirical sensitivity. It [multiplicity] is about broadening as opposed to substituting the analytical resources" (Jensen, 2021).

ANT and multiplicity present a similar framing to explain the interconnectedness of technology and society. Both frameworks recognise that technology is not an isolated entity but rather embedded within complex networks of human and non-human actors (Law, 1992). Both aim to give "..a social account of technology, one that understands what a device does in terms of its role in a social collective" (Rosenberger, 2017, p.13). ANT demonstrates how actors affect the networks they inhabit and how they may become more powerful by creating associations with

others to reach stability (Latour, 1991). Multiplicity is less concerned about how these actors attempt to reach stability; rather, it focuses on tracing the different connections between different performances to describe the development of specific technologies (Law, 1999). The agenda for multiplicity put forward by scholars is sometimes presented as an 'after-ANT' approach. Vikkelsø (2007) prefers to describe it as "a multiplicity-oriented ANT. Rather than following a particular actor or program, it invites exploration of the multiplicity of a phenomenon, that is, of the ways in which coexisting and partly connected versions of reality are enacted" (p. 301).

De Laet and Mol's paper frames the Zimbabwe bush pump (henceforth 'bush pump') as a fluid technology. De Laet and Mol "treat everything in the social and natural worlds as a continuously generated effect of the webs of relations within which they are located" (Law 2009, p.141). They exemplify this fluidity by "investigating the intricacies of an admirable water pumping device" in Zimbabwe (De Laet & Mol, 2000, p.226). The fluidity of the pump is a "part of a number of different actor-networks, the actor-network it is part of chang[es] and adapt[s] to local circumstances, and there is no strategic and centralised effort to align and stabilise these actor-networks" (Jensen, 2021).

Through a multiplicity perspective, this paper will use De Laet and Mol's framing of fluid technologies to examine how CNs can too be seen as a fluid technology through their multiple evolving identities, entanglement in different networks and relations, and ability to adapt to local circumstances. By presenting this research through De Laet and Mol's lens, it will attempt to show how a CN's fluidity enables it to develop and 'work' in various but not limitless ways. Similarly to the bush pump, where its maker does not assume a role of power, this research will present how CNs are shaped by their surroundings and communities. CNs are a specific technology distinguished by characteristics that are shared and, at the same time, in opposition to similar technologies. As the bush pump needs to be specific to accentuate its own being, CNs also will be defined as specific but as "continuous with a number of others" (De Laet & Mol, 2000, p.231).

## 6.2 Feminist Theory of Technology and Haraway's Situated Knowledge

Within Social and Technology Studies (STS), feminist theory is diverse and encapsulates many perspectives and approaches (Wajcman, 2010, p. 143). It generally seeks to understand the complex relations between technology and society, aiming for a more equitable and ethical technological development. One fundamental notion is the socio-constructivist approach of technology which recognises that objects and artefacts are interconnected with society, forming a socio-technical network that combines artefacts, people, cultural meanings, organisations and knowledge (Bijker et al., 1987; Hackett et al., 2008; Law & Hassard, 1999; MacKenzie and Wajcman, 1999 as cited in Wajcman, 2010).

Feminist theories address issues of power, gender, inequality and social change, examining how marginalised groups have been historically excluded or oppressed by the impact of dominant social structures, thus influencing the design, technical content and use of artefacts (Wajcman, 2010, p. 149). Drawing inspiration from Donna Haraway, an STS and feminist theory scholar, this paper examines her concept of situated knowledge to understand how power relations in knowledge production influences technology development and potentially accentuate social inequalities in the contexts where CNs operate.

In her essay: Situated Knowledge: The science question in Feminism and the Privilege of partial perspective" (Haraway, 1988). Haraway reflects on objectivity, which is closely related to her understanding of science and technology. She challenges the assumption that these fields can be used to create universal, objective, value-free knowledge and tools. She argues that all knowledge and technology are situated and can not be detached from the political, social, and economic realities in which they are produced. (Haraway, 1988, p. 110)

Haraway also criticises the predominance of Western knowledge systems in science and technology, arguing that it eclipses other forms of knowledge and reinforces dominant power structures and social hierarchies. She advocates for a diverse and inclusive approach that acknowledges and respects what she calls "subjugated standpoints" (Haraway, 1988, p. 117), referring to the alternative perspectives of those who build knowledge about the world differently from what is dominantly established as truth. Haraway argues for the need to rethink our relationship with technology by acknowledging situatedness. By embracing alternative perspectives, we can challenge dominant structures of power and oppression and build a more equitable and inclusive society: "We are also bound to seek perspective from those points of view, which can never be known in advance, which promise something quite extraordinary, that is, knowledge potent for constructing worlds less organised by axes of domination" (Haraway, 1988, p.118).

Haraway proposes the need to have an "earth-wide network of connections" that facilitates sharing of knowledge, ideas and cultural practices while avoiding imposing a universal framework on diverse communities that does not respect diversity and differences: "We also do not want to theorise the world, much less act within it, in terms of Global Systems" (Haraway, 1988, p. 113). She also emphasises the need to: "partially translate knowledge among very different – and power-differentiated – communities." That means that the ability to share and translate knowledge requires acknowledging diversity and power dynamics.

This study will use Situated knowledge (1988) to argue that CNs possess unique and situated knowledge within their communities and the movement itself. That knowledge is tacit, built through relations, social interactions, artefacts, practices of skills, and embodied experiences and rooted in local cultures and values. CN's collaborative and inclusive practices align with Donna Haraway's ethos of embracing alternative perspectives for a more accurate understanding of the world. Additionally, this framework critically examines how dominant Western

epistemologies have excluded African ways of knowing, impacting their contribution to technology development (Haraway, 1988, p. 116). This paper suggests that CNs have a valuable opportunity to leverage their knowledge to provide meaningful ICT to their communities. By embracing their situatedness, CNs can advocate for alternatives in bringing technology to communities while challenging the imposed technology implementation in Kenya.

## 6.3 Concluding the Theory's Contribution

Both theories will be used to frame and interpret the resulting findings in the analysis, helping to answer the research questions.

De Laet and Mol frame technology as having multiple identities, in multiple networks, allowing it to work in many ways. Analysing CNs through this understanding will help uncover the multiple networks and identities that CNs are entangled in, which will help identify the ways in which CNs are attempting to **address the digital divide** and their **potential roles in Kenya's digital transformation.** De Laet and Mol consider one of the ways that the bush pumps successfully work is because of the ways that locals can autonomously operate and maintain it with local resources and knowledge. Viewing technology as successful because of its ability to operate in a way that makes sense in a local context, will help answer how **CNs are bringing the internet in a meaningful way,** and are successful because of their ability to operate within local contexts, with local materials and knowledge.

Through Haraway's Situated knowledge, this research can be viewed through her perspective on the interdependence between technology and knowledge, and the existence of a dominant knowledge system - recognizing knowledge as context-dependent. Her perspective will be used to uncover **how CNs are addressing the digital divide to promote meaningful digital inclusion and equity,** by exploring how dominant and foreign knowledge systems influence the digital divide and the power dynamics that shape the introduction of technology in Kenya. Additionally, investigate the impact of these factors on technology adoption and relatability. To understand **CNs' potential role in Kenya's digital transformation,** this research will use Situated knowledge to see how CNs leverage their own situated knowledge to produce more equitable and inclusive digital solutions in Kenya's digital transformation.

# 7.0 Analysis

This section presents the resulting analysis based on the data collected for this study (see section 4.2 Research Design). The results are aimed at answering the research question of; **how are Kenyan Community Networks (CNs) addressing the digital divide to promote meaningful digital inclusion and equity and what are CNs' potential roles in Kenya's digital transformation.** The findings are structured according to the three main themes that emerged from the thematic coding process, which are: fluidity, locality and collaboration. Although the structure of the paper is sectioned as such, many of the topics within each theme overlap with one another. The analysis is structured in a way that the topics that are closer to the next section/theme have a greater cross-over, as seen in the diagram below:

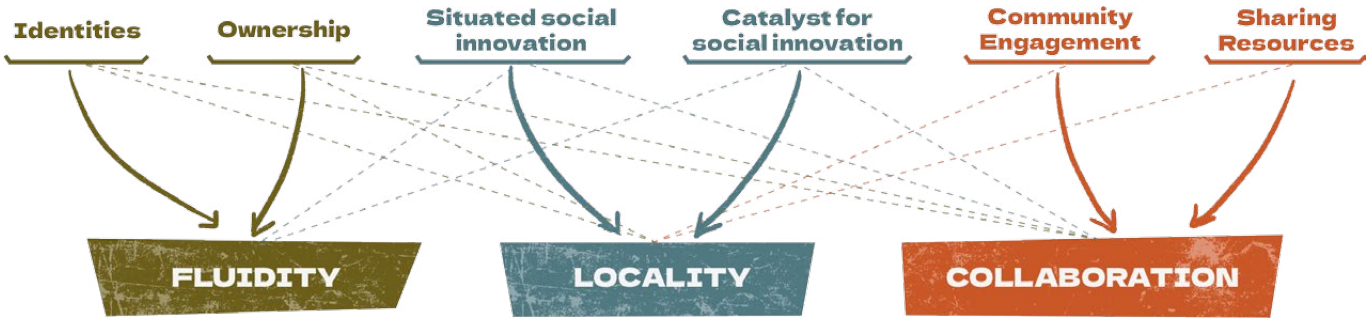



Figure 5. Analysis structure diagram

## 7.1 Fluidity

The first theme to be introduced is fluidity, which is borrowed from the concept presented by De Laet and Mol (2000) in their study on the Zimbabwe Bush Pump. Fluidity refers to the various ways that a technology is adaptable to its context. It is a property of an object that is not too rigorously bounded and that does not impose itself (De Laet & Mol, 2000, p.226).

CNs are a system (or technology) which provides internet access. They differ from other internet proving systems (ISPs) as CNs act and are configured in different ways depending on the circumstances of each community and have a number of possible boundaries. In some ways, CNs identify as a device or collections of devices that provide the internet; in other ways, they encompass social and cultural worlds that shape their existence.

> CNs are very important because their frameworks are based on communities, which means it is a community initiative, which means people can come together based on their needs to tackle issues affecting them on digital technology. The community is able to see an organisation that will recognise the efforts and the needs. (Rapudo, 2023)

CNs can be considered a fluid technology, as it is deployed and adapted to local circumstances using available resources. It is also fluid because its technical components do not solely define its identity. Because CNs are fluid and act in many ways, this section attempts to uncover what it means for CNs to work successfully. Furthermore, it will explore how the possibilities of fluidity depend on community members who bring technology into being. The concept of fluidity serves as a lens to explore how community networks innovate and evolve to remain relevant in a constantly shifting environment.

This section will expand on the multiple identities that make CN a fluid technology and how CN members enable fluidity by translating and adapting technology to their local context, which ultimately fosters ownership, crucial for long-term network sustainability.

## 7.1.1 CNs and their multiple Identities

### 7.1.1.1 As Infrastructure

CN's core identity is to establish a system that provides the internet. However, the seven CNs interviewed for this case study are all structured and maintained in different ways and have different strategies in how to provide internet depending on their: geographical area and environment, human and technical resources, affiliations with external partners, degree of in-house technical expertise, and community engagement. There is no standard way to set up a CN network. The network infrastructure acts as a fluid actor without clear-cut boundaries because it is set up with the resources available and adapted to local circumstances.

Dunia Moja is located in the coastal town of Mtondia with rolling hills and tall palm trees; its network devices need to be mounted on tall masts to effectively bring internet to its headquarters (known as the 'Hub') and its clients. Building their own masts is not currently possible, so they place the main antennas (network transmitters) on existing towers owned by private companies. Dunia Moja would like to own their masts and are interested in building bamboo masts, similar to how they are doing in Bosco Uganda, as "bamboo masts are just a way of giving the community a chance to use locally available resources to build this very critical infrastructure" (Kaylo, 2022). Bamboo also grows naturally in Mtondia and would be a suitable material because it can be built to high heights, its compressive strength is two times higher than concrete, and its tensile strength is close to steel (Nurdiah, 2016). Building their masts would aid the CN's sustainability as they would not have to pay to use another company's masts. CNs have the opportunity to use locally available and affordable resources and develop sustainable solutions to networking systems.

Due to the high upfront cost of setting up the infrastructure and the continual cost of maintaining the network, each CN is at a different developing stage. While some CNs, such as Dunia Moja and Tanda, have set up several of their own connection points, others, such as Athi or OWNNET, rely on existing internet providers. As Omot explains:

> At first, I wanted to redo the satellite, because I was aware of Safaricom' network issues. But I found that it was a bit expensive, not on the package part of it, but band equipment at first. And I couldn't get the capital to do that. So I just started with Safaricom but now I had to push them a little, then I got a router from them, which is the only router they give which is only 5 Mbps network speed, which they say it is, five, but it is not. (Ogul, 2023)

All CNs are providing internet access for their community, and the way in which they bring connectivity is based on their location, technical and human resources, affiliations with external partners, and their in-house technical aptitude.

In the community of Mtondia where Dunia Moja is situated, there are many electrical and internet blackouts due to severe rains and subsequent flooding, construction, and technical malfunctions. If there is an issue only with the internet, not because of electricity, the CN is able to host a 4G hotspot from the owner's phone for those who are physically located in the 'hub'. But for their clients, they have to work with several authorities and communicate with their clients on the status of the internet failure and purpose solutions. This is very onerous and time-consuming and requires an employee to understand both the technical issues and the existing relations with the client. If there is no employee there with reliable technical skills, another task falls on the owner's shoulders.

The fluidity of CN's technical infrastructure and devices allows CNs to operate with locally available resources and to manoeuvre and adapt themselves within their own situational circumstances.

#### 7.1.1.2 Beyond infrastructure

The fluidity of a community network is also understood beyond the technical aspects of the internet infrastructure, as it is entangled with the social and cultural contexts that shape its existence. According to De Laet and Mol, a technology like the Bush Pump is embedded in multiple worlds and constantly changing its identity. Similarly, the infrastructure CNs set up becomes not just a technical system but an actor that enables other human interactions and relationships to exist, which are constantly changing.

To understand what it means to be a CN, one needs to look beyond its objective function of internet connection and examine the activities, people and relations that surround it. Each CN has a unique set of elements that become an integral part of its identity and influence how it is perceived and used. Among the seven CNs studied, there are common elements and activities that exemplify their fluid identity. The following section will expound on a selection of the current identities CNs embody.

##### A Way to Bringing Community Members Together

CNs focus on cultivating social connections that strengthen relationships among

community members. These relationships are distinct from typical transactional interactions between regular service providers and consumers. For example, Dunia Moja connects schools while creating close relationships between the CN members and the school administration, providing a direct channel for sharing information about issues the schools face. These relationships are based on trust; the clients trust Dunia Moja's decisions, and together, they glide fluidly through issues or when changes need to be made because the clients trust that the members of the CN are coming from a place of 'goodness'. These relationships create links and connections between community members, which benefits community cohesion and contributes to the success and development of CNs.

All CNs have a physical space where community members gather and engage with digital technologies. The purpose and function of these spaces vary, but they commonly allow community members to access devices, participate in digital literacy classes, and provide technical support. For instance, Siaya CN established a physical space that began as a library, which can be particularly valuable in contexts where power shortages are a recurrent issue. Currently, community members are working towards bringing the internet and transforming it into a digital library, as Abawo explains: "We were trying to encourage an environment where people could read, but we noticed some gaps such as the digital divide. When people come to the library, they also expect internet access" (Abwao, 2023). These physical spaces become a place that facilitates social connections and empowers local communities through digital engagement.

CNs also nurture a sense of belonging and connectedness among their members, creating a shared social movement that goes beyond local settings to national and global contexts. This sense of unity was evident during the 'School', where several representatives from various CNs with their unique challenges came together to demonstrate a united effort towards a common goal that ultimately aims to benefit their communities.

## Providing Education and Opportunities to Acquire New Skills

Community networks fulfil an educational purpose within their communities by promoting digital literacy skills to bridge the digital divide. They do it in several ways: creating programs to teach digital skills, collaborating with educational systems to offer support, and mentoring community members. Their educational activities stem from a place of believing in the power of accessing global knowledge and resources of the internet. As Twahir from DUnia Moja explains:

> The world we live in right now is a digital world. We live in a global village. If the people of Mtondia are not being exposed to the expanse of knowledge, the expanse of availability of resources within the internet we are doing them a disservice. It is more of trying to bring the community together and bridge the gap between a boy in Mtondia and a boy in Copenhagen or in Washington. (Hussein, T., 2022)

For instance, Oasis Mathare offers a 'Tech School' for young people who have finished high school but encounter socio-economic barriers to joining college. This program focuses on teaching technical skills and aims to produce tangible projects while providing a space for the youth to learn new skills and invest in their future. As Arleen who is one of the project managers from Oasis Mathare, explains:

> The Tech school is mostly for the youth, those who are finished with Form four [highschool] and are done their national examinations. So it is that period of time that they don't know if they have enough money to join colleges, or they are starting to look for jobs. (Rackita, 2023)

Another example of the educational role of CNs is the week-long coding camp organised in Dunia Moja for the youth in the village of Mtondia. Most participants were enrolled in school but lacked the proper exposure to devices or adequately trained teachers. CNs aim to address the educational gap because "there is a lack of ICT teachers. Even if you want to bring computers to a school; there is still that gap. The ministry doesn't really focus on ICT training for teachers." (Kyalo, 2022) In Dunia Moja, training does not only happens in the Hub; university students are also sent to different schools to train teachers and pupils. CNs are training schools on how to use the Internet for educational purposes. As Abwao points out, "A teacher can show a video on YouTube showing a clean and dirty environment. [So] the children can make a clean environment for a better community. So those are the kinds of things we are adopting" (Abwao, 2023).

Mentoring is another way CNs fulfil an educational gap. Through mentorship, community members and CN employees learn hard and soft skills - from technical skills to values, ethics and personal and professional growth. At Kijiji Yeetu,

> someone is able to learn from others, they can be taught how to use Facebook, they're able to know how to communicate on Twitter, for their business, because maybe they're writing about Ebola. Maybe they're ahead to the tailor shop, maybe they are selling charcoal. (Rapudo, 2023)

At Dunia Moja, Twahir provides guidance and advice to those willing to listen and learn. In the Hub, he often initiates debates and encourages everyone in the space to reflect and contribute. When he brings technical experts to establish or maintain the network, he ensures that other students shadow and participate in the expert's tasks. He also ensures that interns accompany him when performing connectivity tasks.

Figure 6. Google network technician teaching university students to debug network issue
Figure 7. Dunia Moja university students connecting a school

## A Welfare technology

Another significant factor that defines the identity of a CN is their commitment to addressing the welfare of their communities. CNs are non-profit organisations; their main objectives include helping communities lift from poverty, providing job opportunities for the disadvantaged, and addressing social issues such as early pregnancies, drug abuse, school dropouts, and gender violence, as Twahir explained:

> We have a lot of problems with job unemployment. Whereby with the male youth, they end up getting into drug abuse. Unfortunately the girls end up getting into prostitution or early pregnancies. Both take the community down. Once we have digital resources available it means that they are not confined to just getting the normal jobs that will always be available for them. (Twahir, 2023)

The Internet is seen as a critical passage to increased community welfare. Here a CN's identity could also be seen as a welfare technology as the technology of a CN (providing Internet) acts as a way to increase the overall livelihood of its community. The CNs share this sentiment: Mrs C feels that "the community is very happy and very proud of us that they are seeing in the future. Most of the people will have skills, and no one will be struggling" (C, 2023). She says, "most of the youth are unemployed. So, if we bring the Internet, we can improve the livelihood of youth" (C, 2023). Josie also states: "I have a passion for my community and to see the welfare of the community change" (Philips, 2023). Hawi also believes that,

> once they [members of the community] become self-taught, then they're able to gain literacy skills, defend themselves and even have a digital economic base, which is very important for our CN because people want to see benefits: how they can communicate, make money, relate with others, be respected, which means they

> have a voice. CNs bring respect, people are able to see that you are discussing a normal issue, even if you're not able to give a solution, but the way you're conducting the meeting and the people who are in that meeting, it brings a lot of dignity. And when women and girls and young people are able to get these kinds of skills, then their rights will be respected. People want to join because they feel that is a space where my voice can be respected. (Rapudo, 2023)

In previous research on the Socio-technical imaginaries in Dunia Moja (Pubill & Tilcock, 2022), community members viewed internet and device access as a way to better their lives. Mr T imagined how his welding business and drawing skills could be improved with access to a computer allowing him to draw, archive and present his designs to his customers. Mr T is hopeful about what ICT can do for his business. However, since most educational activities and resources are directed towards the youth, older generations have more challenges in realising those dreams.

Like Mr T, the CNs and their communities are very hopeful about the possibilities and benefits of the Internet. Whether through conversations with CN members, community interactions, or participation in conferences like the 'school', there is a palpable energy of optimism and hope. CNs are attempting to make a significant impact by bringing prosperity, equality and basic human rights. By prioritising these objectives, they are aiding in the welfare of their community. CNs are advocating for the Internet to become a right in Kenya because of its potential to change communities' welfare, "we've moved from the Internet being a basic need. Now it is right, more than a need" (Rapudo, 2023).

### An encouragement for others

CNs advocate for a decentralised system; even if they can grow bigger, they encourage other community members to start their networks. At Dunia Moja, the university students assisting in the Hub are registering a new CN, KilifiNet, which will target mainly university students in the nearby town of Kilifi. The owner of Dunia Moja guided the students, hoping they would ultimately take ownership of the project so that they could earn their own wages while giving affordable internet access to the many university students in the area.

At Tanda, Risper is facilitating introductory sessions about establishing CNs for organisations and communities. Tanda is passionate about promoting connectivity in remote, marginalised and underserved communities in Kenya through peer-to-peer learning between existing and emerging CNs. Their initiative is to support the creation, development and consolidation of CNs, as they believe empowering more communities to implement sustainable network infrastructure is essential in bridging the digital divide (Arose, 2023).

### Fluidity and E-readiness: the Interplay of technology and community

While interacting with CN members, it became apparent that their understanding

of technology is directly interrelated with people and that it affects multiple worlds. Catherine spoke about the notion of E-readiness, an assessment of the community to evaluate how likely it is for a CN to succeed and which gaps need to be addressed to make it a sustainable project. As Cathrine explains:

> E-readiness is about combining connectivity with meaningfulness, otherwise you will take the computers, you will take the connectivity, but people will not be able to use it because they don't even have the devices or if they have devices they don't even know how to use them. (Kyalo, 2023)

The notion of E-readiness is closely associated with the concept of fluidity, which refers to the adaptability of technology to various contexts and the ability of users to shape and modify it. E-readiness recognizes and assesses the impact of digital technologies on communities, and it also aims to adapt technology to meet the needs of those communities. E-readiness considers the fluidity of technology by acknowledging the importance of technology's ability to conform to diverse situations and be moulded by its users.

What it Means for a CN to Work

CNs face several challenges; they might have a different level of technical and human resources than a conventional ISP, and many rely on external grants and donations to cover the costs of their networks. However, those are the circumstances in which a CN's fluidity makes them adaptable and resilient. Because CN's identity is not rigorously bound to the well functioning of the network system, its success is also not limited to it. As Mol and De Laet reflect on the functioning of the Zimbabwe Bush Pump: "Even if a lot of its many elements get transformed, the whole does not fall apart" (p.248). The fluidity of CN allows for the emergence of alternative realities, thus expanding what it means for a network to work successfully.

CNs can be viewed as a fluid technology whose existence is intertwined with many worlds. The paragraphs above note several activities contributing to its overall identity. A CN brings connectivity and access to devices. However, it also brings community members together, serves as a space for educational opportunities and personal growth, promotes welfare and social equality and contributes to the emergence of other CNs, thus advocating for decentralised network management. The following sections will present the importance of ownership in adapting and translating technology to local contexts, further expanding the concept of fluidity.

### 7.1.2 Ownership

Community Networks (CNs) implicitly and explicitly attempt to translate and adapt technology into their local contexts, which makes them fluid and adaptive entities. A sense of ownership and an understanding of their local context allows CNs to shape and adjust the technology to fit their community needs. Development projects or technology solutions brought from the outside often fail because they lack the understanding of the local needs and assume what is best for them.

Ownership means community members can have a meaningful stake in the technology while promoting community involvement and participation. In this context, ownership has a different meaning from the Western perspective, which is often linked to the individual right to have private property. Rather than accumulating resources for wealth which ultimately accentuates existing inequalities, ownership refers to having an equitable part in technology development while giving power to the collective.

By encouraging ownership and leveraging their situated knowledge, CNs can become enablers of fluidity. This section presents examples of how CNs foster a sense of ownership and the dialogues that emerge when confronting the obstacles of adapting technology to contexts where it was not originally designed, with particular emphasis on marginalised communities.

Local deployment and management of Infrastructure

Involving locals in deploying infrastructure or monitoring network problems cultivates a sense of ownership. For example, at Dunia Moja, Twahir engaged technical students from national and local universities to demonstrate the network's setup. In a short period, the students could connect client schools on their own and put into practice skills gained in university. However, a drawback of this system is that the students are temporary, and the knowledge acquired does not remain within the organisation.

In Tanda, Alphonce, an experienced local engineer, mentors and teach connectivity skills to fellow Tanda employees, enabling them to take more responsibility. By working together in connecting and deploying connection spots, junior engineers get hands-on experience in the field (Odhiambo, 2023). Alphonce also teaches online courses for anyone interested in Mikrotik equipment and setup, which is especially valuable for CN members who do not have in-house technical expertise.


Figure 8. Mikrotik Tutorial by Alphonce from Tanda

A challenge that some CN face is the lack of mentors or, as some members refer to: 'the local champion'. The issue arises in communities where there is a greater reliance on the champion. As Josephine explains: "When the champion is not available, the CN is also not available" (Miliza, 2023). In some community networks, the workload mainly falls on one person, creating a challenge when that person is unavailable. For instance, at OWNET, Omot is currently one of the few people with technical expertise to set up and maintain the network. He is passing on his knowledge to non-technical community volunteers so that they can perform basic functions such as monitoring and connecting to the network. He plans to create a small site or blog where they can access information on how to troubleshoot issues. As he explains:

> I am teaching them [volunteers] how to monitor and connect. Now I am thinking of creating a small site or a blog that they can log in to and they can just go through and check and see what they need to do or what they should do. But of course, I'm still learning it from scratch I still have lot of work to manage all of this. (...) I have to talk to people make them understand that yes I'm done for buying the network but I'm also getting a link from someone else who's controlling his own thing. (Ogul, 2023)

Devices

> If we are looking at resources, we don't have enough, can we reuse resources. For example, we have people with computers that ended up broken. So, people have been trained on repairing and dismantling some of these phones and computers. They're able to bring them back together and use them, which means they're able to save money. (Rapudo, 2023)

CNs have limited resources and access to working devices. Hawi believes "the biggest lesson right now is if you want to capture the digitalization front, you need to go to things like repair maintenance" (Rapudo, 2023). At Dunia Moja, they fixed the laptops that one of the client schools had; these laptops were given by USAid and required the presence of a USAid admin to update the operating system (OS). As it had been many years since these laptops were given, they were sitting in the school, unusable. Dunia Moja used their interns' technical skills to force install a new OS called MINT, reclaiming control over the devices and eliminating the need for external organisations to manage and update their resources. In turn, the school agreed to share these laptops with Dunia Moja, giving Dunia Moja and the school a newfound collaborative ownership of devices.


Figure 9. USAid Computers donated to Dunia Moja from Kibarani School for the Deaf

## Owning Local Content

Once connectivity is running, communities' next step is acquiring digital skills and use the available tools and recourse to navigate and benefit from the digital space. With the advancements in network infrastructure and social media platforms, communities can communicate and share their stories and cultures with a broader audience. CNs advocate for active participation in the digital space, empowering communities to become creators and disseminators of knowledge instead of passive consumers of digital content and entertainment. The following examples illustrate how CNs think about issues surrounding local content and ownership of technology while examining their role in translation.

In the context of ownership, a key point to consider is that the tools and software used in the digital space are primarily developed and distributed by organisations from the Global North. While it is not necessary to reinvent the wheel, and some of these tools are indeed useful and necessary, it is vital to acknowledge the power imbalances that arise from this situation, which can impact the sense of ownership and the role of CNs in translation technology. CNs recognise the relevance of this topic and its effects on their community. Hawi talks about the need for recognising the history of colonisation and private for-profit economic models and their impact on the ecosystem of the internet:

> we have to understand the history, we talk about the colonialism, colonised and within, this is a very strong time [to talk about colonialism], because we're talking about this unequal ecosystem of the internet...The Internet is growing on the hands of the private sector, and they are able to influence the way the community engage. (Rapudo, 2023)

Recognising that historical and contemporary power imbalances shape ownership and control of technology is a step towards challenging inequalities and promoting a socially just digital space. Risper from Tanda notes: "I've been using the internet but just bringing to the attention, as you know, that it can also be a way to colonise which is not physical, using smarter structures to perpetrate what happened, you know, years back" (Arose, 2023). She also speaks to another challenge that communities face: the language barrier. While some of the members speak fluent English, most local communities speak Swahili or their local indigenous languages:

> The internet speaks English. And it's just recently that it has started to incorporate other languages like Kiswahili and whatnot. So, I wouldn't want to talk biasedly, but I know that just at the language level, there's already a barrier for a lot of people who are not really conversant with English. (Arose, 2023)

In Dunia Moja, during the one-week-long coding camp aimed to teach the youth the principles of code, they used a Google curriculum to teach the coding basics using Scratch (a graphics-based program that teaches children to code). However, all the content was in English. Most of the kids in the camp did not speak fluent English and used examples from the West. Volunteers needed to translate the technical and cultural knowledge that was unreachable to most of the children. It is important to note that Scratch is available in Swahili and that more software and tools are starting to incorporate more languages. However, that does not change the fact that those tools have been created in a different context which can contribute to a lack of relatability and connection with the teaching material.

Figure 10 - Volunteer helping explain Scratch to children in Lamuka Hub

CNs play a role in shaping and translating digital technologies to fit their local contexts, and they are helping communities enter the digital space in a relatable way. Ownership is crucial because it allows community members to have some degree of autonomy over the effects of digital technologies in their communities.

CNs strive to become sustainable and minimise dependence on external funds and donations. Being local allows them to relate and speak to the local people and stakeholders. CNs aim to establish collaborative relationships rather than purely commercial ones. They also understand the importance of participating in the online space to fight against the power disbalances of the digital world. CNs demonstrate how technology is not neutral, and with their tacit experience, they can identify the limitations and work towards a more inclusive future. Ownership is also about empowering communities to understand the power of their 'voices' and their impact on shaping the online space. As Josephine highlights, many community members do not recognise the potential impact of their stories and experiences: "We don't know that our stories are powerful enough" (Miliza, 2023).

CNs have the ability and potential to create and share resources in a decentralised, collaborative manner, and digital technologies can help them do so. Despite

limited resources, CN can also be a space for members to develop tools and software anchored in local approaches. By doing so, CNs can empower their communities to be active creators in the digital space while promoting their sense of ownership and agency over the technology they use. This empowerment can enable their members to become catalysts for fluidity. The following section will discuss the importance of embracing locality in developing relevant solutions for the communities where CNs operate.

## 7.2 Locality

Locality is the second theme used to analyse Community Networks (CNs). Locality refers to the acknowledgement and understanding of the culture, social practices, economy, and politics in a given geographic area. Locality represents a perspective that avoids imposing a universal framework as it recognises the distinctiveness of each place.

In the context of CNs, there is an emphasis on harnessing the potential of locality, which is necessary to develop impactful technology solutions for the community. Locality can be viewed as the ground for fruitful innovation. CNs recognise the need to focus on local resources, knowledge and capacity building to design resilient and sustainable innovations over time rather than relying on external donors or inputs. Innovation rooted in local contexts, cultures, and values, is more likely to be accepted and adopted by local communities. Unlike the commercial ISP, innovation that happens within CNs is aimed at benefiting communities, which makes it social in nature.

In Haraway's essay Situated Knowledge the term 'innovation' nor 'social innovation' is not used explicitly. She discusses the importance of acknowledging diverse perspectives and experiences in shaping knowledge production. In her view, knowledge is always shaped by the interests, perspectives and experiences of the individuals and communities involved in its production. Knowledge and understanding often provide the basis for technological development. Haraway's perspective can inform social innovation by focusing on involving the community experience in design and innovation.

This section will examine how CNs are both a local social innovation in themselves and a space where local social innovation occurs.

### 7.2.1 CNs as a Situated Social Solution

> I think community networks give us the greatest opportunity to ensure that the internet and technology go mainstream to the masses. (Ali, 2023).

CNs emerged as a response to connectivity within local communities. At Dunia Moja, Twahir realised how access to digital knowledge provided him with opportunities in life that were unavailable in the village where his father lived. At OWNET, Omot faced a similar situation as he noted that the lack of affordable and accessible

internet was a key motivation for establishing a CN: “My first motivation was the lack of internet. I mean, the cost of it and availability of the internet in our place in Turkana” (Ogul, 2023).

In Siaya, unaffordability was another driving factor behind the need for connectivity in the community. As one of the representatives explained, “We have about 89% of the residents have smartphones. So you know what they lack is the internet. And why? Because the cost of the internet is very expensive” (Abawo, 2023).

CNs also aim to support the most vulnerable groups of people within marginalised communities, including but not limited to children with disabilities, women affected by gender-based violence, and women affected by HIV. For instance, Dunia Moja connected Kibarani School for the Deaf. The internet assists children in learning concepts through images or video resources found online. According to Mr K the deputy principal, connectivity has changed teaching and learning in the school. The children can grasp complex topics more easily through online videos; and as he states:

> The connectivity helped us [Kibarani School for the Deaf] to search for resources that are not locally available. We are also able to take the children on “digital tours”. Where we talk about reserves, parks and rivers in Africa. We talk about mountains, towns and other things. It is very useful, specially, when the teacher has challenges in drawing or looking for these photographs and other images. (K, 2022)

Besides providing connectivity, a former Dunia Moja employee learned Kenyan sign language to assist in teaching digital skills to children from Kibarani School. Similarly, at Action pour le progress, Mrs M also had expertise in sign language and could teach deaf kids from the community.

Figure 11. Kids in Kibarani School for the Deaf learning about snakes

This section exemplifies how CNs can be considered a local social innovation emerging from a social demand aiming to aid vulnerable groups. These innovations are altruistic in nature, as their creators prioritise the community’s welfare while aspiring to facilitate their growth and prosperity.

### 7.2.2 CNs as a space for local Social Innovation

CNs can act as incubators for local social innovations. Many of the programs they build are 'new' to their communities and aim to make a positive impact. These programs can be seen as innovative systems and technologies. CNs utilise their situated knowledge to build locally minded programs that consider the local: economy, environment, and social challenges.

Economy

Amongst many other CN, Siaya and Athi reside in areas where the primary economy is agriculture; they plan to further collaborate with farmers, providing them with guidance on utilising the Internet effectively to overcome agricultural challenges. At Athi, they "connect [farmers] with apps that may increase their knowledge in farming" (C, 2023). The need to understand and build new knowledge around agriculture is becoming a more prevalent issue because of the environmental devastation that is happening in the area due to climate change. In Siaya, there is a "limitation of harvest, in that there are people that use seeds that cannot bring a good harvest. And when the rains have delayed, you will find there will be less harvest, and this makes people not have good food for their families" (Philips, 2023). Josie explains the plans for a new project that will address this issue by providing farmers with knowledge and using the Internet for communication:

> So my CN will address this. We are going to teach farmers on the timings of the rains, and planting, we shall provide fertiliser and provide good seeds. The internet is involved because when we shall deal with the farmers to reach even the lowest person in the community. We are going to use the network to communicate [with them]. (Philips, 2023)

At Dunia Moja, the local primary job for male youths is a Boda Boda driver, which is a local motorbike taxi and delivery system. Dunia Moja feels that male youths in the area need more opportunities and are also unmotivated to acquire new skills to get jobs that could lift them out of poverty. Dunia Moja attempts to engage this group to diversify the job market and offer more opportunities.

CNs are interested in working with the devices that their communities have, which are phones, "now the phone is used every day, so, the phone has become a very important focus" (Rapudo, 2023). Josie also explained that older women who sell vegetables can be seen using a phone, despite the fact that they are likely illiterate (Philips, 2023).

Kenyans also use social media sites to promote and conduct business. This means that social media is a desirable space for CNs to innovate in, as their communities are familiar with the platforms.

> There is someone who uses her phone to do business and to do online business. She has the commodities physically, but uses the phone to advertise her commodities through Facebook, through Instagram. And you find she gets customers who will physically go and buy after the advertisement. So those are some of the stories that are out there who use their phones for bringing a change for them (Philips, 2023)

CNs aim to build programs around specific local economies and support families so parents can work. In the city of Nairobi, many parents are not able to go to work because of child care, so at Oasis Mathere, they have created a free daycare centre to help women go to work:

> We [in Mathere] have this issue of early teenage pregnancies and it's an issue because they are not able to raise the children. So in our community network, we work with a daycare. We have the parents leave the children here, we stay with them and they can go to work and earn a living because some workplaces will not allow them to go there with their children. (Rackita, 2023)

Content Creation

Local content creation is a central pillar of the Kenyan Nation School of CNs (KNSCN). Therefore, all the CNs within the case study have a strong focus on developing local content. In Kenya, CNs are actively producing hyper-local content that is tailored to the specific needs and interests of local communities

> because when it comes to content, you find that most content we see is foreign, not really from us. And if it's from us, it's not from your region. It might be from Kenya, but it's not from your region. So then you don't really get to understand things from your own context. And that's what these local podcasts and community radios are trying to do, controlling the narrative. (Kyalo, 2023)

One way CNs are doing this is by hosting and producing podcasts. These podcasts fill a gap where locals can be informed on what is happening in their area in their local language. CNs are developing local content with the community and teaching the community how to create their content "by training, in engaging with the CN that we are supporting, to not only connect their communities but also find ways to engage the community to create content that is relevant to them" (Arose, 2023).

Ngikeyokok, a CN in Turkana, creates local animations. A notable example is Baby Paws, a 2D animation channel educating children about the local animals in their natural habitat (Baby Paws, 2022). While Ngikeyokok was not directly involved in the case study, they were referenced by Catherine and actively participated in the workshops alongside the researchers during their internship. Along with producing these animations and providing community training on animation creation, Ngikeyokok has developed culturally representative characters that can be shared with other local creatives striving to create content. Local content creation that

embodies the local languages and traditions of the community, such as Turkana animations, serve as educational material and a way of preserving local culture.


Figure 12. Dominique from Ngikeyokok presenting Baby Paws in KNSCNs

During the KNSCN, several CNs were engaging with each other on how they could build programs and systems that could aid in preserving local and traditional culture. At Athi, they plan to create local content to preserve their culture because they see in their community that some cultures are being forgotten (C, 2023).

Cultural Innovations

Hawi advocates for the importance of creating cultural innovations, "If you're doing an innovation, do a cultural innovation, something that someone cannot take from you, you can only explain it what is" (Rapudo, 2023). This statement speaks to larger tensions that exist in Kenya around technology development and innovation. Hawi remarks how big tech companies such as Google and Microsoft began to invest in Kenya during the emergence of the Silicon Savannah, giving pitches and sponsorships for startups. However, most of the projects that got funding were ideas originating from the West.

> But now, when you do a prototyping session, when it came to the announcements of the winners and losers, there is lots of data to support the fact that a significant majority, around 80% of the winners, were from the West (...) some [kenyans in the start up scene] are aware that they have to team up with someone from Europe to secure funding or support for their startup ventures. (Rapudo, 2023)

Hawi remarks how the majority of investments in technology (tech) innovation and research in Kenya stem from G20 countries. He points out how this perpetuates patterns of colonisation and notes the importance of decolonisation to become independent of foreign research and innovation. These tensions speak to the power imbalances between multinational corporations and local stakeholders, which might prevent local agency and knowledge from thriving in the tech scene and affect the country's self-sufficiency. Hawi's emphasis on cultural innovation speaks to concerns about the potential erosion of local culture as global technological platforms dominate the digital space. By recognising and discussing the influences

of the West in the digital space, CNs can challenge this power dynamic. CNs can play a role in shaping the narrative around how innovation and power relations shape forms of knowledge. This can contribute towards a more inclusive and equitable distribution of power and knowledge by fostering cultural and local innovations.

During this case study, it became apparent that there is a scale of development that CNs reside in, primarily based on the duration since the creation of the CN. Given that the KNSCN focuses on emerging CNs, many of the CNs in this study are new or in their early stages of development, between two and four years. They have the visions and are engaging in discussions with other CNs but may not be able to actualise their ideas primarily due to financial and resource constraints and resistance from the community. Other CNs, such as Tanda and Oasis, whose role was to help facilitate the programs within the 'school', has been more successful in actualising their ideas to produce social and cultural innovations. For instance, at Osais, they have a digital literacy centre that also is a tech incubation space for the locals. Young people can experiment and create tangible products, such as games using Arduino or develop apps.

Figure 13. Students presenting their projects in Oasis Mathare Tech Hub

Beyond just providing internet to the communities, CNs are, and becoming a space for social innovations. These innovations are based on the local needs of the community and have an opportunity to empower locals. These innovations do not need to be seen as 'fast', 'glitzy' or resembling the Western innovation paradigm originated outside Africa. Rather they should be celebrated for their impact and importance to a local context, as Hawi states: "Spend time on making sure that the things that have been developed, can be adapted to your community, adapted to your needs, adapted to your concerns, and be able to facilitate public good to your community" (Rapudo, 2023).

CNs can be seen as a social innovation and a space where social innovations can occur. CNs development brings forward new interpretations of roles, relations, expectations, practices, norms and values. Their actions are intended to transform the prevailing institutions in Kenya, attempting to address social problems. They see themselves playing a role in addressing the social problems that exist in remote, marginalised and underserved communities and to become a normalised and

accredited institution that fills this gap. There is great power in CNs continuing to develop and adapt systems and technologies from their own situated knowledge rather than trying to fit systems and technologies that come from a different context. CNs could become an alternative tech space where cultural innovation emerges as they understand their community's social, political and geographical contexts and have the potential to work with the community to build relatable and adjusted digital solutions.

The following section will delve into how CNs collaborate and engage with their communities and the role of the community in how CNs operate.

## 7.3 Collaboration

Collaboration is the last theme in the analysis. Collaboration can be understood as the collective effort towards a common goal, often involving sharing knowledge, resources and expertise, creating a space for trust and different perspectives, and engaging in effective communication to achieve mutual understanding and consensus. In the context of CNs, collaboration is an essential aspect and is highly valued and encouraged. Due to limited resources and capital, CNs rely on collaboration to be resilient and sustainable.

Both theoretical frameworks used in this paper address the topic of collaboration. While Haraway's situated knowledge does not explicitly focus on collaboration, it recognises its importance of it by emphasising the value of engaging with diverse individual and communal perspectives, expertise and voices to produce knowledge. Similarly, De Laet and Mol associate the pump's success with its ability to involve the community. "There are many examples in Zimbawe where the rig is operated fully under control of the villagers, which has an important influence on the success or failure of the final installation" (2000, p. 234). This section speaks about the nature and dynamics of collaboration that take place within and among Community Networks.

### 7.3.1 Community Engagement

Community networks are developed for the community. Their slogan is "for the community, by the community, with the community" (KNSCN, 2022). Community engagement is evident because those who often set up the CN are local members, and the way they strive to include the community in their decision-making and program creation.

Acknowledging Diversity

There are many tribes, religions and groups in each CN community, and when they engage the community, they acknowledge this diversity. By working with multiple cultures, they act as a translator between these groups to build one space where the whole community can relate to and collaborate with. This can undoubtedly become a challenge, but as Kenyans, they are very used to working and collaborating with many cultures. Through interacting with CNs and their members, there

is a real sense of pride in one's culture and interest and celebrating others. During 'School' workshops 'ice-breakers', each culture came up and sang the same song but in their own language, some from Kenyan cultures and others from different countries in Africa and of course the researchers themselves who are Spanish and Canadian. This opened up a dialogue throughout the workshops where people asked about one another cultures and celebrated each other's uniqueness. This attitude of openness, acceptance and interest in CNs permeates into how they operate, which is especially necessary for those who work in refugee camps where there are even more cultures, nationalities and tensions.

CN Programs Built with Community

CNs aim to build programs for and with the community. For example, at Athi, Mrs C explains how they asked the community which activities would be meaningful to them. They answered that they were missing technical expertise around Closed Circuit Televisions (CCTVs) because there was no one in their village with such skillset:

> Some of the youth come by and say they want to do something, maybe there is something that they need to know. We ask if somebody can volunteer and do that training for them. We engage them [the community], for planning. So if we come up with our idea, they may not respond the same. So we listen to them about what they need to know or to do and find a way to help them. They wanted to know about CCTV installation because, in our community, nobody has ever done it. So since there is no one, and if CCTV needs to be installed, we hire from other communities. (C, 2023)

Collaborating with the community means CNs can build programs that meet their wants and needs without making assumptions. This approach ensures that the community will engage with the programs because they are relevant to them. Often community members can become disengaged with the activities that occur with the CN, perhaps because they do not align with what the community acutely wants.

At Tanda, they have developed a program where Risper facilitates discussions with the community about the issues that can arise while navigating the internet.

> I have had sessions with different groups in Kibera. There is an issue in the role of technology in abuse. People are finding creative ways to abuse, especially women, and children. There are no clear laws, or rules if someone is violated online. So people become silent, and no one in the community is talking and sharing their experiences, and its brewing problems in the social fabric of the community (Arose, 2023)

Tanda also collaborates with social groups and organisations in the area by providing internet services that can aid these social groups' missions. One is a creative centre for HIV-positive women who sell their craft products in person and online to give income to HIV-positive women and provide medicine and support to those

families affected by HIV while promoting HIV destigmatising activities in Kibera. Tanda also supports a startup incubator in Kibrea. In this instance, Tanda is not developing its own programs but is supporting programs that are meaningful to the community.



Figure 14. Visit to Power Women Group creative centre
Figure 15. Introduction to the work from Power Women Group

By engaging with the community and understanding the breadth of their challenges, CNs can work within these gaps to build and support programs that consider the needs and desires of the community.

A way of life

The way CNs collaborate mirrors the way their communities structure themselves. Several CNs highlighted the importance of including specific community members. Hawi speaks about how they include the chief in the initiatives of his CN:

> We're working with the chief of the area, he is a member of our community network. So as we have meetings, every now and then the chief is able to report even incidents of what's happening in the village concerning digital issues. (Rapudo, 2023)

In Oasis Mathare, Arleen also remarks how the involvement of respectable figures in the community, such as the elders or the chief, can help to spread the word about their initiatives and ensure more people participate: "So through the chief, then the elders, then some of our colleagues that will work with them afterwards if they help us craft the information to get to get those the target audiences we want." (Rackita, 2023). Hawi remarks about how females need to be key figures in CNs as they also play crucial roles in the structure and operations of the community:

> Here [In Kijiji Yettu] women and girls must be included in this process. This is not a question mark, because the foundation of our community is based on women and girls. Because when you go to a home, the person who will always give you information of what is happening in that village is always the woman, she is the person who will connect to the networks. We are talking about networks that exist within the community. The women are the people who

> are easier even to mobilise. Men will take time, question a lot of things , ask about money, but a woman or a girl will come and take the time to listen keenly, know what is going on, then be able to see what they'll get out of the process. So that process of adaptation is very important because we are talking about passing information from one generation to another because we have traditional mechanisms. (Rapudo, 2023)

At Siaya, Abawo speaks about how the CN will hold a 'Baraza Baraza' to discuss issues among the members of the public and representatives from various sectors of the community:

> Baraza Baraza...means a public engagement or public forum where people come to engage and speak about issues or challenges....It is usually the liking of the professionals that it happens in the city hall, or you can have it in open air. Right now it's very hot, so perhaps under a under a tree, somewhere shady is good, where people can come and talk. And we can have representations from all sectors, we can have the professionals, we can have the artisans and all sorts of people involved in economic activities. (Abawo, 2023)

Embedding a way of life in how CNs operates allows the community to engage in an organic and familiar way.

Shift of Mindset

Although CNs attempt to engage and involve community members, a common challenge they face is meaningful community engagement. At Dunia Moja, community members sit out in the bushes that surround the hub to access the internet for their entertainment. When approached by employees from the CN, they are uninterested in learning about what the internet can do and how it can be used productively and educationally. This lack of enthusiasm is an issue for CNs, as they believe that the internet's value lies not only in mere access but in fostering meaningful access, which some community members seem uninterested in pursuing. As Josie points out her perspective:

> I have a passion for community to see the welfare of the community change, and to see the transformation of the mindset of the community. You know, there are cultures that have taught a lot of things that made people need to have a change of mindset. So I am passionate and interested in seeing the transformation of the mindset of the community so that they will not lag behind when new inventions are made. (Philips, 2023)

Several CNs, such as Siaya and Dunia Moja, have mentioned that they have issues engaging children whose parents do not see the value or the need for the internet and that a lot of their work has to do with shifting the mindset of the community around the potential of the internet:

> You know, parents need to understand kids need the internet, why the community needs the internet, and why studies have gone to a level that they need the internet to expose these kids, not just when they're in school, because we understand what is happening on the ground. (Abawo, 2023)

Change does not happen abruptly, and CNs understand this and the delicate nature of bringing in new practices in traditional areas. As CNs are built and maintained by community members, they can fully understand and empathise with those not entirely convinced about technology and understand the local circumstances that may be preventing their fellow community members from accepting technology. CNs are attempting to play a role in building new positive relations between their communities and technology. Collaborating with the community is critical in building new values around technology. While they have challenges in doing so, they understand that is a large part of what it means to bring the internet.

Opportunity: Technology Awareness at the Local Level

CNs are deeply involved with the community and have an opportunity to involve the community even more in their organisations. As some CNs, such as Athi, are having success co-creating activities with the community to increase engagement, other CNs could also adopt this approach to strengthen their community engagement. Tanda is facilitating discussion sessions with community members on critical aspects of technology, spreading awareness of how it can be misused; this could be a role other CNs could adopt. CNs gain a local understanding of patterns of use and abuses of technology. If they have the knowledge of how the community is using and abusing technology, they can then raise awareness and address challenges based on their understanding.

### 7.3.2 Sharing resources

CNs are built from a culture of sharing which is often driven by the desire to build relationships and help others. The motivation for CN members to engage in the movement stems from their sense of altruism and care for the well-being of others. Arleen described how her sense of fulfilment comes from seeing others grow: "I just want to say my greatest achievement is helping people grow and have things that they do not have, so I think it is a mission to help people have a different life" (Rackita, 2023).

Sharing can take various forms, including the exchange of material resources. Power is a scarce resource in the Kakuma refugee camp, where OWNET is located. Omot collaborates with families who have enough power capacity by placing the hotspot in their compounds; he explains:

> Power in Kakuma is a challenge, you can't put internet everywhere because devices requires power. I place devices to that person or the family that does have enough power, we just agree that they can support me on the power side of it. (Ogul, 2023)

This implies that Omot relies on the support of the community to enable the functioning of internet hotspots in a mutually beneficial agreement.

Communities of Practice: Sharing Knowledge

In CNs, material items are often limited, while intangible resources, such as time, knowledge, information and relationships, are the most available and valuable resources to share. Communities of Practice (CoP) serve as platforms to facilitate sharing among members who have similar interests and professional skills. A CoP is a collaborative way of producing and sharing knowledge while building a stronger network, generating a sense of belonging and establishing emotional support between peers who face similar challenges.

Figure 16. CN members participating in on-site training on connecting a hotspot during the KNSCNs Infrastructure training
Figure 17. Team-building activities and cultural exchange games

In Kenyan CNs, CoPs are self-organised, and anyone is welcome to contribute. This aligns with Haraway's ideas on situated knowledge, in which any individual with real-world and contextualised experience has valuable insights to contribute to the production of knowledge. The framework of the 'School' contribute to CNs' collective CoP as their program is centred around each CN acquiring and exchanging knowledge on sustainability, local content, and infrastructure. The 'school' also prioritises and facilitates dialogues, allowing everyone to contribute to constructing new practices, ideas and solutions.

A culture of sharing allows community networks to grow despite having limited material resources. The CNs that are in a more advanced state are making considerable efforts to help smaller CNs build capacity, allowing others to strengthen their capabilities to become self-functioning. For example, Alphonce and Risper from Tanda went to Action pour le Progres to support infrastructure and local content training outside the 'School's' formal framework. While these efforts are necessary, they can also become a burden to the capacity of the more advanced CN. The hope is that once smaller CNs have the capacity, they will take on the role of training, creating a ripple effect of passing knowledge from one to another.

CNs face a challenge in retaining and archiving knowledge. The amount of information and experiences shared in training spaces are vast, and it is typically transmitted orally, often derived from tacit experiences, reflections and discussions. Oral storytelling

has been a way for African communities to share their stories, so it is important to maintain this way of sharing information. However, there is an opportunity for documenting and archiving this knowledge, which could be done through oral channels. In addition, some CN members have expressed their interest and the importance of conducting local research, as research is often conducted by outsiders or remains closed within universities. Venturing into research that is done by local experts can be an opportunity to inform policies and decision-makers.

Collaboration supports the movement and helps in building programs that address specific community needs. CNs also collaborate to share valuable resources, such as knowledge, time, and emotional support. They have developed a rich body of knowledge that originates from their members' lived, hands-on experiences. They have created common learning spaces, such as The Kenyan National School of CNs, where this knowledge can be shared to collectively find a mutual agreement on how to solve relevant matters. Collaboration is vital to integrate and translate technology in the contexts where CNs exist, ensuring that it is implemented in a way that aligns with the community's well-being and respects local contexts.

# 8.0 Discussion

This section interprets the main research findings by drawing on existing literature, interviews and the researcher's fieldwork experience. The aim is to demonstrate the significance of the results and their contribution to broader socio-technical conversations. The findings were obtained through a coding process of qualitative data, which consisted of three months of fieldwork, participant observation in two events of the Kenya National School of Community Networks (KNSCN), eleven semi-structured interviews conducted during the researcher's stay, and nine complementary interviews from different members who participated in KNSCN. The results have been divided into three main categories, corresponding to three key themes: *fluidity, locality,* and *collaboration*. These themes shed light on common traits among the seven CNs from which this study collected empirical data.

Under the theme of fluidity, CNs can be seen as fluid entities as their initiatives go beyond their primary role as network infrastructure and internet access providers. Analysing the results through the lens of multiplicity (Vikkelsø, 2007) and the concept of fluidity (De Laet & Mol, 2000), the results show that CNs embody multiple identities that reflect the complexities of the so-called 'digital divide', which extends past material access, affordability and digital skills (Van Dijk, 2020, Chapter 1). While access to technology and resources is crucial, CNs address the immediate needs of connectivity and tackle deeper tensions related to social inequalities, culture preservation, and knowledge production.

As bottom-up initiatives, CNs establish an authentic connection with the struggles of their communities. Examining CNs through the framework of fluidity (De Laet & Mol, 2000), CNs show that even in a scenario where Kenya obtains widespread access, their adaptable nature will enable them to continually evolve and explore alternative avenues or identities. Their resilience and adaptability stem from their desire and purpose to advance the well-being of the community. Due to Mol's and De Laet's nuanced interpretation of what it means to 'work', CNs will remain relevant as they strive to fulfil less quantifiable and material. These include but are not limited to; fostering belonging and community respect, promoting local culture, shifting the community's mentality to embrace change and new opportunities, education and personal growth. Therefore, by embracing these diverse identities and being resilient to external circumstances, CN will continue to play a vital role in equitable digital transformation.

While fluidity is viewed as a positive quality that allows CN to be resilient and adapt to constant changes, it is important to recognise the potential downsides. Some CNs attempt to address multiple issues beyond connectivity, which can sometimes stretch their resources thin. With limited financial and human resources, CN can also experience difficulties planning, organising and implementing solutions. Small CNs relying heavily on volunteers or interns to sustain network operations and initiatives may hinder their stability and impact long-term sustainability. CNs

recognise these challenges and engage in conversations to increase community ownership and collaboration.

The next theme presented in the analysis is *locality*. The results frame CNs as a local social innovation, as their existence can be considered innovative and address a local need. They also hold the potential to foster and empower communities to be social innovators. CNs consider that meaningful innovation has to come from the community and be something that they can relate to. This narrative emphasises the notion that technology that is introduced in Kenya's rural and marginalised areas is often unsuited for African users and cultural settings, leading to further disbalances and inequalities (Csikszentmihalyi et al. 2018, as mentioned in Bidwell, 2022). This arises from the understanding that technology is not neutral and carries the perspectives and biases of its creators.

In contrast, CNs advocate for community-generated content and ownership of the digital environment to reflect the voices and experiences of the community. This aligns with Haraway's argument that 'subjugated' communities can use their voice to challenge dominant narratives and promote alternative ways of representing knowledge (Haraway, 1988, p.117). CNs also emphasise the importance of being sustainable entities without relying on external donors and charities, which can create innovative opportunities for them. CNs feel that the internet is not representative of themselves nor their communities. They want to be included, to be seen and heard and to consume locally produced content as quickly as it is to consume content from across the world. While they advocate for the voices of the communities, they also encourage collaboration with different cultures and nationalities as they believe in the power of knowledge and cross-cultural exchanges.

The value of CNs lies in their integrated approach to technology. It is integrated in a sense that "the focus is not on the technology itself, but on the philosophical, cultural and socio-economic approach to technology." (Dertouzos, 2001). This approach affirms cultural identity alongside technological knowledge, creating conditions for the autonomous development of communities and individuals.

The last theme presented is collaboration. Collaboration is an essential component in making CNs 'work' and appropriately addressing the specific needs of the community. Literature suggests that globalisation has facilitated technology diffusion, often driven by dominant narratives about 'development' and 'progress' that impose a 'universal view'. This approach might overlook the intrinsic relation of technology with the cultural, social and contextual dimensions of human life. The collaboration in CNs has the potential to challenge this notion of 'universality' by striving to build knowledge and technology that involves diverse social groups, acknowledging their unique perspectives, and wanting them to express their voice. This approach aligns with Haraway's collaborative approach to producing knowledge as she argues that including and valuing the perspectives of situated individual experiences in producing knowledge will generate more accurate accounts of the world (Haraway, 1988, p.122).

The research findings on CNs relate to relevant STS conversations, such as the

critique of dominant knowledge systems, the importance of situated knowledge and the value of diverse perspectives in technology development, and the importance of cross-cultural collaboration and participation in challenging ‘universalising’ digital solutions. These findings can serve designers, researchers, policymakers and developers of technology that want to promote more contextualised, ethical and inclusive technological solutions.

# 9.0 Future Work

It would be worthwhile to continue this research by going physically to all the communities within this case study, as many nuances could only be elicited from observation and participation. Additionally, it would be valuable to interact with the community members, those who collaborate with CNs and those who are reluctant to digitization. Both activities could uncover new and different roles of CNs and the national, institutional and local tensions that exist within the digital transformation in Kenya. If this research could continue outside the limitations of academia, it would be beneficial to co-create this research by promoting our interviews to co-authors, so they can then share their own stories and contribute to the gap of accessible Kenyan research about CNs from Kenyans themselves.

# 10.0 Conclusion

Community Networks (CNs) have emerged in Kenya to bridge the digital divide by providing internet access and digital literacy skills to marginalised and rural communities. They aim to enable the same socio-economic opportunities that may be afforded to those with internet access and digital education. By developing a case study based on seven CNs across Kenya, this paper attempted to uncover; **how Kenyan CNs are addressing the digital divide to promote meaningful digital inclusion and equity** and **their potential role in Kenya's digital transformation.**

CNs bring meaningful internet access through *fluidity*, *locality* and *collaboration*. Their identity is fluid; they act as a network infrastructure built and operated differently depending on their situation and circumstances. Beyond their technical infrastructure, they also act as; a vehicle to bring communities together, a means to provide new types of socio-economic and educational opportunities, and as a welfare technology advocating for a better life for their communities. By understanding their local context and fostering a sense of ownership, CNs are able to shape and adapt technology to fit their specific community needs. Through encouraging ownership and leveraging their situated knowledge, CNs can be seen as enablers of fluidity.

In Kenya, the internet is recognised as an avenue to support vulnerable groups, but many communities are unable to afford it. CNs can be framed as a local social innovation that addresses social issues, and become a site to support and develop further local social innovations. CNs work closely with local communities, leveraging the internet to address challenges such as climate change in farming, diversifying economic opportunities for youth, producing culturally situated content, and fostering community-driven innovations that reflect and align with their reality.

Community participation is a vital component of CNs, as reflected in their slogan: "For the community, by the community, with the community". CNs operate in a way that embeds a local way of life, allowing communities to engage in an organic and familiar way. CNs often work with different tribes, religions and groups; they acknowledge the diversity of their community and act as translators of technology, creating a shared space for relatedness and collaboration. While some community members may remain reluctant to embrace digital areas, others actively participate and collaborate with the CNs, building meaningful educational programs and sharing internet resources with their neighbours despite religious or cultural differences.

CNs cultivate a culture of sharing both tangible and intangible resources with their clients and among themselves to build mutually beneficial relationships. CNs place great value on the knowledge exchanged between their networks. In this case study, CNs have come together to contribute to a Communities Of Practice (CoP). Through the CoPs, they have accumulated knowledge, enabling members to overcome similar challenges, develop new skills, and foster a strong sense of belonging within the movement.

This research concludes that CNs assume multiple impactful roles in their communities, allowing them to develop and successfully 'work' in many ways. Despite being small organisations with limited resources, they empower their communities and make meaningful contributions. Kenyan CNs are a *fluid* and situated social innovation that collaborates with communities to bring internet access in a meaningful and local way. They are attempting to bridge the digital divide not only by providing internet access but also by empowering communities to leverage their own situated knowledge for positive change. This study positions the contributions of CNs as a reclamation of the importance of local and situated approaches to technology in the face of the prevalence of Western content and knowledge systems embedded in technology.

Introducing the internet to communities may generate uncertainties and doubt, but it is here to stay. CNs fill a necessary gap to bring technology in a compassionate, ethical and locally minded way. CNs can all be categorised as optimistic about the positive role the internet can play in the future and its potential to drive social change for the betterment of people's lives. The impact on their communities is significant, and their efforts deserve recognition and appreciation.

# 11.0 Afterword

This section will share our personal views and reflections on our research journey and involvement with the CN movement. While the narrative presented in the analysis embeds our positionality (as discussed in the 4.0 methodology, positionality), we intentionally create a clear boundary from this section as this expresses our perspective as 'outsiders'. Our reflections will highlight some of the tensions experienced while working and researching in a different cultural context, along with valuable learnings that we have gained throughout this experience.

Relatedness

During our fieldwork, we observed the active involvement of CNs in discussions surrounding emerging technologies such as Blockchain, AI, and Robotics. We recognise that CN are committed not only to bringing internet access but also ensuring that their communities are aware of and have a stake in the high-tech advancements happening globally. While we acknowledge the relevance of this endeavour, we sensed a potential imbalance in involving the community in complex technologies, considering the varying circumstances and levels of technical knowledge. Introducing high-tech concepts in ways that are not relatable or disconnected from the community's aspirations can result in a higher reluctance to adopt technology, and may enhance the feeling of 'being left out', especially in adults.

During our stay in Mtondia, adults expressed that digital skills are necessary for all but are mainly for the youth. Engaging the older segments of the population is already difficult as they may not feel welcomed, or simply because they do not have the time to acquire new digital skills. Although some CNs are already engaging with older groups, further efforts could be made to find innovative approaches to engage and collaborate with those groups.

For example, while working in Mtondia, we had the opportunity to interact with Mama Florence, a local fruit seller who had a stall nearby. We believe, like Dunia Moja, that Mama Florence could benefit from digital skills in her business. She already uses her phone to receive payments through the popular digital payment system MPESA. However, to fully leverage the adoption of new digital tools, she would need to see the value of using them for her business. Moreover, the digital skills should be presented to her in a way that makes sense and aligns with her aspirations. For example, learning about AI or blockchain may steer her away from technologies that could help her manage her produce or budgeting. We wonder how Mama Florence can use digital tools in a way that is relatable and applicable to her business and way of living. CNs have an opportunity to make an impact on adults' lives. By giving them basic computing and internet skills, they have the potential to make a significant impact; while that may not be in advancing robotics, it is a starting point that then adults could explore more.

We found that something that works well is including local role models or mentors in the community who can exemplify how those skills can be meaningful and transform a person's livelihood. For example, we witnessed how Twahir's digitally literate sister was able to help a local lady to apply for an online grant to get a fishing boat. We also saw Twahir mentoring a young woman who came to the hub to present her locally produced 'chapati' (flat bread) making machine. The idea came to her while working in a local bakery. She wanted to scale up her business, but the industrial machinery was too expensive, so her invention was mechanical and made with locally available materials such as wood. Her project was a clear example of how innovation can be done without high-tech solutions. By having local mentors, the adults can be exposed to the skills currently in use and understand how those skills can benefit them.

A Relational Internet

Being with CN made us reflect about our mediated relationship with the internet. Like many consumer goods in 'developed' countries, the internet has become another commodity that is taken for granted. Our interaction with internet service boils down to paying a monthly bill or getting assistance from the 'invisible' operator that helps us when the Wifi signal is too slow. While living in Mtondia, we could not take the internet for granted, as there were consistent blackouts or malfunctions. However, that sometimes meant we could start a conversation or stop staring at our computer screens and go for a walk. While we do not want to romanticise a rural life and acknowledge that not having consistent internet is undoubtedly an important issue, we recognise how there is also value in the way CNs bring an internet that is more relational than transactional. Some of their members achieve meaning and purpose in life by being connected to the process of setting up a network and being members of the movement. By being creators rather than just consumers, their relationship with technology becomes different, perhaps more meaningful.

## The Problem-Solving Urge

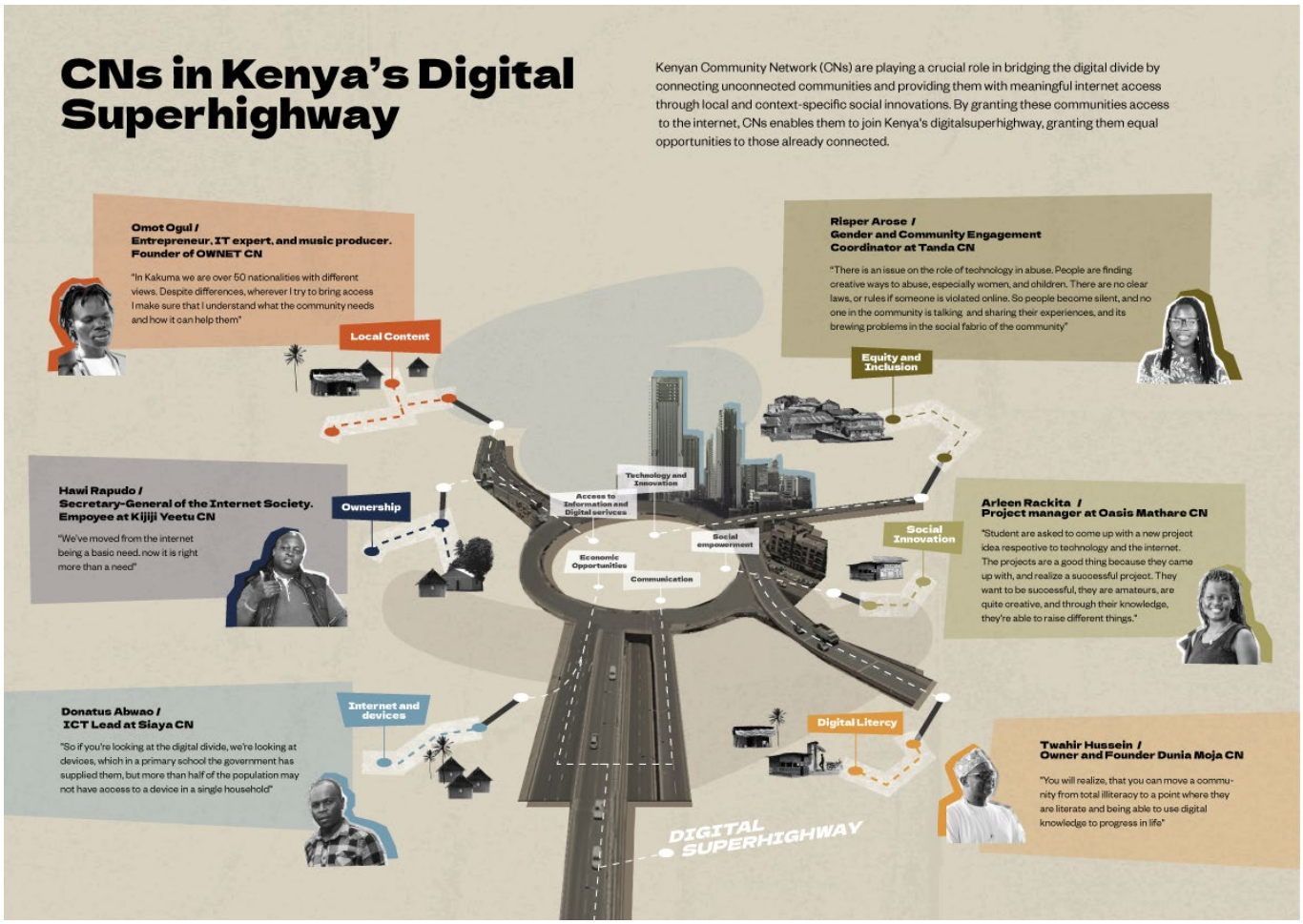
As researchers with technical backgrounds in interaction design (Ainoa) and software development (Kira), we are used to creating out in the world. We often feel the urge to solve problems with design/technological solutions. This master's and this research has forced us to take a step backwards and reflect on the role of design and our responsibility as designers. Our experience with CN has challenged us numerous times to prioritise observation and listening over sharing our thought or ideas. This approach has allowed us to gain a deeper understanding of the context before offering interpretations or solutions. Through this process, we feel we have gained meaningful insights and are open to continue collaborating with the CN movement in one way or another.

As outsiders engaging with problems, circumstances, and cultures beyond our own context, we recognise the importance of ensuring that the resulting research is:

- Accessible and distributable to those it involves

- Makes those who have contributed to the work visible
- And to ensure there is a mutually beneficial exchange of knowledge

In creating these guidelines for ourselves, we have attempted to satisfy them by developing a visual representation of parts of the research that can then be shared and accessed within the CN network and beyond, as well as making sure that the paper itself can be published and distributed. We have also attempted to make it clear in the paper who has contributed to this research by crediting their names throughout the paper. We have also discussed with some of the interviewees what we could do to help and how our skills could be helpful. We were asked to create an infographic on the digital divide and the gap that CNs are filling, as this is something that they wanted to do but did not have the time for. We combined their brief with our research and findings to create the following infographic protoype, that we will contuine to develope with the CNs:



# Footnotes

1. 1.If you are interested in seeing these transcripts, please contact the researchers.

# References

Abwao, D. (2023, March 8). Personal communication [Personal interview]

Adamu, M. S. (2023). No more "solutionism" or "saviourism" in futuring African HCI: A manyfesto. *ACM Transactions on Computer-Human Interaction*, *30*(2), 1-42.

Arose, R. (2023, January 2). Personal communication [Personal interview]

Association for Progressive Communications (n.d.). *Internet for social justice and sustainable development*. https://www.apc.org/

Athi Community Network. (2022). About. *Athi Community Network* https://www.athicommunitynetwork.org/about/

Atieno, L. (2014). Implementation of digital village projects in developing countries - case of Kenya. *British Journal of Applied Science & Technology*, *4*(5), 793–807. https://doi.org/10.9734/bjast/2014/6663

Bidwell, N. J., Winschiers-Theophilus, H., Kapuire, G. K., & Rehm, M. (2011). Pushing personhood into place: Situating media in rural knowledge in Africa. *International Journal of Human-Computer Studies*, 69(10), 618-631

Bidwell, N. J. (2021). Decolonising in the gaps: Community networks and the identity of African innovation. *Re-imagining Communication in Africa and the Caribbean: Global South Issues in Media, Culture and Technology,* 97-115.

Baby Paws. (2022, November 23). *SIKU YA KUZALIWA KWA PIKI - Piki's Birthday | Baby Paws* [English Subtitles] [Video]. YouTube.https://www.youtube.com/watch?v=Y365ual7kN4

Børsen, T. (2013). Identifying interdisciplinary core competences in Techno-Anthropology: interactional expertise, social responsibility competences, and skills in anthropology-driven design. In *What is Techno-Anthropology?* (pp. 35-66). Aalborg Universitetsforlag.

Brudvig, I. (2019, June 19). *New knowledge paradigms for tech and I: Toward a more Ethical Digital Society.* World Wide Web Foundation. https://webfoundation.org/2019/06/new-knowledge-paradigms-for-tech-and-i-toward-a-more-ethical-digital-society/

C. (2023, March 31). Personal communication [Personal interview]

Carr, K., Kendal, R. L., & Flynn, E. G. (2016). Eureka!: What is innovation, how does it develop, and who does it?. *Child development, 87*(5), 1505-1519.

De Laet, M., & Mol, A. (2000). The Zimbabwe bush pump: Mechanics of a fluid technology. *Social studies of science*, 30(2), 225-263.

DiMaggio, P. J. (1988). Interest and agency in institutional theory. *Institutional patterns and organizations*, 3-21.

Dunn, H. S. (2021). Globalisation from within: Enhancing digital productivity and technology transformation in the south. *Re-imagining Communication in Africa and the Caribbean: Global South Issues in Media, Culture and Technology*, 33-50.

Gad, C., & Bruun Jensen, C. (2010). On the consequences of post-ANT. *Science, Technology, & Human Values*, *35*(1), 55-80.

Given, L. M. (Ed.) (2008). The SAGE encyclopedia of qualitative research methods. SAGE Publications, Inc., https://dx.doi.org/10.4135/9781412963909

Hammersley, M., & Atkinson, P. (2007). *Ethnography : Principles in Practice*: Vol. 3rd ed. Routledge

Haraway, D. (1988). Situated knowledge: The science question in feminism and the privilege of partial perspective. *Feminist studies, 14*(3), 575-599.

Hussein, A. (2023, March 2). Personal communication [Personal interview]

Hussein, T. (2022, September 30). Personal communication [Personal interview]

International Trade Administration. (2023). *Kenya Digital Superhighway Project*. https://www.trade.gov/market-intelligence/kenya-digital-superhighway-project

Internet Society. (2023, March 28). *About the Internet Society.* Internet Society. https://www.internetsociety.org/about-internet-society/

Jensen, T.E. (2021). *Multiplicity* [PowerPoint presentation]. *Aalborg University.*

K. (2022, September 4). Personal communication [Personal interview]

Kassouwi, I. K. (2023). *Kenya seeks World Bank support for its Digital Superhighway Project*. Ecofin Agency. https://www.ecofinagency.com/telecom/0703-44324-kenya-seeks-world-bank-support-for-its-digital-superhighway-project#:~:text=-The%20digital%20superhighway%20project%20will,the%20economy%20and%20reduce%20unemployment.

KICTANET. (n.d.). About KICTANET | KICTANet Think Tank. Copyright KICTANet Think Tank - All Rights Reserved. https://www.kictanet.or.ke/about-kictanet/

Kijiji Yeetu. (2020). *Kijiji Yeetu.* Kijiji Yeetu Linkedin. https://www.linkedin.com/company/kijiji-yeetu/

Kijiji Yeetu *(n.d.) About.* Kijiji Yeetu. https://kijijiyeetu.co.ke/

Kleiner, Dymtri: *The Telekommunist Manifesto*. Amsterdam: Institute of Network Cultures 2010 (Network Notebooks 3). DOI: https://doi.org/10.25969/mediarep/19295.

Kyalo, C. (2022, September 6). Personal communication [Personal interview]

Kyalo, C. (2023, March 31). Personal communication [Personal interview]

Latour, B. (1991) 'Technology is society made durable' in Law, J. (ed) A Sociology of Monsters? Essays on Power, Technology and Domination. *Sociological review Monograph 38*, London: Routledge, 103-131.

Law, J. (1992). Notes on the theory of the actor-network: Ordering, strategy, and heterogeneity. *Systems practice*, *5*, 379-393.

Law, J. (1999). After ANT: complexity, naming and topology. *The sociological review*, *47*(S1), 1-14.

Law, J. (2004). *After method: Mess in social science research.* Psychology Press.

Law, J. (2009). Actor Network Theory and Material Semiotics. In: Turner, Bryan S. (ed). *The New Blackwell Companion to Social Theory*. Malden; Oxford: Wiley-Blackwell, 141–158.

Mbarika, V. W. A., Manyozo, L. K., and Kamugisha, C. (2009). Mapping digital media: Kenya. *Open Society Foundations*.

Mortari, L. (2015). Reflectivity in research practice: An overview of different perspectives. *International journal of qualitative methods, 14*(5), 1609406915618045.

Mol, A. (1999). Ontological politics. A word and some questions. *The sociological review, 47*(1_suppl), 74-89.

Mol, A. (2002). *The body multiple: Ontology in medical practice.* Duke University Press.

Murisya, E., & Yarime, M. (2011). *Understanding the grassroots dynamics of slums in Nairobi: The dilemma ...* International Transaction Journal of Engineering, Management, & Applied Sciences & Technologies . https://www.researchgate.net/publication/50392060_Understanding_the_Grassroots_Dynamics_of_Slums_in_Nairobi_The_Dilemma_of_Kibera_Informal_Settlements

Ndung'u, N (2019) Digital Technology and State Capacity in Kenya *Center for Global Development* Policy Paper 154. Retrieved from: https://imaraafrica.com/wp-content/uploads/2021/09/digital-technology-and-state-capacity-kenya.pdf

Nurdiah, E. A. (2016). The potential of bamboo as building material in organic shaped buildings. *Procedia-Social and Behavioral Sciences*, *216*, 30-38.

Ndlovu-Gatsheni, S. J. (2022). *Empire, global coloniality and African subjectivity*. Berghahn Books

Nyabuga, G., Booker, N., Dragomir, M., Thompson, M., Jamaï, A., Chan, Y. Y., & Nissen, C. S. (2013). *Mapping digital media: Kenya* (p. 1). Nairobi: Open Society Foundations.

Nyamnjoh, F. B. (2002). Children, media and globalisation: A research agenda for Africa.

Oasis Mathare. (n.d.). *About.* Oasis Mathare. *https://www.oasismathare.org/*

Odhiambo, A. (2023) Where are Community Networks in the Digital Super Highway. *Tanda Community Based Organization*. gonnline.africa/2023/05/16/communitynetworks-in-digital-superhighway

Odhiambo, A. (2023, January 2). Personal communication [Informal conversation]

Ogul, O . (2023, March 13). Personal communication [Personal interview]

Onsongo, E. (2017). Institutional Entrepreneurship and Social Innovation at the base of the pyramid: The case of M-pesa in Kenya. *Industry and Innovation*, *26*(4), 369–390. doi:10.1080/13662716.2017.1409104

Philips, A. (2023, March 2). Personal communication [Personal interview]

Poggiali, L. (2016). Seeing (from) digital peripheries: Technology and transparency in Kenya's Silicon Savannah. *Cultural Anthropology*, *31*(3), 387–411. https://doi.org/10.14506/ca31.3.07

Pubill, A., & Tilcock, K. (2023). The Sociotechnical Imaginary of Mtondia. *Aalborg University Copenhagen*

Rackita, A. (2023, January 2). Personal communication [Personal interview]

Rapudo, H. (2023, January 31). Personal communication [Personal interview]

Reframe. (n.d.). *Action pour le progres.* Reframe. https://reframe.network/profile.php?org=Action+pour+le+Progres

Rey-Moreno, C. (2014). Understanding CommunityNetworks in Africa. *Report. Internet Society, May,* 20

Rey-Moreno, C., Miliza, J., Mweetwa, F., Van Stam, G., & Johnson, D. (2016). "community networks" in the African context. *Proceedings of the First African Conference on Human Computer Interaction*. doi:10.1145/2998581.2998620

Rifkin, J. (2011). *The third industrial revolution: how lateral power is transforming energy, the economy, and the world*. Macmillan.

Rogers, S. E. (2016). Bridging the 21st century digital divide. *TechTrends*, *60*(3), 197-199.

Rosenberger, R. (2017). *Callous objects: Designs against the homeless.* U of Minnesota Press.

Siaya Community Library. (2015) *About us.* Siaya Community Library https://www.siayalibrary.org/

Siyam, S., & Rey-Moreno, C., (2022) Community Networks for Digital Inclusion in Rural Areas: What Are the Opportunities for Cameroon? *Association for Progressive Communications.https://www.apc.org/sites/default/files/pb_cameroon_english_online.pdf*

Solidarités Jeunesses. (2022) The *Oasis Community center Mathare* https://www.solidaritesjeunesses.org/chantier/the-oasis-community-center-mathare-2279

Spradley, J. P. (1980). Doing participant observation. *JP Spradley, Participant observation, 53,* 84.

Star, S. L. 1991. Power, technologies and the phenomenology of conventions: On being allergic to onions. *In A sociology of monsters: Essays on power, technology and domination, ed. J. Law,* 26-56. London: Routledge.

T. (2022, October 2). Personal communication [Personal interview]

Vikkelsø, S. (2007). Description as intervention: Engagement and resistance in actor-network analyses. *Science as Culture, 16*(3), 297-309.

Van Dijk, J. (2020). *The digital divide*. John Wiley & Sons.

Wajcman, J. (2010). Feminist theories of technology. *Cambridge journal of economics,* 34(1), 143-152.

Wanjiru-Mwita, M (2023). *The fascinating history of how residents named their informal settlements in Nairobi*. The Conversation. https://theconversation.com/the-fascinating-history-of-how-residents-named-their-informal-settlements-in-nairobi-159080#:~:text=In%20Kenya%27s%20capital%20city%2C%20Nairobi,the%20city%20as%20registered%20laboure

Wanzala, O., & Nyamai, F. (2018, July 23). *Big hurdles thwart Jubilee's laptop plan.* Daily Nation. https://nation.africa/kenya/kenya/news/big-hurdles- thwart-jubilee-s-laptops-plan-69972

Wasserman, H. (2021). New Optics on Digital Media Cultures in Africa. *Re-imagining Communication in Africa and the Caribbean: Global South Issues in Media, Culture and Technology,* 19-32.

Wildermuth, N. (2018). Kenya's Digital Divide. Digital inclusion: An international comparative analysis, 187.

Yin, R. K. (2018). *Case study research and applications: Design and methods*. SAGE.

# Appendix A

## Combined List of Open Codes

| Name | References | Name | References |
|---|---|---|---|
| Actors | 3 | Create relevant content for the community | 1 |
| Adoption of basic tech | 1 | Day care for parents not able to raise kids | 2 |
| Addressing Illiteracy | 1 | Dealing with non-supporters | 2 |
| Acknowledging diversity within communities | 3 | Depending on donors | 1 |
| Awareness through WhatsApp | 1 | Different place - different situation | 2 |
| Be bold and think out of the box | 1 | digital transformation | 1 |
| Being patient enough | 1 | Dividing tasks | 1 |
| Business model for internet service | 1 | Double edged sword | 3 |
| Challenges | 0 | Dropping out of school | 1 |
| Access to devices | 1 | Drug abuse | 1 |
| Affordability | 1 | Early stages | 2 |
| Data literacy and awareness | 3 | Enabler of communication | 1 |
| Education | 4 | Encouraging local content to decolonise the internet | 2 |
| Policy and Regulation | 1 | Ending up committing crime to earn a living | 1 |
| sustainability | 1 | English is the language of the internet | 2 |
| Closing the connectivity gap | 1 | Enhancing the uptake of group lending | 1 |
| CN's Potential for innovate | 2 | Ensure tech access and literacy to the masses | 1 |
| Community | 5 | Entrepreneurial nature of Kenyans | 1 |
| Community engagement | 2 | Explaining how internet can help community | 1 |
| Community leaders | 1 | Feeling that they belong | 1 |
| Passing information to the community | 1 | giving people autonomy | 1 |
| texting among community members | 1 | Google as a source of knowledge | 1 |
| WhatsApp | 2 | Group lending | 2 |
| Community supporting the network | 1 | Guide and Awareness | 1 |
| Connectivity failure | 1 | Help with School Dropout | 1 |
| Covid | 1 | Helping affected people because of fire | 1 |

| | | | |
|---|---|---|---|
| illiteracy | 1 | helping people have better life | 4 |
| Innovation | 5 | Moving from traditional to online | 1 |
| internet allows communities to organise | 1 | Narratives on tech | 1 |
| Internet and Education | 2 | Need of connection to get jobs | 1 |
| Internet is creating opportunities for young people | 1 | No resources for further studies | 1 |
| Internet presence is mostly from Global North | 1 | Not allowing kids in workplaces | 1 |
| Internet structures can perpetrate colonisation | 1 | Nurturing and educating the youth | 1 |
| ISP fail to provide good service | 3 | Online abuse becomes a tabu | 1 |
| Kenyan Innovation Ecosystem | 2 | Online abuse to minorities | 1 |
| Dealing with dominant powers in the innovation ecosystem | 1 | Open-source tools | 1 |
| KOKO networks | 2 | Organisations earning by engaging in an online space | 1 |
| MPESA | 1 | Organising social action | 1 |
| Network effect | 1 | Partnerships with international organisations | 2 |
| Policy and regulation against dominant power | 1 | Passing on information | 1 |
| Kids stop at school to bring money to their families | 1 | Path to profitability | 1 |
| Lack of electric power | 1 | Patient capital | 1 |
| Lack of mentors | 1 | People take credit for the stories about communities | 1 |
| lack of motivation | 2 | Policy and Regulation | 1 |
| lack of mutual understanding | 1 | Products of a digital economy | 2 |
| Lack of regulation for violations in the online space | 2 | Promoting the internet while bringing awareness | 1 |
| Language barrier | 1 | Registering CBO | 1 |
| Local innovation in Africa generally | 1 | Responsibility in surfing the web | 1 |
| Monetising online content | 1 | Rigid minds | 2 |

| | | | |
|---|---|---|---|
| Robotics as innovation | 1 | Access to knowledge | 7 |
| Satellite internet | 1 | Adapting to the community needs | 11 |
| Engaging | 9 | Behind in research and innovation | 3 |
| Sharing Ideas and Knowledge | 2 | Benefits not to the people | 4 |
| Sharing internet | 1 | Cell Phone ownership | 2 |
| Slum fires | 1 | CN still developing | 5 |
| Starting from the ground up | 2 | Collaboration between CNs | 2 |
| support in creating their own content | 1 | Communication | 3 |
| High cost of internet | 2 | Community Projects | 3 |
| Tech hubs or Tech Schools | 2 | Content Creation | 3 |
| Tech projects for the community | 1 | Controllers of the internet | 6 |
| Technology to make a living | 1 | Corporate Responsibility | 1 |
| the internet reproduces power structures | 1 | Cultural Innovation | 1 |
| theft | 1 | Digital divide | 5 |
| Understanding and listening to the community | 1 | Digital literacy | 5 |
| Uniqueness of CN | 1 | Education system | 5 |
| Using traditional existing models to innovate | 4 | Empowerment | 1 |
| Value in enabling access to marginalised areas | 1 | Voice | 4 |
| Vision | 1 | Give back to community | 3 |
| westers should collaborate with and support communities | 2 | Government | 5 |
| WhatsApp as a tool to organise help | 2 | Idol youth | 2 |
| Who gets to have a voice | 2 | Inclusion | 3 |
| Young people engaging on the online space | 1 | Inequality in the internet | 1 |
| Youth | 1 | internet as a right | 2 |
| Internet for farming | 6 | Unemployment | 2 |

| | |
|---|---|
| Internet for the youth | 1 |
| Internet ownership | 4 |
| Learning from each other | 6 |
| Left behind | 2 |
| Maintance | 2 |
| Michael Joseph Center | 1 |
| Need for public engagement | 1 |
| New way of life | 1 |
| Online Jobs | 1 |
| Passion for community | 1 |
| Personal data collection | 5 |
| Perception from community | 1 |
| Internet as a good life | 2 |
| Power | 1 |
| Private sector | 3 |
| Recourses | 5 |
| Respect | 4 |
| Roles in digitization | 2 |
| Shift in thinking | 5 |
| Side effect of the internet | 6 |
| Change communities | 1 |
| Influence | 2 |
| Job loss | 3 |
| Surveillance | 1 |
| Traditional ways-of-life built into new process | 10 |
| Transparency | 1 |

# Appendix B

Semi-structured interview guidelines.

The following appendix is a list of questions that were asked during the interviews. Each interview was planned in advance, taking into account the expertise and background of the interviewees to ensure the relevance and depth of the discussions.

- What are some of the controversial topics that are emerging from the process of digitalisation in Kenya?
- How do you feel the internet is helping Kenya?
- Are there any ways that it is harming Kenya?
- What are your thoughts on having the internet decolonized? Why do you feel it is important or not?
- What is your position on the global north's investment in Kenyan digitalization transformation?
- What is the potential of Community Networks in innovating within the digital transformation of Kenya?
- What do you think are the biggest challenges for community networks in making a difference in this transformation?
- Could you give us an overview of how big tech giants are investing in Kenya, how is that affecting local knowledge and local creativity?
- How do you see innovation different in Kenya than in other parts of the world?
- How does local cultural influence the development of innovation
- We saw on LinkedIn a project on KOKO networks, looks quite unique and innovative, considering local needs. What made this project succeed?
- What are the challenges among innovators in Kenya?
- How can innovation in Kenya be made meaningful to its citizens?
- How is digital technology being appropriated in Kenya?
- When we talked to some people in Mtondia and in the CN context. There is this feeling of being left behind in the digital global world. Do you know why and how different people are addressing this issue?
- Do you feel there are any challenges with technology built outside of Kenya fitting the needs of Kenya?
- What motivated you to join the organization?
- What community issues are your CN trying to address? Are there any challenges that are particularly unique to the area?
- What does community mean to you?
- Can you tell us about a project where the community came together to solve a problem?
- How do you engage the community?
- How are you making sure the community is getting meaningful access to the internet?
- What does innovation mean to you?
- Can you tell us about an innovation within your CN?
- How is creating local content an important activity to do in your CN?
- How is your CN unique?
- What are the biggest challenges in sustaining and maintaining a CN?
- From your experience and learnings in CN, how would you start a new CN? What would be the main components?

AALBORG
UNIVERSITY