The commercial potential of Superapps in the Consumer Internet of Things (CIoT) ecosystem within South Africa

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ABSTRACT

The study explores the adoption of a Superapp for consumer IoT products and services, with MTN serving as the platform owner. Employing a mixed-methods research approach grounded in TAM, the study integrates consumer survey data alongside qualitative interviews involving SMEs, SOHOs, and Developers.

In the quantitative phase, the principal findings show that Perceived Usefulness and Ease of Use considerably influence consumer adoption. At the same time, the moderating role of Perceived Cost was not statistically significant. Additionally, factors like Attitude and Variety of Services are critical in shaping consumer attitudes towards a CIoT Superapp, mainly due to their ability to offer numerous services through MiniApps, influencing user preferences and choices. The thematic analysis of the qualitative interviews unearthed insights into businesses' perceived challenges and opportunities, shedding light on their expectations and apprehensions about adopting and integrating a CIoT Superapp in their operations. Themes included the potential of CIoT Superapp to streamline operations, broaden market reach, and offer cost-effective solutions.

This research contributes to the digital transformation discourse by highlighting the CIoT Superapp's potential to reshape the business landscape in South Africa, emphasizing its role in driving growth and innovation within the CIoT ecosystem. It offers original insights into the multi-sided nature of a CIoT Superapp platform and its implications for various stakeholders, positioning the CIoT Superapp as a transformative tool in the South African Market.

Keywords: Superapp, Internet of Things (IoT), Consumer Internet of Things (CIoT), CIoT Superapp, Platforms, Technology Acceptance Model (TAM), Multi-Sided Platforms, Platform Business models

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List of Acronyms

API	Application Programming Interface
APPS	Applications
CIoT	Consumer Internet of Things
CRM	Customer Relationship Management
IoT	Internet of Things
MTN	MTN Group Limited
MSP	Multi-Sided Platform
PEOU	Perceived Ease of Use
PU	Perceived Usefulness
SME	Small and Medium sized Enterprise
SOHO	Small Office/Home Office
TAM	Technology Acceptance Model
UTAUT	Unified Theory of Acceptance and Use of Technology
VOS	Variety of Services

1 INTRODUCTION

1.1 Purpose of the study

The consumer Internet of Things (CIoT) market is a rapidly growing industry; a recent study by Precedence Research stated, *"The global CIoT market size is expected to hit around USD 616.75 billion by 2032 from valued at USD 221.74 billion in 2022 and growing at a registered CAGR of 10.77% from 2023 to 2032 (Research, 2023)."* CIoT refers to the interconnected network of smart devices, appliances, and sensors designed to communicate with each other using the internet (Pocher & Zichichi, 2022). This technology can revolutionize our lives, from smart homes to personalized healthcare, pet tracking, and more. However, the adoption rate in South Africa is lower than in other global markets (Voltage, 2022). A recent paper by Julies and Zuva (2022) found that to enhance the adoption of CIoT (Consumer Internet of Things) in South Africa, improving user understanding, simplifying the technology, raising awareness, and emphasizing the benefits are crucial. Additionally, addressing the issue of multiple apps created by different companies by developing a user-friendly platform for managing and interacting with CIoT devices can enhance user experience and convenience (Consortium, 2022).

This leads to a further challenge: although businesses, especially startups and Small and Medium-sized Enterprises/Small Office Home Office (SME/SOHO), see digital as a key to unlocking future values in the South African economy, they lack the money, skills, or marketing power to create a market driven by their IoT-connected devices (Vodacom, 2022a).

One way to create value in the CIoT market is by creating a Superapp that integrates multiple functions and services into one platform (Consortium, 2022). Superapps have become popular in Asia, particularly in China and Southeast Asia, where they are used for everything from mobile payments to food delivery to ride-hailing. These apps have successfully created a multi-sided platform-

based ecosystem where users can access various services and businesses can reach a large customer base (Shimota, 2022).

A Superapp for CIoT could solve CIoT adoption problems by providing a single, easy-to-use platform for users to manage their connected devices. Such an app could offer various CIoT MiniApps, such as a marketplace, connectivity management, payment solutions, and other services, all from a single interface. This would simplify the user experience and encourage more people to adopt CIoT technology.

Therefore, this paper seeks to understand if the model of a Superapp can be applied to CIoT—specifically, its characteristics to create a multi-sided platform ecosystem. The research will focus on the platform's two sides: the consumer buying services and the businesses selling their products and services via a Superapp. The survey data from the different stakeholders will provide valuable insights into the commercial potential of a multi-sided platform-based CIoT ecosystem in the South African market.

1.2 Background of the study

The digital transformation of homes has increased due to more people working and studying from home and wanting to experience a better digital lifestyle (Maalsen & Dowling, 2020). One of the main reasons is that Covid-19 has increased the adoption of digital technologies. People were forced to shop online, spend more on internet services, use technology to join work and study groups remotely, and use more digital apps to connect with family outside the home (Musakwa & Petersen, 2023). One industry benefitting from this globally is the CIoT sector (Umair et al., 2021). More homes are becoming Smart Homes as more home users invest in CIoT technology to create a better, simpler lifestyle and achieve cost savings as per the research done by Jiang et al. (2004), a smart home is equipped with various intelligent technologies and devices that enable automation, remote control, and monitoring of various home functions. These

functions may include lighting, heating, ventilation, air conditioning, security, entertainment, and appliances. The goal of a smart home is to enhance convenience, comfort, and energy efficiency and improve the overall quality of life for the occupants by integrating these technologies**.** However, despite the significant growth potential, the South African IoT market still faces several challenges, including fragmented ecosystems, lack of standardization, trust issues, and the cost and complexity associated with the technology (Bradfield & Allen, 2019; Meintjes et al., 2021; Ngwenya & Ngoepe, 2022). Moreover, most IoT solutions are single-use applications that are not integrated with other systems, limiting their scalability and functionality (Consortium, 2022).

Positive signs impacting CIoT South Africa include our growing middle class wanting a digital lifestyle, increasing mobile and fixed internet penetration, and a high urbanization rate (Vibes, 2023). However, despite the positives in South Africa, there are many challenges, such as income inequality, limited internet access in some areas, load shedding, and a lack of infrastructure that impacts CIoT adoption (Voltage, 2022). A combination of these challenges and positives shows that the South African market has potential for growth in the CIoT market, and a Superapp could be an effective way to capture this potential. For example, during load shedding, IoT empowers consumers with remote control, energy monitoring, backup solutions, and cost management for efficient energy usage (Voltage, 2022).

Traditional apps differ in functionality, scope, and approach. A traditional app is designed to perform a specific function or set of functions, such as social media, gaming, or e-commerce (Consortium, 2022). The user downloads and installs the app on their device and runs it independently of others. On the other hand, a Superapp offers a wide range of features and services within one platform, creating a seamless user experience (Ryu et al., 2022). Superapps typically provide functionalities such as e-commerce, payment systems, social media, messaging, ride-hailing, and food delivery (Shimota, 2022).

The benefits of a Superapp include convenience, efficiency, and reduced clutter on a user's device (Ryu et al., 2022). Instead of switching between multiple apps, users can access all the services they need within one app (Ryu et al., 2022). Superapps also often offer loyalty programs and specials for their services, further enhancing their appeal (Shimota, 2022). Reducing the number of apps a user has, and the app's small size is handy in South Africa, where consumers pay high data costs. With these benefits, a few prominent companies in South Africa have begun investing in Superapps as a value-added service to their customers, be it the enterprise or consumer market.

Examples are:

- Nedbank with AVO – This Superapp provides various services for consumers while enabling businesses to sell their services on the platform (Nedbank, 2021).
- Vodacom with Vodapay offers a range of consumer apps on its Superapp, from ordering food to buying electricity. At the same time, it works with businesses, especially in the SME/SOHO sector, that lack the app development skills needed to become an app company (Vodacom, 2022a, 2022b).
- MTN with Ayoba—This Superapp provides standard content, from music and gaming to the news, while giving consumers access to a MiniApp ecosystem. Businesses can publish their MiniApp and get access to the broader Ayoba customer base (MTN, 2022, 2023).

1.3 Research problem

Our world is moving to a digitally connected world where everything that can be connected digitally will be connected. Organizations and consumers are trying to bridge the physical and digital worlds using technologies like CIoT. With these new technologies, many organizations are embarking on new digital initiatives, such as moving to platform companies by investing in new technologies such as

Superapps and CIoT to create new business models and, in turn, creating network effects and ecosystems making it easier for their target markets to become adopters of digital products such as CIoT products and services. However, recent papers by (Bradfield & Allen, 2019; Julies & Zuva, 2022; Musakwa & Petersen, 2023; Ngwenya & Ngoepe, 2022) have focused more on the challenges with the adoption of CIoT in the South African Market and less on the potential solutions which can increase the adoption and create new digital business models.

The limited research on the commercial potential of a Superapp for creating a multi-sided platform-based ecosystem for CIoT in the South African market presents a gap that requires further study. This knowledge gap limits our understanding of the South African market's potential for adopting and benefiting from a Superapp in the context of CIoT. The concept of a Superapp, which integrates multiple services and functionalities, has gained popularity in various regions. However, its potential in the South African CIoT market still needs to be explored. By conducting an exploratory study, this research aims to shed light on the commercial benefits a Superapp can bring to the South African market, particularly in the context of CIoT.

Therefore, to address this gap, the research provides insights into the commercial potential of a Superapp, creating a multi-sided platform-based ecosystem for CIoT in the South African market. The findings of this study can be used by businesses and investors to make informed decisions about investing in developing a CIoT Superapp in South Africa. Overall, the paper looks at how a Superapp-based ecosystem has the potential to transform the South African CIoT market by creating a comprehensive, integrated, and scalable multi-sided platform-based ecosystem creating the desired platform network effects, in turn, addressing the challenges faced by the current fragmented and single app IoT based solutions.

1.4 Research Aim and Questions

This research aimed to analyse the commercial potential of developing a Superapp for the CIoT ecosystem within the South African market. This included examining how such a platform can enhance consumer adoption by simplifying the user experience and benefit SMEs, SOHOs, and developers by providing increased business opportunities, market reach, and operational efficiencies. Additionally, the research aimed to assess the overall commercial viability of the CIoT Superapp, leveraging MTN as the platform owner to create a robust multi-sided ecosystem that drives growth and innovation within the CIoT market in South Africa.

To achieve this objective, the study addresses the following research questions:

1. What is the commercial potential of developing a Superapp as a multi-sided platform-based ecosystem for CIoT within the South African market?
2. How can a CIoT Superapp impact SMEs/SOHOs or Developers in the South African market?
3. How can businesses leverage these technologies to enhance their competitiveness and growth potential?

1.5 Rationale

The rationale for the study centred on the significant interest Superapps have attracted in both academic and business sectors, driven by WeChat's pioneering success in the digital landscape. However, as this is a new topic, limited scientific literature has focused on the South African market. At the same time, the corporate sector has taken the lead. Therefore, the study contributes to both the academic and business sectors in the following ways:

- This study contributes to understanding the commercial potential of a Superapp-based ecosystem for CIoT in the South African market.

- The study's findings give insight to stakeholders in the CIoT industry, including entrepreneurs, investors, policymakers, and academics. By identifying the challenges and opportunities for growth in the CIoT market in South Africa, the study delves into the potential of a Superapp-based ecosystem to address these challenges and capture the growth potential.
- Additionally, the study contributes to the literature on Superapps, multi-sided platforms, and CIoT.

1.6 Delimitations of the study

The study is delimited to the following.

1. Geographic scope: The study focused on the South African market and did not consider other regions or countries.
2. Industry focus: The study focused on the CIoT industry and did not consider other industries or sectors.
3. Superapp features: The study examined the commercial potential of a Superapp creating a multi-sided platform-based ecosystem for CIoT. However, it did not delve into the technical details of developing a Superapp or its subsets.
4. Data sources: The study used a mixed-method approach with data sources from online surveys and interviews.
5. Sample size: The study used a sample of participants from various sectors of the CIoT industry and did not include every company or organization.

1.7 Definition of terms

This study had the following essential terms that need to be defined.

- **Superapp:** A mobile application that offers a wide range of services and functions, such as e-commerce, payment, messaging, entertainment, and more, all within a single platform (Shimota, 2022).
- **MiniApp**—A MiniApp is a small application within a Superapp. These MiniApps often provide specific functions or features that enhance the overall user experience. In the context of a Superapp, a MiniApp could be, for example, a Pet Tracking app where users can install a device on their pets for tracking purposes (Shimota, 2022).
- **Multi-sided platform:** A business model that connects two or more groups of customers, such as consumers and producers, through a platform, enabling them to interact and transact with each other (Mishra & Tripathi, 2020).
- **Ecosystem:** A system of interconnected and interdependent entities, such as companies, individuals, and organizations, that interact on the Superapp to create value (Mishra & Tripathi, 2020).
- **CIoT:** A network of devices equipped with electronics, software, sensors, and connectivity capabilities, enabling them to gather and share data or external systems, thereby enhancing user experiences (Alahmadi et al., 2023).
- **Commercial potential:** The likelihood that a Superapp will generate revenue and profits in each market based on demand from the consumer and supply side (Mishra & Tripathi, 2020).
- **Network effects:** Where the value of a product or service increases as more people use it. In other words, the benefit a participant in the ecosystem derives from the Superapp product or service depends on the product's quality or features and the number of other users or participants in the network (Shimota, 2022).

1.8 Assumptions

For this study, the following assumptions were made:

- Respondents in the study had a basic understanding of English, as all instruments used in the research study were in English.
- The respondents answered all survey questions honestly, ensuring the accuracy and reliability of the collected data.
- Consumers are assumed to have a basic understanding of CIoT technologies and how CIoT technologies apply to their needs.
- As a Superapp is a disruptive technology that has seen a recent increase in consumer adoption due to apps provided by Vodacom, Nedbank, and MTN, the adoption rate within South Africa could be low. Therefore, it is possible that some respondents may not have had practical experience working with Superapps and may only possess a theoretical understanding of Superapps.

2 LITERATURE REVIEW AND THEORETICAL FRAMEWORK

The literature review explores the commercial potential of a Superapp in creating a multi-sided platform-based ecosystem for CIoT in the South African market. By reviewing relevant literature and developing a theoretical framework, this study aims to shed light on the various factors influencing the success of such an ecosystem.

The review explores the integration of Superapps and CIoT, the commercial potential of Superapps, and the impact of CIoT and Superapps on SMEs, SOHOs and Developers. The review draws from credible journals, books and online sources to provide a thorough understanding of the topic.

The chapter is organized into two main sections corresponding to the research questions addressed in this study. Sections 2.1 to 2.4 provide an overview of the research study by exploring the concepts of CIoT, Multi-Sided Platforms (MSPs), Superapps and a conceptual model of a CIoT superapp based on the previous sections.

Section 2.5 introduces the Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT), and Transaction Costs Economics as relevant theories for validating the CIoT Superapp model. It highlights their key concepts and applications in understanding user acceptance and transaction costs within the proposed model.

Section 2.6 introduces the research model, encompassing viewpoints from consumers, SMEs, SOHOs, and Developers. It outlines the key factors and relationships within the research framework.

2.1 CIoT: Definition and Characteristics

CIoT, often called the Internet of Things for consumers, encompasses a network of interconnected devices embedded in everyday consumer products and services. This section provides an overview of the definition, characteristics, challenges, and advantages of CIoT.

2.1.1 Definition of CIoT :

Academic literature and industry reports provide various definitions of CIoT, emphasizing its consumer-centric nature and the integration of innovative technology into everyday life. In the context of this study, a CIoT can be defined as a network of physical objects, appliances, and devices that are embedded with sensors, software, and connectivity capabilities, allowing them to collect, exchange, and act upon data to enhance consumer experiences (Alahmadi et al., 2023). An example of CIoT solutions is shown in Figure 1.

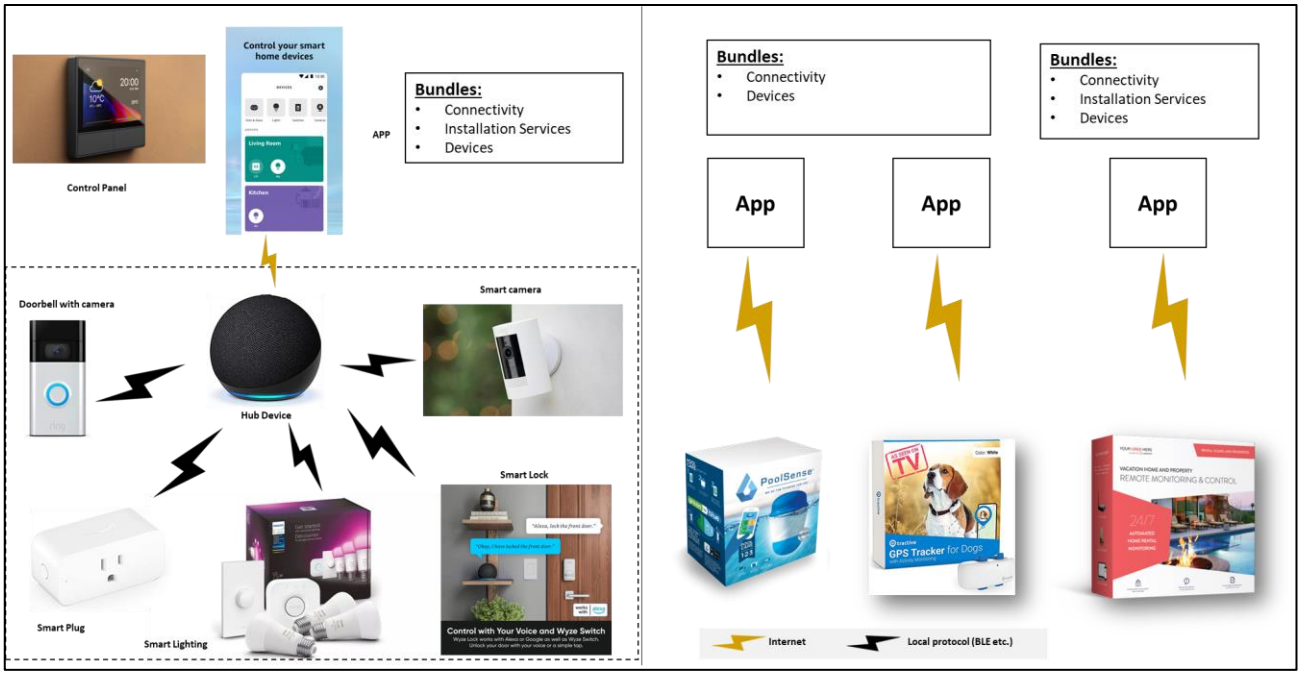

Figure 1:Type of CIoT Product and Services (Fattahi, 2022)

2.1.2 Key Characteristics of CIoT :

CIoT devices offer key functional features; firstly, they provide connectivity by allowing devices to connect to the internet, facilitating smooth communication and data exchange between users and devices. Secondly, CIoT devices have sensors to gather real-time data on environmental conditions, user behaviour, and device status. Thirdly, these devices are designed to be interoperable, meaning they can work together and communicate, allowing users to create interconnected systems and achieve automation and control across multiple devices. Moreover, CIoT devices utilize the data collected from sensors and user interactions to make data-driven decisions, providing personalized and context-aware experiences. Lastly, CIoT devices offer remote accessibility and control, enabling users to monitor and manage their devices from anywhere using dedicated mobile applications or web interfaces (Fattahi, 2022).

2.1.3 Implications of CIoT for Consumers:

CIoT devices bring numerous benefits driven by the need to enhance the quality of life, such as the ability to enhance convenience and efficiency by automating tasks, enabling remote control, and simplifying daily routines (Fattahi, 2022; Li et al., 2021). CIoT devices offer personalized experiences by learning user preferences and adjusting functionalities, catering to individual needs. These devices improve safety and security through features like remote monitoring, intrusion detection, and emergency alerts, ensuring peace of mind for consumers. CIoT devices promote energy efficiency and sustainability by enabling energy monitoring and optimization, contributing to environmentally friendly practices, and reducing overall environmental impact.

2.1.4 Challenges and Considerations:

While CIoT offers numerous benefits, it also poses challenges and considerations that must be addressed (Consortium, 2022; Fattahi, 2022; Li et al., 2021). The

challenge of setting up and configuring IoT devices can be overwhelming for non-technical users, potentially discouraging adoption among less tech-savvy consumers. Additionally, the cost of purchasing multiple devices for various purposes and ongoing expenses like data plans and subscription fees can act as deterrents to embracing IoT technology. Privacy and security concerns arise as CIoT devices collect and transmit sensitive user data, necessitating robust security measures and regulatory frameworks to mitigate risks. Moreover, the need for standardization and interoperability among CIoT devices can impede seamless integration and cross-platform compatibility. It is crucial to educate consumers about the functionalities, risks, and privacy implications of CIoT devices to enable them to make informed decisions and protect their privacy. The incompatibility of IoT devices with legacy systems and infrastructure may require additional investments in upgrading or retrofitting, limiting adoption in older buildings or regions with outdated infrastructure. While CIoT offers significant benefits, it also presents challenges and considerations that must be addressed.

2.1.5 Examples of CIoT Use Cases

CIoT encompasses various applications and use cases (Intelligence, 2023; Research, 2023; Telukdarie & Mkhize, 2018). Smart home automation allows for the automation and control of home appliances and systems, such as smart thermostats, intelligent lighting systems, and smart security systems. Wearable health monitoring devices enable individuals to track their health and fitness levels, including heart rate, sleep patterns, and activity. Connected kitchen appliances, like smart refrigerators, ovens, and coffee makers, offer enhanced functionality and convenience through features like food inventory tracking and remote control. In the automotive sector, IoT integration in cars provides benefits such as real-time GPS navigation, vehicle diagnostics, and safety features like collision detection. IoT devices are crucial in healthcare, enabling remote patient monitoring through wearable devices and smart pill dispensers. Smart entertainment systems integrate devices and services, offering personalized content recommendations and multi-room audio setups. Smart energy

management allows consumers to monitor and optimize their energy consumption using devices like smart energy meters and connected plugs. The retail industry benefits from IoT-enabled beacons and sensors that track customer movements and offer personalized offers. IoT devices in fitness and sports provide real-time performance tracking and personalized workout programs. For outdoor spaces, smart gardening devices assist in maintaining and optimizing gardens through features like automated sprinkler systems and gardening sensors. IoT-enabled water monitoring systems provide real-time data on water consumption and leak detection. CIoT extends to pool management, improving automation, monitoring, and energy efficiency. Finally, IoT devices enable pet owners to track and monitor their pets in real-time, ensuring their safety and well-being. These use cases demonstrate the diverse applications of CIoT in various aspects of everyday life, ranging from home automation and energy management to health monitoring, water conservation, and pet care.

2.1.6 Challenges in Customer Adoption due to App Overload.

The previous chapter has highlighted some of the many use cases in the CIoT market. However, having too many apps for different CIoT use cases can impact customer adoption in several ways. The complexity and fragmentation introduced by the need to manage multiple apps are at the heart of the issue. Each app has its user interface, settings, and learning curve, making it cumbersome for users to navigate and switch between different apps. This inconsistency hampers the seamless integration of data and functionalities across apps, limiting the potential for cohesive interactions and CIoT cross-use case synergies. This complexity can be overwhelming, discouraging users from exploring the full potential of CIoT solutions. The World Wide Consortium (2022) MiniApp standardization paper highlights how such fragmentation can lead to user disengagement, underscoring the need for a more streamlined approach.

Moreover, these standalone apps' installation and setup process requires considerable effort and time. Users find themselves tasked with searching for,

downloading, creating accounts for, and configuring each app individually. This adds friction to the adoption process and can deter users from incorporating CIoT solutions into their lives, as noted by the World Wide Consortium (2022). Furthermore, the need for interoperability among IoT devices and services exacerbates the problem. This situation forces users to rely on dedicated apps for each device or service, complicating the creation of an integrated IoT ecosystem within a user's home or environment. Users often face compatibility issues and struggle to manage multiple devices from a centralized platform, a challenge that the World Wide Consortium (2022) emphasizes as a barrier to practical CIoT applications.

This leads to significant concern about app overload and the consequent consumption of valuable device storage space. With devices often having limited storage capacity, users may hesitate to install multiple apps, wary of the burden of constantly managing and updating them. Peker (2021) identifies this as a pivotal issue, pointing out the need for a more efficient way to deliver CIoT functionalities without overwhelming users' devices. Furthermore, the proliferation of apps also risks user engagement and abandonment. The overwhelming variety of apps can lead to declining active usage, as users may lose interest or feel overburdened by the choices available. As Peker (2021) points out, it limits the potential benefits and value of CIoT solutions, affecting their overall adoption rate.

Lastly, the affordability of CIoT solutions is a crucial factor, especially in regions with developing economies or for organizations operating on limited budgets. Bradfield and Allen (2019) suggest that misalignment between the costs of CIoT implementation and the financial capabilities of potential adopters can hinder widespread adoption, limiting the accessibility of this promising technology.

2.1.7 Mitigation of the challenges using an MSP model.

As we have seen in the previous section, there are many challenges for consumer's adoption of CIoT products and services. These challenges range

from interoperability issues and security concerns to the complexity of integrating and managing multiple IoT devices. In this context, multi-sided platforms have emerged as a promising solution to address these challenges and facilitate the widespread adoption of CIoT. Below is a summary of the literature:

1. Guijarro et al. (2019) highlighted the significance of multi-sided platforms where different players in IoT act as intermediaries, connecting users who provide sensor data and services with app developers who need access to that data for various applications. The paper emphasizes the value of MSPs in the IoT ecosystem, showcasing their potential to drive efficiency, foster innovation, improve user experiences, and generate sustainable revenue streams.
2. Karapantelakis and Markendahl (2015) proposed a model where a mobile network operator is a mediator in an MSP-based IoT ecosystem. By leveraging the strengths of the mobile network operator and other value-added services, they can facilitate interoperability across different players in the ecosystem.
3. As highlighted in section 2.1.5, wearable technologies are one of the CIoT use cases. Yablonsky (2017) proposed a model for an IoT wearable-based MSP, which he defined as:

   "An IoT Wearable Multi-Sided Platform (Wearable as a Service) is an organization that creates value primarily by enabling direct interactions between three (or more) distinct types of affiliated actors: IoT Wearables Data Suppliers (human or artificial), IOT Wearable providers, and IoT Wearable consumers or Data Users (human or artificial)"

   The author identified different business models that can be applied to the IoT Wearable MSP and mitigate the challenge of high costs, which is a barrier to adopting CIoT solutions.
4. Schreieck et al. (2017) studied existing IoT platforms in the market to propose a theoretical construct of an MSP IoT Platform, which he labelled as advanced versus standard IoT Platforms, as shown in Figure 2. The differentiation was primarily based on the presence or absence of marketplaces. Advanced IoT

platforms featured marketplaces, enabling complementors to engage with users directly and offer extra services. This led to their categorization as multi-sided platforms (MSPs). They identified players in an IoT platform ecosystem, and four distinct partner groups were identified: reselling platform partners, device integrators, platform complements, and infrastructure providers, each playing a unique role.

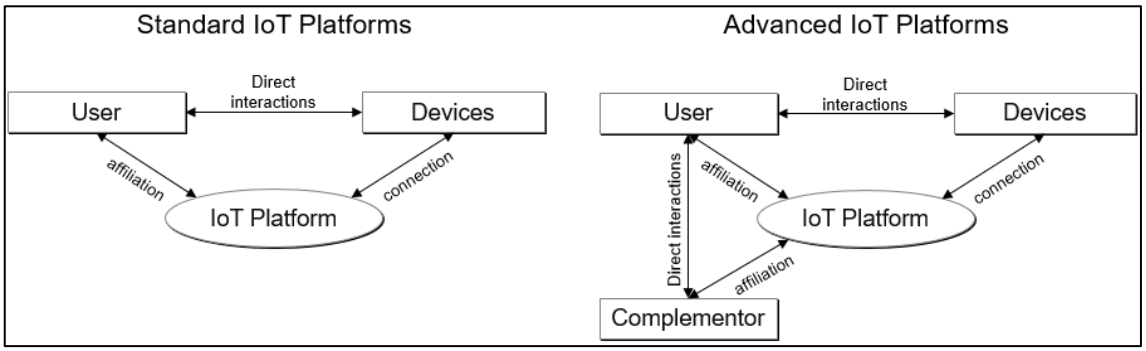

Figure 2: Standard IoT Platforms vs MSP (Schreieck et al., 2017)

5. Degrande et al. (2018) argue that providing a core IoT platform can address the challenges of a fragmented IoT industry. The MSP becoming the core of the IoT ecosystem and embracing openness will enable different stakeholders to interact with each other across verticals. The MSP provides a standardized protocol for devices to communicate with each other, reducing interoperability issues. Also, MSPs can offer a secure data sharing and processing environment, ensuring that sensitive information is protected.

In conclusion, MSPs have emerged as a solution to overcome the challenges faced by consumers in adopting IoT technologies. In the next section, we explore the concept of MSPs in further detail.

2.2 Multi-Sided Platforms: Definition and Characteristics

Platform-based business models, especially multi-sided platforms, have become a hot topic in the digital business as companies pursue new platform strategies (Abdelkafi et al., 2019; Hagiu & Wright, 2015). The concept of multi-sided

platforms has its roots in economics, particularly in the work of Rochet and Tirole (2003). They introduced the concept of two-sided markets, where a platform brings together two distinct user groups and facilitates interactions. Over time, the concept has expanded to include multiple user groups, leading to multi-sided platforms. In our paper, we use the definition by the authors Hagiu and Wright (2015) as their definition highlights the fundamental characteristics of MSPs: the presence of two or more distinct user groups, such as buyers and sellers, and the facilitation of value exchange between them by an organization using a digital platform.

In the book by Armstrong and Lee (2021), they identified the below participants in a platform-based ecosystem:

- **Owner:** The owner or operator of the platform who manages and governs it.
- **Complementors:** Participants who provide offerings that enhance the platform's value for producers and consumers.
- **Producers:** Participants who create and supply products, services, or content on the platform, generating the core value.
- **Consumers:** The primary users of the platform who benefit from the offerings provided by producers.
- **Providers:** Participants who offer resources, infrastructure, or support services that enable the platform's operation.

The following sections provide a review of papers by (Abdelkafi et al., 2019; Boudreau & Hagiu, 2009; Hagiu & Wright, 2015; Rochet & Tirole, 2004; Sanchez-Cartas & Leon, 2019), which provides a summary of the key characteristics and benefits, reaching critical mass and challenges of MSPs.

2.2.1 Key Characteristics of Multi-Sided Platforms

Researchers have unveiled distinct attributes and mechanisms that set MSPs apart from traditional one-sided markets in their study. One of the defining

features of MSPs is the presence of multi-sided network effects, which stem from the interdependence among different user groups. This dynamic fosters a virtuous cycle where adding users on one side of the platform inherently boosts attractiveness for users on the opposite side, thereby creating a substantial competitive edge for MSPs through a positive feedback loop.

Another critical aspect of MSPs is their platform governance. MSP owners play an instrumental role in orchestrating the interactions and transactions across various user groups. They are responsible for setting up the framework of rules, standards, and protocols that ensure transactions are conducted fairly and efficiently. This governance structure is pivotal in building trust and coordinating activities among participants, ensuring the platform operates smoothly and effectively.

Furthermore, MSPs are notable for their innovative pricing strategies tailored to cater to the divergent interests of the user groups they connect. A common approach is the subsidization model, where services are provided free or at a reduced cost to one side of the platform. This strategy is designed to entice participation and foster network effects, a crucial lever for platform growth. Also, MSPs are vital intermediaries in facilitating value creation and exchange between user groups. They reduce transaction costs and enhance convenience, enabling users to connect, interact, and transact seamlessly. MSPs deliver significant value to all participants through these roles, distinguishing themselves from traditional market structures.

2.2.2 Benefits of Multi-Sided Platforms

MSPs bring many advantages to users and stakeholders, transforming how transactions and interactions are facilitated across user groups. These platforms significantly enhance efficiency by streamlining resource allocation. For example, ride-sharing platforms have revolutionized the transportation industry by

matching drivers with riders in real time, thus optimizing vehicle usage and reducing empty miles and traffic congestion.

In addition to efficiency, MSPs are instrumental in expanding markets. They bridge the gap between buyers and sellers who might have yet to connect, providing sellers access to a broader customer base. This expansion is not just about numbers; it is about opening up new opportunities and avenues for economic growth that were previously inaccessible.

Another critical benefit of MSPs is the network effects they generate. The value of a multi-sided platform increases as more users join, creating a self-reinforcing growth cycle. This network effect is crucial for MSPs, as it attracts and retains users by continuously enhancing the platform's value proposition for all involved. Consequently, a successful MSP can secure a formidable competitive advantage. Establishing a substantial user base creates a barrier for new entrants, making it difficult for them to siphon off users from an entrenched platform, resulting in high switching costs.

However, the above can only be achieved with reaching critical mass. Critical mass is a concept that plays a crucial role in the success and sustainability of multi-sided platforms. It refers to the point at which a platform reaches enough users on each side, creating a network effect that attracts and retains more users, ultimately leading to its growth and viability.

2.2.3 Achieving critical mass

Achieving critical mass for a multi-sided platform requires targeted strategies to navigate its complexities. One practical approach is to initially focus on attracting one side of the market by offering a compelling value proposition, encouraging participation from the other side. Early stages often benefit from subsidizing user acquisition through discounts or free trials to overcome initial hesitancy and stimulate growth. Partnerships with complementary businesses can also expedite user acquisition by tapping existing user bases and fostering network effects.

Furthermore, building trust through robust safety measures and verification processes is essential for retaining users and ensuring the platform's long-term success. Collectively, these strategies contribute to reaching and sustaining the critical mass necessary for a platform's viability.

2.2.4 Challenges of Multi-Sided Platforms

Despite their numerous advantages, MSPs encounter distinct challenges that necessitate strategic responses. A primary obstacle is the chicken-and-egg problem. To create value, MSPs must simultaneously attract users to both platform sides. For instance, a startup ride-hailing service must recruit drivers and riders. Overcoming this initial challenge demands meticulous coordination and the efficient allocation of resources to ensure both sides are adequately bootstrapped.

Another critical issue is balancing the interests of MSPs' different user groups. Catering excessively to one group at the expense of another can result in dissatisfaction and ultimately lead users to leave the platform. Striking a fair balance requires continuous management effort and the ability to adapt to the evolving needs and feedback of the platform's users.

Moreover, MSPs face intense competitive pressures. The market often hosts multiple rival platforms fighting for user engagement, making it imperative for MSPs to continually innovate and distinguish their offerings. This competition necessitates that platforms improve existing services and explore new ways to add user value.

Lastly, the phenomenon of multi-homing presents another layer of complexity. Users who engage with multiple platforms, aka multi-homing, can easily switch based on their preferences or the benefits perceived on each platform. This behaviour intensifies competition among MSPs, pushing them to constantly enhance their services and value propositions to attract and retain users. This

dynamic environment challenges MSPs to stay agile and responsive to the shifting landscape of user preferences and competitive strategies.

2.2.5 Research on MSP-based IoT Platforms

Although the papers by Degrande et al. (2018), Guijarro et al. (2019), Karapantelakis and Markendahl (2015), Schreieck et al. (2017), and Yablonsky (2017) propose the advantages of using an MSP focusing on the benefits of such a model, they did not focus on customer experience. The challenge of a customer installing multiple native mobile apps from the iOS and Andriod stores for the different use cases identified in section 2.1.5. In the paper by Guijarro et al. (2019), the author bases the concept of an MSP on sensing data shared on a core MSP where developers can access the data to create their applications. Yablonsky (2017) proposed a wearable as a service MSP. Karapantelakis and Markendahl (2015) proposed that a mobile provider become a horizontal MSP owner. An IoT horizontal platform approach, as researched by Schermuly et al. (2019), aims to provide a generalized platform that can be utilized across various industries and use cases. It focuses on flexibility, scalability, and adaptability to accommodate multiple applications. Horizontal platforms offer a standard set of features and services that can be leveraged by different industries, potentially reducing development and maintenance costs. Although an essential building block for an IoT MSP, it is based on allowing developers or companies to build their applications. It does not propose an architecture where customers can get a single mobile app for all their use cases.

2.2.6 Mitigation of the challenges using a Superapp model.

Multi-sided platforms have emerged as a powerful solution to overcome the challenges faced by consumers in adopting IoT technologies. These platforms foster interoperability, simplify device management, create network effects, and promote innovation, creating an ecosystem that enables seamless integration and interaction between IoT devices and services. However, most of the research

in MSP IoT is based on horizontal-based IoT platforms, which will allow companies/developers to create their applications. It does not focus on creating a personalized user experience where if an end user wants multiple CIoT use cases, they can do all of it on a single app. It also creates its challenges, as discussed in section 2.2.4.

In this context, Superapps has emerged as a promising solution to address these challenges and facilitate the widespread adoption of CIoT. Below is a summary of the literature:

1. A study by Schreieck et al. (2023) on Superapps highlighted that one of the reasons a user will use this app versus a standalone native is that it removes the need for one to download multiple apps. Each standalone now becomes a MiniApp in the Superapp. The simplicity of the MiniApps, standardization, and the platform owner coordinating the ecosystem help reduce costs and improve user experience.
2. Nugraha (2020) did a case study on the Superapp Jaki developed by the Jakarta government, which was designed to meet citizens' needs by prioritizing the convenience, effectiveness, and efficiency of government-related services. The app integrates multiple services the government, community, and private industry/start-ups provide while creating a collaborative ecosystem. The Superapp ecosystem players in the JAKI ecosystem are shown in Figure 3. A recent study by Maajid and Rachmawati (2023) on user engagement found that the public recognizes the positive impact of the JAKI app on enhancing public services in Jakarta.

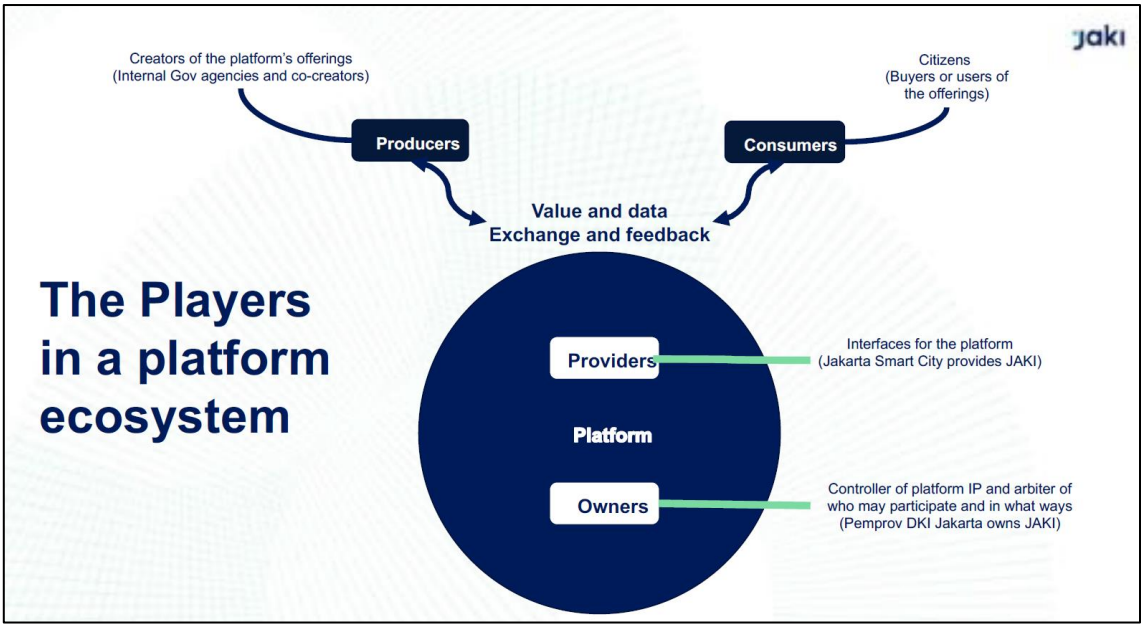

Figure 3: JAKI Ecosystem (Nugraha, 2021)

3. Superapps' success was seen in emerging Asian countries, compared to the heart of the app revolution in Silicon Valley. Ye (2022) identified four reasons this is the case. First, slower internet adoption in developing countries leads to higher switching costs for users as they tend to stick with the first platform they learn to use. Second, platforms from developing countries have incentives to diversify, while those from developed countries focus on specialized growth. Third, emerging markets have less stringent regulations, allowing Superapps to operate with flexibility. Lastly, institutional voids in emerging markets create opportunities for various products and services, enabling emerging market platforms to imitate, learn, and scale. These factors contribute to the higher prevalence of Superapp's success in emerging markets like South Africa.
4. A recent World Wide Consortium (2022) paper discussed how native apps with limitations in installation, storage, data sharing, and platform-specific development could be resolved using a Superapp model. The paper further discusses how MiniApps, a key component of Superapps, offer benefits like free installation, improved performance, access to operating system capabilities, and distribution across multiple platforms. The authors

argue that a MiniApp for IoT enables interoperability across multiple IoT device platforms and operating systems.

In conclusion, Superapps have emerged as a new type of MSP focusing on customers' user experiences. These use cases require interaction with multiple apps and data sharing across these apps. In the next section, we explore the concept of Superapps in further detail.

2.3 Superapp: Definition and Characteristics

The emergence of smartphones and the rapid advancement of digital technologies have revolutionized how we interact, work, and engage with various services. Superapps, a relatively new concept in the digital landscape, have gained considerable attention in recent years. The definition of Superapps varies across literature, reflecting the evolving nature of this concept. A Superapp is a mobile application combining multiple functionalities and services within a single platform, offering users a seamless and comprehensive experience (Consortium, 2022; Shimota, 2022). Superapps often combine multiple MiniApps, like instant messaging, social media, e-commerce, online payments, ridesharing, food delivery, and more, into a single app, providing a one-stop solution for various everyday needs. Steinberg (2020) argues that Superapps often employ a "platformization" strategy, acting as a gateway to multiple third-party services and integrating them seamlessly into their ecosystem.

2.3.1 Key Characteristics of Superapps (Schreieck et al., 2023; Shimota, 2022):

Superapps represent a transformative approach to digital services, integrating many services within a single platform. This integration provides a significant convenience for users, enabling them to access diverse services without switching between different applications. By consolidating these services,

Superapps streamline the user experience, offering a one-stop digital solution for numerous daily tasks.

A key feature is the user-centric approach that prioritizes convenience and personalization. Through a unified interface, personalized recommendations, and smooth navigation across services, these platforms leverage user data and sophisticated algorithms to craft experiences uniquely tailored to each user. This enhances user satisfaction and encourages longer and more meaningful engagement with the app.

Superapps often engage in ecosystem development by partnering with external service providers or opening their platforms to third-party developers through APIs (Application Programming Interfaces) to further enrich their offerings. This strategy encourages a culture of innovation, broadening the app's capabilities and attracting a broader user base by offering various services and functionalities. Additionally, incorporating MiniApps within Superapps allows users to access specific services or functionalities without needing separate installations or downloads. These embedded applications further enhance the seamless nature of the Superapp experience.

Companies behind Superapps also focus on empowering developers through access to comprehensive development tools and programs, facilitating the easy creation and deployment of MiniApps. For instance, platforms like Vodacom (2023) Vodapay superapp have provided robust tools to lower entry barriers so businesses can become part of the ecosystem. This openness accelerates innovation within the platform and enriches the user experience by continuously expanding the range of available services.

2.3.2 Benefits of Superapps:

Superapps offer several advantages to users and businesses, summarized below as extracted from papers by Consortium (2022), Pitre (2022), Schreieck et al. (2023) and Shimota (2022).

Superapps significantly enhance the digital user experience by centralizing many services into one comprehensive platform. This consolidation eliminates the need for individual app installations, allowing users to effortlessly navigate between various tasks like food ordering, ticket booking, or making hotel reservations, all within a single app. MiniApps within the Superapp streamline this experience by providing access to specialized services without switching between apps, offering a seamless and integrated user experience.

One of the critical advantages of MiniApps within Superapps is their minimal requirement for storage and data. These lightweight applications do not demand significant storage space or data usage, which spares users from frequent updates and conserves their device's resources and data plans.

Moreover, Superapps open up avenues for cross-promotion and monetization by leveraging their extensive user base. Through advertising, service fees, commissions, or business partnerships, Superapps can enhance revenue generation opportunities.

Thanks to the platform's large user base and built-in features like search functions and recommendations, MiniApps within Superapps benefit from enhanced discoverability. This visibility allows businesses and developers to reach a broader audience and increase their presence. Furthermore, for businesses, developing and maintaining a MiniApp within a Superapp ecosystem presents a more cost-effective solution than creating standalone applications. It reduces development efforts, taps into an existing user base, and offers a streamlined distribution channel, making it an attractive proposition for businesses looking to expand their digital footprint.

2.3.3 Challenges and Concerns:

While Superapps offer numerous advantages, they also face specific challenges, summarized below as extracted from papers by Consortium (2022), Pitre (2022), Schreieck et al. (2023) and Shimota (2022).

Superapps, with a wide range of services in a single platform, handle extensive user data, bringing privacy and security issues to the forefront. Research on the subject emphasises the importance of implementing stringent data protection measures, maintaining transparency in data practices, and ensuring users' informed consent to mitigate these concerns. Handling such vast amounts of sensitive information demands carefully safeguarding users' privacy and maintaining their trust.

The development and maintenance of Superapps require a substantial upfront investment, contributing to their relatively scarce number. Owners must focus on delivering an exceptional user experience, which often means postponing monetization strategies and accepting a longer growth cycle. Success in the Superapp arena also hinges on attracting ecosystem partners and driving user traffic. These tasks demand significant investments in time and resources.

The competitive landscape presents another hurdle for Superapps, especially with established standalone apps dominating specific niche markets. As the demand for Superapps grows increasingly competitive, particularly with critical players solidifying their positions in certain regions, new entrants encounter significant challenges in breaking into these markets and distinguishing their services.

The regulatory environment poses a considerable challenge for Superapps, as their expansive reach across multiple service sectors can trigger government scrutiny. The potential for industry domination raises concerns over unfair advantages and anti-trust issues, leading to possible legal entanglements. Superapps must navigate a complex web of regulations that vary across different jurisdictions, especially concerning data privacy, financial services, and competition law, complicating their efforts to expand and operate globally.

2.3.4 Global Examples of Superapps and the Need for an Anchor Point.

Superapps have gained significant popularity in various parts of the world. Examples include WeChat in China, which combines messaging, social media, e-commerce, and financial services; Grab in Southeast Asia, which offers ride-hailing, food delivery, and digital payment services; and Gojek, also in Southeast Asia, providing a multitude of services, including transportation, food delivery, logistics, and financial services (Pitre, 2022; Ye, 2022). However, to succeed in the competitive market, Superapps must establish a strong anchor point, as shown in Figure 4 (BPC & Fincog, 2022; Shimota, 2022; Ye, 2022). An anchor point refers to a core service or feature that attracts and retains a significant user base, serving as a foundation for expanding into additional offerings (Pangarkar, 2019). One can relate to a shopping mall where anchor tenants are large stores such as Edgars or PicknPay, which drive foot traffic to shopping malls.

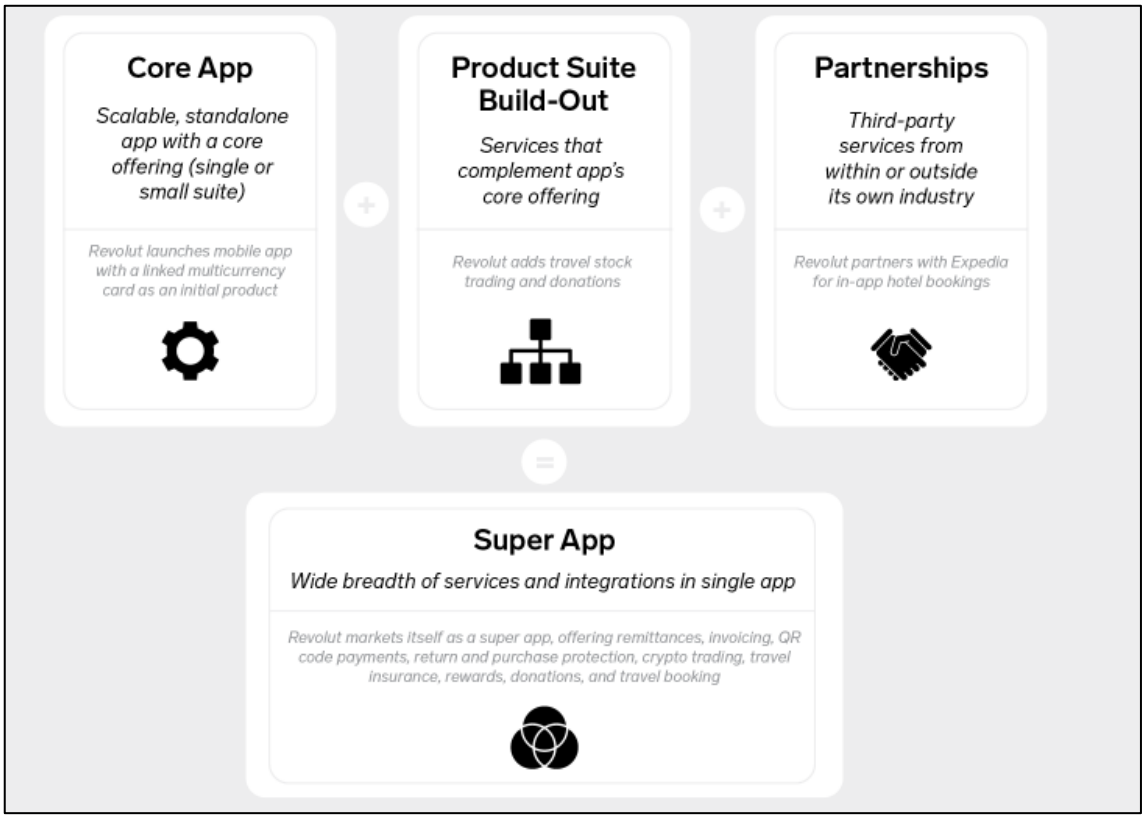

Figure 4: Elements to build a Superapp (Intelligence, 2022)

Below is a high-level overview of how the examples listed started with a core service and then expanded their app to create a Superapp-based ecosystem, creating the network effects of an MSP.

Industry examples:

- **WeChat (China)** - WeChat started as a messaging app but quickly expanded to become a Superapp by integrating various services such as social networking, mobile payments, ride-hailing, food delivery, and more. The messaging feature served as the anchor point, attracting millions of users and enabling WeChat to build a robust ecosystem of services (Shimota, 2022).
- **Grab (Southeast Asia)** - Grab started as a ride-hailing service but transformed into a Superapp by integrating additional services like food delivery, digital payments, and financial services. Initially focusing on transportation and building a massive user base, Grab attracted numerous partners, including restaurants and financial institutions, to join their platform. This network effect helped Grab to become a dominant player in the Southeast Asian market (Pitre, 2022).
- **Alipay (China)** - Alipay, initially a mobile payment platform, used its anchor point to build a comprehensive financial ecosystem (Diaz Baquero, 2021). It expanded into services like wealth management, insurance, and lending, leveraging the trust and user base established through its core payment service. This diversification allowed Alipay to capture a significant financial market share and generate substantial revenue.
- **Gozem (West and Central Africa) -** Gozem is a Superapp founded in 2018 and based in West Africa. Launched initially in Togo, Gozem expanded its services to other regional countries, including Benin, Gabon, and Ivory Coast. The platform initially started as a ride-hailing service, providing convenient transportation solutions to users. Over time, Gozem expanded its offerings to include various services such as food delivery, parcel delivery, and even mobile money transactions. By integrating multiple services into a single app,

Gozem aims to provide users with a comprehensive and seamless experience catering to their daily needs (Pitre, 2022).

- **Vodapay (South Africa) –** VodaPay by Vodacom, as shown in Figure 5, is a Superapp in South Africa that provides various services, including mobile payments, bill payments, airtime, data purchases, and digital financial services. VodaPay's anchor point lies in its robust mobile payment system, which leverages its extensive customer base and vital telecommunications infrastructure. VodaPay strong anchor point has allowed it to become a trusted and widely adopted payment solution in South Africa. VodaPay has attracted numerous merchants and partners to join its platform by capitalizing on its existing mobile customer base and expanding its ecosystem. Users can now conveniently make payments at various retailers, restaurants, and service providers, eliminating the need for cash transactions or multiple payment apps. Building upon its anchor point, VodaPay has expanded into additional financial services, microloans, insurance premiums, and remittances, which has enabled VodaPay to cater to various financial needs of its users and capture a significant portion of the digital financial services market in South Africa (Vodacom, 2022b).

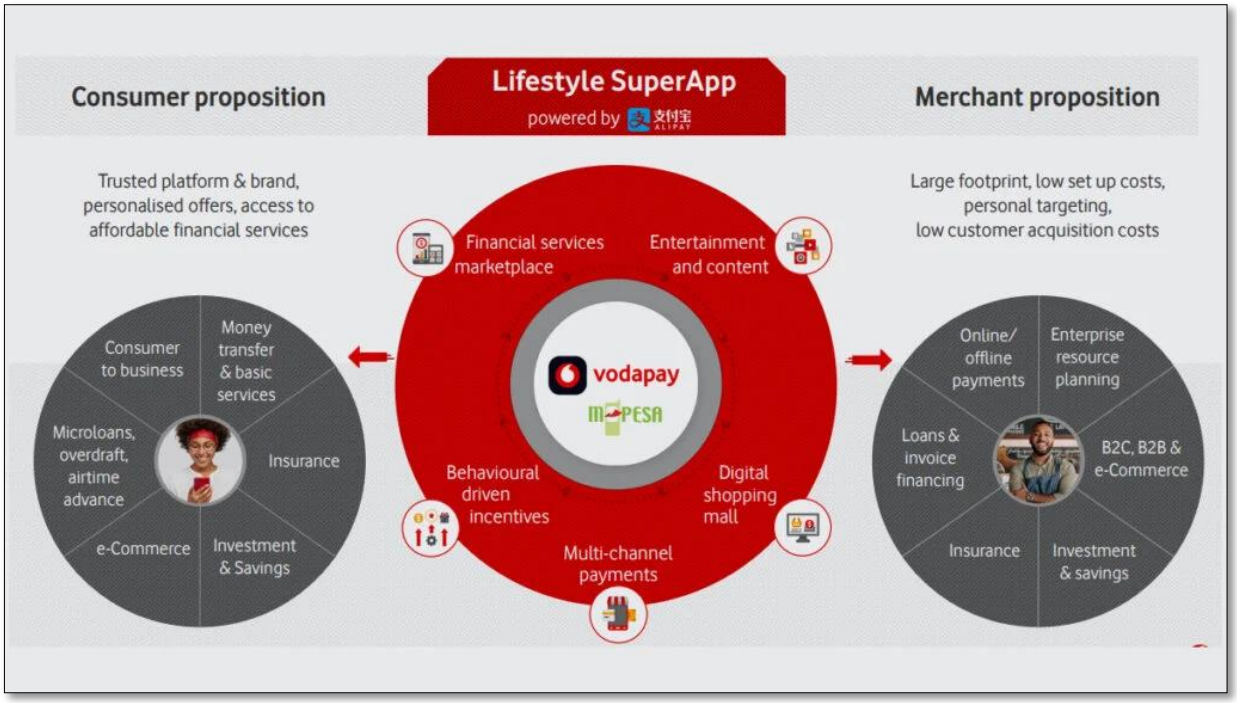

Figure 5:VodaPay Superapp

- **Nedbank Avo (South Africa) -** Nedbank Avo, by Nedbank, is a Superapp in South Africa that combines banking services with a range of lifestyle offerings. Nedbank Avo's anchor point lies in its comprehensive banking services, providing users with convenient access to their accounts, payments, transfers, and financial management tools. Building upon its anchor point, Nedbank Avo has expanded its offerings to include lifestyle features such as personalized offers, rewards, travel bookings, event tickets, and discounts from partner merchants. This integration of lifestyle services enhances the user experience, making Nedbank Avo an all-encompassing platform for financial and non-financial needs (Nedbank, 2021).

The above companies show how they have used the key characteristics of Superapps to diversify their business offerings using the core business offerings as the anchor point. In summary, having a solid core and moving to a Superapp result in the following benefits:

Enhancing User Experience—A strong anchor point allows Superapps to provide a seamless and convenient user experience, increasing user adoption and engagement. The Superapp becomes an indispensable user tool by offering a compelling core service, consolidating users' needs into a single platform. This simplifies users' daily lives, creates loyalty, and reduces the need to switch between multiple apps.

Leveraging Network Effects - A strong anchor point allows Superapps to benefit from network effects, where the platform's value increases as more users join. Superapps can leverage network effects to attract other businesses, service providers, and partners by focusing on a core service with a broad user base. This, in turn, leads to more diverse offerings and a richer experience for users. For example, in the case of VodaPay, as more users adopt the VodaPay platform for their payment needs, more merchants and service providers are incentivized to integrate with the app, expanding the range of offerings available to users. This virtuous cycle strengthens VodaPay position in the market. It creates a competitive advantage over other Superapps or standalone payment solutions.

Monetization Opportunities - A strong anchor point provides Superapps with various monetization opportunities. Superapp can leverage its user base and brand recognition to expand into other lucrative business areas by establishing a core revenue-generating service. This diversification of revenue streams reduces dependency on a single source of income. It strengthens the long-term sustainability of the Superapp. For example, in the case of Vodapay, by establishing a core payment service and diversifying into financial services, VodaPay can generate revenue through transaction fees, interest on savings accounts and loans, insurance premiums, and other financial products. This diversified revenue stream reduces dependence on a single source of income and ensures long-term sustainability.

Differentiation and Competitive Advantage - A strong anchor point enables Superapps to differentiate themselves from competitors and gain a competitive advantage. Superapp can establish a unique value proposition that sets them

apart by excelling in a core service. This differentiation attracts users and helps fend off competition, as it becomes challenging for competitors to replicate the entire ecosystem. Building upon its anchor point, VodaPay has expanded into additional financial services, such as savings accounts, microloans, insurance, and remittances. This diversification has enabled VodaPay to cater to the various financial needs of its users and become a significant market player providing digital financial services in South Africa.

2.3.5 Superapp and CIoT Integration

Creating a Superapp for CIoT helps solve the challenges, as highlighted in section 2.1.4. These challenges can be mitigated by consolidating multiple use cases into a single Superapp. A Superapp provides a unified and streamlined user experience, reduces complexity, and eliminates the need for users to manage and navigate through multiple apps. This cohesive approach enhances user adoption and engagement, simplifying accessing and controlling various CIoT functionalities within a single app.

A Superapp can effectively address the challenges of both CIoT and an MSP business model. It overcomes the chicken and egg problem by leveraging its existing user base to attract both sides of the platform simultaneously. The Superapp balances the interests of different participants, provides equal opportunities, and fosters fair competition. It combats competitive pressures by leveraging network effects, offering a wide range of services, and incentivizing users to stay within the platform. Additionally, it reduces multi-homing tendencies by providing a comprehensive suite of services, an exceptional user experience, and exclusive benefits.

2.4 Application of the Theory to CIoT Superapp

In this section, we look at the application of CIoT Superapp, including different user groups involved, such as consumers, developers, SOHOs and SMEs, and

their interdependencies within the platform ecosystem. We consider the potential network effects that can be generated and the mechanisms for value creation and capture within the Superapp ecosystem.

2.4.1 A Proposed Model for a CIoT Superapp Using MTN as the Platform Owner

2.4.1.1 The Role of MTN:

In the paper by Karapantelakis and Markendahl (2015), they proposed a conceptual model of a mobile network operator acting as a mediator in a two-sided market by leveraging the company's strengths to create an MSP business model. We expand on that model by leveraging the benefits of a Superapp, as highlighted in Chapter 2.3, to define a CIoT Superapp conceptual model using MTN SA.

MTN SA is a leading telecommunications company known for its extensive network infrastructure and diverse range of products and services. With a strong presence in South Africa, MTN SA is well-positioned to leverage its infrastructure and customer base to create a robust CIoT ecosystem (MTN, 2022). The proposed CIoT Superapp will use the current MTN SA offerings as an anchor point, which will be expanded to create a broader ecosystem. The app will enable users to connect, configure, and control their devices, creating a cohesive user experience for many use cases.

Collaboration with external partners will be essential to maximize the potential of the CIoT Superapp. Through partnerships and collaborations with SMEs, SOHOS, and Developers, MTN SA can provide customers with a one-stop solution for managing their IoT ecosystem. MTN can establish partnerships with third-party IoT service providers, enabling them to integrate their offerings into Superapp and expand its capabilities. Additionally, MTN can provide developers with APIs and tools to build and deploy their IoT applications within the ecosystem, fostering innovation and further enriching the user experience.

The CIoT Superapp will support seamless integration with IoT devices, including smart home appliances, wearables, and connected cars. Beyond any IoT services or devices provided solely by MTN, the CIoT Superapp will aggregate the partners' various services applicable to this market. This could include home security and monitoring, energy management, healthcare, smart transportation, and professional and other innovative services. Centralizing these services within the CIoT Superapp allows customers to easily subscribe, manage, and customize their preferences, fostering a personalized and holistic IoT experience.

2.4.2 Multi-Sided Platform Elements in MTN CIoT Superapp

MTN CIoT Superapp exhibits vital elements of a Superapp:

- **Core Services** – Its MoMo (Mobile Money), a financial service offered by MTN SA, provides users with a secure and convenient way to manage their finances using mobile devices (MTN, 2022). Key features include peer-to-peer transfers, bill payments, mobile recharge, merchant payments, and linking bank accounts for seamless transactions. MTN's robust network infrastructure and extensive coverage will ensure reliable connectivity for the IoT ecosystem. The Superapp will leverage MTN's network capabilities to provide seamless connectivity for IoT devices, regardless of location. This will enable customers to stay connected to their devices and services, even while on the move, ensuring a consistent and uninterrupted experience.
- **Buyers -** End-users or consumers are the individuals or organizations that utilize IoT devices and benefit from the MiniApps provided by the CIoT platform. They may include individuals using smart home devices, businesses implementing IoT solutions for improved operations, or industries leveraging IoT for monitoring and control purposes.
- **Sellers - CIoT services providers (SMEs/SOHOS)**: Companies that provide end-to-end CIoT use cases. They offer their MiniApps as a subscription model, which may or may not include a device.

- **Sellers - Device Manufacturers**: The companies or organizations responsible for designing, producing, and distributing physical IoT devices. They contribute to the ecosystem by creating a diverse range of connected devices that can collect and exchange data.
- **Complementors** - **Developers:** Developers play a crucial role in the CIoT ecosystem by creating applications that utilize the data generated by IoT devices. They leverage the platform's APIs, development tools, and resources to build innovative solutions that enhance the functionality and value of IoT devices.
- **Complementors** – **Other SMEs/SoHo's** – Companies who want to join the CIoT ecosystem, such as plumbers, electricians, or other consumer services providers. They will also collaborate with other businesses to create custom applications or integrate existing IoT solutions into their workflows. For example, if the homeowner wants to share the solution with a plumber, the selected provider will get a notification and come out and do a repair if a water leak is found. An example is shown in Figure 6.

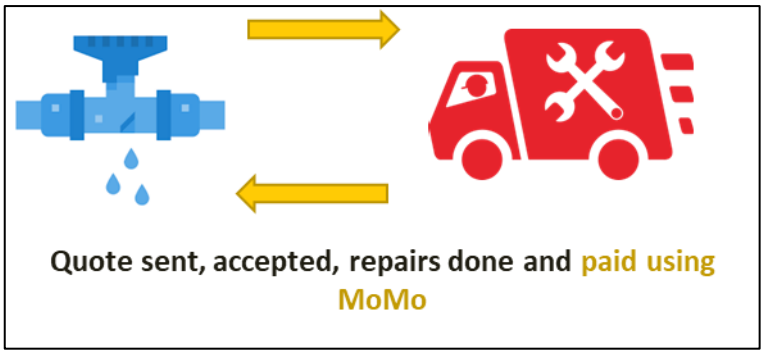

Figure 6: Services sent to a plumber.

The sellers and complementors sell their services in the Superapp created by the platform provider. The MTN CIoT Superapp will be offered as a service targeting their existing customer base, as shown in Figure 7 and Figure 8, with the anchor points being MTN financial, connectivity, and other company value-added services. They will also provide Superapp SDKs, which are Software Development Kits (SDKs) that include libraries, documentation, and tools specific to the MTN platform. These SDKs enable developers to access the platform's

features, APIs, and services, facilitating the development of applications and services while seamlessly integrating with the Superapp.

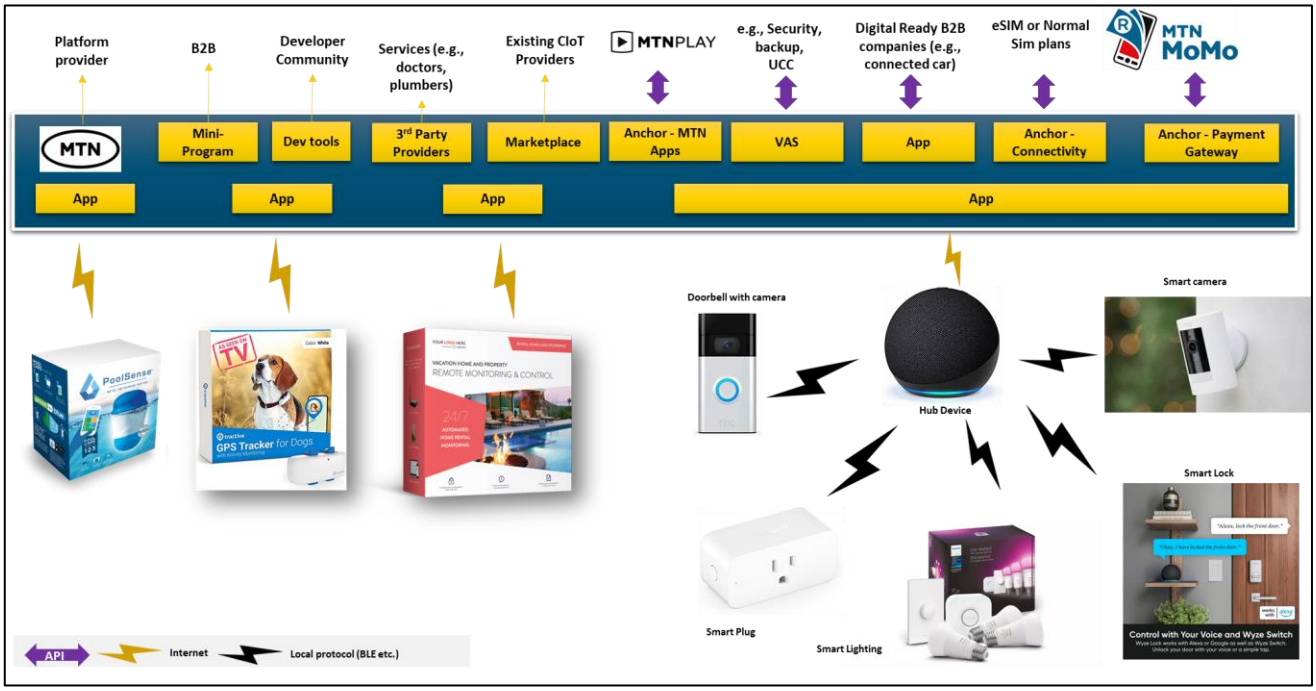

Figure 7: Example of MTN CIoT Superapp

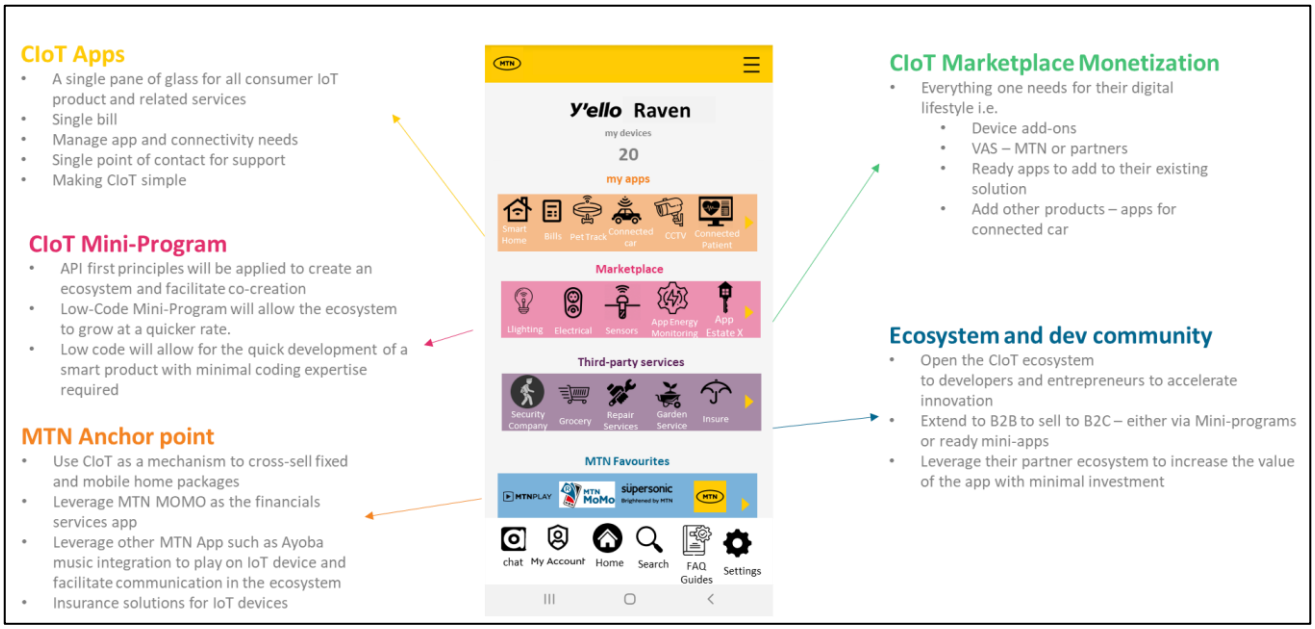

Figure 8: MTN CIoT Superapp

2.4.3 Value Creation and Capture

The chapter explores how a Superapp can create value for users within the CIoT ecosystem, such as MTN SA, consumers, developers, and businesses. Additionally, it examines the mechanisms for capturing value through monetization strategies and revenue models. We explore the application of Kotler's Five Product Levels to a CIoT Superapp in the context of value creation and value. Kotler's Five Product Levels is a model that helps businesses understand and deliver value to customers. The model consists of Core, Generic, Expected, Augmented, and Potential product levels. The Core level represents the fundamental benefit provided, while the Generic level includes differentiating features. The Expected level meets customer expectations, the Augmented level adds value beyond expectations, and the Potential level explores future innovations. By addressing these levels, businesses can create compelling products and services that exceed customer needs and stay ahead of the competition (Chen et al., 2022; Kloter, 1967; Rabkin, 2020). We use one of the use cases for CIoT, smart homes. By Applying Kotler's Five Product Levels, we consider each level a typical product construct when MTN SA is developing and marketing CIoT Superapp. We identify the core benefit of the CIoT, which will be provided, define unique features at the generic level, how we meet customer expectations at the expected level, add value through enhancements at the augmented level, and explore further ecosystem possibilities at the potential level.

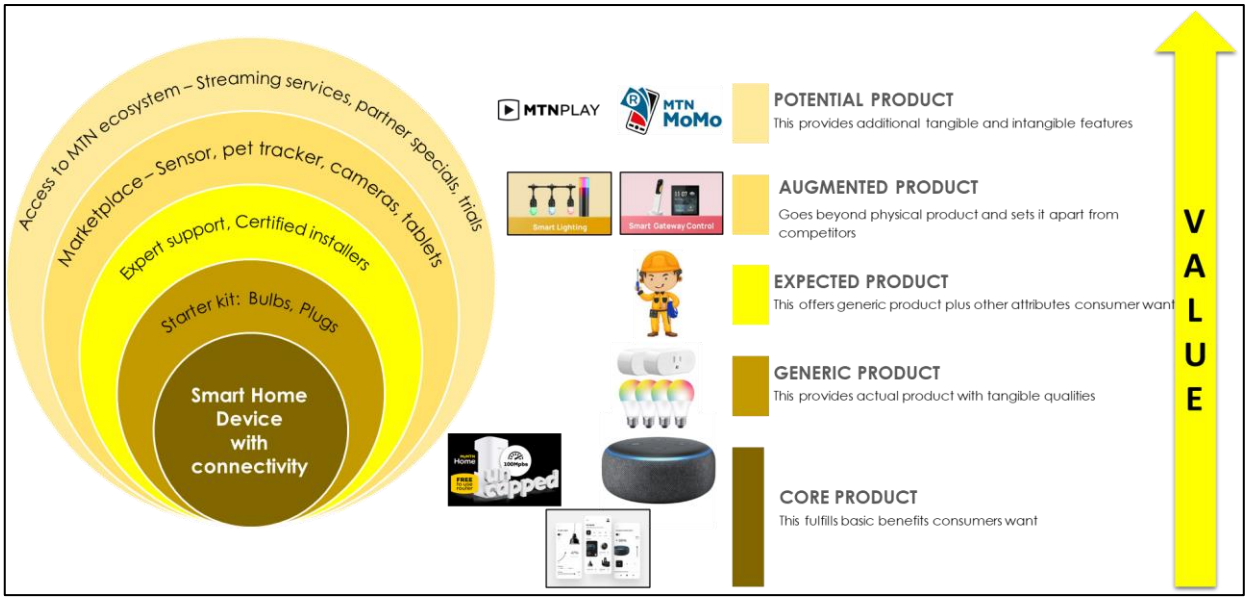

Figure 9: Building blocks of CIoT Product

2.4.3.1 Core Product Level: Connected Lifestyle Platform

The core product level of the CIoT Superapp is its connected lifestyle platform. It provides users a comprehensive solution to connect and control various IoT devices and services seamlessly. The core product creates value by enabling users to manage their smart devices, access personalized services, and integrate different aspects of their daily lives into a single, unified platform. The CIoT Superapp has many other use cases. One is the smart home, which bundles connectivity to MTN SA's core offering.

2.4.3.2 Generic Product Level: IoT Device Integration and Connectivity

The generic product level integrates and connects many IoT devices and services into the Superapp. This level creates value by providing a unified interface and seamless user experience. Users can easily add and manage their smart devices, including home appliances, wearables, security systems, and more, all within the Superapp ecosystem.

2.4.3.3 Expected Product Level: User-Friendly Interface, Convenience, and Third-Party Services

At the expected product level, the smart home ecosystem focuses on delivering a user-friendly interface, convenience, and access to third-party services. Users can easily control their smart devices through the ecosystem's intuitive interface, set up automation rules, and receive notifications.

2.4.3.4 Augmented Product Level: Personalization and Value-Added Services

The augmented product level involves personalization and value-added services within the Superapp ecosystem. MTN SA can leverage user data and preferences to offer tailored experiences, personalized recommendations, and customized automation. MiniApps for energy management, home security, health monitoring, and entertainment options can further enhance the value proposition for users, creating a differentiated offering within the ecosystem.

2.4.3.5 Potential Product Level: Ecosystem Expansion and Partnerships

The potential product level focuses on expanding the ecosystem and establishing partnerships. MTN SA can collaborate with third-party IoT device manufacturers, service providers, and other relevant stakeholders to offer an extensive range of products and services within Superapp. This level creates value by broadening the ecosystem, unlocking new functionalities, and enabling users to access a broader range of connected devices and services. By incorporating MTN's value-added services, such as MoMo, Ayoba, and MTN Play, at this level, the smart home ecosystem enhances convenience, offers seamless payment options, provides communication channels, and integrates entertainment options.

2.4.3.6 Value Capture

As highlighted in section 2.3.2, MTN SA can employ various strategies to capture value within the CIoT Superapp ecosystem. One such option is the potential to

unlock multiple revenue streams, starting with subscription and service fees, where customers can access premium features, value-added services, or enhanced customer support. Additionally, specific services such as home security monitoring, energy optimization, or personalized recommendations can be monetized through service fees.

Another significant revenue source comes from device sales and partnerships. The company can sell IoT devices directly through its platform or via collaborations with device manufacturers. This generates income from the sales of devices and allows the company to broaden its ecosystem through strategic partnerships, offering customers a more integrated experience. Data monetization presents a lucrative opportunity as well. By anonymizing and aggregating user data, the company can offer valuable insights to partners, third-party advertisers, market researchers, and other entities interested in understanding consumer behaviour and preferences within the ecosystem.

Advertising and sponsorship offer additional revenue avenues. Targeted advertising, tailored to user preferences and behaviour, enables advertisers to connect with a highly engaged audience, generating ad revenue for the platform. Moreover, exploring sponsorship deals with relevant brands and partners can introduce new income streams, further diversifying the company's revenue sources. At the same time, ecosystem partnership revenue in an MSP is a crucial growth area. Through collaborations with third-party service providers or integration with external platforms, the company can establish revenue-sharing agreements or earn referral fees. This not only expands the services available within the ecosystem but also provides a financial incentive for MTN SA to facilitate and promote transactions, significantly benefitting our target research market, which comprises SMEs, SOHOs, and developers.

The proposed CIoT Superapp, owned by MTN SA, can create value by offering a connected lifestyle platform, integrating IoT devices and services, providing a user-friendly interface and personalization, and expanding the ecosystem

through partnerships. Value can be captured through subscription and service fees, device sales, and data monetization.

2.4.4 Impact of CIoT and Superapps on SME/SOHOs or Developers in the South African Market

Participation in the proposed CIoT Superapp ecosystem presents many advantages for SMEs, SOHOs, and Developers. One of the foremost benefits is the access to a broader customer base. By integrating into the ecosystem, SMEs and SOHOs can connect with a larger pool of potential customers, leveraging the MTN SA CIoT Superapp's extensive user base. With MTN SA's current subscriber count at 36.5 million, even a minor fraction of these users engaging with the Superapp translates into significant exposure and market expansion opportunities, a feat challenging to achieve independently due to high customer acquisition costs and the time required to build similar network effects (MTN, 2022).

The ecosystem offers enhanced business prospects by allowing SMEs and SOHOs to directly market their products or services to a targeted audience within the CIoT Superapp, thereby increasing the potential for sales, partnerships, and collaborations. Seamless integration and interoperability with the platform and other IoT devices and services simplify the process for SMEs and SOHOs to incorporate their offerings, reducing development time and effort. Developers, in turn, benefit from the platform's existing infrastructure and APIs to create innovative MiniApps.

The opportunity to provide value-added services and customization further empowers SMEs and SOHOs within the CIoT Superapp ecosystem. They can tailor their services or develop specialized applications to meet the unique needs of specific user segments, differentiating their offerings and securing a competitive advantage. Additionally, the ecosystem encourages collaborative ventures, opening avenues for partnerships with other participants, including developers, service providers, and device manufacturers. These collaborations

can lead to co-creating solutions, sharing resources, exploring new market territories, and enhancing the capabilities and market positioning of SMEs and SOHOs.

Developers stand to gain from a comprehensive suite of tools, documentation, and support facilitated by the CIoT Superapp, streamlining the development process, enabling efficient troubleshooting, and ensuring ecosystem compatibility. MTN SA's ability to provide developer acceleration programs, Software Development Kits (SDKs), and platforms for knowledge exchange fosters a supportive community and enhances development efficiency.

SMEs, SOHOs, and Developers can derive revenue through direct sales, subscriptions, licensing, or revenue-sharing models. With the CIoT Superapp infrastructure supporting transactions, billing, and analytics, ecosystem participants can concentrate on delivering value and innovation while capitalizing on their investments, ensuring a sustainable and profitable engagement within the CIoT Superapp ecosystem.

2.4.5 Summary

The Superapp solves CIoT's pain points for customers, SME/SOHO, and Developers. With the CIoT Superapp, a company like MTN SA can create a win-win situation for all players in their CIoT ecosystem while solving the challenges associated with CIoT adoption, as shown in Figure 10. Solving CIoT pain points for customers and partners involves addressing their needs and providing valuable solutions. For customers, the focus is on ensuring safety, convenience, access to quality products and services, and simplified billing. Data privacy, secure networks, and easy payment options provide a safe and secure experience. All-in-one app connectivity and support streamline the user experience, while a single bill for all services simplifies billing.

For partners, addressing pain points involves offering secure cashless payment options and providing opportunities for scalability and growth. Increased visibility,

access to a new customer base, and an online sales channel enhance partner visibility and sales potential. Customer insights and data-driven marketing help partners identify upsell and marketing opportunities and drive product roadmap decisions. Lower costs through reduced transaction costs and operational expenses benefit partners, along with simplified business operations and tools for managing customer support and reconciliations.

By addressing these pain points, customers and partners can experience enhanced value and improved experiences within the MTN SA CIoT ecosystem.

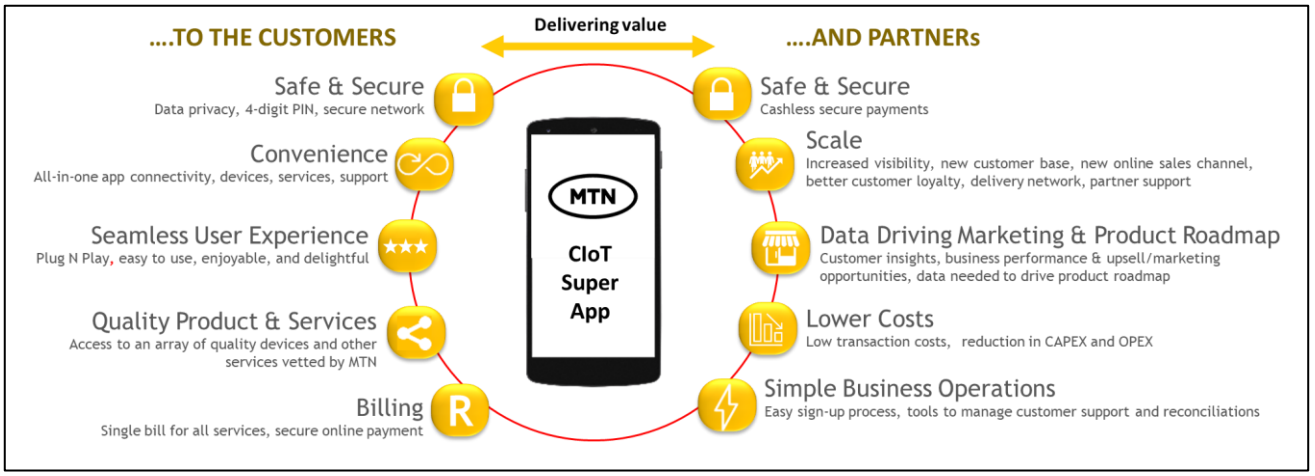

Figure 10: The value created by the MTN CIoT Superapp

2.5 Theory for validating the model of CIoT Superapp

2.5.1 Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) is a widely used theoretical framework that aims to understand and predict individuals' acceptance and adoption of new technologies. Developed by Davis (1989) in the 1980s, TAM has been extensively applied in various domains to explain the factors influencing users' intentions to use and adopt the technology. TAM is rooted in the broader field of behavioural sciences and draws upon theories such as the Theory of Reasoned Action (TRA) and the Theory of Planned Behaviour (TPB). It proposes that individuals' behavioural intentions are determined by their perceived usefulness

and perceived ease of use of technology. In his paper, Davis defined key Constructs of TAM, such as Perceived usefulness, while referring to an individual's belief that using a particular technology will enhance their job performance or daily activities. It assesses the extent to which a technology is perceived as beneficial and capable of improving efficiency, productivity, or effectiveness. He also included perceived ease of use, which refers to an individual's perception of the effort required to understand and use technology. It reflects the user's belief regarding the ease of learning, navigating, and interacting with the technology.

TAM proposes that perceived usefulness and perceived ease of use directly influence an individual's attitude toward using a technology, which, in turn, influences their intention to adopt and use the technology. Attitude serves as a mediating variable in the TAM model. Several factors can influence an individual's perception of a technology's usefulness and ease of use. These factors include eternal variables such as system characteristics, information quality, and user interface design that can influence perceived usefulness and ease of use. For a CIoT Superapp, seamless integration with IoT devices, an intuitive user interface, and reliable performance are crucial in shaping user perceptions. Individual differences such as users' prior experience, technological expertise, and personal characteristics can influence their perceived usefulness and ease of use. Familiarity with similar technologies or positive past experiences can enhance perceived usefulness. At the same time, technological anxiety or lack of confidence may affect ease of use perceptions.

TAM has been extensively applied in various domains, including e-commerce, healthcare, education, and the adoption of CIoT Superapps. By assessing users' perceived usefulness and ease of use, organizations can identify potential barriers to adoption, design user-centric interfaces, and develop targeted strategies to promote acceptance and adoption.

While TAM has proven to be a valuable framework, some criticisms highlight its limitations in capturing the complexity of user behaviour and the dynamic nature

of technology adoption. To address these concerns, researchers have proposed extensions to TAM, such as TAM 2 by Venkatesh and Davis (2000) and TAM 3 by Venkatesh and Bala (2008), incorporating additional factors and variables. TAM 2 expanded upon the original TAM by introducing additional elements such as social influence and cognitive instrumental processes. TAM 3, the most recent iteration, integrates new constructs such as hedonic motivation and habit formation.

The paper by Mahmud et al. (2022) provides a comprehensive literature review of the factors that affect consumer adoption of Internet of Things (IoT) technologies. The authors analyzed 87 publications from 13 conferences and 54 journals from 2014-2020. Among the articles reviewed, the TAM (Technology Acceptance Model) is the most frequently utilized model, with 40 papers. Following that, the UTAUT (Unified Theory of Acceptance and Use of Technology) is referenced in 23 papers, and the theory of planned behaviour (TPB) is mentioned in 8 papers. The study authors also developed a comprehensive model for CIoT adoption based on an analysis of the 12 most influential predictors. The top predictors identified were perceived ease of use, usefulness, trust, satisfaction, habits, perceived value, subjective norm, enjoyment, facilitating condition, performance expectancy, self-efficacy, and attitude. These predictors have consistently shown significance in the existing literature. The study also found that attitude mediates between perceived ease of use, perceived usefulness, and intention.

A recent paper by Salehi et al. (2023) examines the factors influencing the adoption and use of Superapps. The authors use the technology acceptance model (TAM) and the social construction of technology (SCOT) theory to develop a theoretical framework. The authors hypothesized that the quality, hedonic benefit, social benefit, and variety of services offered would influence the adoption and use of Superapps. The authors studied the Rubika Superapp in Iran, which offers a diverse range of digital services in a single package. It includes messaging, payments, shopping, entertainment, education, and other

features such as news and weather updates. One of the study's results showed that a diverse range of services within a Superapp is crucial for promoting adoption and usage. Offering a wide selection of services positively impacts user satisfaction and engagement. Therefore, it is recommended to prioritize providing various services within the Superapp to enhance its appeal and utility for users.

2.5.2 Unified Theory of Acceptance and Use of Technology (UTAUT)

The Unified Theory of Acceptance and Use of Technology (UTAUT) is a widely recognized theoretical framework that explains individuals' acceptance and adoption of new technologies. Developed by Venkatesh et al. (2003), UTAUT is an extensive theoretical framework that consolidates and expands upon multiple established theories on technology acceptance. By integrating elements from theories such as the Theory of Reasoned Action (TRA), the Technology Acceptance Model (TAM), the Theory of Planned Behavior (TPB), and the Innovation Diffusion Theory (IDT), UTAUT provides a comprehensive model that takes into account various factors that influence technology adoption. This integration allows a more comprehensive understanding of technology acceptance and usage complexities.

The Unified Theory of Acceptance and Use of Technology (UTAUT) identifies critical technological adoption components. Performance expectancy captures how technology enhances job performance, while effort expectancy focuses on ease of use. Social influence examines the impact of social factors on adoption and facilitating conditions considering organizational support. UTAUT also considers moderating factors like gender and experience. UTAUT has been extended to various domains and technologies, with UTAUT2 introducing constructs such as hedonic motivation.

2.5.3 Transaction costs economics

In economics, transaction costs play a crucial role in understanding the functioning of markets and organizations. Coined by Coase (1937) in his paper "The Nature of the Firm," published in 1937, transaction costs refer to the costs incurred in conducting economic transactions. Transaction costs encompass a broad range of costs associated with conducting economic exchanges. These costs arise due to various factors, including search and information costs, bargaining and negotiation costs, monitoring and enforcement costs, and costs related to establishing and maintaining contracts (Hansen Henten & Maria Windekilde, 2016). Transaction costs are not limited to monetary expenses but include time, effort, and other resources to facilitate transactions (Hansen Henten & Maria Windekilde, 2016). Transaction costs are vital in determining the success and efficiency of this intermediation process in MSPs (Hagiu & Wright, 2015). Platforms strive to reduce transaction costs for all parties involved, making transactions more accessible and affordable. By doing so, they create value and attract a more extensive user base (Hagiu & Wright, 2015; Hansen Henten & Maria Windekilde, 2016).

Cross-subsidization is a pricing strategy often employed by multi-sided platforms. It reduces transaction costs by subsidizing one user group while generating revenue from another (Kung & Zhong, 2017). This approach encourages participation, balances supply and demand, and lowers overall transaction costs (Fisher, 2019). Network effects, influenced by reduced transaction costs, play a significant role in multi-sided platforms (Hansen Henten & Maria Windekilde, 2016). As transaction costs decrease, platforms make it easier for users to find and engage with each other, thereby increasing the platform's value. This attracts more users, creating a positive feedback loop. Governance structures in multi-sided platforms are designed to minimize transaction costs by establishing reliable transaction environments (Martin et al., 2022). Reputation systems, dispute resolution mechanisms, and secure payment systems reduce transaction costs and foster trust among users (Nagle et al., 2020; Tadelis, 2016).

Transaction costs also impact platform competition. High transaction costs can act as barriers to entry, favouring established platforms. However, changes in transaction costs or technological advancements can disrupt the market, leading to the emergence of new platforms or the reshaping of existing ones. Understanding the role of transaction costs in multi-sided platforms provides valuable insights into their functioning, pricing strategies, network effects, governance, and competition (Hagiu & Wright, 2015). By considering transaction costs, we can better comprehend the dynamics and success of the proposed CIoT Superapp.

2.6 Research Model

2.6.1 Consumer

TAM was chosen as the model as it is the most widely used model for testing the adoption of CIoT products. In the next section, the TAM outlines the relationships between the key constructs when applied to consumers' adoption of a CIoT Superapp platform.

2.6.1.1 **Perceived Usefulness (PU)**

Perceived Usefulness is a fundamental construct in TAM and plays a vital role in users' technology adoption decisions. In the context of a CIoT Superapp platform, Perceived Usefulness refers to users' assessment of the benefits and value they expect to gain from using the platform. Including Perceived Usefulness in the conceptual model has enabled us to examine how users' perceptions of the platform's utility impact their attitudes and intentions to adopt and use it. When users perceive the CIoT Superapp platform as highly useful, they are more likely to recognize its potential to enhance their productivity, efficiency, and overall user experience.

Hypothesis 1: Perceived usefulness positively influences attitude.

2.6.1.2 **Perceived Ease of Use (PEOU)**

Perceived Ease of Use is a fundamental construct in TAM and plays a crucial role in users' technology adoption decisions. It refers to users' subjective assessment of how effortless they believe it is to use the CIoT Superapp platform.

Including Perceived Ease of Use in the conceptual model has enabled us to examine how users' perceptions of the platform's usability impact their attitudes and intentions to adopt and use it. When users perceive the CIoT Superapp platform as easy to use, they are more likely to believe that it requires minimal effort, is intuitive, and does not involve complex processes.

For example, suppose users find the CIoT Superapp interface intuitive, the navigation straightforward, and the interactions seamless. In that case, they are likelier to perceive it as easy to use.

Hypothesis 2: Perceived Ease of Use positively influences attitude.

We also consider the impact of Perceived Ease of Use on Perceived Usefulness by influencing users' perception of the CIoT Superapp platform as easy to learn, understand, and use. The below hypothesis is based on the understanding that users' perceptions of the ease with which they can interact with the platform impact their overall assessment of its usefulness. Suppose users find the CIoT Superapp platform user-friendly, intuitive, and effortless to navigate. In that case, they are more likely to believe that it provides value, meets their needs, and enables them to achieve their goals.

Hypothesis 3: Perceived Ease of Use positively influences the Perceived Usefulness of the CIoT Superapp.

2.6.1.3 **Platform Trust**

Perceived usefulness, as a central construct in TAM, is influenced by users' trust in the CIoT Superapp platform. A recent paper by Ngwenya and Ngoepe (2022) emphasizes the need for solid stakeholder trust in South Africa to facilitate the

rapid adoption of CIoT. Trust is a foundation for users' assessment of the platform's capabilities and benefits, increasing their perception of usefulness. Furthermore, users' trust in the CIoT Superapp platform also influences their attitude. Trust creates a positive perception of the platform's credibility and reliability, which, in turn, fosters a positive attitude toward using it. Users who trust the platform are more likely to have a favourable attitude toward using it, leading to a higher intention to adopt and use it.

Hypothesis 4: Platform trust positively influences perceived usefulness.

2.6.1.4 **Variety of services**

The variety of services is an essential factor influencing users' perceptions and adoption of the CIoT Superapp platform. When users encounter a platform that offers a wide range of services, it increases their perception of the platform's usefulness. Users value platforms that cater to multiple needs and provide comprehensive solutions.

For example, suppose the CIoT Superapp platform offers services such as smart home automation, health monitoring, transportation booking, entertainment streaming, and more. In that case, users are more likely to perceive it as applicable. The availability of these various services increases the utility and convenience offered by the platform, making it more appealing to users. Moreover, the variety of services aligns with the TAM framework. Perceived usefulness is a crucial determinant of users' attitudes toward technology use. When users perceive a CIoT Superapp platform as highly useful due to its variety of services, it positively influences their attitude towards using it, as stated in Hypothesis 1.

Hypothesis 5: A variety of services positively influences perceived usefulness.

2.6.1.5 **Perceived critical mass.**

The success of MSPs heavily relies on achieving critical mass, wherein enough users on each side of the platform create network effects that drive adoption and value creation. In a paper by Lou et al. (2000), the authors proposed an external variable perceived critical mass to the original TAM model. The author's study showed that perceived critical mass influences perceived usefulness and ease of use. We, therefore, use the critical mass component in our model, which emphasizes the threshold level of user participation necessary to trigger network effects and create value on the platform. It incorporates factors such as the number of users, activity levels, and user heterogeneity as key elements influencing the attainment of critical mass. Based on the conceptual model, the following hypotheses are proposed to explore the relationship between critical mass, TAM constructs, and CIoT Superapp adoption.

Hypothesis 6: A positive relationship exists between perceived critical mass and perceived usefulness of the CIoT Superapp. A more extensive user base on each side of the platform contributes to individuals' perception that the Superapp is more helpful in achieving their goals.

Hypothesis 7: Perceived critical mass positively influences individuals' perceived ease of use of the Superapp. A more extensive user base on each side of the platform leads to a perception of more accessible interactions, higher transaction opportunities, and reduced complexity, enhancing the ease of use.

2.6.1.6 **Perceived cost**

Perceived cost plays a crucial role in shaping users' intentions and decisions, as highlighted in a paper by Park et al. (2018). The platform offers different business models, such as commission-based, subscription-based, or advertising-based, reducing the overall transaction costs one expects to pay. These transaction costs are a subset of perceived costs and relate specifically to the expenses associated with conducting transactions within the CIoT Superapp platform. These transaction costs could include fees, charges, the time required, the effort

needed to complete transactions, and the complexity involved in the process. When the perceived cost is high, it can weaken the intention to use the app even with a positive attitude. Conversely, when the perceived cost is low, a positive attitude is more likely to result in a stronger intention to use the app. Perceived cost is a moderator that affects the relationship between attitude and intention to use.

Hypothesis 8: The relationship between attitude and intention to use the CIoT Superapp is moderated by perceived cost, such that the influence of attitude on intention to use will be more substantial when the perceived cost is low compared to when the perceived cost is high.

2.6.1.7 **Attitude**

This construct represents users' overall positive or negative evaluation of the CIoT CIoT Superapp platform. It is influenced by their perceptions of usefulness and ease of use.

Hypothesis 9: Attitude towards using the CIoT Superapp positively influences intention to use.

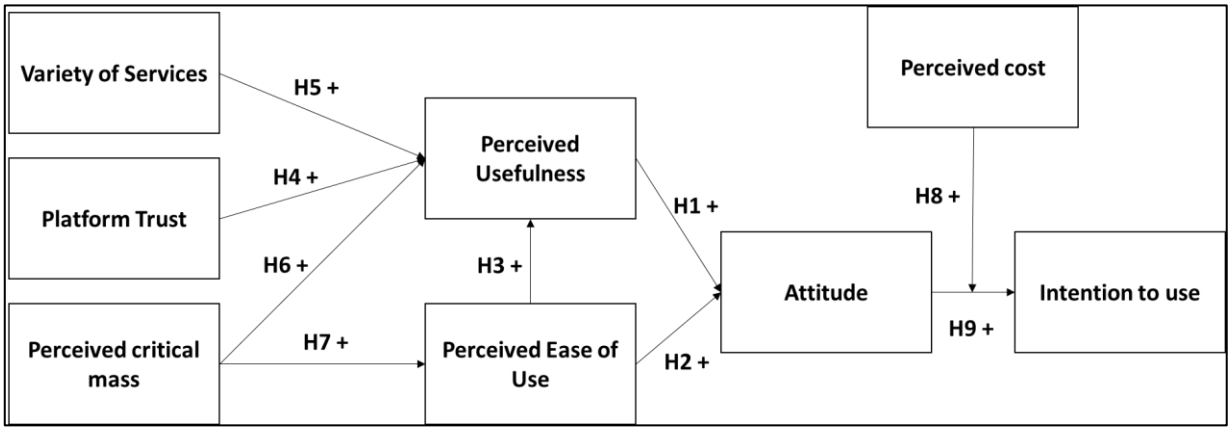

Figure 11: Consumer research model - Demand Side

2.6.2 SME/SOHO and Developer

For the supply side of the platform, we use the constructs from TAM, modifications of TAM based on proposed extensions, and the combination of

transaction theory to explain the adoption of a Superapp platform by SME/SOHO/Developers. The study explored the perceptions of SME/SOHO/Developers regarding the platform's usefulness, ease of use, critical mass, reputation, governance, openness, perceived barriers, and transactional benefits based on the proposed model outlined in Chapter 2.4.

These factors significantly impact the decision-making process of SMEs, SOHOs, and Developers regarding their engagement with the CIoT Superapp platform. The qualitative insights from these factors were used to answer the research questions proposed in section 1.4 as they collectively contribute to understanding the motivations and considerations of potential platform participants.

2.6.2.1 **Perceived Usefulness (PU)**

The extent to which SMEs, SOHO businesses, and Developers perceive that joining a multi-sided platform will provide benefits such as increased market reach, access to new customers, cost savings, resource pooling, and enhanced collaboration opportunities.

2.6.2.2 **Perceived Ease of Use (PEOU)**

The degree to which SMEs, SOHO businesses, and Developers perceive the multi-sided platform to be user-friendly, easy to understand, and easy to integrate into their existing workflows.

An easy-to-use CIoT Superapp platform simplifies tasks, improves efficiency, enhances user satisfaction, and promotes adoption and continued usage. When the platform is perceived as easy to use, it strengthens the perception of usefulness, making it more appealing for SMEs/SOHOs and Developers to join and actively engage.

2.6.2.3 **Perceived critical mass.**

Critical mass refers to the minimum number of users required to create a self-sustaining ecosystem within a CIoT Superapp platform. For SMEs/SOHOs and

Developers, joining a platform with a critical mass of users offers several benefits. Firstly, it increases market reach, allowing them to access a more extensive customer base. Secondly, it facilitates customer acquisition, as users already present on the platform can discover and engage with their products or services. Additionally, the network effects generated by a critical mass of users enhance the competitive advantage and partnership opportunities for SME/SOHO and Developers.

2.6.2.4 Platform Reputation

The reputation of the multi-sided platform, including its trustworthiness, reliability, and security, positively influences the decision of SMEs, SOHO businesses, and Developers to join.

2.6.2.5 Platform Governance

Strong governance practices, including data privacy and security, trust and reliability, dispute resolution, and platform updates, enhance the perceived usefulness of a CIoT Superapp platform for SME/SOHO and Developers. Robust governance measures instil confidence regarding data protection, foster trust in reliable interactions, provide effective dispute-resolution mechanisms, and facilitate access to updated features and innovations. These aspects contribute to the perception of the platform's usefulness in terms of secure transactions, building relationships, and accessing competitive services.

Governance practices, including clear guidelines and policies, user-friendly interface design, and training and support provision, enhance the perceived ease of use for SME/SOHO and Developers on a CIoT Superapp platform. Well-defined governance provides explicit instructions, promotes usability standards, and offers resources to overcome challenges, reducing cognitive effort and enhancing the ease of use.

2.6.2.6 Openness

Openness refers to the extent to which a CIoT Superapp platform allows external developers and third-party service providers to integrate their services, applications, or functionalities into the platform ecosystem. It represents the platform's flexibility and support for external innovation, which can attract developers and enhance its value proposition.

2.6.2.7 Perceived Barriers

The perceived barriers, such as the complexity of the platform, high switching costs, lack of technical expertise, and concerns over data privacy, negatively affect the decision of SMEs, SOHO businesses, and Developers to join a multi-sided platform.

2.6.2.8 Transactional Benefits

This construct, derived from transaction economics, encompasses the benefits SMEs/SOHOs and Developers gain from participating in the CIoT Superapp platform. It includes increased market reach, customer acquisition, transaction facilitation, reduced transaction costs, and access to value-added services.

3 RESEARCH METHODOLOGY

3.1 Research Philosophy and Design

The proposed research philosophy for the study on the commercial potential of Superapps in the CIoT ecosystem within South Africa was based on pragmatism. Pragmatism is an approach that emphasizes the practicality and usefulness of research, focusing on real-world implications and problem-solving (Saunders et al., 2010). It recognizes the value of both quantitative and qualitative methods. It seeks to integrate them to understand the research topic comprehensively (Saunders et al., 2010).

Quantitative Study (Consumer Market):

In line with the pragmatic research philosophy, the quantitative study aimed to provide practical insights into the commercial potential of a CIoT Superapp in the South African consumer market. The survey-based approach was designed to collect data from a large sample of consumers, focusing on critical constructs defined in section 2.6.1. The survey questionnaire was developed based on the extension of the TAM framework. It included a five-point Likert scale questionnaire to measure participants' perceptions, attitudes, and intentions related to the CIoT Superapp. The study generated practical knowledge about adopting a CIoT Superapp by analyzing the quantitative data using statistical techniques.

Qualitative Study (SME/SOHO/Developer Market):

The qualitative study, conducted within the pragmatist framework, focused on understanding the perspectives, challenges, and opportunities of the SME/SOHO/Developer market regarding Superapps in the CIoT ecosystem. It was based on a qualitative phenomenological design. Phenomenology is a qualitative research method focusing on an individual's experiences. It goes beyond quantitative approaches by allowing for a deeper exploration of personal

perspectives, meanings, and interpretations of the phenomenon. By considering individual experiences, phenomenology provides insight that quantitative methods often overlook, contributing to a deeper understanding of the research topic (Saunders et al., 2010).

In-depth interviews were conducted with representatives from SMEs, SOHOs, and Developers to gain rich insights into their experiences, motivations, barriers, and expectations. The qualitative data collected was analyzed thematically to identify practical themes, issues, and insights that can inform decision-making and strategy development for stakeholders in the CIoT market. The TAM-based construct in section 2.6.2 based on the conceptual model defined in section 2.4 was used to guide the research questions to determine the adoption of the CIoT Superapp among SMEs/SOHOs and developers.

A key aspect of pragmatism is integrating different research methods to provide a more comprehensive understanding. In this study, the quantitative and qualitative data were integrated to derive practical insights into the commercial potential of Superapps in the CIoT ecosystem. By comparing and contrasting the findings from both studies, the research yielded a nuanced understanding of consumer behaviour, market demand, and the experiences of SMEs, SOHOs, and Developers. This integration enabled the researchers to develop practical recommendations for the commercial viability of a Superapp in the South African CIoT market.

The pragmatic research philosophy ensured that the study focuses on real-world applicability and addresses stakeholders' needs and concerns. By considering both quantitative and qualitative perspectives, the research provided a well-rounded view of the commercial potential of Superapps, leading to insights for creating a Superapp with the South African CIoT ecosystem.

3.1.1 Advantages and disadvantages of the approaches

When conducting an online survey, one must consider its advantages and disadvantages. It offered a cost-effective strategy compared to other data collection methods, reducing the time and resources required for data collection. The online survey enabled the researcher to reach a wide range of respondents and gather essential data within a shorter time frame (Saunders et al., 2010). This was particularly beneficial for studying the commercial potential of a Superapp in a rapidly evolving technology-driven market like CIoT.

The quantitative survey design offered several advantages for investigating the commercial potential of Superapps in the consumer market. Firstly, it allowed for generalizability, as a large sample could be surveyed, providing insights that could be applied to a broader population. The design also offered efficiency in data collection, as the survey was administered to multiple respondents simultaneously, saving time and resources. Furthermore, the quantifiable nature of the data collected through surveys enabled statistical analysis, facilitating the identification of trends, correlations, and predictive relationships.

However, the quantitative survey design had limitations. One disadvantage is the limited depth of understanding. The survey typically relied on pre-determined response options and closed-ended questions, which may not have captured the richness and nuances of individual experiences and perspectives (Saunders et al., 2010). While the survey excelled at collecting specific data points, it may not have provided a comprehensive understanding of the underlying reasons and motivations driving these preferences and behaviours.

The qualitative phenomenological design offered a unique advantage in exploring the commercial potential of Superapps in the SME/SOHO/Developer market. One significant advantage is the richness of data it provides. The phenomenological interviews allowed for open-ended questioning and an in-depth exploration of individual experiences, enabling researchers to uncover detailed and context-specific insights (Bevan, 2014). This design also facilitated

a depth of understanding, as it allows for exploring underlying motivations, challenges, and opportunities that influence the adoption and usage of Superapps in this market segment. Additionally, phenomenology emphasized the importance of understanding experiences within their specific contexts, allowing for a holistic understanding of the commercial potential of Superapps in the SME/SOHO/Developer market.

Nevertheless, the qualitative phenomenological design has limitations. One disadvantage is the limited generalizability of findings. The phenomenological study involved a small sample size, which may limit the applicability of the findings to the broader population. Additionally, interpreting data in phenomenology relies on the researcher's subjective analysis, introducing the possibility of bias (Saunders et al., 2010). Furthermore, conducting in-depth interviews, transcribing, and analysing qualitative data was time-consuming and resource-intensive, posing time and resource management challenges.

By combining the advantages of the quantitative survey design and the qualitative phenomenological design, the researcher could overcome some of the limitations of each approach. The quantitative survey design provided generalizable and quantifiable insights into consumer preferences and behaviours. In contrast, the qualitative phenomenological design offered an in-depth and contextual understanding of the experiences and motivations of SMEs, SOHOs, and Developers. Integrating these approaches provided a more comprehensive and nuanced understanding of the commercial potential of Superapps in the South African CIoT ecosystem.

3.2 Data collection methods

A combination of data collection methods was employed to gather the necessary data for investigating the commercial potential of Superapps in the CIoT ecosystem within South Africa, which focused on the consumer and SME/SOHO/Developer market. This included quantitative surveys for the

consumer market and qualitative interviews for the SME/SOHO/Developer market. The choice of methods for data collection was driven by the research objectives and the need to gather specific types of data to answer the research questions. The quantitative survey method was appropriate for the consumer market as it allowed for the collection of large-scale data from a representative sample. On the other hand, the qualitative interview method was chosen for the SME/SOHO/Developer market as it allows for a more in-depth exploration of experiences and perspectives from experts in the industry.

An online survey was the primary data collection method for the consumer market. Its convenience, efficiency, and ability to reach a broad sample size drive this methodological choice (Saunders et al., 2010). The online survey was done using a five-point Likert scale to assess participants' attitudes, perceptions, and preferences related to the commercial potential of the Superapp. The survey consisted of structured questions allowing participants to rate their agreement or disagreement with specific statements, capturing their opinions on various aspects per the constructs created in section 2.6.1 and the proposed conceptual model defined in section 2.4. The online survey method offered several advantages for this study. Firstly, it allowed for data collection from many participants, providing a broader representation of consumers in the CIoT market. This enhanced the generalizability of the findings and allowed for a more comprehensive understanding of the commercial potential of the CIoT Superapp. Additionally, the online survey method was cost-effective and efficient, eliminating the need for face-to-face interactions or physical distribution of questionnaires. Participants could conveniently access and complete the survey at their convenience, increasing the likelihood of higher response rates.

In-depth interviews were conducted to gather qualitative data from the SME/SOHO/Developer market. These interviews allowed for open-ended questioning using the questions created from the TAM construct based on the conceptual model proposed, as described in sections 2.6.2 and 2.4. The semi-structured interviews provided a framework for the discussion while allowing

flexibility for participants to share their unique insights and narratives. The interviews were done through an online platform, which was based on participants' preferences and availability.

The researcher gathered a comprehensive range of data using quantitative and qualitative methods, incorporating numerical and narrative perspectives. This mixed methods approach ensured a more holistic understanding of the commercial potential of Superapps in the South African CIoT ecosystem, addressing the research questions and objectives from multiple angles.

3.3 Population and sample

The population for this study consisted of two distinct groups: consumers and SME/SOHO/Developers, who are the potential users of the CIoT Superapp platform in South Africa. It allowed for the perspectives and insights from both user groups, enabling a holistic evaluation of the platform's viability and effectiveness in creating a multi-sided platform-based ecosystem.

- Consumers: The sample included individuals interested in using the Superapp for daily activities, such as managing household IoT devices, accessing various services, and making transactions. Sampling for the consumer population was conducted using convenience sampling. Convenience sampling offered several advantages in terms of accessibility, time, and cost efficiency for studying the commercial potential of a CIoT Superapp in the South African market (Saunders et al., 2010). First, convenience sampling allowed the researcher to include participants who were easily accessible and readily available to participate in the survey (Saunders et al., 2010). This is particularly beneficial when reaching a large and diverse consumer population, which may be challenging due to geographical constraints or limited resources for extensive recruitment efforts. By selecting participants who are easily

accessible, the study ensured a more efficient data collection process (Saunders et al., 2010).

- Additionally, convenience sampling is a time—and cost-effective approach. It enables the researcher to collect data quickly and with minimal resources, making it suitable for exploratory studies with limited time and budget. Compared to other sampling methods that require extensive planning, coordination, and financial resources, convenience sampling is a practical solution for data gathering (Saunders et al., 2010).
- SME/SOHO Developers: The SME/SOHO developer population comprises individuals or businesses that develop and provide IoT services or applications on the CIoT Superapp. Sampling for this population was done using a purposive sampling technique, targeting SME/SOHO developers actively engaged in the CIoT market (Saunders et al., 2010). They were identified through the researcher's extended network.

3.4 The research instrument.

An online questionnaire was used to gather data from consumers. At the same time, person-to-person interviews were conducted with SME/SOHO/developers, aligning with the research questions and theoretical framework.

3.4.1 Quantitative Consumer Survey

Part 1: Demographic Information:

The questionnaire included only age and location; no other factors were considered. This approach was utilized to expressly exclude participants under 18 and not located in South Africa.

Part 2: Consumer Perspectives on Superapps:

The instrument was designed to collect data on key constructs derived from the Technology Acceptance Model, including Perceived Usefulness, Perceived Ease

of Use, Platform Trust, Variety of Services, Perceived Critical Mass, Perceived Cost, Attitude, and Behavioral Intention to Use as defined in section 2.6.1. The questionnaire included these constructs as separate sections, each with relevant Likert-scale questions aligned with the conceptual model and hypotheses. The Likert scale ranged from "strongly disagree" to "strongly agree," allowing respondents to indicate their agreement or disagreement with each statement.

The survey was designed to be short and easy to complete. A brief introduction to the CIoT Super app was added to the study. The introduction provided an overview of the CIoT Superapp, its features, and its benefits. It allowed respondents to learn more about the CIoT Superapp and decide whether they would be interested in using it.

3.4.2 Qualitative SME/SOHO/Developer Interview

The interviews were done using Microsoft Teams, an online video conferencing platform. The questions were prepared as open-ended to capture more detailed insights from respondents using a semi-structured interview format. It focused on the constructs created in section 2.6.2 and the proposed conceptual model outlined in section 2.4. These measures aimed to gain in-depth insights into SMEs/SOHOs/Developers' perceptions of the usefulness and ease of use of the platform, the influence of critical mass, platform reputation and governance practices, the openness of the platform for integration, perceived barriers to adoption, and the transactional benefits gained from participating in the platform.

In summary, the mixed-method approach allowed for a comprehensive understanding of the adoption and usage of Superapps in the South African CIoT ecosystem. The quantitative data from consumers provided numerical insights and statistical analysis. On the other hand, the qualitative data from SMEs/SOHOs/Developers offered rich, descriptive information and detailed perspectives, allowing for a deeper exploration of their experiences, challenges, and motivations.

Combining quantitative and qualitative methods enabled the researcher to gather a holistic understanding of the commercial potential of Superapps.

3.5 Procedure for data collection

3.5.1 General

A short introduction section explained what a CIoT Superapp is to consumers and SME/SOHO/Developers based on the conceptual model defined in Chapter 2.4. For consumers, it highlighted how a CIoT Superapp combines various IoT devices and services into a single, user-friendly platform. It emphasized the app's essential features, such as convenience, connectivity, and enhanced control over their smart home or lifestyle. For SMEs/SOHO/Developers, the researcher used the introduction to explain how a CIoT Superapp provides a multi-sided platform to connect their products or services to a larger ecosystem, reach more customers, and explore collaborative opportunities. It emphasized the potential for increased market reach, the concept of MiniApps, cost savings, access to developer tools, new innovative products and business models and the potential for new partnerships.

3.5.2 Consumer Data Collection:

The survey was designed using a reputable survey platform named Qualtrics to reach many respondents efficiently.

The survey was pilot-tested to ensure that it was easy to use and that the questions were practical. The survey was revised based on pilot test findings to enhance quality. The final survey was distributed online through email and social media based on the targeted sample population. A cover letter was included to introduce the study and its purpose.

In summary, the process followed was:

- The researcher created a survey instrument and a cover letter using Qualtrics.
- The researcher pilot-tested the survey instrument to ensure that it was easy to complete and that the questions were practical.
- The researcher made the necessary revisions to the survey instrument based on the pilot test results.
- The researcher then distributed the survey instrument to consumers.
- The researcher then collected the survey data and uploaded it into SPSS for statistical analysis.

3.5.3 SME/SOHO/Developer Data Collection:

Semi-structured interviews were conducted with SMEs/SOHOs and Developers. Depending on the participants' availability and preferences, the interviews were conducted via videoconferencing. A purposive sampling technique was utilized to select participants who have direct experience with the CIoT market and can provide valuable insights. The interviews were audio-recorded with participants' consent to ensure accurate data capture.

3.6 Data Analysis Strategies and Interpretation

3.6.1 Consumer Method

The collected survey data was cleaned and prepared in the data analysis and interpretation phase. This involved ensuring accuracy and consistency, checking for missing values, and response inconsistencies.

Descriptive statistics was used to summarize the data and provide an overview of critical variables. Measures of central tendency (mean and median) and dispersion (standard deviation and range) were calculated.

Regression analysis was used to test the hypotheses based on the relationships outlined in the research model in section 2.6.1. For example, the independent variables such as Perceived Usefulness, Perceived Ease of Use, Platform Trust, Variety of Services, and Perceived Critical Mass were used to predict Attitude and Intention to Use as dependent variables (Meintjes et al., 2021). The moderation effect between attitude and perceived cost was analyzed by assessing the significance and magnitude of the coefficient for the interaction term in regression analysis. A positive and significant interaction term suggests that the influence of attitude on intention to use is more substantial when the perceived cost is low. In contrast, a negative and significant interaction term indicates a weaker influence when the perceived cost is high (Gou). This highlighted the role of perceived cost in moderating the relationship between attitude and intention, shedding light on how cost perception can enhance or weaken the impact of attitude on users' adoption and usage of the CIoT Superapp platform. The regression coefficients and their significance were interpreted to determine the strength and direction of the relationships. Statistical tests were employed to evaluate the importance of the regression results.

The findings from the regression analysis were interpreted within the context of the research model. The strength and significance of the relationships between the independent and dependent variables were examined.

3.6.2 SME/SOHO/Developer Method

The qualitative study used thematic analysis to provide valuable insights and answer the research question. Thematic analysis is a method of identifying, analyzing, and reporting patterns or themes within qualitative data. The thematic analysis involved systematically coding and identifying themes or patterns within the collected data. Analyzing data involved multiple stages, such as becoming familiar with the data, creating initial codes, identifying themes, reviewing and refining those themes, and ultimately defining and labelling them. Thematic analysis was utilized to identify relevant themes related to the research question

and the constructs of interest based on the research framework. For example, themes emerged related to the perceived benefits and drawbacks of joining a Superapp platform, participants' views on the user-friendliness and integration of the platform into their workflows, perceptions of the platform's critical mass and reputation, experiences with platform governance and openness, and barriers perceived by participants. Once the themes were identified, the researcher interpreted and analyzed the data within each theme to gain a deeper understanding of participants' perspectives and experiences. This involved examining the relationships between themes, identifying variations or contradictions within the data, and providing detailed descriptions and explanations of participants' viewpoints. The researcher also uses quotes or examples from the data to support their interpretations and provide evidence of the themes identified. By conducting a thematic analysis of the qualitative data, the researcher could comprehensively understand the factors influencing the adoption of a Superapp platform by SMEs/SOHOs and Developers. The analysis generated themes from the data, shedding light on participants' perceptions of the platform's usefulness, ease of use, critical mass, reputation, governance, openness, barriers, and transactional benefits. The findings helped answer the research questions by providing insights into potential platform adopters' key considerations, motivations, and concerns.

In the discussion and conclusion section, the implications of the findings are discussed with the research objectives and hypotheses. The results are interpreted within the context of the research model and the CIoT Superapp's commercial potential in the South African market. Limitations in the study are addressed. Recommendations for future research and practical implications based on the results are provided.

3.7 Quality Assurance

3.7.1 Consumer Model

External validity refers to the extent to which the findings of a study can be generalized or applied to a larger population or different contexts (Saunders et al., 2010). In the context of this study, external validity was essential to determine the extent to which the findings about the commercial potential of a Superapp in the South African market can be generalized to other similar markets or regions. It was crucial to carefully select the sample of consumers to ensure representativeness and diversity in demographics, geographic locations, and industry sectors. By doing so, the study could enhance external validity and increase the likelihood of the findings applying to a broader population of consumers and Developers in the South African market and potentially other similar markets.

Reliability refers to the consistency and stability of a study's measurements or data collection methods (Saunders et al., 2010). Establishing reliability was important in this study to ensure that the data collected from consumers were accurate and dependable.

To achieve reliability, standard, and validation, the study utilized established and validated measurement scales or questionnaires to assess perceived usefulness, perceived ease of use, platform trust, and attitudes. These scales have demonstrated reliability and validity in previous research to ensure consistency in measurement. However, the researcher edited the wording to match the study context. To further enhance reliability in data collection, Cronbach's Alpha coefficient was used to measure internal consistency (Al-Husamiyah & Al-Bashayreh, 2022; Saunders et al., 2010). Cronbach's Alpha assessed the extent to which the items within a scale or questionnaire are interrelated and measure the same underlying construct (Al-Husamiyah & Al-Bashayreh, 2022).

Calculating Cronbach's Alpha for each construct measured in the study indicates the instrument's reliability.

3.7.2 SME/SOHO/Developer Model

Transferability means the study's findings can be applied to similar contexts or settings outside the South African market (Saunders et al., 2010). The study provided a detailed description of the research methodology and participant details used in the research, which will enable other researchers to assess the applicability of the findings and identify similarities and differences in various contexts.

Dependability relates to the reliability and consistency of the study's findings (Saunders et al., 2010). In ensuring reliability, detailed documentation was done (including coding decisions, thematic development, and interpretations)

Credibility refers to the believability and trustworthiness of the study (Saunders et al., 2010). To establish credibility, we must reflect on our biases, be transparent about our positionality and potential conflicts of interest and involve participants in member checking to ensure accuracy and alignment with their experiences. Our study enhanced credibility through various means, including interviews with participants from diverse backgrounds and roles in the CIoT ecosystem and seeking participant feedback to validate interpretations.

Confirmability relates to the objectivity and neutrality of the study's findings (Saunders et al., 2010). To enhance confirmability, it is essential to maintain a clear and comprehensive audit trail of the research process and seek external input through peer review. In our study, confirmability was achieved by acknowledging and addressing the researcher's perspectives and potential biases and maintaining an audit trail to demonstrate the transparency and accountability of the research process.

3.8 Ethical considerations

This study implemented several ethical considerations to ensure participants' protection and rights. Firstly, informed consent was obtained from potential participants before their involvement in the study. They were provided with a comprehensive and transparent explanation of the study's purpose, and informed consent forms were sent to interview participants. At the same time, for the online survey, a screening question was added to document their voluntary participation agreement. This process ensures that participants clearly understood their involvement and allowed them to make an informed decision about their participation.

Data storage and retention were handled carefully and in compliance with the Protection of Personal Information Act (POPIA). Any personal data collected during the study was securely stored and retained only for the duration necessary to fulfil the research objectives and legal requirements. Once the retention period expires, personal information will be safely disposed of following the guidelines outlined in POPIA, guaranteeing the protection of participants' data.

Confidentiality and anonymity were strictly maintained throughout the study. Any personal identifiers were removed from the collected data during the analysis phase to ensure the anonymity of participants. The data was reported in aggregate form, meaning individual responses were not linked to specific participants for the online survey. In contrast, pseudo-names were created for the interview participants. Additionally, data was securely stored and accessible only to authorized researchers, ensuring the confidentiality of participants' information.

Voluntary participation is a fundamental aspect of this study. Participants were assured that they could opt out at any point without encountering adverse repercussions. The voluntary participation and withdrawal process was communicated and emphasized to ensure that participants felt comfortable and empowered in their decision-making throughout the study.

The research underwent a thorough review by the Wits University Ethics Committee to ensure ethical compliance. The detailed WBS ethics form was completed and submitted for approval before the data collection began. This process ensured an independent evaluation of the study's ethical implications and safeguards, reinforcing the commitment to conducting the research with integrity and respect for ethical guidelines.

4 PRESENTATION OF RESULTS

4.1 Introduction

The investigation is methodologically divided into two phases: a quantitative analysis and a qualitative exploration.

4.1.1 Phase 1: Quantitative Analysis

The study's first phase employed a quantitative approach to focus on the consumer market's response to Superapps in the CIoT ecosystem. A comprehensive online questionnaire was crafted and sent through various digital platforms to ensure a wide-reaching and diverse participant pool. The survey tool of choice was Qualtrics, which efficiently captured and collated the data.

The core of this phase entailed a rigorous analysis of the collected data, undertaken through the application of SPSS Statistics V28. This advanced statistical software package played a crucial role in the validation of the data, as well as in conducting regression analysis.

4.1.2 Phase 2: Qualitative Analysis

Following the quantitative analysis, the study transitioned into its second phase, adopting a qualitative approach. This phase was designed to delve deeper into the intricacies of the CIoT market, particularly concerning the role and impact of Superapps in the SME, SOHO and Developer segments. To achieve this, in-depth interviews were conducted with SMEs, SOHOs, and Developers actively offering services within the IoT market.

Thematic analysis was utilised to extract and interpret insights from the interviews. Microsoft Excel and Word were utilized for coding and analyzing the interview transcripts. This approach facilitated an organized and systematic

method to decipher the intricate layers of opinions, experiences, and perspectives shared by the interviewees.

The remaining chapters present the findings and results from both study phases. It systematically unfolds the insights, patterns, and implications from the quantitative data, followed by a rich, thematic presentation of the qualitative findings. This dual-phased approach not only provides a comprehensive understanding of the commercial potential of Superapps in the South African CIoT ecosystem but also offers a well-rounded understanding of how these digital solutions are perceived, used, and envisioned by different stakeholders in the market.

4.2 Phase 1 – Quantitative Analysis

4.2.1 Survey Pilot and Refinement

Prior to its full-scale implementation, the online survey underwent a piloting process. This preliminary step was crucial in ensuring the questionnaire's clarity, relevance, and comprehensiveness. Feedback from respondents during this pilot phase was crucial in user experience, leading to refinements that enhanced the clarity and effectiveness of the survey questions. This process was instrumental in developing a robust tool capable of yielding insightful and reliable data.

4.2.2 Survey Participation and Response

The survey was distributed through various digital channels, reaching the target audience significantly. A total of 281 individuals responded to the survey, reflecting a diverse cross-section of the South African population with varying experiences and perspectives on Superapps in the CIoT landscape. Of the 281 respondents, 10 were excluded as they are not based in South Africa.

4.2.3 Consent and Data Integrity

Following ethical research practices, obtaining consent was a mandatory condition for participation in the survey. Among the 281 respondents, 4 opted not to consent to their data being used in the study, and their responses were excluded from the dataset.

4.2.4 Completeness of Responses

Data quality and completeness are vital for the integrity of the analysis. In this regard, 47 responses were identified as incomplete and consequently excluded from the final analysis. This step ensured that the analysis was based on complete and reliable data, thereby enhancing the validity of the study's findings.

4.2.5 Analysis of Valid Responses

After removing responses lacking consent and those identified as incomplete and outside South Africa, the remaining 220 valid responses were subjected to thorough statistical analysis using SPSS Statistics V28.

4.2.6 Reliability of measurement scale

4.2.6.1 Perceived Usefulness (PU)

In analysing the inter-item correlation matrix and item-total statistics for items PU2, PU3, and PU1, it was found that PU2 and PU3 have a moderate positive correlation (.587), indicating a significant relationship. In contrast, both have weaker correlations with PU1 (.271 and .200, respectively), suggesting PU1 measures a somewhat different construct. The item-total statistics reinforced this, showing a larger scale mean and lower variance when PU1 is removed and a notably lower corrected item-total correlation for PU1 (.266) compared to PU2 (.511) and PU3 (.458). Furthermore, the scale's internal consistency (Cronbach's Alpha) improved significantly when PU1 was excluded (.738), indicating that PU1

may negatively impact the scale's reliability. These findings suggest that while PU2 and PU3 align closely with each other and the overall scale, PU1 appears less representative of the intended construct. Moving forward, PU1 was removed from the construct.

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.582	.620	3

Table 1: PU Reliability Statistics

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
PU1	8.20	2.818	.266	.076	.738
PU2	7.85	2.962	.511	.369	.315
PU3	7.81	3.352	.458	.347	.414

Table 2: PU Item-Total Statistics

Inter-Item Correlation Matrix			
	PU1	PU2	PU3
PU1	1.000	.271	.200
PU2	.271	1.000	.587
PU3	.200	.587	1.000

Table 3:PU Inter-Item Correlation Matrix

4.2.6.2 Perceived Ease of Use (PEOU)

In the analysis of reliability and item interrelationships for the three-item scale comprising PEOU1, PEOU2, and PEOU3, Cronbach's alpha values (.823 for the scale) indicate a high level of internal consistency, reflecting a robust measure of reliability. Item-total statistics further confirm each item's decisive role in the

scale, with high corrected item-total correlations (over .650) and significant contributions to the scale variance. The scale's internal consistency would decrease if any of the items were removed; therefore, the scale demonstrates high reliability.

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.823	.831	3

Table 4:PEOU Reliability Statistics

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
PEOU1	8.50	1.931	.654	.447	.799
PEOU2	8.39	2.266	.748	.563	.696
PEOU3	8.40	2.369	.657	.464	.778

Table 5:PEOU Item-Total Statistics

4.2.6.3 Platform Trust (PT)

In assessing the reliability and inter-item dynamics for the three-item scale, Cronbach's alpha was found to be .758, indicating an acceptable level of internal consistency. The inter-item correlation matrix displayed moderate positive relationships, with the strongest correlation between PT1 and PT2 (.655). The item-total statistics revealed that PT1 and PT2 have higher corrected item-total correlations (.654 and .641, respectively) compared to PT3 (.482), which, along with the lowest squared multiple correlations (.233) and the most significant increase in Cronbach's alpha if deleted (.789), suggests that PT3 contributes less to the overall scale consistency. This analysis indicates that PT1 and PT2 share a stronger relationship with the scale's underlying construct, whereas PT3 appears less aligned. Moving forward, PT3 was removed from the construct.

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.758	.758	3

Table 6:PT Reliability Statistics

Inter-Item Correlation Matrix			
	PT1	PT2	PT3
PT1	1.000	.655	.450
PT2	.655	1.000	.426
PT3	.450	.426	1.000

Table 7:PT Inter-Item Correlation Matrix

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
PT1	8.41	2.006	.654	.465	.598
PT2	8.32	2.247	.641	.451	.619
PT3	8.29	2.563	.482	.233	.789

Table 8:PT Item-Total Statistics

4.2.7 Variety of Services (VOS)

The reliability analysis for a scale composed of three items (VOS1, VOS2, VOS3) yielded a high Cronbach's alpha of .859, affirming excellent internal consistency. Inter-item correlations were robust, particularly between VOS1 and VOS2 (.718) and VOS2 and VOS3 (.685), supporting that the items assess the same underlying construct. Item-total statistics demonstrated that all items had strong correlations with the total scale score, with VOS2 exhibiting the highest correlation (.781), suggesting a slightly more central role in the construct representation. The scale's internal consistency would decrease if any of the items were removed; therefore, the scale demonstrates high reliability.

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.859	.860	3

Table 9:VOS Reliability Statistics

Inter-Item Correlation Matrix			
	VOS1	VOS2	VOS3
VOS1	1.000	.718	.612
VOS2	.718	1.000	.685
VOS3	.612	.685	1.000

Table 10:VOS Inter-Item Correlation Matrix

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
VOS1	8.34	2.244	.723	.543	.812
VOS2	8.34	2.188	.781	.612	.759
VOS3	8.40	2.194	.700	.499	.836

Table 11:VOS Item-Total Statistics

4.2.7.1 Perceived Critical Mass (PCM)

The reliability analysis on a four-item scale (PCM1, PCM2, PCM3, PCM4) yielded a Cronbach's alpha of .790, demonstrating good internal consistency. The inter-item correlation matrix displayed moderate correlations, with the most vital link between PCM3 and PCM4 (.663), suggesting these items may assess closely related aspects of the construct. Item-total statistics revealed that each item contributes positively to the scale, evidenced by moderate to strong item-total correlations, particularly for PCM4, which showed the highest correlation (.663). Notably, the internal consistency, as measured by Cronbach's alpha, would

decrease if any item were removed, with the most substantial decrease observed upon the hypothetical removal of PCM4, resulting in an alpha of .707.

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.790	.791	4

Table 12:PCM Reliability Statistics

Inter-Item Correlation Matrix				
	PCM1	PCM2	PCM3	PCM4
PCM1	1.000	.557	.443	.481
PCM2	.557	1.000	.339	.433
PCM3	.443	.339	1.000	.663
PCM4	.481	.433	.663	1.000

Table 13:PCM Inter-Item Correlation Matrix

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
PCM1	11.90	4.374	.608	.400	.734
PCM2	11.62	5.085	.539	.346	.766
PCM3	11.86	4.633	.591	.460	.742
PCM4	11.79	4.644	.663	.502	.707

Table 14:PCM Item-Total Statistics

4.2.7.2 Perceived Cost (PC)

The reliability analysis for a three-item scale comprising PC1, PC2, and PC3 yielded a Cronbach's alpha of .805, indicating good internal consistency. The inter-item correlation matrix showed moderate to strong correlations, notably

between PC1 and PC2 (.665), suggesting a closer relationship between these items. Item-total statistics revealed that all items have moderate to strong correlations with the total scale score, with PC2 exhibiting the highest correlation (.757). The internal consistency would decrease if any of the items were removed, most notably with the removal of PC2, indicating that all three items, especially PC2, are essential for maintaining the scale's reliability.

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.805	.803	3

Table 15:PC Reliability Statistics

Inter-Item Correlation Matrix			
	PC1	PC2	PC3
PC1	1.000	.665	.444
PC2	.665	1.000	.620
PC3	.444	.620	1.000

Table 16:PC Inter-Item Correlation Matrix

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
PC1	8.25	2.113	.626	.444	.759
PC2	8.29	1.723	.757	.574	.614
PC3	8.15	2.335	.587	.386	.798

Table 17:PC Item-Total Statistics

4.2.7.3 **Attitude (AT)**

The reliability assessment of a three-item scale including AT1, AT2, and AT3 yielded an exceptionally high Cronbach's alpha of .919, indicative of excellent internal consistency, which remains consistent for standardized items. Inter-item correlation analysis revealed strong relationships among the items, particularly between AT1 and AT2 (.841). This suggests they are closely aligned in measuring the same underlying construct. Item-total statistics demonstrated high corrected item-total correlations for all items, with AT2 exhibiting the highest correlation (.860). The Cronbach's alpha would decrease if any item were removed, underscoring the importance of each item in contributing to the scale's reliability.

Reliability Statistics		
Cronbach's Alpha	**Cronbach's Alpha Based on Standardized Items**	**N of Items**
.919	**.919**	**3**

Table 18:AT Reliability Statistics

Inter-Item Correlation Matrix			
	AT1	**AT2**	**AT3**
AT1	**1.000**	**.841**	**.760**
AT2	**.841**	**1.000**	**.770**
AT3	**.760**	**.770**	**1.000**

Table 19:AT Inter-Item Correlation Matrix

Item-Total Statistics					
	Scale Mean if Item Deleted	**Scale Variance if Item Deleted**	**Corrected Item-Total Correlation**	**Squared Multiple Correlation**	**Cronbach's Alpha if Item Deleted**
AT1	**8.33**	**2.122**	**.852**	**.738**	**.869**
AT2	**8.33**	**2.095**	**.860**	**.748**	**.863**

AT3	8.32	2.328	.797	.635	.914

Table 20:AT Item-Total Statistics

4.2.7.4 Intention to use (INT)

The reliability analysis for a two-item scale of INT1 and INT2 demonstrated good internal consistency, with Cronbach's alpha values of .803 and .805 for the original and standardized items, respectively. The inter-item correlation matrix revealed a strong correlation of .673 between the items, indicating that they are closely related and likely measure similar aspects of the underlying construct. However, the nature of a two-item scale means that deleting any item would render the calculation of Cronbach's alpha meaningless, as it relies on the variance between items. Therefore, both items are integral to the scale's reliability and effectively measure the intended construct.

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.803	.805	2

Table 21:INT Reliability Statistics

Inter-Item Correlation Matrix		
	INT1	INT2
INT1	1.000	.673
INT2	.673	1.000

Table 22:INT Inter-Item Correlation Matrix

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
INT1	3.87	.760	.673	.453	.

INT2	4.05	.636	.673	.453	.

Table 23:INT Item-Total Statistics

4.2.8 Regression Analysis

4.2.8.1 Model 1

The provided regression analysis results test two hypotheses:

- H1: Perceived usefulness positively influences attitude.
- H2: Perceived Ease of Use positively influences attitude.

From the below model summary, we can see that the multiple regression model, which includes both Perceived Usefulness and Perceived Ease of Use as predictors, has an R Square of .442. This means that approximately 44.2% of the variance in attitude is explained by the model, which is a significant proportion. The Adjusted R Square of .437 accounts for the number of predictors in the model and suggests that the model generalizes well. The standardized coefficients (Beta) indicate that Perceived Ease of Use has a slightly more decisive influence on attitude (.391) than Perceived Usefulness (.330). Both predictors are statistically significant ($p < .001$), confirming H1 and H2.

Model Summary									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.665[a]	.442	.437	.54323	.442	85.973	2	217	<.001
a. Predictors: (Constant), PerceivedEaseofUse, perceived usefulness									

Table 24: Model 1 Regression Analysis Summary

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	1.314	.224		5.853	<.001	.871	1.756		
	PerceivedUsefulness	.284	.061	.330	4.655	<.001	.164	.405	.513	1.950
	PerceivedEaseofUse	.400	.072	.391	5.529	<.001	.257	.542	.513	1.950

a. Dependent Variable: Attitude

Table 25:Model 1 Regression Analysis Coefficients

4.2.8.2 Model 2

The regression analysis model evaluates several hypotheses regarding factors that influence the Perceived Usefulness of the CIoT Superapp. Specifically, the analysis includes Perceived Ease of Use, Platform Trust, Variety of Services, and Perceived Critical Mass as predictors.

The tables below indicate an R Square value of .532, meaning that the combined predictors explain 53.2% of the variance in perceived usefulness, which is a substantial proportion. The Adjusted R Square of .524 accounts for the number of predictors in the model, indicating a good fit.

Analysing the coefficients:

- Perceived Ease of Use has the most significant unstandardized coefficient (β = .570) and a significant t-value (7.101, p < .001), indicating a strong positive influence on Perceived Usefulness. This supports Hypothesis 3.
- Variety of Services also has a positive unstandardized coefficient (β = .313) and is statistically significant (t = 3.752, p < .001), supporting Hypothesis 5.

- Perceived Critical Mass (β = .036) and Platform Trust (B = .032) have positive coefficients. However, their small t-values (.512 and .484, respectively) and non-significant p-values (.609 and .629, respectively) indicate that they do not have a statistically significant influence on Perceived Usefulness within this model, not supporting Hypotheses 4 and 6.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.730[a]	.532	.524	.57932	.532	61.189	4	215	<.001

a. Predictors: (Constant), PlatformTrust, PerceivedCriticalMass, PerceivedEaseofUse, VarietyofServices

Table 26:Model 2 Regression Analysis Summary

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	.119	.277		.429	.669	-.428	.666		
	VarietyofServices	.313	.083	.268	3.752	<.001	.149	.477	.427	2.343
	PerceivedEaseofUse	.570	.080	.481	7.101	<.001	.412	.728	.474	2.110
	PerceivedCriticalMass	.036	.070	.030	.512	.609	-.102	.174	.639	1.566
	PlatformTrust	.032	.066	.030	.484	.629	-.097	.161	.557	1.795

a. Dependent Variable: PerceivedUsefulness

Table 27:Model 2 Regression Analysis Coefficients

4.2.8.3 Model 3

The regression analysis was conducted to test Hypothesis 7, which posits that perceived critical mass positively influences the perceived ease of use of the Superapp.

The model summary shows that perceived critical mass alone accounts for 17.3% of the variance in perceived ease of use, as indicated by the R Square value of .173. This suggests that while perceived critical mass is a significant factor, other variables not included in this model may also play a role in influencing the perceived ease of use. The Adjusted R Square of .170 confirms that the result is robust when adjusted for the number of predictors.

The coefficients table indicates that perceived critical mass positively affects perceived ease of use with an unstandardized coefficient (β) of .423. This effect is statistically significant, with a t-value of 6.763 and a p-value of less than .001, supporting Hypothesis 7.

Model Summary									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.416[a]	.173	.170	.64602	.173	45.743	1	218	<.001
a. Predictors: (Constant), PerceivedCriticalMass									

Table 28:Model 3 Regression Analysis Summary

Coefficients[a]						
Model	Unstandardized Coefficients	Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	Collinearity Statistics

		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	2.549	.250		10.203	<.001	2.057	3.042		
	PerceivedCriticalMass	.423	.063	.416	6.763	<.001	.300	.547	1.000	1.000
a. Dependent Variable: PerceivedEaseofUse										

Table 29:Model 3 Regression Analysis Coefficients

4.2.8.4 Model 3

To analyse Hypothesis 8, which posits that perceived cost moderates the relationship between attitude and intention to use the CIoT Superapp, a model incorporating perceived cost (centred) and attitude (centred) and their interaction term was created. The goal was to determine whether the effect of attitude on intention to use changes at different levels of the perceived cost.

The model summary shows an R Square of .594, which means that the model explains 59.4% of the variance in the intention to use the CIoT Superapp. The Adjusted R Square value of .591 indicates that this explanatory power is reliable when the number of predictors in the model is considered. The standard error of the estimate is .48859.

The coefficients for the model indicate that the main effect of attitude on intention to use is significant, with an unstandardized coefficient (β) of .803 and a p-value of less than .001, suggesting a strong positive relationship between attitude and intention to use. However, the interaction term (INT), which represents the moderation effect of perceived cost, has a standardized coefficient (β) of -.022 and is not statistically significant (p = .653). This suggests that the data does not support the moderation effect of perceived cost on the relationship between attitude and intention to use.

Model Summary									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.771[a]	.594	.591	.48859	.594	158.982	2	217	<.001
a. Predictors: (Constant), Attitude, INT									

Table 30:Model 3 Moderating Regression Analysis Summary

Coefficients[a]										
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	.628	.222		2.832	.005	.191	1.065		
	INT	-.011	.024	-.022	-.450	.653	-.059	.037	.809	1.237
	Attitude	.803	.051	.761	15.832	<.001	.703	.903	.809	1.237
a. Dependent Variable: Intentiontouse										

Table 31:Model 3 Moderating Regression Analysis Coefficients.

4.2.8.5 Model 4

The regression analysis model is designed to evaluate Hypothesis 9, which states that a positive attitude towards using the CIoT Superapp will positively influence the intention to use it.

From the model summary, we observe an R Square value of .594, indicating that attitude accounts for 59.4% of the variance in the intention to use the CIoT Superapp. This high value suggests that attitude is a robust predictor of intention to use. The Adjusted R Square value of .592 is nearly identical to the R Square

value, suggesting that the predictor is relevant and the model generalizes well to the population.

The coefficients table shows that the unstandardized coefficient (β) for Attitude is .813, and the standardized coefficient (Beta) is .771, indicating a strong positive relationship between attitude and intention to use. This relationship is highly statistically significant, with a t-value of 17.859 and a p-value of less than .001, meaning there is a very low probability that this result could have occurred by chance.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.771[a]	.594	.592	.48770	.594	318.927	1	218	<.001

a. Predictors: (Constant), Attitude

Table 32:Model 4 Regression Analysis Summary

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	.579	.192		3.008	.003	.200	.958		
	Attitude	.813	.046	.771	17.859	<.001	.723	.903	1.000	1.000

a. Dependent Variable: Intentiontouse

Table 33:Model 4 Regression Analysis Coefficients

4.2.8.6 Summary

These results indicate that out of the eight hypotheses tested across the four models, six hypotheses (H1, H2, H3, H5, H7, and H9) were supported by the data, showing statistically significant effects as per the coefficients and significance levels reported. Hypotheses H4, H6 and H8 were not supported based on the data, as their effects were not statistically significant. The final model based on the findings is reflected in Figure 12.

Hypothesis	Description	Outcome	Supported
H1	**Perceived usefulness positively influences attitude.**	**Significant positive influence (p < .001).**	**Supported**
H2	**Perceived Ease of Use positively influences attitude.**	**Significant positive influence (p < .001).**	**Supported**
H3	**Perceived Ease of Use positively influences the Perceived Usefulness of the CIoT Superapp.**	**Significant positive influence (p < .001).**	**Supported**
H4	**Platform trust positively influences perceived usefulness.**	**Not statistically significant (p > .05).**	**Not Supported**
H5	**A variety of services positively influences perceived usefulness.**	**Significant positive influence (p < .001).**	**Supported**
H6	**Perceived critical mass positively influences perceived usefulness**	**Not statistically significant (p > .05).**	**Not Supported**
H7	**Perceived critical mass positively influences individuals' perceived ease of use of the Superapp.**	**Significant positive influence (p < .001).**	**Supported**
H8	**The relationship between attitude and intention to use the CIoT Superapp is moderated by perceived cost.**	**The moderation effect is not statistically significant (p > .05).**	**Not Supported**
H9	**Attitude towards using the CIoT Superapp positively influences intention to use.**	**Significant positive influence (p < .001).**	**Supported**

Table 34:Summary of Hypothesis Findings

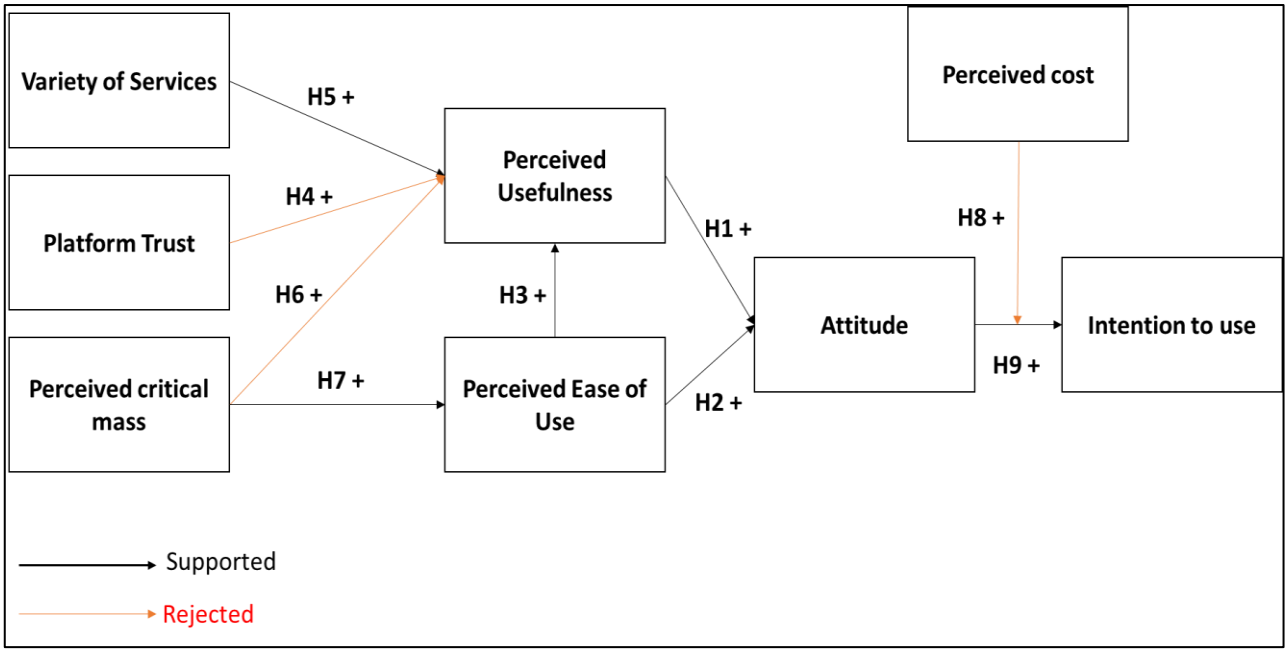

Figure 12: Final Consumer Adoption Model

4.3 Phase 2: Qualitative Analysis

4.3.1 Participant Details

The participants selected were from various backgrounds and roles within the IoT industry. The insights gathered from these participants shed light on the nuances and opportunities for Superapps in this burgeoning field. Here are the key findings from each participant:

- Participant 1 (P1) – Co-founder of an IoT Agriculture startup with previous experience as a commercial manager for a consumer Superapp for a leading mobile network operator: P1 brings a unique perspective to the discussion, having experience in both IoT and Superapps.
- Participant 2 (P2) – Co-founder of an IoT startup specializing in solutions for the mining industry: P2's expertise includes working in the Industrial IoT sector, where they successfully built an Industrial IoT platform for a leading car manufacturer.

- Participant 3 (P3) – IoT Solutions Architect at a global mobile virtual network operator: P3's role in a company focused on IoT connectivity and device-based solutions provides valuable insights into the technical aspects of IoT.
- Participant 4 (P4) – Owner of an agriculture company involved in IoT Agritech solutions: P4's dual role as both an agriculture company owner and an IoT solution provider for the agricultural sector brings a unique perspective to how a business can utilize IoT for their own needs and in turn creating a new source of revenue stream.
- Participant 5 (P5) – Co-founder of a software-based horizontal IoT platform: P5's experience building a software-based horizontal IoT platform gives insight into current challenges when building a platform-based business.
- Participant 6 (P6) – Co-founder of an IoT startup offering diverse consumer solutions: P6's experience in CIoT solutions, including smart metering, asset tracking, water leak detection, and geyser monitoring, brings valuable insight into the consumer-based IoT market.
- Participant 7 (P7) – Co-founder of an IoT startup serving various industries, including cybersecurity: P7's emphasis on cybersecurity within the IoT ecosystem brings insight into how this can impact building a new solution.
- Participant 8 (P8) – Co-founder of an IoT company with asset and animal tracking solutions: P8's involvement in IoT-enabled asset and animal tracking brings valuable insights into the consumer-based IoT market.
- Participant 9 (P9) – Owner of a company providing video monitoring and home automation solutions: P9's experience selling and installing video monitoring and home automation brings valuable insight into how something like this can impact their existing customers and partner relationships as they are currently reselling these solutions.
- Participant 10 (P10) - IoT Solutions Architect at an IoT Technology Company specializing in building new products and services for

companies seeking IoT-based solutions developed using their in-house Horizontal platform and IoT gateways. They bring a unique insight into what to consider when designing and selling solutions in the market.

4.3.2 Thematic analysis process

This process consisted of several key stages, each contributing to generating themes and sub-themes that shed light on our research questions. The stages involved in our thematic analysis process are as follows:

4.3.2.1 Familiarization

The first step in our thematic analysis process involved the researcher doing an in-depth analysis of the dataset gathered through ten interviews. This initial stage was crucial for comprehensively understanding the data and its relevance to the research objectives.

The research employed a deductive method, where the researcher, drawing upon their expertise and reviewing existing literature, analyzed the data from a specific, informed viewpoint. The prior knowledge and literature review had already equipped the researcher with a conceptual framework and key themes related to the potential application of Superapps in the CIoT context.

This stage allowed for recognising patterns, recurring ideas, and critical concepts within the data. It was a crucial foundation for the subsequent stages of coding, generating themes, and conducting a systematic analysis. The familiarity gained during this initial phase ensured that the analysis remained aligned with the research objectives and enabled the application of a deductive approach when identifying codes and themes in the dataset.

4.3.2.2 Coding of the data

Employing a deductive approach shaped by prior knowledge and the extensive literature review, 94 codes were identified from the review of the ten transcripts.

These codes encompassed a diverse range of concepts and observations related to the commercial potential of Superapps in the South African CIoT ecosystem. Each code represented a specific dataset element deemed pertinent to the research objectives.

Codes			
API Management	Developer Onboarding and Market Access	Sector-Specific Strategies	Business Flexibility and Lock-In Strategies
Algorithmic Fairness	Developer Solution Deployment	Secure and Trusted Platform	Mental Wellness and Technology
Anticipation for Superapp Capabilities	Dispute Resolution	Service Offering Transparency	Defined Technical Criteria
Brand and Trust in Superapp	Encouraging Developer Innovation	Service Offerings and Non-Favouritism	Cost Analysis and Considerations
Branding Influence on Platform Choice	Financial and Ecosystem Aspects	Strategic Business Decision Making	Quality Control Measures
Business and Ecosystem Strategy	Industry Specific Application	Superapp Usage and Advocacy	Continuous Learning and Improvement
Business Growth and Expansion	Infrastructure and Governance Trust	Tangibility and Growth Planning	Adaptability in Business Strategies
Business Process Creation	Product and Service Development	Trust and Security	Superapp Development Strategies
Business Visibility and Growth	IoT Device Interoperability	User Engagement and Retention	Superapp Cost Analysis
Centralized IoT Control Preference	Operational and IoT Integration	User Feedback Management	Risks of Platform Adoption
Centralized Professional Services	Innovative IoT Solutions	Vendor Confidence and Trial Periods	Business Expansion
Challenges and Barriers to Platform Adoption	Market Accessibility and Localization	Visibility and Market Expansion	Integration and Development
Governance and Compliance	Market Fairness and Equity	Wallets and Payment Integration	Security and Governance
Comprehensive IoT Management Preference	Platform and Market Analysis	CIoT Strategies	Platform Governance
CIoT Market Innovation	MiniApps and Enterprise Solutions	Market Analysis and Strategic Opportunities	Governance Transparency
Consumer-Centric Efficient Solutions	Multilingual Services	Platform Adoption Strategies	Trust and Vendor Reliability
Customization and Branding	New vs Established Platform Comparison	Technology Perception in Specific Sectors	User Experience Focus
Customer Engagement Strategies	Platform Adoption and Visibility	Superapp Market Acceptance	Area-Based Revenue Expansion
Business Expansion	Platform Capabilities	Superapp Development Challenges	Operational Efficiency and IoT
Customer Retention and Platform Engagement	Platform Governance and Ethics	Revenue and Cost	
Customer and User Experience	Platform Participation Analysis	Support Systems in Business	
Data Utilization and Security	Platform Trust and Reputation	Practical Implementation Challenges	
Deployment Ease and Adoption	Trust, Security, and Privacy	Superapp Governance Standards	
Innovation and Ecosystem Development	Process Optimization	Transaction Costs	
Developer Opportunities	Revenue Enhancement via Superapp	Intelligent Systems in Consumer Interaction	

Table 35: List of codes

4.3.3 Generating and Defining Themes

Following the coding phase, the next part was generating and refining themes, where themes were established as overarching patterns and concepts drawn from the coded data. These themes were reviewed iteratively to ensure alignment

with the data and research objectives and were refined for clarity and coherence. Clear definitions were provided for each theme, and appropriate names were assigned. Below is the overview of the themes, their definitions, and a summary of codes per theme:

Research Question 1: Explore the commercial potential of a Superapp for creating a multi-sided platform-based ecosystem for CIoT in the South African market.

- **Superapp Market Potential:** This theme explores the general perception, acceptance, and enthusiasm for the CIoT Superapp in the South African market, including the potential for market penetration, scalability, and the ability to meet diverse consumer and business needs.
- **Integration and Usability:** Focusing on the technical and user experience aspects of the CIoT Superapp, this theme examines how they integrate various services and features, their ease of use, and overall usability from a consumer perspective.
- **Consumer Engagement and Stickiness:** This theme examines how the CIoT Superapp can enhance consumer loyalty and retention, including strategies to build trust brand recognition, and create a compelling value proposition that encourages long-term consumer engagement.
- **Security and Privacy Concerns:** This theme addresses the issues of data security, privacy, and data ownership in the context of the CIoT Superapp. It explores the standards, regulations, and practices necessary to protect user data and build consumer trust.

Research Question 2: How can a CIoT Superapp impact SMEs/SOHOs or Developers in the South African market?

- **Business Growth and Revenue:** This theme covers how the CIoT Superapp can support business growth, provide new revenue opportunities, and enable market access for SMEs, SOHOs, and

Developers, particularly regarding customer reach and business expansion.

- **Business Efficiency and Cost Management:** This theme examines how the CIoT Superapp can contribute to operational efficiency, cost reduction, and resource optimization for businesses, including discussions on cost-effective strategies and management practices.
- **Collaboration and Ecosystem Participation:** Focusing on the dynamics of participating in the CIoT Superapp ecosystem, this theme explores collaboration opportunities, API strategies, and the benefits and challenges of being part of a larger platform.
- **Competitive Advantage and Market Positioning:** This theme emphasizes how businesses can leverage the CIoT Superapps to gain a competitive edge, differentiate their offerings, and effectively position themselves in the market landscape.

Research Question 3: How can businesses leverage these technologies to enhance their competitiveness and growth potential?

- **Strategic Business Decisions:** This theme concerns the strategic choices and decisions businesses must make when adopting and leveraging the CIoT Superapp technologies, including business model adaptations and long-term planning.
- **Customer-Centric Approach and Innovation in CIoT Superapps for Competitive Advantage**: It encompasses the strategic utilization of the CIoT Superapp capabilities to tailor services to consumer preferences, enhancing user engagement and loyalty. Innovation within this framework involves integrating emerging IoT technologies and data analytics to create personalized and seamless consumer experiences.
- **Adaptation and Flexibility:** Exploring the need for businesses to be adaptable and flexible in a rapidly changing technological landscape, particularly in embracing the CIoT Superapp capabilities and responding to market demands.

- **Innovative Marketing and Promotion:** Examining innovative ways businesses can use the CIoT Superapp for marketing and promotion, including creative engagement strategies, branding techniques, and outreach to target audiences.

4.3.3.1 Summary of findings

Themes	Code Count
Superapp Market Potential	3
Security and Privacy Concerns	6
Consumer Engagement and Stickiness	6
Integration and Usability	6
Business and Revenue Growth	21
Market Fairness and Equity	2
Collaboration and Ecosystem Participation	8
Competitive Advantage and Market Positioning	11
Business Efficiency and Cost Management	5
Strategic Business Decisions	3
Innovative Marketing and Promotion	4
Adaptation and Flexibility	6
Customer-Centric Approach and Innovation	13
Total	**94**

Table 36: List of themes

Notably, the "Business and Revenue Growth" theme received the highest number of codes, with 21 instances highlighting the substantial focus on how the CIoT Superapp can drive business expansion and revenue generation, particularly for SMEs, SOHOs, and Developers.

Themes such as "Customer-Centric Approach and Innovation" (13 codes) and "Competitive Advantage and Market Positioning" (11 codes) underscore the importance of consumer-centric strategies and gaining a competitive edge

through the CIoT Superapp. These findings emphasize the role of the CIoT Superapp in enhancing consumer engagement, loyalty, and brand recognition while positioning businesses strategically in the market landscape.

"Collaboration and Ecosystem Participation" (8 codes) shed light on the dynamics of participating in the CIoT Superapp ecosystem, emphasizing collaboration opportunities and the benefits of being part of a larger platform.

Themes like "Security and Privacy Concerns" (6 codes), "Integration and Usability" (6 codes), "Consumer Engagement and Stickiness" (6 codes), and "Adaptation and Flexibility" (6 codes) highlight crucial aspects related to data security, user experience, consumer engagement, and adaptability within the CIoT Superapp environment.

While "Market Fairness and Equity" (2 codes) received relatively fewer codes, it underscores the importance of fairness and transparency in the CIoT Superapp markets.

5 DISCUSSION OF THE RESULTS

In discussing the results for the chapter on the commercial potential of Superapps in the CIoT ecosystem within South Africa, the study explores the market's receptiveness to a multi-sided platform-based ecosystem through the lens of a CIoT Superapp.

5.1 Consumer adoption factors

The survey-based research, underpinned by a pilot and refinement process, ensured the collection of clear, relevant, and comprehensive data from a diverse sample of South African respondents.

The analysis of valid responses, which accounted for consent and data integrity, utilized SPSS Statistics V28 to ascertain the reliability of various constructs such as Perceived Usefulness, Perceived Ease of Use, Platform Trust, Variety of Services, Perceived Critical Mass, Perceived Cost, Attitude, and Intention to Use. Each construct was carefully examined through inter-item correlations and item-total statistics, leading to the refinement of measurement scales for enhanced reliability.

The testing of hypotheses through regression analyses found that the data supported six of the nine proposed hypotheses. The analysis, grounded in TAM, found strong support for the influence of Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) on user attitudes towards CIoT Superapps, aligning with Davis (1989) foundational principles of TAM. These results are consistent with previous research on the consumer adoption of Internet of Things products and services, such as the work by Mahmud et al. (2022). Our findings highlight the enduring relevance of these core constructs in explaining consumer adoption behaviour in the evolving CIoT Superapp landscape.

Moreover, the significance of the Variety of Services in determining the Perceived Usefulness echoes the expanded considerations of TAM 2 and TAM 3, where

additional factors beyond the original model's scope were recognized for their impact on technology adoption. This reflects the diverse nature of a CIoT Superapp as a comprehensive platform that integrates multiple services, underscoring the importance of service diversity as highlighted by Salehi et al. (2023) in their study of Rubika, a Superapp that integrates multiple digital services such as messaging, social media, financial transactions, and more into a single platform.

Our extended TAM model of Platform trust positively influences perceived usefulness, as highlighted by Ngwenya and Ngoepe (2022), that trust is a factor in increasing CIoT adoption. Our study did not find a significant influence of Platform Trust on Perceived Usefulness. This suggests a possible divergence in the CIoT Superapps context from other technological domains, where trust was previously identified as a critical factor. This outcome could be attributed to several factors. First, in the rapidly evolving CIoT space, users might prioritize immediate functional benefits and the tangible quality of services over abstract trust in the platform. Users may assess usefulness based on their direct interactions and the convenience offered by the CIoT Superapp rather than the perceived trustworthiness of the platform itself.

Additionally, trust might be inherently embedded in the decision to use a CIoT Superapp; once the decision to engage with the app is made, trust could become a baseline expectation rather than a distinct influencer of perceived usefulness. This suggests that while trust is crucial for initial adoption, its role in enhancing perceived usefulness might be overshadowed by the immediate, observable benefits of using the CIoT Superapp. This insight calls for a deeper exploration of the dimensions of trust, including security, privacy, and reliability, and how they separately influence user adoption beyond the initial engagement.

The concept of critical mass plays a pivotal role in the ecosystem of MSPs, of which the CIoT Superapps are defined in Chapter 2.2. This concept is underlined in the study by Lou et al. (2000), which introduced perceived critical mass as an influential external variable to the TAM, highlighting its significance as a

determinant influencing user perceptions and ease of use. However, in our testing, the hypothesis positing that perceived critical mass significantly affects perceived usefulness did not find statistical support ($p > .05$), indicating a lack of significant influence. Conversely, the hypothesis that perceived critical mass positively affects the perceived ease of use of the Superapp received empirical support, demonstrating a significant positive effect ($p < .001$). The hypothesis that a more extensive user base directly enhances perceived usefulness did not find empirical support, indicating that users may not equate the app's utility with its popularity or user count. In contrast, the significant positive influence of perceived critical mass on perceived ease of use suggests that users value the practical benefits of a widespread user base, such as more accessible interactions and enhanced platform dynamics. This discrepancy underscores the complexity of factors influencing user adoption of a CIoT Superapp. It highlights the role of critical mass in shaping user perceptions and behaviours within the CIoT Superapp ecosystem.

The hypothesis regarding the moderating role of Perceived Cost between attitude and intention to use was made based on transaction cost economics and the work of Park et al. (2018), who found that the perceived cost of smart home services negatively impacts the intention to use these services. The hypothesis posited that the relationship between a positive attitude towards the CIoT Superapp and the intention to use it would be contingent upon the level of perceived cost. Specifically, it suggested that when perceived costs were low, the positive influence of attitude on usage intention would be more positive. High perceived costs could potentially diminish this influence. A regression model, incorporating the main effects of attitude and perceived cost and their interaction term, was employed to assess the combined impact on users' intention to use the CIoT Superapp. A moderating regression model was employed, incorporating the main effects of attitude and perceived cost along with their interaction term. The interaction term is critical in moderation analysis, as it represents the combined effect of attitude and perceived cost on the intention to use the CIoT Superapp. The model summary reported an R Square of .594, indicating that the model

could explain 59.4% of the variance in the intention to use the CIoT Superapp. The coefficients for the model showed that attitude had a significant main effect on the intention to use, with a strong positive relationship, as evidenced by the unstandardized coefficient (β) of .803 and a highly significant p-value of less than .001. However, the interaction term (INT), which captures the hypothesized moderating effect of perceived cost, had an unstandardized coefficient (β) of -.022 and was not statistically significant (p = .653) in line with the finding from Park et al. (2018) as the negative sign of the coefficient suggests that as perceived costs increase, there is a slight tendency for the positive influence of attitude on intention to use to decrease. However, the non-significant p-value suggests that there is not enough evidence in the data to support the claim that perceived cost changes the strength of the relationship between attitude and intention to use. In other words, regardless of whether the perceived cost is high or low, the positive relationship between attitude and intention to use remains consistent and is not significantly affected by cost considerations.

These findings underscore the importance of ease of use, service variety, and a positive attitude in fostering the adoption of a CIoT Superapp within the South African market. The CIoT Superapp's commercial potential is thus closely tied to its ability to meet user expectations in these areas. However, the lack of significant influence from platform trust and critical mass suggests that other factors may also play a role in adoption decisions, warranting further investigation. The limited impact of a significant moderating effect of perceived cost indicates that while cost is a consideration, it does not alter the strength of the relationship between attitude and intention to use as much as hypothesized. Therefore, strategies aimed at enhancing positive attitudes could be effective without focusing on altering cost perceptions.

5.2 SME/SOHO and Developer Impact

The findings from the thematic analysis of interviews with key participants in the IoT industry provide a comprehensive understanding of the commercial potential

and challenges of Superapps for SMEs, SOHOs and developers in the CIoT ecosystem in South Africa. This chapter discusses the implications of these findings, focusing on the themes identified in the analysis and the insights shared by the participants.

5.2.1 Research Question 1: What is the commercial potential of developing a Superapp as a multi-sided platform-based ecosystem for CIoT within the South African market?

5.2.1.1 Superapp Market Potential

The Superapp Market Potential theme analysis reveals strong market acceptance and anticipation for Superapp's capabilities in South Africa. Participants supported the concept, highlighting its relevance in addressing current market challenges.

P5 noted*, "Yeah, so I mean, I am a fan of the Superapp concept. Furthermore, it is because of what we have seen in the industry. Whether you are a consumer or a business owner, you still have that same problem, the inundation of multiple apps and so forth."* This sentiment is echoed by P7, who emphasised convenience: *"I support the Superapp, definitely. The reason for this is convenience. Okay? We have too many apps on our phones... and I think people could be exhausted by it."*

P6 added, *"I would prefer to use something like a Superapp because of the fact that you are selling a comprehensive solution to a customer rather than just one little function."* These insights highlight the need for a comprehensive, streamlined solution that consolidates multiple services into a single platform, addressing the issue of app overload.

The requirement for market accessibility and localization was also prominent, with participants emphasizing the importance of understanding the unique characteristics of the South African market. P8 highlighted the potential of a CIoT

Superapp deployed by a major company: *"So if the Superapp was sort of deployed by a massive company, a telco or an MNO, that immediately says, okay, I have got an active subscriber base."* Similarly, P2 pointed out, *"I think it is quite important also to understand the unique characteristics of the South African market and find ways to tailor the platform for those needs."*

P7 advocated a broad market approach, stating, *"So I would say no limitations, no borders, no restrictions. You go full out to the market. That's going to be your best shot."*

The anticipation for the capabilities of the CIoT Superapp was evident in P3's comment: *"So I am excited to see this come into play, and I am really excited to see, you know, the functionality behind it."* This enthusiasm underscores the market's readiness for innovative, integrated solutions in the CIoT ecosystem.

5.2.1.2 **Integration and Usability**

The analysis of the theme of Integration and Usability provided essential insights into what makes a CIoT Superapp viable and user-centric in the CIoT landscape. A key aspect identified is the significance of API management. Efficient and accessible API endpoints are crucial for facilitating smooth integration between different services on the platform. As P2 emphasized, *"So, for example, which API endpoints can we expose from our side that allows for easier and easy integration with other participants on the platform? So connecting those back-end dots would be really beneficial for us."* This comment highlights the need for accessible and efficient API endpoints to ensure smooth integration between different services on the platform.

Another critical factor is the ease of deployment and adoption. Simplifying designing, implementing, and getting a CIoT Superapp running is essential for encouraging user and developer engagement. As P3 pointed out, *"If there is less complexity in designing the process... I am probably going to be one to say I will probably go through with this, and you won't really see me moving away from it*

anytime soon because it was so easy to get on board with it." This ease of use is a significant draw for users who seek convenience and simplicity in their interactions with technology.

The interoperability of IoT devices within the CIoT Superapp ecosystem is also a key concern. Participants noted the importance of seamless interaction among various IoT devices to create a cohesive and functional user experience. P3's comments on the need for IoT devices like cameras and lights to interact seamlessly highlight this necessity. *" So if my camera alarm gets triggered outside, I would also want my IoT light to switch on immediately when an alarm happens. Right now, my standalone apps, like I am using, let's say, EasyVis cameras, for example, they don't allow me to trigger alarms on different IoT devices or trigger actions on external devices."* In a related note, *P8* added: *"Yeah, I think it comes down to a little bit of functionality. So like if I have a smart home app and it's designed specifically for the controller and devices that I have in my home, I wouldn't want to be switching to something generic and inferior, you know. So but if I was, let's say, switching from a standalone app to, or the standalone native app for a particular system to a MiniApp which functions much the same way, that would be fine. But I wouldn't want to downgrade, right?"* Users expect a CIoT Superapp to integrate different services and enhance the functionality and user experience compared to standalone apps.

Lastly, high-quality integration, robust technical infrastructure, and skilled development teams are essential for the CIoT Superapp's reliability and performance. P7 *stated, "But they need to be so sure that the integration is smoking hot. I've got no other words to describe it. And that they have enough team of developers to know, like, here's what it's built on, here's how it should work."* The emphasis on "smoking hot" integration reflects users' high expectations for the technical prowess of CIoT Superapps. Ensuring the platform is built on solid technical foundations is crucial for gaining user trust and ensuring long-term viability.

5.2.1.3 **Consumer Engagement and Stickiness**

The analysis of the theme of Consumer Engagement provided valuable insights, highlighting several key aspects that enhance consumer engagement and stickiness.

Participants emphasized the importance of centralized control and automation features in CIoT Superapps, which can significantly enhance the user experience. P3 articulated this need by stating, *"And I always wanted a way to do if-else statements or a centralized way to do if-else statements. So I think if you Superapp can do this, there's a platform out there that's called IFTTH, if this then else, or something like that. If your platform can incorporate that if else trigger mechanism for external third-party devices, that will be a huge selling point for me because I would definitely jump onto that."* This desire for a rules engine to manage various IoT devices reflects the user's need for a platform that simplifies and automates their interactions with multiple devices.

The empowerment of consumers through knowledge and information is another critical factor. *P7* highlighted this aspect: *" I mean, consumer has the power, right? The power is knowledge, information, and then gaining knowledge. any knowledge but the danger here is if you look at restaurant apps, if you look at restaurants, I mean you can't expect a restaurant to be at a level 4 all the time because you have one or ten bad reviews because the customer didn't like the way the waiter looked at him or her, they give you a 1. So then your rating goes very low. So there has to be some intelligence applied to ratings."* However, they also noted the importance of applying intelligence to features like rating systems to ensure fairness and accuracy. This indicates that empowering users goes beyond just providing information; it also involves creating a trustworthy and reliable platform.

Customer retention strategies significantly enhance stickiness, particularly those leveraging user familiarity and comfort with existing platforms. P8 discussed the advantage of building on familiar platforms: *"Yeah, definitely, it makes sense...*

You'd want to add on to something that people are comfortable with. It's definitely a big plus point." This approach can reduce the barriers to adoption and encourage long-term user commitment. Engaging users through personalized content and features is crucial for maintaining interest and loyalty. P6 highlighted the importance of creating a sticky ecosystem*: "Yeah, once again, I would say it creates a sticky ecosystem with the customer. You know, once he gets more entrenched in it, would use it a bit more and more."* This illustrates the need for CIoT Superapps to offer personalized and relevant content to keep users engaged and invested in the platform.

5.2.1.4 **Security and Privacy Concerns**

The analysis of the Security and Privacy Concerns theme provided valuable insights into various dimensions of security and privacy that the CIoT Superapp must address to gain user trust and ensure compliance.

One of the key concerns highlighted by participants is the importance of conducting thorough background checks to ensure the reliability and trustworthiness of all parties involved in the CIoT Superapp ecosystem. P3 emphasized this need, stating, *"Even the people representing the vendors themselves. We want to make sure that they don't have any criminal records, backgrounds, things like that."* This highlights the necessity of vetting individuals and organizations involved to maintain a secure and trusted environment.

The management and usage of consumer data were also a significant point of discussion. P6 noted, *"The data of your consumers being the key thing there. Furthermore, I mean, most consumers would opt-in. They would sign terms and conditions. So it would be absolutely, you know, legal to use their data to enhance other services, products and services toward them."* This statement reflects the need for transparency and legality in handling user data, ensuring that consumers are informed and their consent is obtained.

Balancing data collection with privacy concerns was another critical factor. P4 addressed this balance: *"Yes, I think gathering data with a view of improving the*

way things work is a great idea. The key factor is privacy. Can that data be anonymized?" The concern for anonymizing data underscores the importance of protecting individual privacy while utilizing data to improve services.

Legal compliance, particularly with privacy regulations, was another area of focus. P1 pointed out the challenges posed by such regulations: *"Yeah, so POPI is obviously important, protection of customer information. It's a very interesting view, because sometimes POPI stops you from getting information that can actually help the customer than do harm."* This highlights the complexity of navigating privacy laws while striving to provide beneficial services.

Technical aspects of data security were also emphasized. P2 spoke about the need for robust data protection measures: " *Yeah, that's a big one, especially for if we're sharing data with third party. So it would obviously be compliance with data regulations. Yeah, just as GDPR, and it would obviously be having an understanding of how our data is, the integrity of our data is retained on this platform, for example, is it encrypted addressed from a technical level, for example, and can we provide the encryption keys to open it? So we sort of have an extra layer of security"* This focus on encryption and compliance with data regulations like GDPR underscores the technical measures required to ensure robust data protection.

Lastly, the security of the platform's architecture and its ability to securely handle large volumes of traffic and data was discussed. P3 elaborated on this aspect: " *Yeah, I think it's extremely important, especially coming from a POPI practice like you mentioned, ensuring that both the consumer and the vendors or the partners information is trusted, secured, not being shared to anyone and any who. Also, things like our pricing book is most probably going to be advertised and displayed. And in some cases, we don't want consumers to see the full on pricing book. So, we would want that to be secure, trusted. Obviously, the architecture, we don't want the service to be sitting in some foreign country that's going through war right now. So, we would want to know where the architecture sits, where the platform actually sits and whether it's quite new and you're obviously going to get*

customers right off the bat and partners and things. So I would also want to know how is your platform capable of managing capacity and load and things like that. Has it been stress tested and stuff like that?" This encompasses concerns about data access, server location, and the platform's capability to manage and secure data effectively.

5.2.1.5 **Summary**

Our analysis focused on four key themes: Superapp Market Potential, Integration and Usability, Consumer Engagement and Stickiness, and Security and Privacy Concerns.

Firstly, the analysis revealed a robust market acceptance and eager anticipation of CIoT Superapp capabilities within South Africa. CIoT Superapps is perceived as a viable solution to prevailing market challenges, notably the issue of app overload. Participants recognized the potential of CIoT Superapps to offer convenience and streamlined solutions, particularly emphasizing the need for market accessibility and localization to cater to the unique requirements of the South African market.

Secondly, participants stressed the significance of efficient API management and ease of deployment as paramount for CIoT Superapp success. A user-friendly and technically robust platform emerged as essential to facilitate seamless integration between various services, thereby ensuring a superior user experience. Additionally, participants underscored the critical role of interoperability among IoT devices within the CIoT Superapp ecosystem and the imperative for high-quality technical integration to enhance usability and technical excellence.

Thirdly, our analysis underscored the importance of features that enhance user engagement and retention (stickiness) as pivotal for CIoT Superapps. Centralized control and automation and the empowerment of consumers through knowledge emerged as crucial elements in engaging and retaining users.

Participants also emphasized delivering personalized and relevant content to maintain user interest and foster loyalty.

Lastly, security and privacy concerns were found to be paramount in the development and adoption of CIoT Superapps. A comprehensive approach encompassing thorough background checks, transparent and legal data usage, data anonymization, compliance with privacy regulations, and robust technical security measures is imperative. Ensuring user trust and aligning with legal and ethical standards were identified as cornerstones for successfully establishing a CIoT Superapp in the South African CIoT market.

In conclusion, our findings indicate a substantial commercial potential for a CIoT Superapp in the South African market. To realize this potential, it is essential that a CIoT Superapp effectively addresses market needs, facilitates seamless integration, engages users effectively, and maintains rigorous standards in security and privacy.

5.2.2 Research Question 2: How can a CIoT Superapp impact SMEs/SOHOs or Developers in the South African market?

5.2.2.1 Business Growth and Revenue

The theme Business Growth and Revenue provided various perspectives on how CIoT Superapps can contribute to business expansion, revenue generation, and market opportunities.

Participants expressed optimism about the revenue-generating potential of CIoT Superapps and how they can facilitate business growth. P9 conveyed the benefits for small independent businesses: “*I think in terms of revenue it will be better for me as a small independent based on the from what we just discussed earlier on is that, you know, if this is your area and MTN says, we allocate this the area to you, you'll be entitled to more customer base in that area. So the integration will create more revenue in that sense*." By allocating specific areas to businesses,

CIoT Superapps can provide a more extensive customer base in those areas, thus increasing revenue potential. This local-focused approach can be particularly beneficial for independent businesses looking to expand their reach within a certain region. This sentiment was echoed in their further statement: *"Okay, well, it will attract more business in my case."*

P5, as a startup owner, emphasized the need for clear business benefits: *"Because now I'm a business owner, startup owner, and I need to understand is this thing going to help me gain business? Quickie. If it's not, I'm not going to use it."* This highlights the importance of immediate and tangible advantages for businesses when considering joining a CIoT Superapp platform.

P2 suggested that CIoT Superapps could *"not only increase the revenue but also open up to new business avenues from a digital space."* This insight points to the potential of CIoT Superapps to expand market reach and create new business opportunities.

P8 discussed the value addition of integrating with a CIoT Superapp: "*If you have an app as a standalone, it becomes a value add to the business... as opposed to adding your service onto a Superapp becomes a new business that you otherwise would not have acquired."* They also raised questions about cost implications: *"I think what we have to understand as a vendor is what are the cost implications of that, or what is the cost structure in place with the Superapp?"* For businesses with existing apps, adding their services to a CIoT Superapp can lead to new business opportunities by tapping into the CIoT Superapp's user base; however, it is dependent on the overall cost structures and the implications for businesses, emphasizing the need to understand the financial aspect of joining a CIoT Superapp. Suppose the model meets the requirements of the business. In that case, it can be the business model related by the statement: "*Maybe my whole business is purely based around my being onboarded onto the Superapp. That could be my business*". In a relatable comment, P7 spoke about scaling business through Superapps: *"Yeah, look, I think if I'm going to be a supplier to the company driving the Superapp... It's a very good scalable channel to market."*

They noted the trade-off between revenue sharing and reduced costs: *"But at least your costs are curbed, okay. Your costs are curbed very well."* The convenience, scalability, and potential for a stable revenue stream offered by CIoT Superapps make them an attractive platform for business growth. However, the revenue-sharing model and the need for careful cost-benefit analysis underscore the importance of strategic decision-making when considering partnerships with CIoT Superapp platforms.

P1 addressed the efficiency aspect: *"In terms of efficiency, if I usually had to spend to reach or have a footprint of, let's say, a million customers on my website, but you can guarantee two million, and it only costs me a lower amount to be on your platform, then that will also be a determining factor*." CIoT Superapps presents a compelling case for businesses aiming to optimize their marketing and customer acquisition strategies by offering access to a more extensive customer base at a lower cost.

P3 considered the marketing advantage: *"But if we can count as a business owner, if I can count on the Consumer Superapp, pushing out ads or giving consumer suggestions on my business and things like that, I think it would exponentially increase my market share in that particular area."* CIoT Superapps can be crucial in increasing a business's market share and visibility in specific areas by providing targeted advertising and suggestions to consumers.

Lastly, P6 highlighted the time-to-market advantage*: "Time to market is much faster with something like a low-code app... You don't want to sit in a six-month to a year cycle, developing an app and developing integration."* By enabling faster development and deployment of services, CIoT Superapps can help businesses reach customers more quickly than traditional app development cycles, which is crucial in the fast-paced digital market.

5.2.2.2 **Business Efficiency and Cost Management**

The Business Efficiency and Cost Management theme provided insights into various efficiency and cost management aspects, highlighting the potential benefits and challenges associated with integrating into a CIoT Superapp platform.

Participants underscored the potential of CIoT Superapps to enhance operational efficiency. P4 emphasized the significance of CIoT Superapps being reliable and affordable: *"...and it works reliably, and it's affordable, and it saves you time and effort and whatever."* This point underscores the necessity for CIoT Superapps to offer cost-effective solutions that improve efficiency, thereby saving business time and resources. Which was discussed by P8 in how CIoT Superapps can streamline the decision-making process for businesses*: "You know, I think provided, if the Superapp is giving me access to services that I'm currently either one, don't have, or two, have multiple sources of getting them, then that reduces my decision-making process of actually switching."* This indicates that CIoT Superapps can simplify operations by providing a centralized platform for accessing various services, thereby reducing the complexity and time involved in managing multiple service providers.

The complexities of device integration and its impact on business operations were discussed by P5, who noted, "*It's that provisioning that is the big, big hurdle at the moment. Do I scan the code? Now the Superapp doesn't understand that this is a Samsung watch, and now I've got a Huawei.*" This highlights the challenges businesses may face in ensuring their products or services are compatible with various devices and platforms within a CIoT Superapp ecosystem. The effort and cost of seamless integration are critical for businesses considering the impact on their profit margins. P5 discussed the impact on profit margins and the potential for cost savings when using third-party hardware providers: "*And then, you know, the margins are impacted... there's a cost-saving element to a third-party provider doing the hardware*. *So they build the hardware, right? They build it. Then, they have two mechanisms to get to the data. So they give you connection to a*

platform that's theirs, and they pipe data to you. Or they're like, hey, you can pipe data directly from this device, but you must go implement that integration. And now, if you have the technical capability, then there's a little initial cost factor for you " However, CIoT Superapps have the potential to simplify this process by providing a universal platform with built-in integrations to various third-party devices. The CIoT Superapp model offers a cost-effective solution to device integration challenges, reducing the need for individual partnerships and technical expertise.

P1 addressed the cost-benefit analysis regarding customer conversion: *"I am likely, as a business, to attract a similar customer, it's a lower conversation cost than a completely new demographics customer... Superapp offers this much, so for this cost, they offer so many customers and potential conversion, and then I will really compare to, say, does it cost me less to convert so many more of my customer base before I would join that platform."* A CIoT Superapp can help with the problem of cost-effectiveness in customer conversion by providing businesses with a centralized platform that offers access to a more extensive and diverse customer base. This consolidated approach reduces the need for businesses to invest in multiple marketing and sales channels, thereby lowering the overall costs of reaching and engaging potential customers.

P7 discussed the consideration of development costs and the convenience of low-code solutions: "*It all depends on the cost to serve because you don't want to now get into a world of like super heavy development costs and super heavy assets in your business... But if it's convenient, and they make it convenient for it to work for the suppliers on low-code drag and drop, that's easier*." A CIoT Superapp can alleviate high development costs by offering low-code solutions that simplify the app development process. With pre-built functionalities and easy-to-use interfaces, businesses can efficiently integrate their services into the CIoT Superapp, reducing the need for extensive coding and lowering development expenses. This approach enables businesses to focus on their core offerings without the burden of heavy technical development.

5.2.2.3 **Market Fairness and Equity**

The Market Fairness and Equity theme analysis provided insights into several aspects of fairness and equity, emphasizing the importance of transparency, unbiased algorithms, and equal opportunities for businesses on CIoT Superapp platforms.

The need for transparency in how CIoT Superapps operates, especially regarding algorithms for recommending businesses and products, is a significant concern. *P2* highlighted this aspect, stating, *"So the documentation side if we have a clear definition of how the algorithm actually works in terms of recommending businesses for products... And there's fairness in that, right? So, yeah. So, it would be transparency.*" This insight underscores the importance of transparent and fair algorithms that prevent bias and promote equitable business exposure.

Equitable representation on CIoT Superapp platforms is another crucial factor. *P3* expressed the desire for fairness in service offerings: *"I wouldn't want the app to favour sort of Takealot or Mr Delivery when they could be using my delivery service... I would want there to be a fairness in terms of my service being offered to the customer."* This sentiment reflects the need for CIoT Superapps to ensure that all businesses, regardless of size or popularity, have equal opportunities to be discovered and utilized by consumers.

Ensuring authenticity in ratings and reviews is vital for maintaining a trustworthy platform. *P1* addressed the issue of fake app ratings: *"We know that sometimes there's an opportunity of fake ratings to make a platform look good. So it'll be good to have a platform where it can guarantee that you don't have fake ratings."* The integrity of ratings is essential for upholding fairness and providing accurate representations of businesses on the platform.

P5 discussed the concept of fair play regarding resource allocation: "*Yeah, look, personally, I'm a believer of fair game. So what I don't like is, it's like, you know, suddenly there's one of the users of the Superapp, and they now the first to*

10,000 devices. Now, suddenly, all the resources go into that world. Now, from a technical upkeep perspective." This comment indicates the importance of ensuring equitable support and resources for all businesses on the platform, avoiding favouritism or disproportionate focus on particular partners in the ecosystem created by the platform.

P8 raised the concern of not being overshadowed by other businesses: *"I wouldn't want to be alone; I also wouldn't want to be drowned out by a million other guys."* This highlights the need for a balanced approach in representing businesses on the CIoT Superapp, ensuring that no single business dominates to the detriment of others.

P9 called for unbiased treatment of all providers on the CIoT Superapp*: "So, look, I think it should, in terms of product fairness, I think there shouldn't be biases amongst the developer of the app and the providers. It should be basically fair throughout the app if I can put it that way."* This perspective emphasizes the expectation of a level playing field where all businesses are treated impartially and given equal chances to succeed.

5.2.2.4 **Collaboration and Ecosystem Participation**

The analysis of the theme Collaboration and Ecosystem Participation provided valuable insights into the benefits and opportunities that arise from collaborative efforts and active participation within a CIoT Superapp ecosystem.

Participants spoke about the potential for collaboration within the CIoT Superapp ecosystem and how it can foster comprehensive solutions for consumers. P8 highlighted the opportunities that arise from having a large user base: "*If you have a lot of active users, that's brilliant. It also maybe offers opportunity to collaborate, right?... So that allows me to train someone to have a quality of service that they can adhere to."* This insight suggests that CIoT Superapps can enable partnerships between different types of businesses, such as combining hardware sales with installation services, thereby creating integrated solutions for users.

Resulting in win-win relationships within the CIoT Superapp ecosystem as captured by P9: *"It's a win-win on both sides... they are putting fibre in the area; they need someone to do installation of access control or monitoring devices that can be done."*

Furthermore, P1 highlighted the potential for network effects, particularly among businesses*: "There is also big opportunities in terms of network effects within businesses... How can I as a business also benefit from other businesses on the platform and, you know, that B2B player, not just B2Cs?"* This emphasizes the ability of CIoT Superapps to create opportunities for businesses to drive sales and services through ecosystem partnerships. P6 illustrated this point with an example*: "You have a smart meter that can detect leaks, right? A partner, you can a plumber on your ecosystem, could sell this meter to a consumer... I mean, that would increase his business, basically, in simple terms."* Such symbiotic relationships within the ecosystem can drive business growth for individual participants. These insights underscore the CIoT Superapp's ability to facilitate B2C, B2B and B2B2C interactions and partnerships. This capability of CIoT Superapps to facilitate these partnerships underscores their role in creating a dynamic and synergistic multi-sided platform ecosystem.

The significance of maintaining an open ecosystem to ensure diverse participation was emphasized by P6: *"You need to have an open ecosystem, obviously within reason... If you keep it closed, I believe it will die a slow death."* This perspective underlines the importance of allowing various startups and larger companies to connect to the platform, enhancing the overall value and appeal of the CIoT Superapp.

P2 discussed how integrating with other service providers can open new revenue streams: *"So if we can use this platform, for example, to integrate into other vendors that provide different services and make money from those transactions, that would be something that would create a new revenue stream for us."* Additionally, they pointed out the benefits of sharing information within the ecosystem, leading to improved services and new business opportunities.

5.2.2.5 **Summary**

The analysis of various themes reveals that a CIoT Superapp presents substantial business growth and revenue generation opportunities, especially beneficial for SMEs and SOHOs. They provide a platform for accessing larger customer bases and facilitate opening new digital business avenues. Understanding the financial models and cost implications of integrating with a CIoT Superapp is crucial for businesses aiming for expansion.

Additionally, CIoT Superapps enhance operational efficiency and offer cost-effective solutions, which is particularly advantageous in streamlining operations and reducing the complexity of managing multiple service providers. They address common challenges like device integration and provide low-code development solutions to reduce the technical burden on businesses.

Ensuring market fairness and equity on CIoT Superapp platforms is another critical aspect. Maintaining transparency in algorithms, offering unbiased treatment of businesses, and ensuring authenticity in ratings and reviews are essential for creating a level playing field. This approach allows businesses of all sizes and types equal opportunities to succeed.

Furthermore, CIoT Superapps facilitate collaboration and ecosystem participation, enabling partnerships between different types of businesses to create comprehensive solutions for consumers. The potential for win-win relationships and network effects, particularly in B2B interactions, is notable. CIoT Superapps are dynamic multi-sided platforms encouraging diverse business participation while driving collaborative opportunities in the CIoT ecosystem.

Overall, CIoT Superapps significantly impact SMEs, SOHOs, and Developers in South Africa by offering opportunities for business growth, operational efficiency, market fairness, and collaborative partnerships, making them a dynamic and beneficial platform in the evolving digital landscape.

5.2.3 Research Question 3: How can businesses leverage these technologies to enhance their competitiveness and growth potential?

5.2.3.1 Competitive Advantage and Market Positioning

The analysis of the theme Competitive Advantage and Market Positioning provided valuable insights into how CIoT Superapps shape businesses' strategic positioning and competitive edge, focusing on SMEs, SOHOs, and Developers in the South African market.

P1 underscored aligning business offerings with CIoT Superapp's customer demographics to ensure effective market positioning. They emphasized, *"It's good to have a large customer base, but does that large base fit my profile of the type of customer I seek on that platform?"* In a crowded and competitive market, the ability to identify and target a suitable customer base is a key differentiator. Suppose the CIoT Superapp can enable businesses to leverage insights on customer demographics to position their offerings. In that case, they will have a competitive edge over those that do not. This strategic positioning enables businesses to stand out and capture the attention of their ideal customers within the CIoT Superapp ecosystem.

The same participant also highlighted the significance of customer retention as a key performance indicator, stating, *"Retention is good for any business, right? It's one of the key critical KPIs that one would look at, and any platform that can have that level of retention would definitely be a platform of interest."* Acquiring new customers is generally more expensive than retaining existing ones. The CIoT Superapp, with high customer retention rates, can reduce the need for businesses to invest heavily in customer acquisition. Instead, they can focus on engaging and upselling to their existing customer base on the platform, optimizing their marketing spend.

P2 discussed the advantage of aligning with larger groups for resource availability. They noted*, " I'm talking about capabilities now. So MTN it's a bigger group can dedicate more resources to moving faster. So, if we say there's a new concept we want on this platform that would help our businesses move faster, they have got a bigger team that can actually make that happen, for example.*" For businesses, especially SMEs and startups, scaling up operations can be challenging due to limited resources. A CIoT Superapp backed by a larger organization can facilitate this scaling process by providing the necessary support and infrastructure. This can include anything from financial marketing to customer support systems, allowing businesses to expand their reach and operations without the typically associated high costs. P5's comments further complement this perspective by underscoring the critical importance of market access for smaller businesses. *"So, as a startup business, one of the biggest problems we encounter is access to the market. And that's where the partnership with a large CIoT telco type of organization, or like a Microsoft or whatever, things like that, that you want."*

P3 touched upon the shift from traditional marketing to digital platforms, highlighting the role of CIoT Superapps in customer acquisition*: " Yeah, I think a majority of the users are sitting on their cell phones, and they're probably gonna download the Consumer Superapp. And traditionally, what would we do? We would drop flyers and start marketing campaigns and things like that."* Underscores consumers' widespread adoption of digital technology and the increasing relevance of mobile platforms for marketing, for which companies may not have the resources, as mentioned above.

They also mentioned the desire for a safe and trustworthy way to acquire customers, which CIoT Superapps can provide: *" But I want a safe and trustworthy way to acquire them. And I think that's what the CIoT Superapp is actually gonna bring for me. Because you have all these professional services like plumbers and electricians loaded onto it. And I just have to go in over there, click what I want and off they go, right out they come to me."* Suppose a CIoT

Superapp can provide access to creditworthy customers. This feature significantly enhances the platform's value for businesses, mainly regarding financial transactions and risk management.

Furthermore, suppose the CIoT Superapp can provide to consumers professional services on the ap. In that case, it enables technology-focused businesses to expand their reach and tap into new customer segments. This accessibility to diverse services within a single platform presents significant opportunities for businesses to increase their visibility and market presence.

P8 discussed the CIoT Superapp opening new revenue streams outside traditional models: *" Yeah, absolutely. I mean, we're here to scale, and we're here to basically to make more money as a business that's what you're trying to do. So if this opens the opportunity for me to have a revenue stream outside of this app or something I haven't thought about just by way of the ecosystem, seeing what I do, then absolutely that's a big plus."* This reflects the impact of a multi-sided platform to create an environment where businesses can discover and capitalize on opportunities that may not be available in more conventional marketplaces. For example, businesses can leverage the CIoT user base and partner ecosystem to introduce complementary services or products, tapping into new markets and customer needs that might not have been possible in isolation.

P9 emphasized the importance of positioning in niche markets, such as security: *"Security is one of the biggest contributors to the tech industry... So in terms of having a Superapp and being a preferred provider in that area, it would make a lot of sense."* This highlights how the CIoT Superapp can offer an effective platform for businesses to gain visibility in specialized markets like security. By being part of the CIoT Superapp that caters to a wide range of services, businesses in niche sectors can showcase their expertise and services to a broader audience they might not reach through traditional channels. This increased exposure is crucial for businesses looking to establish a strong presence in their specific market.

5.2.3.2 **Strategic Business Decisions**

The analysis of the theme of Strategic Business Decisions provided valuable insights into important considerations for businesses contemplating the adoption of a CIoT Superapp.

P1's contribution underscores a foundational concern: Return on Investment (ROI) assessment. It is necessary to assess the potential financial impact of integrating such platforms into their business models. P1 expressed this concern by stating, "*So, the first thing I would need to worry about is what my ROI would be if I joined this platform."* The ROI assessment involves analysing the potential revenue growth and the costs associated with joining and operating within a CIoT Superapp ecosystem. Businesses must consider how the CIoT Superapp can enhance their sales, customer reach, and market presence against the costs of integration, subscription fees, and additional investments in technology or marketing. For a business to decide on joining a CIoT Superapp, the anticipated ROI must align with its broader business goals and strategies. The CIoT Superapp should offer financial returns and support the company's long-term vision, such as expanding into new markets, enhancing customer experience, or improving operational efficiency. The integration with a CIoT Superapp should be seen as a strategic move that complements and enhances the business's overall direction.

They further discussed the integration of CIoT Superapps with existing business models: "*So my business shouldn't change too much. The Superapp should just be an extension of what is my brick-and-mortar ways of working."* This perspective suggests that CIoT Superapps should complement and enhance existing business operations rather than necessitating significant changes. The participant also noted the possibility of expanding into the e-commerce space if the CIoT Superapp successfully drives customer engagement: *"And then should the platform eventually bring me enough customers, then I could eventually then introduce a new department that solely focuses on the e-commerce space."* Integrating the CIoT Superapp with existing business models bridges the gap

between traditional brick-and-mortar operations and the digital world. This approach allows businesses to maintain their established working methods while leveraging the advantages of digital platforms. P1's perspective suggests a gradual transition to digital platforms, where CIoT Superapps are an extension of existing business practices. This gradual approach minimizes disruption and allows businesses to adapt to digital processes at a manageable pace. It enables companies to test and learn from the digital platform before fully committing to more significant changes in their business model.

P4 raises a pertinent issue, highlighting potential resistance from a lack of technological proficiency. They point out that reluctance toward technology adoption may persist among less tech-savvy individuals, as emphasized by the point, *“And I think a lot of people are just simply old fashioned and they're not tech savvy.”* The reluctance or inability of some individuals to adapt to new technologies can pose a challenge to adopting a CIoT Superapp for a business whose target market is older users. This gap in technological proficiency means that CIoT Superapps must be designed with a wide range of users in mind, including those who may not be familiar with or comfortable with advanced digital platforms. Addressing this gap is crucial for ensuring that CIoT Superapps are accessible and beneficial to a broader audience.

P5 discussed the importance of the CIoT Superapp's functionality and its role in driving business growth: "*This is not the problem in there. It's like, is the Superapp going to provide intelligence? Or is it going to do its actual job really, really, really, really well? And if it's going to do that, then yeah, sure, we'll recommend it, we'll use it. It can drive business growth. It's like Azure. It must get to that stage. Nothing is there, it's running, it's like a super, super, super infrastructure platform as a service app, you know, and people use it"* Drawing a comparison to established platforms like Azure, P5 suggests that the CIoT Superapp should aspire to reach similar levels of reliability, performance, and user satisfaction. Azure, known for its robust infrastructure and wide range of services, sets a high benchmark for CIoT Superapps. Achieving such standards would mean that CIoT

Superapps can support a variety of business needs and can be trusted for critical operations.

P9 speaks to the convenience of a unified platform: "*So Superapp is very ideal compared to having a standalone. You have to open up one app to do this and open up another app to do that. It's a waste of time.*" This statement underscores the efficiency and time-saving benefits that a CIoT Superapp can offer. By consolidating various services into a single platform, the CIoT Superapp streamlines user experience, making it easier and quicker for users to access the services they need without the hassle of switching between different apps. However, as P8 points out, while the consolidation of services in a CIoT Superapp offers numerous benefits, it also entails risks, particularly regarding over-dependence, "*Secondly, I mean it makes sense that you can have everything on a Superapp... On the other hand, it's also putting all your eggs in one basket, right?*". This concern highlights the need for careful risk management and diversification. Relying heavily on a single platform can pose challenges if the platform faces issues, underscoring the importance of maintaining alternative options.

5.2.3.3 **Customer-Centric Approach and Innovation**

The Customer-Centric Approach and Innovation theme analysis provided valuable feedback emphasizing the importance of prioritising consumer and business user experiences for effective platform engagement.

P1 stressed the significance of the consumer journey*: "Because it's one thing making our journey easy, but if the consumer journey is not easy, then there's no point doing it."* The focus on the consumer journey is essential for the success of CIoT Superapps, as it directly impacts user satisfaction, retention, and overall engagement with the platform. Therefore, designing the CIoT Superapp with an intuitive, responsive, and user-centric approach is vital to meeting and exceeding consumers' expectations, thereby fostering a positive and engaging digital environment.

P1 also highlighted the value of having dedicated support for businesses: *"Another thing that would be important for joining this Superapp would be my own business's user experience in terms of, do we have an account manager?"* This insight highlights the necessity for tailored support and guidance for businesses operating within the CIoT Superapp. An account manager's role is pivotal in providing personalized assistance, facilitating effective integration, and optimizing business operations on the platform. This dedicated support is essential for ensuring businesses can maximize their engagement and leverage the full potential of the CIoT Superapp, thereby fostering a more effective and satisfying business-user experience within the digital ecosystem.

P1 underlined the importance of customer feedback: "*So with one of my businesses, one of the things we do is after every single purchase, we contact the customer and ask if they were satisfied with that purchase."* This approach to direct customer engagement is essential for maintaining high service standards and understanding consumer needs. The need for effective feedback channels was further reinforced by P4, who stated, "*And have very important feedback channels... the user's got to be able to say, this doesn't work, or that overlaps with that*." The ability for users to provide direct feedback is crucial for continuously improving the CIoT Superapp's usability and functionality. P5 highlighted the role of customer feedback in driving business growth: *"You want a funnel of that direct consumer or customer sort of feedback channel into that."* Effective feedback mechanisms enable businesses to maintain high service standards, improve usability, understand customer preferences, and drive business growth. This approach to customer engagement is essential for the ongoing refinement of CIoT Superapps and ensuring they meet users' evolving needs and expectations.

P3 focused on resolving customer disputes: "*So if a consumer is not happy with the service I provide them, I would want the consumer app to liaise with me*." The advocacy for a system that facilitates direct communication between the service provider and the consumer is critical to resolving disputes effectively. The

emphasis on timely feedback and resolution is crucial in preventing an escalation of issues and maintaining a positive brand image while also serving as a valuable source of insights for continuous improvement and creating new products and services.

P6 noted the potential for businesses to utilize customer data effectively: "*If he's got a platform view of all the customers he sold the meter to, he could consult them back on the consumption, or they could see the consumption as well. And he would just get exceptions on leaks or burst pipes or something like that. That would drive his business, and it would drive the business of the digital water meter supplier*." The example shows how businesses can use customer data to offer enhanced services. By accessing data such as water consumption, businesses can provide valuable feedback to customers, helping them understand their usage patterns and potentially identify areas for cost savings. This proactive approach to customer service can significantly improve customer satisfaction and loyalty.

The same participant highlighted the benefits of access to broad customer data: *you have access to a lot of data which they have to opt in, and you can see buying patterns, and trends with something like a Superapp across many products and services. So, you can ascertain customer behaviour that can talk to stock levels preparedness for the companies that have integrated into your app."* Determining customer behaviour is crucial for businesses to tailor their strategies and offerings. Based on the data gathered, companies can adjust their inventory levels, develop targeted marketing campaigns, and customize their services to meet customer needs better. This customization leads to more effective and efficient business operations, enhancing customer satisfaction and loyalty. Using this data to explore new product development, improve service delivery, and enhance overall customer experience.

P8 spoke about the importance of customer support and reviews: "*. You know, generally if it's an app, I mean, depending on the size, maybe it would be a chat-based system where the consumer says, okay, this is not working, and you can*

connect them to the relevant vendor." A chat-based system or similar interactive support channels allows immediate communication when users encounter issues. This responsiveness is critical to resolving problems quickly and maintaining user satisfaction. A responsive support system demonstrates a commitment to customer service. It can significantly impact the overall user experience with the CIoT Superapp. However, P8 acknowledges that there are "*a lot of moving parts that happen in the background*" in a Superapp's customer support system. This complexity requires a well-organized and capable support infrastructure that can handle various scenarios, from technical glitches to service inquiries. An effective support system should be equipped to manage these complexities efficiently.

The same participant emphasized the value of customer reviews: "*Nice to see a review from existing customers... And that, in turn, is what upsells you or gets you better ratings."* In many digital platforms, including CIoT Superapps, customer reviews can affect a business's visibility and ratings. Businesses with higher ratings and positive reviews are more likely to appear prominently in search results and recommendations. This enhanced visibility can lead to more exposure and opportunities for customer acquisition. Besides enhancing reputation and attracting customers, reviews also offer valuable business feedback. They provide insights into what customers appreciate and areas where improvements can be made. This feedback is crucial for businesses to refine their offerings and continually improve their services to meet customer expectations.

5.2.3.4 **Adaptation and Flexibility**

The analysis of the theme of Adaptation and Flexibility provides valuable feedback in emphasizing the importance of integration, API strategy, market dynamics, architectural planning, lock-in considerations, and the convenience of a unified platform.

P2 focuses on integrating with the surrounding ecosystem: "*So for most of my projects, that's what I try to do. So, build my own software, solves a particular*

need... So, for me, a key factor is integration." This emphasis on integration highlights the importance of CIoT Superapps being adaptable and flexible enough to work seamlessly with various systems and services. The ability of the CIoT Superapp to integrate effectively with various external systems and services is crucial for its adaptability and utility. This integration enables the CIoT Superapp to function as a cohesive platform that combines disparate services, enhancing the overall user experience. It allows for a more holistic approach to addressing user needs, as the CIoT Superapp can connect to and leverage the strengths of multiple systems.

P6 adds another layer to this discussion by highlighting the significance of a well-structured API strategy, "*So API strategy with an app is very important and, you know, with APIs come a lot of agreements with different companies, but with the Superapp, it covers all of that, I would assume.*" This insight suggests that a comprehensive API strategy is crucial for simplifying the integration process with different companies. A robust API framework allows seamless communication and data exchange between the CIoT Superapp and various external partners, enhancing the platform's overall functionality and utility.

P5 touches on the complexity of CIoT Superapps and the need for proactive architectural planning: "*So Superapps are more complex, no doubt... Because then you're creating a nightmare for yourself and actually don't go the Superapp route if you don't have that in, like, sort of even just that thought.*" This remark underscores the importance of forward-thinking and strategic design to ensure the CIoT Superapp's adaptability and scalability. Proactive planning is crucial to manage the complexities and ensure the platform's long-term success.

P7 addresses the topic of lock-in and the desire for flexibility: "*Then when it comes down to lock-in, if it's convenient to me, I don't have an issue with lock-in... Make it easy for me to leave. I would like that as an option.*" A vital feature of the CIoT is the ability to lock in by offering a range of integrated services and features. While this can be convenient, it may limit users' flexibility to explore other options. P7 suggests that while convenience is desirable, it should not come

at the expense of the user's ability to choose other platforms. Providing an option to exit the platform respects user autonomy and the decision-making process.

5.2.3.5 **Innovative Marketing and Promotion**

The Innovative Marketing and Promotion theme analysis provides valuable feedback on the various approaches and considerations for effective marketing strategies and branding within the platform.

P1 emphasizes the importance of understanding consumer demographics for effective marketing: "*So, if the company is also able to provide that level of detail to say, yes, I can give you an area, but this is also the type of consumer base that we have, that is also critical to my decision-making... So that consumer demographics also becomes critical.*" This perspective underscores the need for targeted marketing strategies that consider different consumer segments' preferences and behaviours. Customized marketing approaches based on detailed consumer insights can lead to more effective promotions and higher engagement.

P3 addresses the need for white-label solutions that allow enterprise customers to brand the app according to their corporate identity: "*Another factor is most of the time enterprise customers, they like their apps to be white labelled in their brand and theme... So, it also depends on whether the CIoT Super app can actually meet the specific requirement.*" This requirement for customizable branding is essential for enterprises that want to maintain their brand image and customer loyalty within the CIoT Superapp environment.

P5 discusses the potential for leveraging existing marketplaces and physical stores for promotion: "*And I mean Telco is a brilliant example. They got stores. People are in the stores all the time. They have marketplaces that are online in there. So, I mean, and I assume they use that marketplaces to sell not only to the direct consumer but also to businesses. So, we would want to leverage that as well.*" Leveraging existing marketplaces and physical stores involves tapping into

established and recognized channels to promote Superapp services. This approach can be convenient because these channels have a pre-existing customer base and brand recognition. For example, Telco stores, as mentioned by P5, can serve as valuable touchpoints to showcase the services and get users to download and engage with the app.

P5 also comments on the importance of product-driven marketing: "*You know, it's just not, don't be driven by the marketing and sales agent only. How is the product driving the IoT world?*" P5's emphasis on product-driven marketing within the CIoT Superapp ecosystem advocates for focusing on products' intrinsic value and impact in marketing strategies. This approach emphasizes quality, relevance, and customer benefits, helping businesses build trust, differentiate in the market, encourage organic growth, and align closely with customer needs. For example, by understanding what users genuinely want and how they can benefit from the product, businesses can tailor their marketing messages to resonate more effectively with their target audience. This also links back to how customer insight data in the platform can create an effective marketing strategy.

P9 speaks to the advantages of regional-based marketing within Superapps: "*I've seen apps in the past where they, like you know, it works on region base so it was allowed you to check your location and then they'll find some service providers... it will automatically give free marketing of sort to the provider.*" As P9 notes, this type of marketing can provide businesses with free or low-cost opportunities to promote their services. The CIoT incorporating regional-based marketing features can automatically include local service providers in relevant user searches and recommendations, reducing the need for providers to invest heavily in separate marketing efforts. This marketing approach is critical for SOHOs and SMEs, for example, a plumber offering their services on the app who is looking to grow their customer base locally in a specific area they service.

5.2.3.6 **Summary**

Our analysis has revolved around five essential themes to answer the research question of how businesses can leverage the CIoT Superapps to enhance their competitiveness and growth potential.

Competitive Advantage and Market Positioning are at the forefront of considerations. To succeed within the CIoT Superapp ecosystem, businesses must align their offerings with the specific demographics of Superapp users. This alignment ensures a broad customer base and targets the right audience, enabling effective market positioning. Businesses that can identify and target their ideal customers within the CIoT Superapp ecosystem gain a significant competitive edge. Additionally, retaining existing customers is highlighted as a critical performance indicator. High customer retention rates can reduce the need for businesses to invest heavily in customer acquisition, allowing them to focus on upselling to their existing customer base.

Strategic Business Decisions are critical when contemplating integration with CIoT Superapps. A careful Return on Investment (ROI) assessment is essential, considering potential revenue growth against integration costs, subscription fees, and additional investments. Integration must align with broader business objectives, offering financial returns while supporting long-term strategies. Gradual integration minimizes disruption, but addressing potential resistance from users less familiar with technology is essential.

A Customer-Centric Approach and Innovation are foundational within the CIoT Superapp ecosystem. Businesses must prioritize the consumer journey, offering dedicated support to ensure a positive user experience. Effective feedback and dispute-resolution channels are crucial for user satisfaction and insights. Leveraging customer data for personalization enhances overall customer experience, allowing businesses to offer tailored services and improve customer loyalty.

Adaptation and Flexibility are crucial for success. CIoT Superapps must seamlessly integrate with external systems and services, necessitating a well-structured API strategy. Proactive architectural planning is essential to manage complexity effectively. The consideration of potential lock-in issues and the ability to allow users to exit the platform are vital for user autonomy and flexibility.

Innovative marketing and promotion strategies are indispensable for thriving in the CIoT Superapp ecosystem. Key strategies to increase adoption include employing targeted marketing tactics based on detailed consumer insights, offering customizable branding options, and maximizing the use of existing channels for promotion. Emphasizing products' intrinsic value and relevance in marketing and regional-based marketing approaches provides businesses with cost-efficient means to connect with their target audience.

In summary, businesses can leverage CIoT technologies to enhance their competitiveness and growth potential by strategically positioning themselves in the CIoT Superapp ecosystem, making informed business decisions, adopting a customer-focused approach, maintaining adaptability, and utilizing innovative marketing techniques. This comprehensive approach enables businesses to effectively capitalize on the opportunities presented in the evolving digital landscape of CIoT Superapps.

5.2.4 Results linking back to the proposed conceptual model

Integrating conceptual insights with empirical findings derived from thematic analysis, this chapter sheds light on the convergence between the proposed CIoT Superapp with MTN as the platform owner, as detailed in section 2.4, and the thematic evidence gathered. The thematic analysis validates the initial concept based on the paper by Karapantelakis and Markendahl (2015), where a telco can act as a mediator in a multi-sided market. The analysis robustly underpins the commercial viability of the proposed conceptual model of the CIoT Superapp, shedding light on the pronounced market enthusiasm for a platform that combines a spectrum of CIoT services. Such insights into market acceptance and

anticipation unveil a demand for a unified solution to the prevalent issue of app overload. This insight aligns with the study by Schreieck et al. (2023), which highlighted the user preference for MiniApps over standalone native apps due to their simplicity and reduced need for multiple app downloads, which is critical to the customer experience by reducing the need for multiple app downloads for different CIoT products and services, reinforcing the conceptual model's assertion of the CoT Superapp as an essential market innovation, as discussed in section 2.4.4.

The thematic analysis underscores the significance of utilizing MTN SA capabilities to surmount integration hurdles and related expenses, which are crucial for establishing an MSP, as discussed in a paper by Degrande et al. (2018). They advocated that MSPs could mitigate the IoT industry's fragmentation by instituting a uniform operating framework for ecosystem participants, a concept our conceptual model tested and confirmed. The model highlights the pivotal role of straightforward integration and deployment facilitated by MTN's infrastructure, APIs, and onboarding procedures. A user-friendly and technologically advanced platform was identified as a critical factor in enabling smooth coordination among diverse services, thus guaranteeing an enhanced user experience. This approach validates the utility of MSPs in addressing industry fragmentation. It emphasizes the critical importance of ease of integration and robust platform design in achieving seamless ecosystem interoperability.

The strategy of harnessing MTN SA anchor points, including its extensive customer base, to foster a dynamic IoT ecosystem resonates with the ambition to enhance the commercial potential of ecosystem monetization, especially for SMEs, SOHOs, and Developers. This approach synergises with the insights Schreieck et al. (2017) provided, who explored existing IoT platforms to articulate a theoretical framework for an MSP IoT Platform. Their research distinguished between advanced and standard IoT platforms, with the former incorporating marketplaces that facilitate direct interactions between users and

complementors, thus offering additional services. This classification into MSPs underscores the importance of a marketplace in enriching the IoT ecosystem. Schreieck et al. (2017) identified critical players within the IoT platform ecosystem to drive monetization, including reselling platform partners, device integrators, platform complementors, and infrastructure providers, which were used as input to the conceptual CIoT as proposed in Chapter 2.4.4. By aligning the strategic utilization of MTN SA resources with the theoretical framework proposed by Schreieck et al. (2017)), this model underscores the imperative of fostering a dynamic, interactive ecosystem through the CIoT Superapp. This approach aims to meet the immediate demands of SMEs, SOHOs, and Developers. It promotes collaborative and integrative efforts towards innovation and value creation within the IoT domain. The envisioned ecosystem would serve as a central hub for various types of SMEs, SOHOs and Developers, such as reselling platform partners, device integrators, platform complementors, and infrastructure providers, thereby enhancing the commercial viability and sustainability of IoT initiatives and enabling them to create new market niches or a 'blue ocean' of opportunity.

The empirical evidence about the impact on SMEs, SOHOs, and Developers substantiates the model's emphasis on ecosystem inclusivity and collaborative dynamism. This concurs with the model's advocacy for a multi-sided platform conducive to co-creative value generation. Moreover, the application of Kotler's Five Product Levels within the conceptual model resonates through the thematic findings related to value creation via personalization, convenience, and enriched user experiences. The stakeholders' focus on seamless integration and the necessity of a unified platform experience corroborates the model's attention to augmented and potential product levels, suggesting that the platform owner's commitment to differentiated services can aptly meet the expectations of business partners. This aspect is supported by the case study on the Superapp Jaki by Nugraha (2020), which demonstrated how a Superapp designed to meet citizen needs through government, community, and private industry collaboration can enhance public services. The thematic analysis thereby validates the CIoT

Superapp model's potential to extend customer engagement and create innovation opportunities, as echoed by the positive impact of the JAKI app on enhancing public services in Jakarta, as found by Maajid and Rachmawati (2023).

Furthermore, the thematic insights regarding competitive advantage, strategic business decisions, and customer-centric innovation echo the model's proposed strategies for harnessing the CIoT Superapp. Businesses are poised to bolster their competitiveness by aligning their offerings with the platform's capabilities, adeptly targeting specific demographics, and capitalizing on data-driven personalization. The discourse underscores the imperative for businesses to integrate flawlessly with the CIoT Superapp, foster continuous improvement through customer feedback, and pursue innovative marketing strategies within the ecosystem. These approaches, strengthened by the model's focus on collaboration and value generation, allow businesses to exploit the CIoT Superapp's potential, catalyzing growth and securing a competitive edge in the digital domain.

Moreover, the model's strategic framework for enabling businesses to harness the full potential of the CIoT Superapp, thereby fostering growth and establishing a competitive advantage, finds validation in the research conducted by Ye (2022). the study delineates critical factors contributing to the success of Superapps in emerging markets, including the significance of higher switching costs for users and the capacity to offer a broad spectrum of services, leveraging institutional gaps. The observations regarding the importance of competitive advantage and customer-focused innovation align with these insights. They underscore the model's applicability and effectiveness in South Africa's burgeoning market, highlighting its potential to meet the diverse needs of SMEs, SOHOs and Developers.

The thematic analysis provides compelling support for the conceptual model's feasibility and strategic vision for the CIoT Superapp, intricately aligning with the outlined research questions. The evidence highlights the CIoT Superapp's considerable commercial potential within the South African SME, SOHO and

developer market, substantiating the first research question by accentuating the pronounced market demand for a cohesive platform. In response to the second research question, the findings outline the CIoT Superapp's profound impact on SMEs, SOHOs, and Developers, demonstrating its role as a crucial enabler for these stakeholders to flourish within the CIoT ecosystem. This readiness affirms the feasibility of evolving a multi-sided platform-based ecosystem for CIoT, positioning a platform owner to enable SMEs, SOHOs and Developers to expand their markets or create new blue oceans. Lastly, in addressing the third research question, the thematic analysis advocates a strategic framework for businesses to leverage the CIoT Superapp in augmenting their competitiveness and potential for growth, thereby effectively capitalizing on the opportunities afforded by the CIoT Superapp to stimulate growth and maintain a competitive stance in the evolving digital landscape.

6 CONCLUSIONS & RECOMMENDATIONS, LIMITATIONS & FUTURE RESEARCH

6.1 Conclusion

6.2 Phase 1 – Customer Adoption

Phase 1 explored the commercial potential of Superapps within the CIoT ecosystem in South Africa, focusing on identifying key factors influencing consumer adoption. The study utilized a quantitative approach, administering an online survey to a diverse sample of 281 respondents. The analysis involved comprehensive statistical techniques, including reliability tests, factor analysis, correlation analysis, and regression models.

Key findings from the study highlighted the importance of Perceived Usefulness, Perceived Ease of Use, Variety of Services, and Attitude in influencing the intention to use CIoT Superapps. Platform Trust and Perceived Critical Mass did not significantly influence Perceived Usefulness within the tested models. The study also revealed that the moderating effect of Perceived Cost on the relationship between Attitude and Intention to Use was not statistically significant, suggesting that cost may not be as pivotal in influencing adoption decisions as initially thought.

These findings contribute to the existing knowledge on technology adoption, particularly within the emerging context of CIoT Superapps. They provide an understanding of consumer behaviour and preferences in the CIoT Superapp domain while providing input for extending traditional technology adoption models like the Technology Acceptance Model (TAM).

6.3 Phase 2 – SME, SOHO and Developer Impact

This research phase explored the commercial potential and impact of the CIoT on the SMEs/SOHOs and Developers' market, as well as the broader implications for businesses seeking to enhance their competitiveness and growth potential. The process followed was a thematic analysis of ten interviews with diverse participants from the IoT industry, which yielded rich insights into the commercial potential and challenges of a CIoT Superapp. Participants from various backgrounds, including co-founders of IoT startups, solutions architects, and business owners, provided a multi-dimensional perspective on CIoT Superapps.

6.3.1 Research Question 1: What is the commercial potential of developing a Superapp as a multi-sided platform-based ecosystem for CIoT within the South African market?

Our findings affirm the significant commercial potential of CIoT Superapps in South Africa. Key themes such as Superapp Market Potential, Integration and Usability, Consumer Engagement and Stickiness, and Security and Privacy Concerns have been thoroughly analysed. The study underscores the market's readiness for a CIoT Superapp, evidenced by solid anticipation and support for their comprehensive, streamlined solutions. Participants have highlighted the need for efficient API management, user-friendly deployment, interoperability of IoT devices, and high-quality integration to ensure usability and technical excellence. Additionally, the critical importance of addressing security and privacy concerns to foster user trust and ensure compliance with legal standards has been emphasized.

6.3.2 Research Question 2: How can a CIoT Superapp impact SMEs/SOHOs or Developers in the South African market

Our investigation into the impact of CIoT Superapps on SMEs, SOHOs, and Developers reveals substantial opportunities for business growth and operational

efficiency. CIoT Superapps have emerged as dynamic platforms that significantly streamline operations, reduce complexity, and offer cost-effective solutions. The importance of fair play, equitable treatment, and unbiased algorithms on these platforms to ensure market fairness has been highlighted. The ability of Superapps to foster collaboration, drive innovative marketing strategies, and offer businesses access to larger customer bases and new revenue streams has also been underscored.

6.3.3 Research Question 3: How can businesses leverage these technologies to enhance their competitiveness and growth potential?

Analyzing Competitive Advantage and Market Positioning, Strategic Business Decisions, Customer-Centric Approach and Innovation, Adaptation and Flexibility, and Innovative Marketing and Promotion themes provide crucial business insights. To leverage the CIoT Superapp effectively, businesses must align their offerings with the specific demographics of CIoT Superapp users, carefully assess ROI, prioritize consumer experience, maintain adaptability, and employ innovative marketing strategies. A comprehensive approach that addresses these themes is critical to capitalizing on the opportunities presented in the evolving digital landscape of a CIoT Superapp.

6.4 Recommendations

This chapter synthesizes the insights from the research on CIoT Superapps in South Africa to present strategic recommendations for enhancing their adoption and effectiveness. These suggestions target developers, marketers, and key stakeholders within the CIoT ecosystem, aiming to optimize the potential of CIoT Superapps in the market.

6.4.1 Consumer Adoption

At the forefront of our strategic recommendations is the importance of user-centric design in promoting broader acceptance among consumers. By urging developers to dedicate resources to crafting interfaces that embody intuitive simplicity and facilitate seamless navigation, we underscore a design philosophy deeply rooted in enhancing the user experience. This approach is not merely about aesthetics; it is about creating a functional and accessible digital environment that resonates with users on a fundamental level.

Moreover, the allure of a CIoT Superapp significantly hinges on its capacity to offer a wide array of services using MiniApps. Expanding the diversity of CIoT products and other services markedly amplifies CIoT Superapp's utility. This broadens its appeal across a varied user base and caters to a comprehensive spectrum of user needs.

Contrary to conventional wisdom that posits higher trust and a more extensive user base as the primary drivers of a Superapp's utility, our findings suggest a different narrative. Users may prioritize immediate functional benefits and the specific services offered over broader considerations such as trust levels or the size of the user community. This insight directs stakeholders to concentrate on the direct benefits and features that shape user perceptions of usefulness, shifting the focus from trust and user numbers to the actual value provided by the CIoT Superapp.

In light of our research, which indicates that the perceived cost's role in moderating the relationship between user attitude and intention to use was not substantiated, a nuanced approach to pricing is advocated. While cost remains a critical element of a Superapp's value perception, the emphasis should evolve towards transparently communicating the intrinsic value and unique conveniences rather than merely positioning cost as the primary driver for user adoption.

Finally, our research underscores the need for a broader exploration of factors influencing CIoT Superapp adoption. By delving beyond traditional metrics such as trust and user numbers to include considerations like service quality, personalization based on different types of services, and user engagement, we can uncover more profound insights into what truly drives the perceived usefulness of CIoT Superapps, both in the South African context and globally. A cross-cultural examination can further enrich this understanding, offering a comprehensive view of the dynamics in CIoT Superapp adoption across different markets.

6.4.2 SME/SOHO/Developer Impact

For SMEs, SOHOs and Developers, the integration with CIoT Superapps allows these businesses to tap into new customer bases and expand their market reach effectively. A critical component of leveraging this digital transformation is the emphasis on user experience. Developing MiniApps with user-friendly interfaces is paramount, as a smooth and intuitive user experience directly impacts customer satisfaction and retention, which are cornerstones of business success in the digital realm.

Moreover, the strategic use of data analytics must be balanced. By harnessing the data capabilities inherent in CIoT Superapps, businesses can gain valuable insights into consumer behaviours, preferences, and trends. This intelligence is instrumental in informing various aspects of business strategy, including marketing campaigns and product development, enabling businesses to make informed decisions that drive growth and competitiveness.

Turning our attention to CIoT Superapp owners, managing transaction costs is a pivotal concern. Effective cost management is essential to ensure the platform remains accessible and affordable for SMEs, SOHOs, and Developers, thus facilitating a vibrant ecosystem where innovation thrives. Creating an environment that encourages innovation is crucial. By supporting and incentivizing SMEs, SOHOs, and Developers to experiment and create novel

solutions, CIoT Superapps can foster a dynamic ecosystem that yields synergistic solutions beneficial to all parties involved.

Security and privacy considerations are paramount, given the growing concerns around data integrity in the digital age. Developers must prioritize incorporating robust security measures to build trust among users, which is fundamental for the adoption and success of CIoT Superapps. Additionally, ensuring interoperability and flexibility is essential. A CIoT Superapp compatible with a wide range of IoT devices and platforms can meet the diverse needs of SMEs, SOHOs, and Developers, enhancing its utility and appeal.

It is also crucial to support the integration of SMEs, SOHOs, and Developers. By providing tools, resources, and support systems, such as developer guides, API documentation, and technical support, CIoT Superapp owners can facilitate the seamless integration of current products or services into the CIoT Superapp ecosystem, thereby enriching the platform and offering users a broader range of services and applications.

For policymakers, developing a supportive regulatory environment is essential to the flourishing of CIoT Superapps. Policies that both promote the growth of these platforms and protect the interests of consumers, CIoT Superapp owners, and businesses participating in this ecosystem are needed. This includes enacting data protection laws, guidelines for fair competition, and standards for interoperability. Such measures will ensure a balanced and sustainable growth of CIoT Superapps, fostering innovation while safeguarding user rights and encouraging fair business practices.

In summary, the collective effort of SMEs, SOHOs, Developers, CIoT Superapp owners, and policymakers is crucial in harnessing the transformative potential of CIoT Superapps. By focusing on user experience, leveraging data analytics, managing transaction costs, facilitating innovation, prioritizing security and privacy, enhancing interoperability, supporting integration, and fostering a

supportive regulatory environment, all stakeholders can contribute to a digital ecosystem that promotes growth, innovation, and inclusivity.

6.5 Theoretical Implication

The findings contribute to the existing literature and offer new insights into the theoretical frameworks underpinning technology adoption and market dynamics in the digital age.

The study's findings have significant implications for technology adoption theories, notably the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT). The positive relationships between perceived usefulness, perceived ease of use, and intention to use align with the core propositions of TAM, reinforcing the model's applicability in the context of CIoT Superapps. Moreover, the study extends TAM by incorporating additional factors like various services, a key feature for a CIoT Superapp. This suggests a need for an expanded theoretical framework that integrates these additional dimensions into the standard TAM model for a more comprehensive understanding of technology adoption for CIoT Superapp.

The research provides novel insights into the dynamics of multi-sided platforms, particularly in the CIoT ecosystem. The importance of service variety and the lack of significant influence from platform trust on perceived usefulness highlight the unique characteristics and user expectations in multi-sided platform environments. These findings suggest that traditional models of platform trust need to be revisited and adapted better to reflect the complexities and user priorities in CIoT platforms.

The absence of a significant moderating effect of perceived cost indicates that users' decision-making processes regarding CIoT Superapps might be less influenced by cost considerations than initially hypothesized. This finding challenges traditional economic assumptions about price sensitivity in technology

adoption. Factors like ease of use and service variety may dominate user decisions when using a CIoT Superapp.

Additionally, the study contributes to the Diffusion of Innovations Theory by emphasizing the role of perceived ease of use and service variety in the diffusion process of CIoT Superapps. The study highlights how these factors can accelerate the adoption rate, suggesting a need to incorporate such elements into the diffusion models for technologies that rely heavily on multi-sided platform structures.

6.5.1 SME/SOHO/Developer Model

The findings of this study contribute to the theoretical understanding of CIoT Superapps, particularly in the context of SMEs, SOHOs, and Developers. The study illustrates how CIoT Superapps can serve as multi-sided platforms, providing a comprehensive solution that addresses the fragmentation and complexity often encountered in the CIoT space.

The study offers theoretical insights into the dynamics of the CIoT Superapp ecosystem, including the roles and interactions of various stakeholders. It underscores the importance of collaboration, network effects, and platform governance in shaping the success and sustainability of CIoT Superapps. These insights contribute to the broader understanding of digital platform ecosystems, emphasizing the unique characteristics and considerations within the CIoT context.

The findings provide valuable contributions to business strategy and marketing theories, particularly in the digital platform and IoT contexts. The study explores how SMEs, SOHOs and Developers can strategically position themselves within the CIoT Superapp ecosystem to maximize growth and revenue potential. It also delves into marketing strategies tailored for CIoT Superapps, offering insights into how these platforms can be effectively promoted and utilized to reach target audiences.

6.6 Limitations of the Study

This research into the commercial potential of Superapps within the CIoT ecosystem in South Africa has provided important insights. However, it is marked by several limitations that merit consideration.

6.6.1 Quantitative Method

The current study focuses on a specific cross-section of the population, further constrained by convenience sampling. While this approach provides valuable insights, it leaves room for future research to adopt a more inclusive and comprehensive sampling strategy. Online survey methodology could also bias the outcomes, excluding those without internet access. The lack of support for perceived cost as a moderating variable, critical mass and platform trust on perceived usefulness suggests the need for further investigation into other factors that may influence the adoption of CIoT Superapps.

6.6.2 Qualitative Method

While the study’s participants brought varied experiences and perspectives, the relatively small and specialized sample may not fully represent the broader population of SMEs, SOHOs, and Developers in South Africa. Future research can explore these findings in a broader context, enhancing generalizability and understanding.

The study did not investigate how external elements like economic conditions, socio-economic circumstances, and regulatory frameworks might affect the adoption and effectiveness of CIoT Superapps in a business setting. For instance, factors such as sluggish economic growth, load-shedding, increased operating expenses, and elevated interest rates in South Africa could play significant roles. These variables are subject to change and can shift market outlooks and strategies, potentially impacting the study's findings' relevance and applicability as time progresses.

Lastly, the study primarily concentrated on the South African market. While this provided specific insights into this region, it might limit the findings' applicability to other geographical contexts. CIoT Superapp adoption can vary significantly across cultural, economic, and regulatory landscapes.

6.7 Directions for Future Research

Future research should extend the understanding of CIoT Superapps and address the current study's limitations. They should employ a broader sampling strategy to enhance the representativeness of the findings. This approach would involve reaching a wider demographic of consumers and businesses, ensuring that the insights reflect the diverse South African market. Including participants from various regions and sectors could offer a more holistic view of CIoT Superapp adoption and usage. Longitudinal studies can establish causality and observe trends over time. These studies could track changes in consumer behaviour, business strategies, and market dynamics in response to CIoT Superapp adoption, providing a dynamic view of the ecosystem's evolution.

Qualitative methods could offer deeper insights into consumer user motivations and barriers. Investigating additional moderating variables might explain the complexities of CIoT Superapp adoption more fully. Cross-cultural studies could reveal how consumer behaviour varies internationally, and keeping abreast of technological advances is crucial for assessing their impact on user perceptions. Intervention studies could test the effectiveness of various strategies to increase CIoT Superapp adoption, and an economic impact assessment would provide a macroeconomic perspective.

Exploring the dynamics of the CIoT Superapp ecosystem, including the roles of various stakeholders and collaboration models, would be beneficial. This research could analyse how participants interact within the ecosystem and the implications for innovation, competition, and market growth. For example, exploring the impact of CIoT Superapps across different industries could offer

valuable insights into how various sectors leverage these platforms. Research could focus on sector-specific use cases, challenges, and benefits, providing a more comprehensive understanding of the CIoT Superapp's versatility and adaptability. This analysis could include healthcare, education, retail, and transportation industries, each with unique requirements and potential for innovation through CIoT Superapps.

Finally, the study suggests that platform trust and perceived critical mass did not significantly influence perceived usefulness. Future research should delve deeper into these aspects and explore additional factors such as social influence, privacy concerns, and security features that might impact consumer adoption. Through these avenues, future research can build a more comprehensive understanding of the factors that drive the adoption and success of CIoT Superapps in diverse markets.

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8 APPENDIX A – Online Survey Participant's Information Sheet

Dear Sir / Madam,

My name is Ravendran Naicker, and I am a master's student in Digital Business at the University of the Witwatersrand, Johannesburg. As part of my studies, I must undertake a research project, and I am investigating the commercial potential of Superapps in the CIoT ecosystem within South Africa under the supervision of Professor Thomas Anning-Dorson.

Your participation in this online survey is entirely voluntary, and you have the right to refuse or withdraw from the study at any time without any negative consequences. If you choose to withdraw, any data you have provided will be used anonymously, without any personal identifiers. Your privacy and confidentiality will be protected throughout the study. All information you provide will be treated as confidential and stored securely. Your responses will only be accessible to the research team and will not be shared with third parties. The data collected from this survey will be used for research purposes only, and any reports or publications resulting from the study will use aggregated and anonymized data.

Although there are no direct benefits to you as a participant, your input will contribute to advancing knowledge in CIoT and Superapps. If you have any questions or concerns about the research, you may contact Ravendran Naicker at 2060635@students.wits.ac.za. For inquiries about your rights as a research participant, please contact the University Human Research Ethics Committee (Non-Medical) by telephone at +27(0) 11 717 1408, email hrecnon-medical@wits.ac.za

The survey is expected to take approximately 20 Minutes to complete, including a video followed by an online questionnaire. By clicking the "Agree" button below, you indicate that you have read and understood the above information. You voluntarily agree to participate in this survey and provide your responses for research purposes.

☐ **AGREE**

Thank you and regards,
Ravendran Naicker

9 APPENDIX B – Online Survey Questionnaire

Before starting the questionnaire, the interviewee was introduced to the concept of the CIoT Superapp. Then, the idea of using one if it were available was proposed. Subsequently, the following questions were asked:

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
SD	D	N	A	SA

On a scale of 1 to 5, where 1 is strongly disagree and 5 is strongly agree, indicate the extent to which you agree with each of the following statements below

Construct	Items	Adjusted question	Reference	SD	D	N	A	SA
Perceived Usefulness (PU)	PU1	If I can use different CIoT use cases in one app via MiniApps, it positively influences the usefulness of the CIoT Superapp.	(Davis, 1985; Nikou, 2019)	1	2	3	4	5
	PU2	The concept of a CIoT Superapp is a useful service.	(Davis, 1985; Nikou, 2019)	1	2	3	4	5
	PU3	If I can access the ecosystem for additional services to accomplish my tasks more rapidly, it positively influences the usefulness of CIoT Superapp.	(Davis, 1985; Nikou, 2019)	1	2	3	4	5

Perceived Ease of Use (PEOU)	PEOU 1	If I can easily download different MiniApps, I would prefer the CIoT Superapp CIOT versus a standalone CIoT App.	(Davis, 1985; Nikou, 2019)	1	2	3	4	5
	PEOU 2	I believe that if the app is easy to use and navigate for multiple use cases, it positively influences the ease of using the CIoT Superapp.	(Davis, 1985; Nikou, 2019)	1	2	3	4	5
	PEOU 3	If I can easily access the ecosystem for additional services, it positively influences the ease of using the CIoT Superapp.	(Davis, 1985; Nikou, 2019)	1	2	3	4	5
Platform Trust	PT 1	If the CIoT Superapp platform owner has a strong brand makes the app trustworthy.	(Li et al., 2018)	1	2	3	4	5
	PT 2	If well-known businesses are part of the CIoT ecosystem, it makes the app trustworthy.	(Li et al., 2018)	1	2	3	4	5
	PT 3	If the platform owner has vetted all the services on the CIoT Superapp in accordance with local privacy laws makes the app trustworthy.	(Li et al., 2018)	1	2	3	4	5

Variety of Services	VOS 1	I believe that if the CIoT Superapp offers a wide range of services, it makes it a helpful app.	(Hsu & Lin, 2016; Salehi et al., 2023)	1	2	3	4	5
	VOS 2	I believe that if the CIoT Superapp 's broad range of IoT services, which allows me to conveniently access and manage all my needs within a single app, makes the app useful.	(Hsu & Lin, 2016; Salehi et al., 2023)	1	2	3	4	5
	VOS 3	I believe that if The CIoT Superapp makes it easy for me to find the right app from the variety of services available makes the app useful.	(Hsu & Lin, 2016; Salehi et al., 2023)	1	2	3	4	5
Percieive Critical Mass	PCM 1	If a large percentage of my personal network uses the CIoT Superapp makes the app useful.	(Hsu & Lin, 2016)	1	2	3	4	5
	PCM 2	I believe that if a large percentage of known businesses is part of the CIoT ecosystem makes the app useful.	(Hsu & Lin, 2016)	1	2	3	4	5

	PCM 3	The number of other consumers using the Superapp CIOT affects my perception of its ease of use.	(Hsu & Lin, 2016)	1	2	3	4	5
	PCM 4	The number of known businesses using the Superapp CIOT affects my perception of its ease of use.	(Hsu & Lin, 2016)	1	2	3	4	5
Perceived Cost	PC 1	If I can use different MiniApps at a lower cost, I would prefer the CIoT Superapp CIOT versus a standalone CIoT App.	(Nikou, 2019)	1	2	3	4	5
	PC 2	If I have options for different pricing models, I would prefer the CIoT Superapp CIOT versus a standalone CIoT App.	(Nikou, 2019)	1	2	3	4	5
	PC 3	If I can access the ecosystem to request other services for example installation and support services at a reduced cost, I would prefer the CIoT Superapp CIOT versus a standalone CIoT App.	(Nikou, 2019)	1	2	3	4	5

Attitude	AT 1	I believe that using a CIoT Superapp CIOT versus a standalone CIoT App is a good idea	(Davis, 1985; Nikou, 2019)	1	2	3	4	5
	AT 2	I will be satisfied using a Superapp CIOT versus a standalone CIoT App	(Davis, 1985; Nikou, 2019)	1	2	3	4	5
Intention to use	INT1	I would use a CIoT Superapp if made available	(Davis, 1985; Nikou, 2019)	1	2	3	4	5
	INT2	Given that more and more Smart Home products and services are in the market, I predict I will use a CIoT Superapp.	(Davis, 1985; Nikou, 2019)	1	2	3	4	5
	INT3	I will adopt Smart Home technology based on using the CIoT Superapp in my house in the near future.	(Davis, 1985; Nikou, 2019)	1	2	3	4	5

10 APPENDIX C Interview Participant's Information Sheet

Dear Sir / Madam,

My name is Ravendran Naicker, and I am a master's student in Digital Business at the University of the Witwatersrand, Johannesburg. As part of my studies, I must undertake a research project, and I am investigating the commercial potential of Superapps in the CIoT ecosystem within South Africa under the supervision of Professor Thomas Anning-Dorson.

As part of the project, I would like to ask you to complete a semi-structured interview. The interview will last approximately 60 minutes and be conducted using online video. As part of this interview, I will ask you open-ended questions to gather information and insights related to the commercial potential of Superapps in the CIoT ecosystem within South Africa. The interview will be recorded solely for accurate data transcription, and the audio recordings will be securely stored and accessible only to the research team. The data collected will be used for research purposes only, and any findings or reports resulting from the study will use aggregated and anonymized data.

Your responses and any information shared during the interview will be kept confidential to the extent permitted by law. Your personal information will be stored securely and only accessible to the research team. Your responses will be anonymized, and any direct quotes used in the study will be appropriately attributed to pseudonyms to ensure your identity remains protected.

Your participation in this interview is entirely voluntary. You have the right to refuse or withdraw from the study at any time without penalty or loss of benefits to which you are otherwise entitled. If you decide to withdraw from the study, any

information or responses you have provided up to that point will be used in the analysis anonymously, without any personal identifiers.

Although there are no direct benefits to you as a participant, your input will contribute to advancing knowledge in CIoT and Superapps. For inquiries about your rights as a research participant, please contact the University Human Research Ethics Committee (Non-Medical) by telephone at +27(0) 11 717 1408, email hrecnon-medical@wits.ac.za

By proceeding with the interview, you indicate that you have read and understood the above information. You voluntarily agree to participate in this interview and provide your responses for research purposes.

Thank you and regards,
Ravendran Naicker

11 APPENDIX D Interview Consent form

The commercial potential of Superapps in the CIoT ecosystem within South Africa

Ravendran Naicker

I, ……., agree to participate in this research project. The research has been explained to me, and I understand what my participation will involve. I agree to the following:

(Please circle the appropriate options below).

I agree that my participation will remain anonymous.	YES	NO
I agree that the researcher may use anonymous. quotes in his / her research report	YES	NO
I agree that the interview may be audio recorded	YES	NO

…… (signature)

…… (name of participant)

…… (date)

…… (signature)

Ravendran Naicker……..… (researcher)

…… (date)

12 APPENDIX E – SME/SOHO/Developer Questionnaire

1. What factors do you consider when deciding between using the CIoT Super App or creating a standalone CIoT App? Would you prefer to use the CIoT Super App or create a standalone CIoT App?
2. Additionally, how do you foresee the CIoT Super App impacting your revenue, expanding your customer base while reducing costs, and providing access to an ecosystem for selling services and collaborating on IoT mini-apps that might not be attainable through independent development?
3. What are your expectations regarding the user-friendliness and ease of integration of the CIoT Super App platform for your business or development needs, and in your view, how likely is it to simplify tasks, improve efficiency, and enhance user satisfaction?
4. What are your expectations for the market reach, customer access, partnership opportunities, and competitive advantage that a CIoT Super App platform with a large user base could offer your business?
5. How do the reputation and trustworthiness of a CIoT Super App platform, as well as its security standards and reliability, impact your decision to join, and to what extent does its reputation among targeted end customers and ecosystem partners influence your perception of its usefulness for your business or development needs?
6. What are your expectations for the role of effective platform governance by the CIoT Super App owner in ensuring fairness and transparency in interactions between SME/SOHO/Developers and other stakeholders, and how do you believe that solid platform governance features like user ratings, reviews, dispute resolution processes, and transparent decision-making would enhance your perception of ease of use and overall satisfaction with the platform?
7. How important is it for you that a CIoT Super App platform allows external developers and third-party service providers to integrate their services or functionalities, and to what extent do you believe that the openness of the

CIoT Super App platform to external innovation would enhance its value proposition for businesses like yours?

8. To what extent do data privacy and security concerns, as well as the perceived complexity of the CIoT Super App platform and high switching costs, influence your decision to join this multi-sided platform?
9. How likely are you to actively use the CIoT Super App platform for your business or development needs, incorporate it into your daily operations or projects, and recommend it to your customers or other SMEs, SOHO/Developers?