Bridging digital gaps in a mobile device age: Evidence from community telecentres in Ghana

[1]Daniel Azerikatoa Ayoung
[2]Frederic Naazi-Ale Baada
[3]Oswin Aganda Anaba
[4]Augustine Aduko Alu

[1]daniel.ayoung@bolgatu.edu.gh
[2]fbaada@bolgatu.edu.gh
[3]oswin.anaba@bolgatu.edu.gh
[4]alu.aduko@cctu.edu.gh

[1]https://orcid.org/0000-0002-8249-0538
[2]https://orcid.org/0000-0003-4981-7620
[3]https://orcid.org/0000-0002-7879-7035
[4]https://orcid.org/0000-0002-4119-1275

[1,2,3]Bolgatanga Technical University, [4]Cape Coast Technical University, [1,2,3,4]Ghana

https://doi.org/10.51867/ajernet.6.3.59

ABSTRACT

This study explores the usefulness of Community Information Centres (CICs) amidst growing ubiquity of mobile phones. It examines how CICs can play a complementary role to personal mobile phones, specifically in facilitating access to information that translates into social and economic progress. This study was guided by an Integrative Model of Digital Engagement and Impact (IMDEI) employing selected constructs from three dominant theories namely the Uses and Gratifications Theory (UGT), Diffusion of Innovation (DOI) theory and Technology Acceptance Model (TAM). Through a quantitative research design, 500 respondents from 10 CICs were surveyed with 451 valid responses returned. SPSS and SmartPLS software version 25.0 were used to process and analyse the data collected. The findings indicate that although mobile phones are suitable for simple tasks, complicated tasks are better performed in CICs, suggesting a complementary nature of the two (2). The study recommends that future telecentre initiatives adopt models of co-location, which are so far lacking in the Ghanaian case. Moreover, the paper discusses the implications of increased information availability, which allows CICs to widen the scope of services and involve more citizens in their operations, thereby enhancing involvement in activities. The research also discusses the implications of universal service on a wider scale, challenging the adequacy of current service definitions to cater to the needs of heterogeneous communities. The paper concludes that CICs remain an indispensable facility for equitable information access and a source of empowerment, but their success hinges on user participation, adequate policies, and deliberate technology integration. The paper argues for a balanced approach that utilises both mobile technology and CICs to maximize community development and engagement. This study contributes to the ongoing discussion on the role of information access in community development in an increasingly digitalised world.

Keywords: Access, Community Engagement, Community Information Centres (CICs), Ghana, Impact, Mobile Devices

I. INTRODUCTION

The emerging fields of nations, communities and individuals are substantially conditioned by Information and Communication Technology (ICT) (Roztocki et al., 2019). According to Brants and Frissen (2017) and Clarke et al. (2013), research shows that ICT can be used to reduce inequality and empower citizens. It has been extensively documented in the literature that ICT is useful for health, education and political participation (Çetin et al., 2021; Shimpy & Singh, 2012).

Several countries (Europe's Telematics Applications Programme and the UK's 'People's Network') have already introduced national policies relating to information and communication technology (ICT) in an effort to address the digital divide (Brophy, 2004; Civic Agenda, 2010). Ghana, recognized as one of the trailblazers of Information and Communication Technology (ICT) policy initiatives in Africa, introduced its ICT for Accelerated Development (ICT4AD) policy in 2003 to combat and reduce the digital divide (G-ICT4AD, 2003). One of the major initiatives in the policy was the rollout of Community Information Centres which provided ICT training and e-government to the people (Awotwi, 2015; Ayoung & Abbott, 2021). But the concern is, despite the wide deployment, their long-term viability has been a question (Ayoung et al., 2015).

On the other hand, in Ghana in the last ten years, mobile phone use has exploded (Boyinbode, 2018; Kukulska-Hulme, 2012). Handheld devices seem to be cheap and accessible to all as compared to in the past when they were

elitist (Akanferi et al., 2014; Yu & Ibtasam, 2018). By 2008, mobile coverage in Africa stood at 60%, while emerging in 2020, Ghana achieved a mobile adoption rate of 55% making it a leader in West Africa and well above the regional average of 44.8% (Omondi, 2020). As of 2019, Ghana had 10.7 million people who accessed the internet through mobile devices, 16.7 million people subscribed to mobile services as well as 15.1 million people used smartphones (GSMA, 2022).

The importance of Community Information Centres (CICs) is being questioned due to the rapid increase in mobile phone ownership. This study intends to examine whether CICs continue to be important for populations with limited resources. It asks a question: What is the usefulness of information centres considering the extensive use of mobile phones in Ghana? The results will direct future ICT4D projects and provide information for discussions about ongoing funding for CICs.

1.1 Statement of the Problem

While there is a widely held belief in the potential of ICT as a driver of development and a vehicle for closing the inequality gap, a critical concern is the continued relevance of Ghana's CICs in the presence of widespread mobile phone ownership. The CICs were established based on the Ghana government's ICT4AD policy to reduce the digital divide especially in underserved communities. There has, however, been an overwhelming uptake of internet enabled mobile devices, enabling access to diverse services to users in hard-to-reach communities leading to some scholars asking whether community multimedia centres are a necessity.

Consequently, this paper investigates the role of CICs in an environment that is increasingly dominated by mobile technology. This topic is especially relevant in support of policy formulation and for development organizations or ICT actors to determine where resources should be spent to promote balanced ICT4D strategies.

1.2 Research Objectives

(i) To determine whether Community Information Centres (CICs) in Ghana still serve a purpose, despite the extensive diffusion of mobile phone technology

(ii) To examine their role in enhancing digital inclusion and access to ICT services among underserved communities.

1.3 Hypotheses Development

Access and Impact

CICs have cooperative goals in promoting education, information access and community support (Moran & Morner, 2017). Access to resources such as eBooks, Internet services and databases empowers CIC to curated information that emanates from information resources to underprivileged communities. CIC also contributes to digital inclusion by providing free or low-cost internet access, bridging the digital divide for rural and underserved communities. They continue to offer lifelong learning opportunities through training and workshops, which could be applied to empower community members.

Their universal design makes them accessible to marginalized members of society, including the disabled and elderly people, thereby augmenting equal education opportunities. Models of cooperative sharing of resources between CICs also enhance sustainability by reducing duplication of services. Empirical evidence shows that CICs strengthen community engagement, health literacy, and triangulation of social services.

H1: There is a positive correlation between Access (to CIC resources) and Impact (CIC effectiveness).

Information and Impact

Sharing information on CIC resources contribute to an enhanced level of CIC diffusion and effectiveness (Moran & Morner, 2017; Scott, 2011). Knowing what resources are available, such as digital repositories, expert directories and training sessions, helps CIC staff help users more effectively—allowing resources to be used more efficiently and reducing redundancy.

CICs, for instance coordinate digital literacy activities to develop the technical abilities of residents. Service information expands resource usage, especially in rural areas. Library Partnerships also make community-oriented programs more accessible. The literature suggests that a well-resourced centre improves educational outcomes, employment opportunities and engenders civic participation. Hence, the study hypotheses that:

H2: Information (library resources information) is positively correlated to Impact (effectiveness of CIC).

Activities and Impact

Well-designed CIC programs, including digital literacy training, job search support and community workshops, improve the capacity, job opportunities and social capital of users (Sey & Fellows, 2009; Gomez et al., 2012). Kapondera

& Mtambo (2024) suggest that active internet use through these programmes achieves more empowerment than passive use of the internet.

Yet, impact heterogeneity is a function of program quality, digital literacy levels of patrons, and the social and economic environment. Scaling activities enhance such benefits, but individual access to CIC resources can also support personal development (Sey & Hafkin, 2019).

H3: Information positively correlates to Impact

Access and Activity

One of the main platforms for digital access, information, and skills is the Community Information Centres (CICs). The theory that there is a positive association between CIC access and utilization to engage in CIC activities implies that the more CICs there are in an area, the more parents are encouraged to be involved in organized programs and services. The connection between access and activity in CICs, as well as the associated indicators, are linked with models of information behaviour and digital inclusion.

Ease of access does improve user engagement (Davis 1989), as indicated by the TAM (Technology Acceptance Model. van Dijk (2017) argues that access is a necessary condition for substantial participation in digital actions. Therefore, an increase in the availability of CIC facility/services will contribute to higher participation in CIC programs and services.

The availability of a more user-friendly infrastructure including high-speed internet, modern computers and library resources supports increased involvement in digital literacy programs. By improving access, participation is expanded through eliminating the physical and financial barriers, raising the profile and encouraging a digital dialogue. This relationship is not straightforward, and it varies by several contextual factors, including socioeconomic status, program of interest, or level of community involvement. Thus, it is hypothesized in the study that:

H4: Access is positively related to activity.

Information and Activity

Useful information contained within CICs, including job opportunities, educational services, etc., motivates people to undertake certain activities. For example, if a CIC offered information about online courses, the users may be more willing to engage in digital literacy classes that were available in the community centre. This is consistent with the argument that knowledge access encourages people to pursue more involvement in a structured learning environment (Dutta, 2020).

In addition, involvement in CIC programmes improves people's access to and understanding of information. One workshop and training session that has proved useful, for instance, focuses on how to use online resources, assess the credibility of facts and figures and exploit digital tools. Participants at CIC Research indicate that those attending digital skills training were more likely to use CIC materials for research and other educational purposes (Kapondera & Mtambo, 2024; Kwatani & Markon, 2017).

The connection between information access and activity participation creates a cycle of interlocking feedback. The more information that is available, the wider CIC activities become known. And participation in those activities improves information-seeking behaviour. Some studies found that communities with well-functioning CICs had higher levels of civic engagement and socioeconomic improvement, due to increased access to both information and opportunities for education (Nguyen et al., 2019). Therefore, the study hypotheses is:

H5: The relationship between information and activity is positive.

Mediating Role of Activity in Access-Impact Relationship

CICs have given people access to key resources such as technology, information, and learning space itself (Gomez et al., 2012). Research has indicated that CIC users receive the benefits of being more knowledgeable, having better digital literacy, and having an increased chance to improve their economic and educational life situations. But just making data available isn't always enough to get users to take full advantage of these benefits. That some or all of these materials are likely to be underutilized by people without motivation and/or the skill to apply them directly, for example, without the scaffolding provided by systematically guided practice.

Moreover, with digital literacy training, job readiness workshops, and community engagement, the capacity of users to translate access into productive use is improved (Toyama, 2011). Studies show that when CICs provide specific programming, users are also more likely to gain skills that will increase their employability, social connectedness, and general well-being (Soriano, 2019). It points to the mediating effect of activities, in that when access is structured, it is more likely that people will benefit from the CIC in a measurable manner.

While activities are key in the connection between access and impact, activities do not serve as a complete mediator of this relationship. Some are immediate benefits of access, such as people accessing the free internet to conduct independent learning and research without the guidance of a formal curriculum (Kapondera & Mtambo, 2024). This implies that if activities enhance the influence of CICs, then simple access can still produce positive outcomes, consistent with a model of partial rather than complete mediation. The study therefore hypothesizes that;

H6: Activity mediates the positive relationship between Access and Impact.

Mediating Role of Activity in Information-Impact Relationship

The direct form of relationship between the availability of information for the individual and the community effect is not self-evident. Activities undertaken in CICs like digital literacy training, workshops and community activities may contribute to the leveraging of access to information. However, merely providing access does not guarantee impact. The way information is used, understood, and applied significantly affects the outcomes (Hair et al., 2017).

Information access is one of the cornerstones of social and economic development. It is about empowering people; through increased awareness, decision-making and economic opportunities. But there's more to impact than just access.The activities that are available within CICs aid in the transformation of raw information to useful knowledge and capabilities. For example, digital literacy training helps users to interact and use online resources effectively (Lee & Prime, 2012). Likewise, through entrepreneurship workshops individuals are assisted with translating economic information into the formation of business strategies that can lead to greater economic well-being for some (MacDonald, 2017). These organised encounters are intermediaries that make information more accessible and useful, and have a multiplied effect.

Structured activities in CCs have been found to enhance digital engagement and social inclusion according to several sources. For instance, Bailey and Ngwenyama (2016) reported that the presence of training programs in CICs and levels of technology adoption can be higher in CICs in relation to communities that only have passive access. Furthermore, Toyama (2011) has also found that the mere provision of information is not enough to generate impact if not combined with programmes that enhance the capacity of the users. Activities enhance and amplify the benefits of information access, ensuring that it translates into tangible community impact. The study therefore, hypotheses that;

H7: Activity mediates the positive relationship between Information and Impact.

This framework underscores the synergistic roles of access, information, and activities in maximizing CIC effectiveness, with activities serving as a critical conduit for impact (See Figure 1).

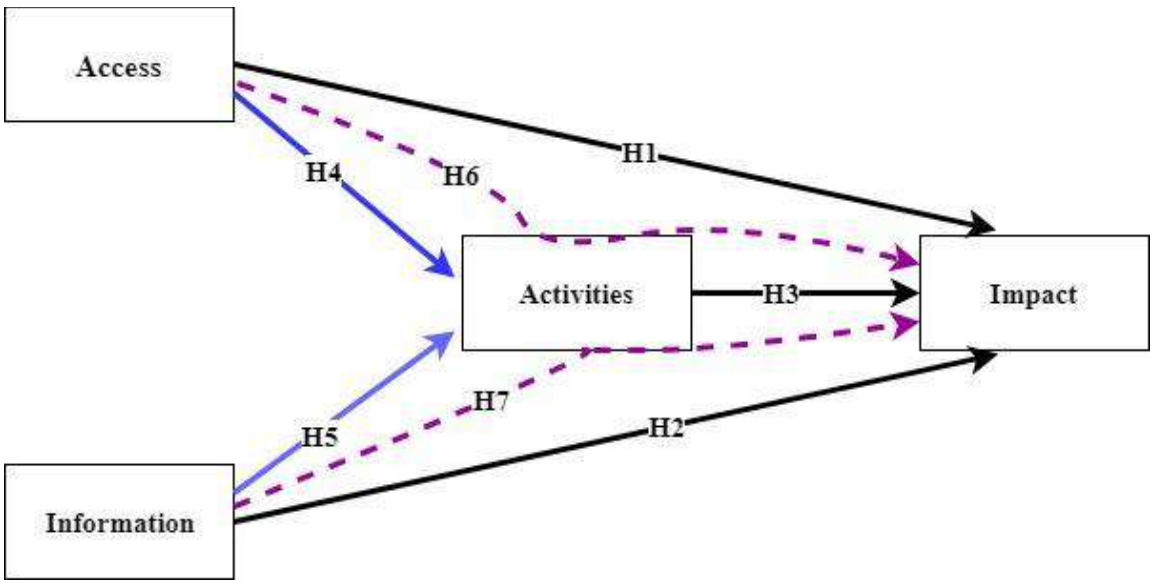

Figure 1
Conceptual Framework

II. LITERATURE REVIEW

2.1 Theoretical Review

2.1.1 Integrative Model of Digital Engagement and Impact

The Integrative Model of Digital Engagement and Impact (IMDEI) model will be used to examine how community information centres contribute to accessing information in the era of mobile devices. An Integrative Model is a framework of conceptual tools that integrates two or more theories, constructs or models in a unified way, to explain a complex phenomenon. An integrative model, instead of being built only with one theory, may comprise of constituents from different theoretical views to explain multifaceted research problems. Rather than being associated with a well-defined approach, an integrative model synthesizes key facets of a plurality of rigorous explanations in order to clarify problematic research issues. This would generate a nuanced comprehension in that the interconnectedness of variables located in disparate domains is quite explicitly acknowledged (Davis, 1989). This study will employ selected constructs from three dominant theories in the information systems domain namely the Uses and Gratifications Theory (UGT), Diffusion of Innovation (DOI) theory and Technology Acceptance Model (TAM) (Davis, 1989).

Uses and Gratifications Theory (UGT): The uses and gratifications theory developed by Blumler and Katz in 1974, aims to explain why people and communities and societies are willing to seek out certain media sources and to use them actively. Building on the general notion that media use can be predicted by the attainment of certain psychological, social, and informational gratifications, UGT describes why individuals choose to use a specific source of information. Among the goals of the current study is a description of the CIC resources (e.g., equipment, Internet access, digital resources, etc.) that support users' information seeking and educational use. The activity in the CIC programs generates socialization, training and games. Upon this realisation rests the second evaluative question; what is the impact or effectiveness of CIC use?

Diffusion of innovations (DOI) theory describes the temporal and structural processes by which an innovation is adopted. It has four main construct which includes; the innovation itself, communication channels that are used for the diffusion process, time and the social system. Applying these concepts to the current work, the DOI exhibits the diffusion of innovations throughout the time-span. In Rogers' initial framework, adoption was treated as being between knowledge/awareness, persuasion/participation and confirmation/outcome assessment.

Technology Acceptance Model (TAM) is the framed concept that helps to understand the reason and sense in which the user eagerly adopts and makes use of technology. TAM asserts that the activities of acceptance depend on the relative usefulness-the aptitude of the technology in advancing the aims and objectives of the users and the ease of use-the presumption of the ability to utilize and access the technology effortlessly-both of them concur with the aspect of impact and accessibility respectively (Davis, 1989).

Table 1 provides a summary of integrative theories that explain how the community information centres (CICs) can promote the accessibility of information. Under each hypothesis there is a particular theoretical route between antecedents and results.

As an integrative model based on UGT, TAM, and DOI, this framework offers a strong analytical frame through which the outcomes related to user access, awareness, and participation in CIC programs could be examined. It substantiates the hypotheses put forward and captures practical situations in digital inclusion using community-based access to ICT.

Table 1

Summary of Integrated Theories Corresponding to Hypotheses and their Pathways

H1: Access → Impact	DOI, TAM, UGT: Perceived ease of use and perceived usefulness: are positively related with online behavioural outcomes.
H2: Information → Impact	UGT: completeness of the satisfaction of the information seeking behaviour is positively related to efficacy.
H3: Activity → Impact	DOI, TAM, UGT: the hypotheses is that online activity is a definite reflection of use and hence predicts perceived results.
H4: Access → Activity	TAM and UGT: Because it is easy to reach, engagement occurs and consequently affects the results.
H5: Information → Activity	DOI: Awareness promotes the usage of resources and their subsequent utilization.
H6: Access → Activity → Impact	TAM and UGT assistive mediation: Access helps participation, which impacts results.
H7: Information → Activity → Impact	DOI: Awareness results in the utilisation of materials (activity), which will culminate in verifiable outcomes.

2.2 Empirical Review

2.2.1 Universal Access

Universal access to digital information has received considerable attention as ICT skills equip individuals to participate in digital societies (Van Deursen et al., 2014). It ensures that marginalized groups of rural areas, people with disabilities, low-income earners and women can have access to computer-based applications and websites and resources and services available over the internet (Dahalin et al., 2017). The objective is to prevent them from being marginalized or excluded while increasing the accessibility of ICT services (Stephanidis & Antona, 2022).

Universal access has been highlighted by the World Bank (2016) as critical for economic development and reducing poverty. ICTs facilitate: (1) global competitiveness and economic rationalisation, (2) delivering public services (e.g., health, education), and (3) generating regular incomes for the poor. Stephanidis and Antona (2022) concluded that universal access is about both technological and non-technological research concerning the availability, accessibility, usability and acceptance of Information Society Technologies (IST). Likewise, Warschauer and Newhart (2016) develop this idea further, highlighting physical (infrastructure), digital (connectivity), human (skills) and social (inclusion) assets. They argue for adaptable situational solutions to serve diverse needs.

The study by Kwatani and Markon (2017) further emphasizes that integrating social and technical aspects could enhance ICT4D initiatives in poor nations. This perspective is in line with the call for an inclusive policy that allows technology solutions to evolve in the context of the changing local reality, rather than applying a one-size-fits-all solution.

2.2.2 Universal Service

The concept of Universal Service has been introduced to assure the provision of affordable basic telephone services or the equivalent for all citizens irrespective of where they live, as first formally stated in the U.S. Communications Act of 1934 (Lee & Prime, 2012). However, regulators face challenges in defining what is "affordable" and "reasonable", leading to subjective judgments. This ambiguity led to the creation of the Universal Service Fund under the 1996 Telecommunications Act (Lewis, 2020). Over time, the US has expanded to include socially desirable services like public payphones and internet access.

In the USA, the Universal Service Administrative Company (USAC) through subsidies supports access for 1) high-cost rural areas; 2) low-income households; 3) schools and libraries; and 4) rural healthcare providers (Lee & Prime, 2012). A question that has framed much discussion in the information society about whether or not these should extend beyond basic connectivity to advanced digital services like itemized billing and call forwarding.

Nallasivam et al. (2024) indicate two types of regulatory challenges in US deployment: (i) Mature Networks- relating to which non-economic services operators should be compelled to provide and how to publicly finance networks and (ii) Developing Networks- regarding whether regulatory interventions should prospectively encourage roll out beyond market demand, such as in the under-developed areas. Notwithstanding such frameworks, USA intervention policies in Africa have had challenges of inadequate comprehensive telecommunication coverage (Arakpogun et al., 2017; Lewis, 2013).

Arakpogun et al. (2017) identify critical barriers to the implementation process such as poor policy making, ineffective stakeholder management, lack of accountability, poor quality data, political interference and narrow US definitions (e.g., the absence of broadband). These problems illustrate why American-led efforts in Africa have struggled to close the connectivity gap.

2.2.3 Role and Relevance of CIC's

Community Information Centres (CICs) were set up in the developing world as gateways ensuring rural access to important information sources. These centres are 'one-stop' outlets that offer various information on agriculture, education, health, governance, and social services (Islam & Hoq, 2017). There is research showing their various benefits. Bekoe et al. (2018) observed that access to the internet played a key role in increasing CIC visits, more especially through email communication, while the study of Kadodo and Ndinde (2014) indicated its role in allowing people in rural communities to market their products, send money, and look for jobs.

The rise of mobile technology has raised many questions about the utility of CICs. They continue to be central to the mobile revolution specifically when it comes to excluded and marginalized groups such as the poor, illiterate, migrants, and people with disabilities who are excluded from commercial digital ecosystems (Gurstein, 2014). This view gains some empirical support because CICs have been shown to continue to have developmental effects. Such networking, as shown by Göransson and Diep (2016), is critical in connecting the urban-rural digital divide in the Vietnamese Dong Nai Province, bringing about socio-economic development and improvements in the standard of living. Their study suggests that successful CIC models should be replicated in other communities. Additionally, as found in Islam and Hoq's (2017) Bangladesh research, CICs were found effective for catering information needs of rural communities and were also highlighted certain operational challenges. The proposed research improvements were to enhance CIC operations as well as internet access.

So, these studies point out three important roles that CICs play. First, they serve as digital inclusion hubs for underprivileged communities who might not have easy access to technology. Second, they act as catalysts for socioeconomic development. And third, they work alongside mobile technologies instead of just replacing them. As mobile technologies continue to evolve rapidly, it is becoming really important to figure out how these CICs can adapt. They need to find ways to enhance modern digital solutions while still being a vital part of community growth. It is a balancing act.

III. METHODOLOGY

3.1 Research Design

This is a quantitative study aimed at understanding how important information centres are in the emergence of mobile phone use in underprivileged communities in Ghana. The study focused on 10 different communities in the Upper East Region which had established community information centres. The centres were mostly located close to the district assemblies in the various districts to take advantage of the bustling activities around such facilities.

3.2 Target Population

The target population was mainly patrons of the CICs who came to use resources and services available at the facility.

3.3 Sampling Technique and Size

The study adopted an accidental sampling approach to select willing participants. The questionnaire used for this research was split into two sections. The first part asked about basic demographic information, while the second part delved into the significance of information centres. It looked at how accessible the CICs are, the impact they have, and what kind of information and activities they offer. A total of 500 community members took part in the study. However, 451 completed questionnaires were received, constituting a response rate of 90%.

3.4 Data Collection Methods

The survey questionnaire contained four (4) constructs. The measure for Access consisted of 8 items. The sample item for Access was “I have easy access to CICs in my community”. Information included 8 items and Activities have 7 items. The sample items for information and activities were “I have information through my phone” and “the activities at the centres are fast”, respectively. Impact/outcome consisted of 13 items. The sample item for impact was “I have experienced a positive impact from CICs in my community’. A 5-point Likert scale was used to evaluate all items (excluding demographic details) where 5 = strongly agree and 1 = strongly disagree. For the expediency of some respondents (without formal education) and to get reliable responses, the questions were verbally administered in the native language.

3.5 Data Analysis Procedures

SPSS and SmartPLS software version 25.0 were used to analyse the data. To determine the authenticity of all the items analysed, a valid internal reliability test was carried out. This was conducted to check if these instruments were offering consistency with the outcomes (Hair et al., 2019). For this, the most used method is Cronbach's α reliability (Nunnally & Bernstein, 2010). The results justified all Cronbach's α reliability coefficients (Access = 0922, Information = 0963, Activities = 0939, and Impact = 0946) which are greater than the value of 070 (Joseph et al, 2010; Tavakol & Dennick, 2011). To ensure that the constructs are dependable, the composite reliability (CR) of the constructs were calculated. As presented in Tables 2 and 3, all the constructs' CR values were greater than the threshold value of 070. The procedures, standard deviations (SD), and intercorrelations among all of the variables and Cronbach's α and CR reliabilities are shown in Table 3.

IV. FINDINGS & DISCUSSION

4.1 Descriptive Analysis

Output from analysis provided the composite reliability (CR) and the average variance extracted (AVE). The study used four constructs in the framework, which were classified as first-order reflective constructs: Activities, Information, Access, and Impact/Outcome. This study starts by examining the individual item reliability for the measurement model (Tables 2 and 3). The indicators surpass the accepted threshold of 0.7 for each factor loading (Ta & Prybutok, 2018). Based on assessment of the results in Tables 2 and 3, all constructs are reliable. The values for both the Cronbach's alpha coefficient and composite reliability are higher than the 0.7 expected in the first phase of the study and the rigidity value of 0.8 for basic research. Note that the AVE must be higher than 0.5, which suggest that at least 50% of the variance of indicators must be calculated (Fornell & Larcker, 1981).

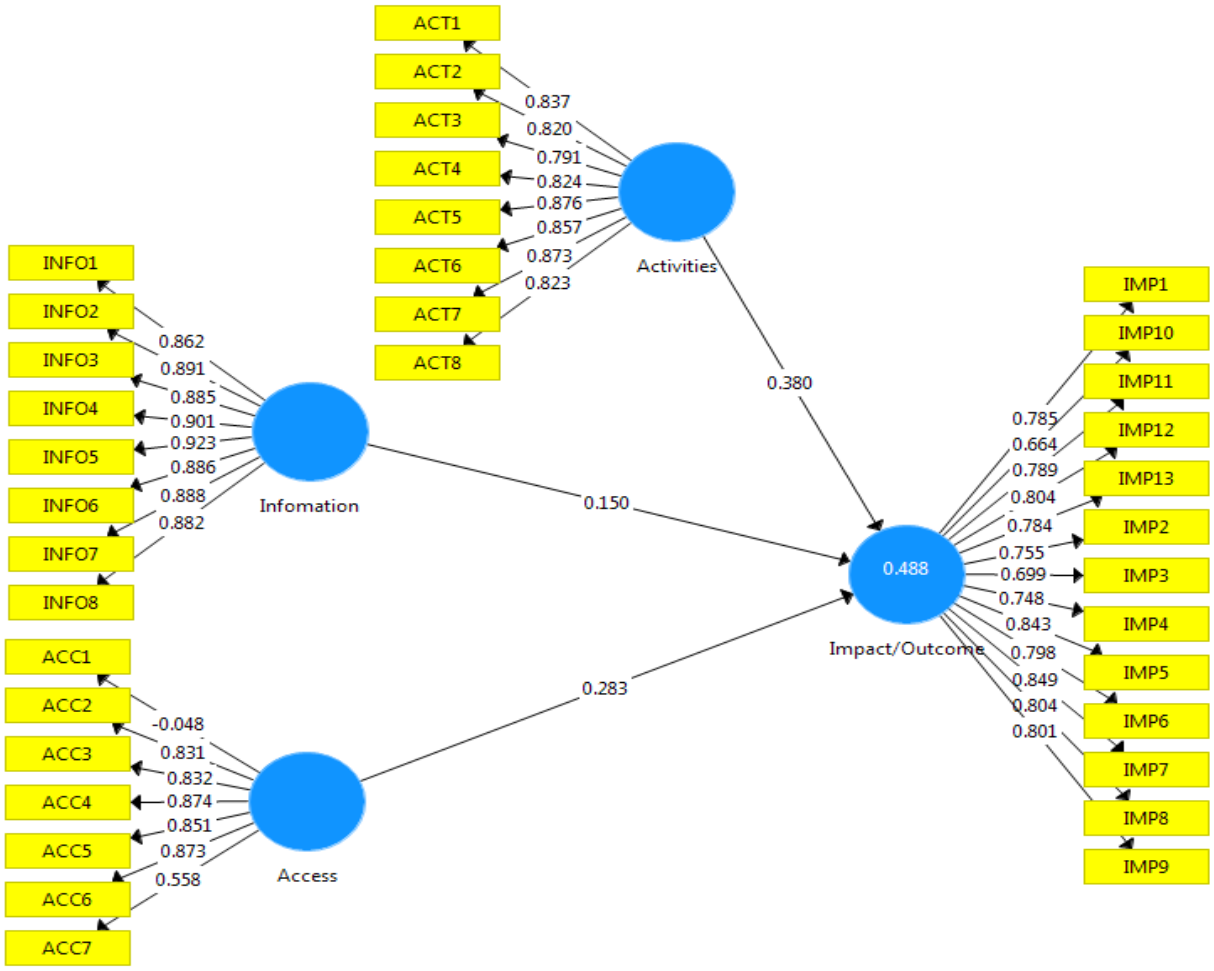

Figure 2
Path Diagram for Initial Model

Table 2
Measurement Model Evaluation Results

	Access	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
ACC1	-0.048	0.83	0.882	0.564
ACC2	0.831			
ACC3	0.832			
ACC4	0.874			
ACC5	0.851			
ACC6	0.873			
ACC7	0.558			
ACT1	0.837	0.939	0.95	0.703
ACT2	0.82			
ACT3	0.791			
ACT4	0.824			
ACT5	0.876			
ACT6	0.857			
ACT7	0.873			
ACT8	0.823			
IMP1	0.785	0.946	0.953	0.609
IMP2	0.755			
IMP3	0.699			
IMP4	0.748			
IMP5	0.843			
IMP6	0.798			

IMP7	0.849			
IMP8	0.804			
IMP9	0.801			
IMP10	0.664			
IMP11	0.789			
IMP12	0.804			
IMP13	0.784			
IMP9	0.801			
INFO1	0.862	0.963	0.968	0.792
INFO2	0.891			
INFO3	0.885			
INFO4	0.901			
INFO5	0.923			
INFO6	0.886			
INFO7	0.888			
INFO8	0.882			

Table 3

Final Measurement Model Evaluation Results

	Factor Loadings	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Access				
ACC2	0.850	0.922	0.941	0.762
ACC3	0.860			
ACC4	0.897			
ACC5	0.874			
ACC6	0.884			
Activities				
ACT1	0.836	0.939	0.950	0.703
ACT2	0.820			
ACT3	0.791			
ACT4	0.826			
ACT5	0.878			
ACT6	0.856			
ACT7	0.871			
ACT8	0.823			
Impact/Outcome				
IMP1	0.785	0.946	0.953	0.609
IMP2	0.755			
IMP3	0.700			
IMP4	0.748			
IMP5	0.843			
IMP6	0.798			
IMP7	0.849			
IMP8	0.804			
IMP9	0.802			
IMP10	0.665			
IMP11	0.790			
IMP12	0.805			
IMP13	0.783			
Information Needs				
INFO1	0.864	0.963	0.968	0.792
INFO2	0.894			
INFO3	0.886			
INFO4	0.902			
INFO5	0.925			
INFO6	0.885			
INFO7	0.886			
INFO8	0.879			

The Fornell-Larcker criterion and the cross-loadings (Table 5) were employed to evaluate the discriminant validity by comparing the square root of each AVE in the diagonal with the correlation coefficients (off-diagonal) for each construct in the relevant rows and columns.

The criterion of Fornell and Larcker (1981) has been commonly used to assess the degree of shared variance between the latent variables of the model. According to this criterion, the convergent validity of the measurement model can be assessed by the Average Variance Extracted (AVE) and Composite Reliability (CR) as seen in Table 3. Overall, discriminant validity can be accepted for this measurement model and supports the discriminant validity between the constructs. The correlation coefficients between the constructs are summarized in Table 4.

Table 4

Discriminant Validity: Fornell-Larcker Criterion

	Access	Activities	Impact/Outcome	Information
Access	**0.873**			
Activities	0.435	**0.838**		
Impact/Outcome	0.511	0.638	**0.781**	
Information	0.429	0.694	0.561	**0.890**

Table 5

Cross Loadings

	Access	Activities	Impact/Outcome	Information
ACC2	**0.850**	0.340	0.467	0.350
ACC3	**0.860**	0.376	0.391	0.362
ACC4	**0.897**	0.370	0.413	0.370
ACC5	**0.874**	0.371	0.423	0.375
ACC6	**0.884**	0.432	0.521	0.408
ACT1	0.407	**0.836**	0.537	0.572
ACT2	0.354	**0.820**	0.492	0.541
ACT3	0.410	**0.791**	0.545	0.584
ACT4	0.358	**0.826**	0.512	0.591
ACT5	0.361	**0.878**	0.547	0.642
ACT6	0.370	**0.856**	0.557	0.567
ACT7	0.352	**0.871**	0.574	0.584
ACT8	0.300	**0.823**	0.507	0.570
IMP1	0.371	0.490	**0.785**	0.401
IMP2	0.356	0.445	**0.755**	0.341
IMP3	0.368	0.454	**0.700**	0.387
IMP4	0.409	0.491	**0.748**	0.476
IMP5	0.436	0.494	**0.843**	0.482
IMP6	0.438	0.459	**0.798**	0.442
IMP7	0.451	0.512	**0.849**	0.407
IMP8	0.424	0.503	**0.804**	0.467
IMP9	0.420	0.536	**0.802**	0.457
IMP10	0.431	0.458	**0.665**	0.415
IMP11	0.321	0.495	**0.790**	0.412
IMP12	0.318	0.549	**0.805**	0.452
IMP13	0.425	0.561	**0.783**	0.518
INFO1	0.392	0.612	0.461	**0.864**
INFO2	0.359	0.590	0.438	**0.894**
INFO3	0.369	0.571	0.490	**0.886**
INFO4	0.373	0.605	0.469	**0.902**
INFO5	0.360	0.639	0.481	**0.925**
INFO6	0.407	0.636	0.530	**0.885**
INFO7	0.381	0.648	0.557	**0.886**
INFO8	0.408	0.633	0.552	**0.879**

4.2 Structural Model Assessment

4.2.1 Relationship between Access and Impact\Outcome

Access (= 0.264, t = 4.297, p = 0.000) is statistically significant in predicting impact outcome, according to the analysis presented in Table 6. Relationship coefficients, the main outcome measure of the model, have a significant R2

value, according to Table 4's analysis of the endogenous constructs' predictive power. With an R2 value of 0.488, the impact/outcome prediction is significant. The importance and applicability of the structural model relationships are taken into account in the structural model analysis. Access and impact outcome have a significant relationship, according to the bootstrapping procedure results in Table 6 and Figure 2. According to the aforementioned findings, an increase in access will result in a 0.264-unit increase in impact and outcome.

The result is undoubtedly true that Access to CICs provides a series of benefits for individuals and communities. CICs provide disadvantaged and underserved communities with access to technology, internet services, and digital literacy. They give access to learning materials like e-books, online training, and digital libraries. They also provide scope for skills development, particularly for young people and adults in rural locations. Similarly, they provide opportunities for the disadvantaged, such as women, minorities, and individuals with disabilities, to receive information and services that they might not otherwise be able to access.

A study found that rural CICs significantly improved the digital literacy of the youth, enabling better job searching and e-learning (Abednego et al., 2024). CICs also provide access to educational content, government information, and agricultural information, enabling communities to make knowledgeable conclusions. Wider access means more people are able to benefit from these resources. Rao (2020) indicates that in Indian rural communities, such centres have facilitated farmers to receive real-time weather updates and market prices, resulting in improved agricultural yields.

The World Bank report (2016) estimates that higher access to CICs has resulted in a 15% rise in self-employment opportunities, indicating that the centres have a direct influence on livelihood by offering financial literacy programs, skill development training, and employment portals. Increasing beneficiaries are linked with measurable economic benefits as access is widened.

The Organization for Economic Cooperation and Development [OECD] (2020) report further states that CICs in Latin America promoted improved learning outcomes through the provision of digital learning resources to marginalized communities. Thus, improved accessibility of CICs closes the gap between urban and rural communities, ensuring that marginalized communities can also benefit from technological progress. Since the statistical analysis confirms a significant positive relationship ($\beta = 0.264$, $p < 0.001$) and the literature supports the real-world impact of CIC access, H1 is accepted.

Table 6

Structural Model Assessment (Model without Mediator)

Endogenous Constructs			**R Square**	**R Square Adjusted**			
Impact/Outcome			0.489	0.483			
Path Coefficients							
	Original Sample (O)	**Sample Mean (M)**	**Standard Deviation (STDEV)**	**T Statistics (|O/STDEV|)**	**P Values**	**Confidence Interval (2.5, 97.5)**	
Access -> Impact	0.264	0.267	0.062	4.297	**0.000**	0.147	0.391
Activities -> Impact	0.408	0.408	0.064	6.397	**0.000**	0.282	0.531
Information -> Impact	0.166	0.165	0.065	2.554	**0.011**	0.034	0.290

4.2.2 Relationship between Activities and Impact/Outcome

Activities (= 0.408, t = 6.397, p = 0.000) is statistically significant in determining impact/outcome, according the analysis shown in Table 6. Table 4's analysis of the predictive ability of the endogenous constructions reveals that the main result indicator of the model, relationship coefficients, has a substantially large R2 value. With an R2 value of 0.488, prediction of impact and outcome is rather strong. The relevance and significance of the structural model relationships are taken into account in the structural model analysis. Table 6 and Figure 2 bootstrapping process results show that access and impact\outcome have a significant correlation.

From the above results, an increase in activity will cause impact\outcome to increase by 0.408 units. More activities mean increased participation from the community, leading to higher awareness and utilization of CIC services. For instance, a CIC that hosts regular digital literacy workshops will see more individuals gaining computer skills, leading to a measurable impact on digital inclusion.

Kapondera and Mtambo (2024) found that rural information centres in Malawi significantly improved users' economic conditions through ICT training. Therefore, activities such as vocational training and entrepreneurship programs equip individuals with job-ready skills, enhancing their employability.

Studies on digital hubs and CICs (e.g. Göransson & Diep, 2016; Islam & Hoq, 2017; Rundel et al., 2020) have demonstrated that increased programming leads to higher educational and economic benefits. The observed increase of 0.408 units in impact for each additional activity in CICs aligns with theoretical and empirical research. The more a CIC engages in activities (training, digital access, workshops, business development etc.), the higher the community benefits.

Since the statistical analysis confirms a significant positive relationship and the literature supports the real-world impact of CIC activities, H2 is accepted.

4.2.3 Relationship between Information and Impact/Outcome

According to Table 6's analysis, Information (β = 0.166, t = 2.554, p = 0.011) is statistically significant in predicting impact\outcome. Table 6's analysis of the predictive power of the endogenous constructs reveals that the model's main outcome measure, relationship coefficients, has a high R2 value. With an R2 of 0.488, the impact/outcome prediction is significant. The relevance and significance of the structural model relationships are taken into account in the structural model analysis. The bootstrapping procedure's results, as shown in Table 6 and Figure 2, indicate a significant correlation between information and impact outcome.

From the above results, an increase in information will cause impact\outcome to increase by 0.166 units. More information ensures that community members have access to diverse and updated knowledge, which can improve decision-making and problem-solving. Also, an increase in available information can make the CIC a hub for civic participation, knowledge centres, leading to greater community involvement in local governance, business, and social initiatives. For instance, a CIC in a rural area providing updated agricultural best practices can lead to better farming techniques and increased crop yield, just as providing government policy updates and job opportunities can lead to higher employment rates and improved livelihoods.

Since the statistical analysis confirms a significant positive relationship and the literature supports the real-world impact of CIC information, H3 is accepted.

4.2.4 Relationship between Access and Activities

According to the analysis in Table 7, access is statistically significant in predicting activities (= 0.270, t = 5.425, p = 0.000). Table 7's analysis of the predictive power of the endogenous constructs reveals that the model's main outcome measure, relationship coefficients, has a high R2 value. The activity prediction has a significant R2 value of 0.505. The relevance and significance of the structural model relationships are taken into account in the structural model analysis. The results of the bootstrapping process as seen in Table 7 and Figure 3, show there is a significant correlation between activities and access.

Given the results above, an increase in access will cause activities to increase by 0.270 units. When access to a CIC increases (e.g., through better infrastructure, longer operating hours, relevant information availability or digital accessibility), more community members can utilize its services, leading to increased activities such as training sessions, meetings, information retrieval and entrepreneurship activities (OECD, 2020). Easier access enables people to connect, share ideas, and organize more community-driven initiatives such as group discussions, seminars, knowledge-sharing, and local governance meetings (International Telecommunication Union (ITU 2020). A World Bank (2016) report indicates that when access to CICs increased (e.g., through better internet and reduced entry costs), activities such as digital training and job application services grew by over 25%. Since the statistical analysis confirms a significant positive relationship and empirical studies support that enhanced access boosts program participation, H4 is accepted.

Table 7

Structural Model Assessment (Model with Mediator)

Endogenous Constructs			**R Square**		**R Square Adjusted**		
Activities			0.505		0.501		
Impact/Outcome			0.488		0.481		
Path Coefficients							
	Original Sample (O)	**Sample Mean (M)**	**Standard Deviation (STDEV)**	**T Statistics (|O/STDEV|)**	**P Values**	**CI**	
Access -> Activities	0.270	0.272	0.050	5.425	**0.000**	0.176	0.371
Access -> Impact	0.285	0.286	0.067	4.263	**0.000**	0.156	0.419
Activities -> Impact	0.375	0.376	0.067	5.624	**0.000**	0.242	0.506
Information -> Activities	0.546	0.545	0.050	10.902	**0.000**	0.444	0.639
Information -> Impact	0.144	0.143	0.069	2.081	**0.037**	0.004	0.278

4.2.5 Relationship between Information and Activities

The results shown in Table 7 indicate that information (β = 0.546, t = 10.902, p = 0.000) is statistically significant in predicting activities. The evaluation of the endogenous constructs' predictive power in Table 7 shows that relationship coefficients, the primary outcome measure of the model, has a substantial R^2 value. Activity prediction has a significant R2 value of 0.505. The importance and pertinence of the structural model relationships are taken into

account in the structural model analysis. The results of the bootstrapping process show that there is a significant correlation between information and activities (Table 7 and Figure 3).

From the above results, an increase in information will cause activities to increase by 0.546 units. Increased information availability allows CICs to diversify and expand their service offerings, attract more community members leading to increasing visits and participation in activities (ITU, 2020; World Bank, 2016). A CIC that provides real-time job listings and business opportunities may see a rise in job-seekers. Similarly, a centre that adds e-government services and educational programs will see more citizens visiting for digital transactions and new online learning resources, increasing daily usage and boosting activity levels. ITU (2020) report suggests that CICs with more diverse information resources experienced a 50% rise in training programs and events. The statistical results and empirical evidence overwhelmingly support H5.

4.2.6 The Mediation Role of Activities

This is carried out to examine the causal relationship between access, information as exogenous variables and impact/outcome as an endogenous variable by the inclusion of a third explanatory mediator variable (activities) (Hair et al., 2017). In PLS-SEM, the bootstrapping approach is suitable for mediation analysis because bootstrapping makes no assumption about the sampling distribution of the statistics and can be applied to small sample sizes (Hair et al., 2017). The first step in performing the mediation analysis in PLS-SEM is to evaluate the direct effect of the exogenous variables (access, activities, and information) on the endogenous variable (impact/outcome), as shown in Table 6 and Figure 3. If the mediator is excluded, this effect should be significant (Zhao et al., 2010).

Following confirmation of the direct path's significance, the mediator variable is added to the PLS path model, and the indirect path's significance is evaluated. One prerequisite for this condition is the importance of every single path. Following the bootstrapping process, the indirect path, as displayed in Table 7, can be evaluated and demonstrates a significant path relationship.

Table 8

Analysis of Mediating Effects

	Total Effect	Direct Effect	Indirect Effect	VAF	Level of Mediation
Access - > Impact	0.332	0.285	0.069	**0.207**	Partial Mediation
Activities --> Impact	0.410	0.375			
Information -->Impact	0.419	0.144	0.255	**0.608**	Partial Mediation
Access --> Activities	0.168				
Information --> Activities	0.622				

VAF > 80%: Full Mediation; 20% ≤ VAF ≤ 80%: Partial Mediation & VAF < 20%: No Mediation

Table 8 demonstrates clearly that Activities (mediator) portrayed a partial mediating relationship between access and impact/outcome, with the VAF 20.7% of the total effect. In addition, the result from Table 8 further reveals that Activities as a mediator partly mediates the link between information and impact/outcome and accounts for 60.8% VAF of the overall effect.

The findings indicate that while activities conducted in CICs act as a mediator between access to the centres and their general impact in the community, additional factors also have an impact on this relationship. Some of the effects of CICs are directly obtained from access itself, independent of specific activities. For instance, access to free internet or library services can automatically enhance the knowledge and prospects of users. Many members utilize CICs for personal learning or personal investigation, bypassing organized activities altogether. This demonstrates that both direct access and organized activities are predictors of community impact but in varying ways. Thus, the mediating influence exerted by CIC activities is partially mediating and not fully mediating. Though these activities enhance and facilitate benefits, they do not constitute the sole mechanism linking access to impact. Both H6 and H7 are accepted - Activities partially mediate the relationships.

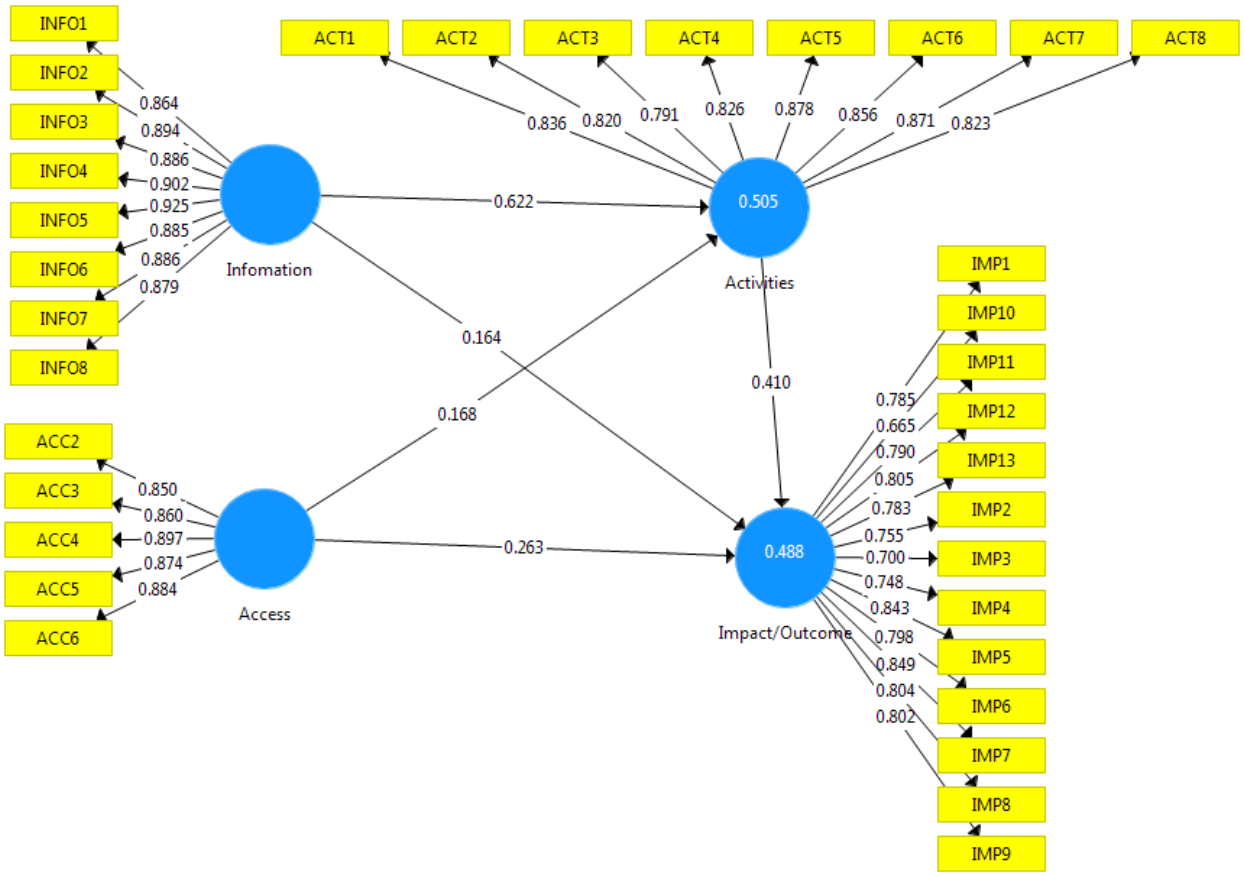

Figure 3
Path Diagram for the Model with Mediation

4.3 Theoretical Link to Hypotheses

As shown in Table 9, each theoretical framework (UGT, DOI, TAM) supports and aligns with the hypotheses (H1 to H7). Each theory provides a unique perspective through which to interpret user behaviours, motivations, and technology adoption related to program engagement and perceived impact. The table juxtaposes hypotheses with theory-based components, and illustrates how constructs such as access, information, awareness, and activity can lead to user participation and outcomes. This theoretical mapping allows the shared consideration of behaviour, explaining factors and strengthens the theoretical context of the study.

Table 9
How Integrated Theories are Aligned to Hypotheses

Theory	**Link to Hypotheses**
Uses and Gratifications Theory (UGT)	H1, H2, and H3 reflect the outcomes of users pursuing gratifications (information and access) leading to perceived impact. H4 and H5 indicate that increased availability and awareness drive more active participation which is a core UGT principle.
Diffusion of Innovation (DOI)	H5 and H7 reflect DOI's idea that awareness leads to trial (Activity) and confirmation (Impact). H6 and H7 (mediating role of Activity) fit within the DOI model of innovation adoption phases.
Technology Acceptance Model (TAM)	Access (H1, H4, H6) directly influences both usage (Activity) and perceived impact. Information (H2, H5, H7) enhances perceived usefulness and encourages program participation (Activity).

V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

This study affirms the continued relevance of Community Information Centres (CICs) alongside mobile devices, demonstrating a complementary relationship where mobile phones handle basic tasks while CICs support more complex

needs. Access to information remains a critical catalyst for socio-economic development, yet its benefits depend on users' skills and motivation to leverage it effectively.

Findings indicate that raising awareness of CIC services enhances community engagement, particularly through digital literacy initiatives that improve skills and opportunities. However, weak policy frameworks in Africa hinder universal service implementation, underscoring the need for stronger stakeholder accountability. Ultimately, CICs remain essential for equitable information access, but their success hinges on user participation, supportive policies, and strategic technology integration. The synergy between CICs and mobile devices presents a viable pathway for sustainable development.

5.2 Recommendation

This study underscores the relevance of Community Information Centres (CICs) in the mobile device era, with key implications for policy, practice, and community development. To remain effective, CICs should integrate mobile technology with traditional telecentre services, enabling users to perform basic tasks digitally while accessing in-person support for complex needs. Such integration enhances accessibility, engagement, and service efficiency, ensuring CICs adapt to a rapidly digitizing society.

Furthermore, digital literacy programs are vital in empowering communities, as evidenced by their positive impact on users' skills and economic prospects. Expanding these initiatives will equip individuals with essential competencies to navigate an evolving digital landscape. Strategic collaborations - particularly with libraries - can further strengthen CICs by facilitating resource-sharing and improving community support systems. Finally, robust policy frameworks are critical to sustaining CICs amid challenges like resource limitations and staffing gaps. Policymakers must prioritize institutional support to ensure CICs fulfil their mission of equitable information access and community development.

REFERENCES

Abednego, A. B., Adu-Agyei, N. O., Pawar, V. P., & Nkrumah, C. (2024). University students' perception of community information centres as a vehicle for climate change awareness creation in Ghana. *International Journal of Research and Scientific Innovation, 10*(12), 748–764. https://doi.org/10.51244/ijrsi.2023.1012058

Akanferi, A. A., Aziale, L. K., & Asampana, I. (2014). An empirical study on mobile phone usage among young adults in Ghana: From the viewpoint of university students. *International Journal of Computer Applications, 98*(5), 15–21. https://doi.org/10.5120/17178-7273

Arakpogun, E. O., Wanjiru, R., & Whalley, J. (2017). Impediments to the implementation of universal service funds in Africa–A cross-country comparative analysis. *Telecommunications Policy, 41*(7–8), 617–630. https://doi.org/10.1016/j.telpol.2017.05.003

Awotwi, J. E. (2015). Challenging the digital divide in a developing country: Ghana case study. In *Digital divides: The new challenges and opportunities of e-inclusion* (pp. 195, 47).

Ayoung, A., Abbott, P., & Armin, K. (2015, May). Influence of 'soft' constructs on the outcome of community ICT initiatives. In *Proceedings of the 13th International Conference on Social Implications of Computers in Developing Countries* (pp. 526–539).

Ayoung, D. A., & Abbott, P. (2021). Minding the design reality gap. *The International Journal of Information, Diversity, & Inclusion, 5*(3), 64–97. https://doi.org/10.33137/ijidi.v5i3.36213

Bailey, A., & Ngwenyama, O. (2016). Community bridging through ICTs: Seeking to overcome digital and community divides. *The Journal of Community Informatics, 12*(1), 69–89. https://doi.org/10.15353/joci.v12i1.3241

Bekoe, S., Atiso, K., Ayoung, D. A., & Dzandu, L. (2018). Examining internet usage patterns on socio-economic benefits of marginalised communities: The case of community information centres in Ghana. *Library Philosophy and Practice, (e-journal),* 1870. http://digitalcommons.unl.edu/libphilprac/1870

Boyinbode, O. (2018). Smart campus: An implementation of a cloud-based mobile learning application. *Journal of Information, 4*(2), 24–33. https://doi.org/10.18488/journal.104.2018.42.24.33

Brants, K., & Frissen, V. (2017). Inclusion and exclusion in the information society. In *Media, technology and everyday life in Europe* (pp. 39–50). Routledge.

Brophy, P. (2004). The people's network: Moving forward. Museums Libraries and Archives Council. http://www.mla.gov.uk/documents/id1414rep.pdf

Çetin, F., Urich, T., Paliszkiewicz, J., Mądra-Sawicka, M., & Nord, J. H. (2021). ICTs, empowerment, and success: Women's perceptions across eight countries. *Journal of Computer Information Systems, 61*(1), 1–10. https://doi.org/10.1080/08874417.2020.1799452

Civic Agenda. (2010). ECEI10: 'Delivering digital Europe in public libraries'. Preliminary invitation to the participants of the EBLIDA-NAPLE Conference, 7–8 May.

Clarke, S., Wylie, G., & Zomer, H. (2013). ICT for the MDGs? A perspective on ICTs' role in addressing urban poverty in the context of the Millennium Development Goals. *Information Technologies & International Development, 9*(4), 5–70. http://hdl.handle.net/2262/71314

Dahalin, Z. M., Ibrahim, H. H., & Yusop, N. I. (2017). ICT adoption and value creation: A telecentre ecosystem approach. *Journal of Southeast Asian Research,* 2017, 1–12. https://doi.org/10.5171/2017.133746

Davis, F. D. (1989). Technology acceptance model: TAM. In Al-Suqri, M. N., & Al-Aufi, A. S. (Eds.), *Information seeking behavior and technology adoption* (pp. 205–219).

Dutta, A. (2020). Impact of digital social media on Indian higher education: Alternative approaches of online learning during COVID-19 pandemic crisis. *International Journal of Scientific and Research Publications, 10*(5), 604–611. https://doi.org/10.29322/IJSRP.10.05.2020.P10169

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, *18*(1), 39–50. https://doi.org/10.2307/3151312

G-ICT4AD. (2003). The Ghana ICT for accelerated development (ICT4AD) policy. The Republic of Ghana. www.moc.gov.gh/sites/default/files/downloads/Ghana-ICTAD%20Policy%20Master-final-2.pdf

Gomez, R., Baron, L. F., & Fiore-Silfvast, B. (2012, March). The changing field of ICTD: Content analysis of research published in selected journals and conferences, 2000–2010. In *Proceedings of the fifth international conference on information and communication technologies and development* (pp. 65–74).

Göransson, B., & Diep, D. D. N. (2016). Bridging the digital divide–The role of the scientific and technological information stations in rural areas of Dong Nai Province. *VNU Journal of Science: Policy and Management Studies, 32*(2), 15–33. https://js.vnu.edu.vn/PaM/article/view/1693

GSMA. (2022). *Annual Report*. https://media.gsma.com/assets/2022/annual_report.pdf

Gurstein, M. (2014). Beyond access: Libraries are the new telecentres. *The Journal of Community Informatics, 10*(1). http://ci-journal.net/index.php/ciej/article/view/1078/1073

Hair Jr, J. F., Matthews, L. M., Matthews, R. L., & Sarstedt, M. (2017). PLS-SEM or CB-SEM: Updated guidelines on which method to use. *International Journal of Multivariate Data Analysis, 1*(2), 107–123.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate data analysis* (8th ed.). Cengage.

ITU. (2020). *Measuring digital development: Facts and figures*. International Telecommunication Union. https://www.itu.int/en/ITU-D/Statistics/Documents/facts/FactsFigures2020.pdf

Islam, M. A., & Hoq, K. M. G. (2017). Community internet access in rural areas: A study on community information centres in Bangladesh. *Malaysian Journal of Library & Information Science, 15*(2), 109–124. https://mjlis.um.edu.my/index.php/MJLIS/article/view/6936

Joseph, F. H. J. R., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis: A global perspective* (7th ed.).

Kadodo, W., & Ndinde, S. (2014). The role of community-based information centres in development: Lessons for rural Zimbabwe. *Developing Country Studies, 4*(19), 107–111.

Kapondera, S. K., & Mtambo, J. (2024). Why do people use telecentres in the age of mobile technologies? Answers from Malawi. *The Electronic Journal of Information Systems in Developing Countries, 90*(2), e12303. https://doi.org/10.1002/isd2.12303

Kukulska-Hulme, A. (2012). Smart devices or people? A mobile learning quandary. *International Journal of Learning and Media, 4*(3–4), 73–77. https://doi.org/10.1162/IJLM_a_00105

Kwatani, E. K. O., & Markon, S. (2017, September). ICT for universal access to agricultural information: The case of Malawian farmers. In *2017 Seventeenth International Conference on Advances in ICT for Emerging Regions (ICTer)* (pp. 1–8). IEEE.

Lee, K., & Prime, J. (2012). US telecommunications law. In I. Walden (Ed.), *Telecommunications law and regulation* (4th ed., pp. 187–274). Oxford University Press.

Lewis, C. (2013). Universal access and service interventions in South Africa: Best practice, poor impact: Challenges in leadership of ICT policy and e-development. *The African Journal of Information and Communication, 2013*(13), 95–107. https://ssrn.com/abstract=2663052

Lewis, C. (2020). Universal access and service in South Africa. In *Regulating telecommunications in South Africa: Universal access and service* (pp. 65–125). Springer International Publishing.

McDonald, R. M. (2017). Geek heresy: Rescuing social change from the cult of technology. *Journal of Interdisciplinary Studies, 29*(1–2), 210–213.

Moran, B. B., & Morner, C. J. (2017). *Library and information center management* (7th ed.). Bloomsbury Publishing.

Nallasivam, A., KN, A. S. I., Desai, K., Kautish, S., & Ghoshal, S. (2024). Universal access to internet and sustainability: Achieving the UN's sustainable development goals. In *Digital technologies to implement the UN sustainable development goals* (pp. 235–255). Springer.

Nguyen, T. M., Nham, T. P., Froese, F. J., & Malik, A. (2019). Motivation and knowledge sharing: A meta-analysis of main and moderating effects. *Journal of Knowledge Management, 23*(5), 998–1016. https://doi.org/10.1108/JKM-01-2019-0029

Nunnally, J., & Bernstein, I. (2010). *Psychometric theory* (3rd ed.). Tata McGraw-Hill Education.

Omondi, G. (2020). Mobile for development: The state of mobile in Ghana's tech ecosystem. https://www.gsma.com/mobilefordevelopment/blog/the-state-of-mobile-in-ghanas-tech-ecosystem/ (accessed 16 December 2024)

OECD. (2020). *Making the most of technology for learning and training in Latin America*. Organization for Economic Cooperation and Development Skills Studies. https://doi.org/10.1787/ce2b1a62-en

Rao, G. D. (2020). ICT infrastructure of disaster management in India. In T. V. V. Kumar & K. Sud (Eds.), *AI and robotics in disaster studies* (Disaster Research and Management Series on the Global South, pp. 245–261). Palgrave Macmillan. https://doi.org/10.1007/978-981-15-4291-6_13

Roztocki, N., Soja, P., & Weistroffer, H. R. (2019). The role of information and communication technologies in socioeconomic development: Towards a multi-dimensional framework. *Information Technology for Development, 25*(2), 171–183. https://doi.org/10.1080/02681102.2019.1596654

Rundel, C. T., Salemink, K., & Strijker, D. (2020). Exploring rural digital hubs and their possible contribution to communities in Europe. *The Journal of Rural and Community Development, 15*(3), 21–44.

Scott, R. (2011). The role of public libraries in community building. *Public Library Quarterly, 30*(3), 191–227. https://doi.org/10.1080/01616846.2011.599283

Sey, A., & Fellows, M. (2009). Literature review on the impact of public access to information and communication technologies. *CIS Working Paper/Center for Information and Society, University of Washington;* no. 6.

Sey, A., & Hafkin, N. (2019). Taking stock: Data and evidence on gender equality in digital access, skills and leadership. United Nations University, Tokyo.

Shimpy, D. S. S., & Singh, S. (2012). Role of information and communication technology in women empowerment. *Aayushi International Interdisciplinary Research Journal, 6*(5), 54–59.

Soriano, C. R. R. (2019). Communicative assemblages of the Pisonet and the translocal context of ICT for the "have-less": Innovation, inclusion, stratification. *International Journal of Communication, 13.*

Stephanidis, C., & Antona, M. (2022). Universal access in the information society (2001–2021): Knowledge, experience, challenges and new perspectives. *Universal Access in the Information Society, 21*(2), 329–331. https://doi.org/10.1007/s10209-022-00884-w

Ta, A., & Prybutok, V. (2018). A mindful product acceptance model. *Journal of Decision Systems, 27*(1), 19–36. https://doi.org/10.1080/12460125.2018.1479149

Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *International Journal of Medical Education, 2,* 53–55. https://doi.org/10.5116/ijme.4dfb.8dfd

Toyama, K. (2011). Technology as amplifier in international development. In *Proceedings of the 2011 iConference* (pp. 75–82).

Van Deursen, A. J., Courtois, C., & van Dijk, J. A. (2014). Internet skills, sources of support, and benefiting from internet use. *International Journal of Human-Computer Interaction, 30*(4), 278–290. https://doi.org/10.1080/10447318.2013.858458

Van Dijk, J. A. G. M. (2017). Digital divide: Impact of access. In *The international encyclopedia of media effects* (pp. 1–11). https://doi.org/10.1002/9781118783764.wbieme0043

Warschauer, M., & Newhart, V. A. (2016). Broadening our concepts of universal access. *Universal Access in the Information Society, 15*(2), 183–188. https://doi.org/10.1007/s10209-015-0417-0

World Bank. (2016). *World Development Report 2016: Digital dividends*. http://hdl.handle.net/10986/23347

Yu, S., & Ibtasam, S. (2018, June). A qualitative exploration of mobile money in Ghana. In *Proceedings of the 1st ACM SIGCAS Conference on Computing and Sustainable Societies* (pp. 1–10).

Zhao, X., Lynch Jr, J. G., & Chen, Q. (2010). Reconsidering Baron and Kenny: Myths and truths about mediation analysis. *Journal of Consumer Research, 37*(2), 197–206.