Urban Resilience and Sustainability Through Regenerative Urban Agriculture

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Abstract

Cities and urban areas are under constant stress from natural disasters and climate changes to pestilences and economic crises, due primarily to anthropological activities and demands. These extraneous circumstances have been aptly highlighted by the recent epidemic, which changed the modus-operandi of the world as we know it. Nevertheless, the nature of this excessive pressure did not change the burden carried by cities to sustain a people, an entire ecosystem, and produce and manage ways that encourage economic successes. Instead, the COVID-19 pandemic merely revealed the cracks in cities and nations' already flawed governing systems. Urban resilience is the capacity of individuals, communities, institutions, businesses, and systems within a city to survive, adapt, and grow no matter what kind of chronic stresses and acute shocks they experience. (Urban resilience - Resilient Cities Network, no date, para. 5). Therefore, urban resilience can be achieved through effective strategies such as regenerative and sustainable Urban Agriculture (UA), which will be the premise of this research. Human behaviour relative to the current environment requires understanding so that cohesive coexistence can be bolstered through regenerative and restorative practices found in the technology and ecology of the nature of reproduction, that is, urban agriculture. City and urban sustainability, specifically for developing countries (the Global South), will shift from the conventional concrete jungle's urban design. Therefore, this urban agricultural perspective is primarily explored through the microscope of bee technology and how this simple practice and its principles can be incorporated within the urban space to enable resilience, food and nutrition provision and promote economic accessibility.

Keywords
Urban Agriculture, City Resilience, Sustainability, Urban Beekeeping., and City of Tshwane

1. Introduction
The foundation of urban resilience is built on the adopted global policy of the Transforming our World, the 2030 Agenda for Sustainable Development. These strategies were implemented as a result and by agreement of the representative nations at the United Nations (UN) Sustainable Development Summit. This prestigious event was held in September 2015 in New York, USA. The stratagem would comprise of the sustainable goals and targets outlined to deal with existing and emerging challenges in the "Global North and Global South". The objectives are to achieve an improved society that is accessible, creates equity and equality, and ensures accountability from the various regions. Out of the seventeen Sustainable Development Goals (SDGs) identified, SDG 11 – "Make cities and human settlements inclusive, safe, resilient, and sustainable" (United Nations, 2016), sets the tone for this research.

Key to this goal is the resilience factor for sustainability and how this influences the viability of a city. Therefore, a sustainable city is defined as engaging its citizens and connecting its infrastructure electronically (Musa, 2016). By this definition, one can deduce that a sustainable city provides accessibility and equal opportunity to its citizens. A sustainable city advances its accessibility through technology, be it connecting services to inhabitants or goods through integrated technological solutions. Therefore, a sustainable city's success relies on many factors, including the city's ability to integrate, adapt, implement, and adhere to the SDG mentioned above. In this success, a continual and maintainable city can achieve sustainability in the environmental, economic, institutional, and social spheres and pillars, as it is defined.

SDG 11 considers that "the urban population is exponentially and rapidly growing "…with approximately 55%, that is, 4.2 billion of the world's population living in urban areas and is estimated to rise to 70% by 2050"(Callaghan et al. 2020)

Even more alarming is the growth of urban slums, one of the "traumas" experienced by a city that overshadows the vision of the ideal and sustainable city model. Challenges arising from urban slums include lack of social services and inaccessibility, perpetuating the societal ills prevalent within these sporadic growths, including inequality, poverty, and unemployment.

The consequences of human developments also have widespread influence over the environment and food security amongst many spheres. The most recent global estimates suggest that under 30% of people live in slum households in urban areas. Most countries across Asia and Latin America had averaged between 10 to 30 per cent of the urban population living in slum households, where some were measured to be slightly higher. Indeed, slum households occurred most prevalently across Sub-Saharan Africa, where most countries had more than half of their urban population living in slum households. Some, such as Sudan, South Sudan, and the Central African Republic, had more than 90 per cent of their urban population in these appalling locations (Ritchie and Roser, 2018).

At the foundation of SDG 11, the proposed sustainability methods are explored to provide end-users with convenient access to essential services, food security, equal job opportunities, quality education, health care, and endeavour to mitigate ecological and environmental impact.

1.1. Objectives

This research explores an overview and a broad perspective of agricultural practices that may impact the sustainable city. These practices are developed through regenerative beekeeping methods, which is the axis through which the research pivots. More intently, the focus is on the Global South experiences while gleaning from the working models of the Global North. As aforementioned, the resolution of the challenges encountered stems from the city's ability to be and remain resilient against and through detrimental human activities, natural disasters, climate change, health epidemics, and economic crises. Therefore, what can a city do to stay viable globally while maintaining and sustaining its inhabitants and the environment therein? The answer to this question is explored through the Global South's Africa, its historical and geospatial canon.

Microcosmically speaking and in the context of urban agriculture, fundamental and straightforward pollination technology is required for any plant-based and subsequent agricultural endeavours to commence. This natural occurrence can be witnessed in the bees and their subsequent operation. Among other pollinating insects, these tiny creatures have a significant influence in that "they form an integral part of cities' natural capital and perform an important ecosystem function with a high degree of relevance to many ecosystems' services" (Stange *et al.*, 2017).

1.1.1. Research Questions

This study seeks to answer the following research questions:
    i.   Can Urban Agriculture be part of the long-term goal of achieving urban resilience?
    ii.   How does Urban Agriculture contribute towards resilience in the City of Tshwane?
    iii.   iii. What improvements can be made in Urban Agriculture to increase urban resilience in the City of Tshwane?

1.1.2. Research Objectives

The research aims to adopt the perspective of people's impact on the current state of the sustainable city model and the environment. Furthermore, the aim identifies how the social aspects of sustainability can "produce" its way out of adversity. The research further seeks to acquire knowledge of the blended ecological and environmental existence within the city and build on any findings currently in place so that:

i.   Existing policies on and practices of urban agriculture in Tshwane may be reviewed.
ii.   The impact of urban agriculture on urban resilience in the City of Tshwane may be identified.
iii.   The gaps and opportunities in current urban agriculture practices in Tshwane may be identified.
iv.   Moreover, a framework for more impactful urban agricultural policies and practices in Tshwane may be proposed.

2.   Literature Review

2.1.   Urban Agriculture in South Africa

Urban green spaces and infrastructure are created for prosperous urban agricultural harvesting. These infrastructure and spaces form safe environments to assist with foraging, pollination, and ultimately, urban food generation. Green spaces such as rooftops and abandoned industrial spaces are platforms for re-use and repurposing in a landless spatial divide and a decreased urban shore. These spaces allow for technological and infrastructural progression in vertical farming, for example, which is more suitable and efficient for leafy vegetables as it uses less space and fewer resources than a traditional farm.

2.2.   Urban Agriculture in the City of Tshwane

In the elementary analysis of the CoT literature review, it is apparent that the city concentrates its efforts on peri-urban farming, where spatial divides afford it the luxury of land. Rooftop gardens and the like are seemingly uncommon, with smallholder farms the next alternative to urban and traditional agriculture. Efforts into policy developments and governmental support concentrate on these areas, with little attention to urban agricultural initiatives in Johannesburg and Cape Town. Spatially speaking, the City of Johannesburg and the City of Cape Town are surrounded by city landscapes and other districts and municipalities that leave the cities' land footprint confined, thus inspiring innovation that removes the boundaries of limitation.

2.2.1.   By-laws and Policies

It would be expected that one of the only cities with a dedicated Department of Environment and Agriculture Management would have specified policies and regulations that would support urban agriculture initiatives and programmes. However, land reforms and spatial redistribution at the national level seem to focus only on land acquisition and not appropriate the land effectively for maximum efforts. Other policy inclusions of agriculture in the urban space are mainly directed to the rural poor and not the urban poor. The City of Tshwane's food security policy is mainly developed to create awareness of food insecurity in the region. It focuses its efforts on food availability and access, inadequate safety nets, food safety and nutrition, and weak information management, in conjunction with the Tshwane Integrated Agricultural Development and Support Strategy. Although the policy recognises and, to an extent, supports the importance of urban agriculture, the policy does extraordinarily little to assist with the implementation strategy of set standards (Haysom, 2014).

The CoT seems to face challenges in implementing urban agriculture (UA) policies, despite the approval of the structure in 2012. The directorate has made no progress in implementing the UA activities. Furthermore, the UA policies are not updated, probably due to staff shortages. The last UA policy document that could be accessed was compiled in 2006. During the interviews with two Directors within Agriculture and Urban Planning in 2013, it was found that budget constraints seem to be the reason for the urban agriculture section not being functional or even existing (Toona, 2015).

2.2.2.   Sustainability

The urban agriculture practice is sustainable; it recognises peoples' needs and its ability to create a circular economy, that is, economic sustenance built on self-reliance and regeneration through the metabolic functioning of an almost independent yet interdependent system. It places the ability of a people to create nutrition using minimal resources, thereby ensuring long-lasting benefits, including those within the health and economy of a particular society. Within the Global South perspective, particularly in Africa, sustainability and food security are vital components that demonstrate the status quo.

In the CoT, the sustainability of urban agriculture depends on many factors, including; policy, financial and governmental support to land access and usability, and transportation and distribution of food products for marketability. Examples of urban agriculture in Tshwane can be seen in the following case studies:

2.3. Urban Agriculture In The Context Of Economy

For economic benefit, possibly environmental regeneration and integrity, urban agriculture can take many forms, one focal form being urban beekeeping. On the grander scale of crop agriculture in what would be deemed agricultural land, the production of modern commercial crops has become markedly reliant on managed pollinators the placement of honey colonies in various cultivated fields as part of pollination services (Abrol 2012).

By 2009, it was estimated that there were approximately 60 million beehives worldwide. Of the 60 million estimated, over a million tons of honey was produced. A quarter of the honey produced is exported, with more than twenty countries producing 90% of the honey. Other by-products such as beeswax, propolis, pollen, royal jelly, broods, and venom are also produced and exported for economic gain (Aiyeloja et al. 2010).

2.4. Economic Viability of Urban Beekeeping in the City of Tshwane

As part of the by-laws of the City of Tshwane (CoT), one can only keep bees within an urban area provided that one is a permit holder. Such a permit stipulates, among other requirements, that those beehives are to be "kept at least 100 metres from any residence, business premises or place where animals or birds are kept. Furthermore, the by-law states that a wire fence must surround the yard in which the hive is kept, a hedge or wall of at least 1,5 metres high and which is at least 5 metres from any part of the beehive" (Gauteng Gazette Provincial, 2011). Additionally, the South African Bee Industry Organisation (SABIO) by-laws require that beekeepers be registered under the Agricultural Pests Act (No 36 1983), with a few conditions to be met, including membership about those owning 50 hives and above (SABIO, 2008). While these acts and by-laws serve a purpose, these are limiting and not coherent. The idea that the city will support beekeeping initiatives within the city's boundaries is somewhat fictional, with those within the peri-urban having access to land space being beneficiaries of the set standards.

Beekeeping is profitable, particularly in the research focus area of the Mampong Ashanti Municipality of Ghana. Aboud (2014) concluded that an average capital investment of GH¢870.18 (what would be 146,74 USD as of July 2021) generated gross revenue of GH¢3,316.00 (559,19 USD as of July 2021) per harvest, giving a return on investment (ROI) of 2,81 (281,10%). Therefore, it would seem feasible to invest in its awareness, practice, and application from a planning and legal perspective. The inputs versus income for a 1-hectare blueberry operation is estimated at just over a million rand, with operational costs amounting to an additional R350,000 per annum. For a yield of a crop "density of 5 000 plants/ha, with each producing about 3kg of berries, income could reach R1,2 million per season at R80/ kg of blueberries. Depending on the grower's set-up, a return on investment can be achieved after three to five years" (Botha, 2020,).

Beekeeping in the CoT is a niche market practice with very few beekeepers in the commercially viable position of beekeeping and much fewer in the urban space. The restrictions on beekeeping practice in the city environment do little for the preservation of the ecology of the city. Also, these restrictions discourage any attempt at economic stimulation. Beekeeping as an economically viable practice is tedious and demanding, with meticulousness applied mainly in the profitability of the urban agricultural sector.

Regardless of the spatial context, beekeeping's success is primarily determined by the demand and market. These run concurrently, with harvesting and supply requiring consistency. Like any other product in demand, the fleeting customer base diminishes quickly without consistent supply. Honey and its by-product are seemingly for the "health-conscious", the middle to higher income groups of society that will pay good money for what is proven to be raw, authentic honey. This niche market is equally fastidious, which is understandable. Having educated themselves to an extent about the product and paying what the lower-income customer cannot afford, the demand for quality, regulated by SABIO in commercial instances, is directly proportional to the effort placed into the final product.

In Tshwane, beekeepers and distributors belong to focus groups and small contact spaces. Through this confined network, it is discovered that beekeeping is not for the fainthearted. Various oppositions are presented, especially when trying to make a living from beekeeping. Hives are lost for various reasons, including; human and animal (honey badgers and baboons) theft and vandalism, which can cost a developing beekeeper their entire livelihood, losing most if not all their hives overnight. Bee diseases, as previously mentioned, are also impactful, requiring

constant monitoring. Most beekeepers who see themselves in the commercial space must move to the peripheries and edges of the city and beyond its boundaries to offer pollination services to farmers who are mindful of their farming practices, using little harmful pesticides. As a result, urban beekeeping becomes relevant to a city's economy during processing.

Honey yields and by-products are processed in what could be very elaborate establishments or basic home facilities with enough space to make a mess. Honey is removed from the hives into eventual packaging and subsequent delivery; most "urban beekeepers" work from home, with shop rental spaces a cost factor for a niche market. This adaptation makes the product's market an even more critical component, with shelve spaces required at various markets and supermarkets.

In a city space such as Tshwane, the lucrativeness of the business model requires access to transportation, internet and phone facility and working space for processing, amongst other implements. These factors can disadvantage those looking to generate a sustained income for their households. Partnerships between these beneficiaries and the government are ways to bridge the gap. For instance, in the case of the CoCT, it was the city's commitment to collaboration with NGOs that enabled the continued functioning of the projects and initiatives. Without support, these programmes eventually collapse, debilitating the objectives envisioned.

Urban agriculture has been dissected and understood as farming in confined spaces throughout the literature review. This agrarian and indigenous way of living has evolved in the last half-century to support humans' desire to stabilise in a particular habitat. As a result, demand has inspired technology to overtake aspects of the practice to achieve social stability. However, the price of rapid urbanisation is environmental degradation and perpetual food insecurity. Further literature review revealed that food availability, accessibility, value, and stability are critical factors that need to be addressed by urban agriculture. Without this vital overview, urban agriculture will be rendered of no effect and be limited to government subsistence.

Other aspects of the literature review considered governing policy, by-laws, regulations, and urban agriculture effects. With a review of case studies both globally and locally, the outcome of this analysis determined that contradicting by-laws hinder efforts of sustained urban agriculture. The practice requires progressive thinking to meet the city's socio-economic needs whilst addressing land use and regularisation issues. The food policy in Tshwane would argue the necessity to support families. However, this is in rural surroundings and speak little towards the urban poor. Additional literature pierces current practices to uncover the economic value of urban agriculture and find that although urban agriculture is feasible, the extent of studies is limited to development programmes rather than economic impact.

In the context of urban beekeeping, the critical value of the study relies on whether it is economically and socially sustainable for a city such as Tshwane. Urban agriculture and its subfunctions are examined to identify its actual ability in achieving the resilience required to overcome events such as the July 2021 unrests spread throughout the country. However, this already sensitive and delicate practice will take a collective effort from policymakers in the town planning, agricultural and environmental sectors and departments who can influence policies for the economic benefit of all. This effort must incorporate law enforcement who can legally recognise that hive theft is a crime. The private collaborators must also be involved at the corporate and individual levels as they have the vision to have a clean ecological impact and sustained growth. The education sector at the primary school level is as vital a stakeholder as those previously mentioned. Without education offered at the grassroots level, ignorance will continue to fuel the stagnancy of the field, thereby creating a stigma to a desperate plight of existence.

After considering the gaps identified in the literature review, the next chapter delves into ways to acquire data so that the aims and objectives of the study are met. As such, chapter 3 covers aspects of the methodology and design of the investigation. Moreover, the chapter encompasses the strategic approach and organisation of data and briefly outlines the challenges that may have influenced the study. To conclude the chapter, quality assurance of the data collection process is provided. This exercise ensures that credibility, transferability, and dependability are achieved.

3. Methods

This study questions whether self-sustenance identified in urban agriculture can resolve the crisis within the "food system and cities" and whether it can acquire food and ensure that it is distributed evenly (Haysom, 2014,). This interrogation of self-sustenance presents challenges when applying methodologies because many factors affect the

outcome, including the city's spatial design, urbanisation development, and other related factors. It would seem easy to conclude that urban agriculture is one of the pivotal sustainability methods, providing non-dependence for its beneficiaries while addressing and meeting various Integrated Development Plan (IDP) targets. However, (Haysom (2014) further argues that accurate determination is complex. Analysing viability, food provision, security, and continuity requires integrated data to validate the methods applied and practised. This assessment, therefore, questions the true impact of urban agriculture and the city's ability to ensure food security, entrepreneurship and employability, and self-sufficiency, especially in times of crisis. Thus, the study's research methodologies, collection, and analysis aim to explore the ongoing status of the urban agriculture practices within the City of Tshwane (CoT).

Therefore, this study is structured qualitatively, with the data requiring a social approach to the acquisition thereof. The research approach taken was the Interpretive Phenomenological Analysis (IPA). This approach was used to understand the people's personal experiences being studied within urban agriculture in Tshwane. The participants' experiences of this phenomenon are relatively common. During the data collection phase, methods of acquiring the information differed depending on the context of the users.

Data were collected using questionnaires, observations, and secondary data. This approach sought to triangulate statistics so that the open-endedness of the research could lead to a substantive conclusion. The procedures included compiling a summary of the research to give perspective to the questionnaire and subsequent interview questions. This tactic allowed the participants to agree or decline the interviews. With their consent, participants had the chance to express their understanding of the questions either verbally or in written format.

Information was collected from participants who, in some ways, were directly involved in the urban agriculture sector either from policymaking, implementation or practitioner's perspective. These levels of engagement were primarily to identify possible areas of failure and success and further determine the viability of urban agriculture in CoT. The dynamism of the research group was to vary the experiences across all sectors. Subsequently, this method ensured that "all sides of the story" were considered for a fair assessment of the situation.

The structure for collecting data revealed layers of operation required to maintain success, profitability, and continuation of urban farming. What was observed were participants who required more than policy intervention but physical protection. What is understood is that people wishing to maximise the potential of the platforms afforded to them required resilience within themselves.

During this phase of the research, the exploration required to extract data revealed pertinent matters related to participants. Participants' experiences were crucial to unveiling the subject matter. Furthermore, understanding the knowledge needed to make the study comprehensive by peering into the participants' skills formed the basis for the organisation of the data. This organisation was helpful in examination and crucial, with the thematic analysis - a very delicate approach to data simulation. Field challenges, ethical considerations, and limitations to the research were crucial components to the study, revealing a lack of preparedness, time and understanding, and bias in information gathering. These aspects are broken down into digestible units to shed light on the status quo. Any improvements required would be for further study and inspection.

4. Data Collection

As city domains become more urbanised, it becomes imperative to perpetuate sustenance to deter degradation. From a health and wealth perspective, societal awareness and support towards alleviating looming pestilences and their effects on survival require migration from mundane practices to innovative, pragmatic, and progressive solutions. This outlook is validated by Cilliers' et al. (2020) exposition of reimagined space. The implications of this transitory work from the literature review will form how chapter 4 can be reinforced. As a result, the data collection is essential to the study in that it necessitates the analysis of the data collected.

Data is collected to determine the thematic nuances of the research so that a coding system, where information or data can be classified, is developed. The next step of data collection includes categorising data into differences similarities and subsequently grouping these within the study. The data collection method can be typically seen as flexible "because there is a recognised need to respond to the context in which research occurs" (Marsh et al., 2009, p. 129).

4.1. Contextualisation (Study Area)

As stated in the study area chosen for this exercise, based on various limitations such as distance and cost and other factors such as saturation of information within the region, the Metropolitan City of Tshwane is in Gauteng, South Africa.

Besides the pragmatic reasons stated above, the city's historic richness led to the interest and directive of the city's vibrance. Tshwane has the gravitational energy to draw various demographics for vast employment and economic opportunities, particularly migrating into the city. It offers the platform for educational development and accommodates heterogeneous groups from various walks of life into its radius. Tshwane is a hive of activity with policies, developments, investments, and advancements in the automotive and industrial sectors.

The Tshwane Automotive SEZ is Africa's First Automotive City, located in the Gauteng Province, the green City of Tshwane, Africa's Capital City, Africa's most significant automotive city, an ideal location for growth, and an attractive investment destination for the Automotive Industry on the African Continent. The SEZ provides un-parallel connectivity and harmony between the living city, green city and the productive city, including an array of modern state-of-the-art infrastructure, government incentives and TASEZ additional investor support and value-added services (The Tshwane Automotive Special Economic Zone, 2021, paras 1–2).

4.2. Methods of Data Collection Explored During the Study
4.2.1. Interviews

A semi-structured interviewing method was employed for the study. A purposive sampling method, wherein the researcher relies on an instinctive preposition in selecting specific participants, is mainly employed where governmental officials and affiliates involved in the city's agriculture sector are located (Smuts, 2021).

This data collection method was led by participants' desire to achieve free expression. Although there are risks to this, the semi-informal approach helped to determine where the real challenge lies, mainly how these strategies were implemented in everyday lives.

Piloting was done with Mr Danie Saayman of CityScope Town Planners, a Regional Town Planner in Tshwane who has had extensive experience in city development, particularly Tshwane. His approach to the questionnaire and subsequent interview was predominantly infrastructure accessibility. The unfolding of the interview included space, water, security, and primary elements of consideration when planning for any development. His critique of the questions that seemed obvious and leading was insightful, asking for the questions to be rephrased as "in what manner", thereby soliciting comprehensive, detailed, and insightful answers. He had also required to understand the intent of the questions. He posed the inquiries back, focusing on the specific motive behind the interrogation line, including either requires solving a problem or finding a problem to solve.

This insightful discussion assisted in the development of the interview structure, with consideration in the interview and questionnaire approach with participants requiring reflexivity, i.e., "reflection on one's identity and one's sense of voice and perspectives" (Gwamba, 2014).

4.2.2. Summary of Participants

Four interviews were conducted and facilitated through questionnaires in the abovementioned categories of stakeholders. The interviews are presented as follows (Table 1):

Table 1. Interview Stakeholders

Partakers/Stakeholders		Number of Interviews Conducted
Name	Representative Organisation	
Dannie Saayman	Practitioner/ Town Planner	1
Jacques du Plessis	Practitioner/ Beekeeper	1
Elize Lundall-Magnuson	ARC – Programme Manager	2
Jacques du Plessis Jr	Practitioner/ Beekeeper	1
Christiaan Alberts	Practitioner	1

4.2.3.   Questionnaires

In his deliberation of questionnaire types, Bryman (2012) posits that there are self-administered questionnaires, where the participants provide answers by themselves, as described in the title. Forms were sent electronically to respondents.

The purpose of this method of data collection was to allow respondents the freedom of answering the questions at their own pace and time. Also, these were designed to ensure that if COVID-19 restrictions impede meeting in person, then data capturing requirements were still fulfilled. Questionnaires are preferred to remove the pressure and obligatory factors but allow the participants to express themselves accordingly.

The questionnaires retrieved for analysis included the following respondents (Table 2):

Table 2. Questionnaire Participants

Participants	
Name	Representative Organisation
Kwena W. Mpati	GDARD
Justice Lekgoro	GDARD

4.2.4.   Observations

For the observation part of the research, a participant-observer approach where the researcher can have a personal experience to produce data is considered an effective tool and strategy. This approach allowed for a rounded determination of data collection to capture unique detail that would otherwise be unavailable (Smuts, 2021).

Observations in this instance were imperative, revealing the intensity in which stakeholders were engaged in their environment. Unrestrained, the participants were able to show how practical it would be to implement urban farming, explicitly speaking to dynamics such as transport, access, and security. Subsequently, this data collection method was employed. Its revelatory prowess was almost unparallel to pure literature acquisition.

A father (Mr Jacques du Plessis) and son (Junior) operation, primarily aimed at developing a generational succession plan, was the focus area for observing urban beekeeping from farming to processing the final product. This observatory analysis served as a case study. As Stuart, George and Bennett (2005) put it – observation brings comparative advantages in that dialogue, verbal and otherwise, communicates a different theory-building that illustrates the groundwork that ensued.

4.2.5.   Secondary Data

Secondary data in the form of reports, content, and discourse analysis, that is, deciphering of ways of communication, either in written or spoken form and case studies, and life histories,1 were also included for the richness of content (Smuts, 2021). Secondary data include case studies and may be described as follows:

Case studies: An intensive study about a person, a group of people, or a unit aimed to generalise over several units. A case study has also been described as an intensive, systematic investigation of a single individual, group, community, or unit. The researcher examines in-depth data relating to several variables (Ibid. 2011).

The idea behind this method of study was to pre-empt failure to meet conclusive evidence. This precautionary measure ensures that if the data collection expired without successfully gathering field data, secondary data would enable the researcher to triangulate and analyse the data accordingly. This intuitive decision proved valuable, as interviewee availability was difficult to achieve during the process. Furthermore, the university's protocols that needed to be adhered to had time implications; matters such as ethics review by the University of Johannesburg's (UJ's) approval committee and the submission of relevant documentation were limitations to data capturing in the field.

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1 "Biographical material that has usually been gathered from a particular individual, perhaps from an interview or conversation. As well as relying on people's memories, other sources of information are used to build as detailed a picture as possible of the experiences, beliefs and attitudes of that individual; these sources might include letters and newspaper articles" (Smuts, 2021, p. 49).

This chapter is a thematic narrative of the experience of participants. The participants detail both the positive and negative aspects, which are not farfetched towards sustainability in the long term. In their answers, urban agriculture is socio-economically viable. However, there is much support required from the government and participants. The data provided indicates that the problems are on both sides of the spectrum. Government failing to address prohibitive and contradictory by-laws and lack of beneficiary commitment is an equally great challenge. Financial backing is also a significant hindrance, with start-ups and development initiatives lacking the ability to maintain operations. Furthermore, the lack of safety and security threatens the feasibility of urban farming. The initiative will be limited to niche markets and basic sustenance for families with no economic impetus.

Moreover, the secondary data collected indicates a high probability of success for urban agriculture and beekeeping, which depends significantly on the higher, dedicated levels of participation, government legislative support, and a strong focus on the practices. Initiatives and development projects and programmes have initial success resulting in failures due to lack of mentoring and long-term objectives. For Tshwane, urban agricultural technologies and innovations have been identified; however, they remain in planning phases until momentum is given to their establishments.

5. Results and Discussion
5.1. Numerical Results
The approach used for data collection is the Interpretive Phenomenological Analysis (IPA) canon, seeking to let the participants' experiences inform the direction and outcome of the study. The snowball sampling method was employed due to the envisioned representative selection technique for the investigation. This technique employs the tools of interviews, observations, questions, and case studies so that this non-probability sampling could indeed be explorative. The data collected was categorised into themes using a coding system. QDA Miner Lite, a coding software that allowed for an automated generation of summarised data. The outcome highlights differences, similarities and frequencies, which enabled the research to have context. The categories developed result from the common words used during the data collection stage and are recorded to align with the objectives and research questions. These include Government Support, Impact and Improvement, Resilience and Sustainability. These categories are subdivided into codes, where a quantified analysis of the cases or occurrences appears. Table 3 below provides further clarity on the data accumulated.

Table 3: Summary of Coding Used to Analyse Data – Source (Author, 2021a)

Category	Code	Count	% Codes	Cases	% Cases
Government Support	Education/Training/Skills/	11	7%	4	100%
Government Support	Policy/Regulations/By-Laws	17	10%	3	75%
Government Support	Red Tape/Bureaucracy/Politics	5	3%	2	50%
Impact & Improvements	Accessibility/Transport	5	3%	2	50%
Impact & Improvements	Challenges/Gaps/Opportunities	18	11%	3	75%
Impact & Improvements	Innovation/Technology	10	6%	4	100%
Resilience	Infrastructure/Water/Services	5	3%	2	50%
Resilience	Land/Spatial	8	5%	4	100%
Resilience	Security/Safety	5	3%	2	50%
Sustainability	Economic Sustainability	36	22%	4	100%
Sustainability	Environmental Sustainability	6	4%	4	100%
Sustainability	Future/Long-term	16	10%	4	100%
Sustainability	Social Sustainable	25	15%	4	100%

5.2. Graphical Results

Table 3 above is graphically translated into Figure 1 below, which shows the number of cases in which a particular sub-category is frequently used. Sustainability, economic, social, and environmental challenges carry the theme of the interactions. Moreover, training, skills, and education, together with issues, challenges, gaps, and opportunities, are frequently determinants of success and failure. It is to be noted that these are positively and negatively grouped, meaning that the distinction and degree to which this supports or negates a narrative will be unpacked in the discussion to follow.
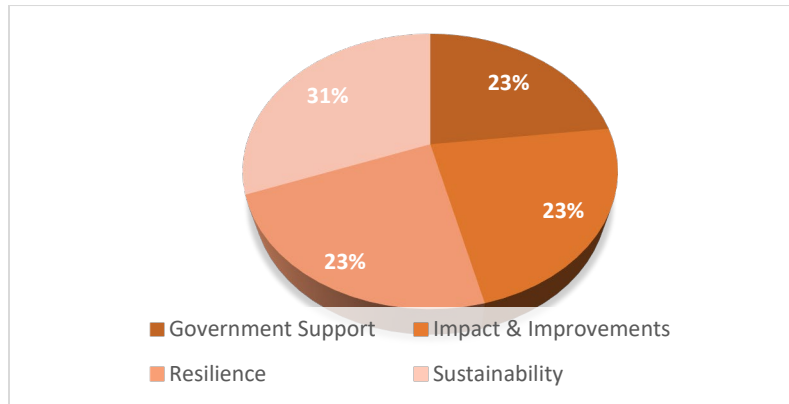
Figure 1. Summary of Contributory Factors to Urban Agriculture – Source (Author, 2021c)

Figure 1 above summarises the contributory factors to the advancement of urban agriculture: Sustainability, which contributes 31%, followed by Government Support, Impact and Improvements and Resilience, which all equally contribute 23% to the success of urban agriculture (Figure 2).
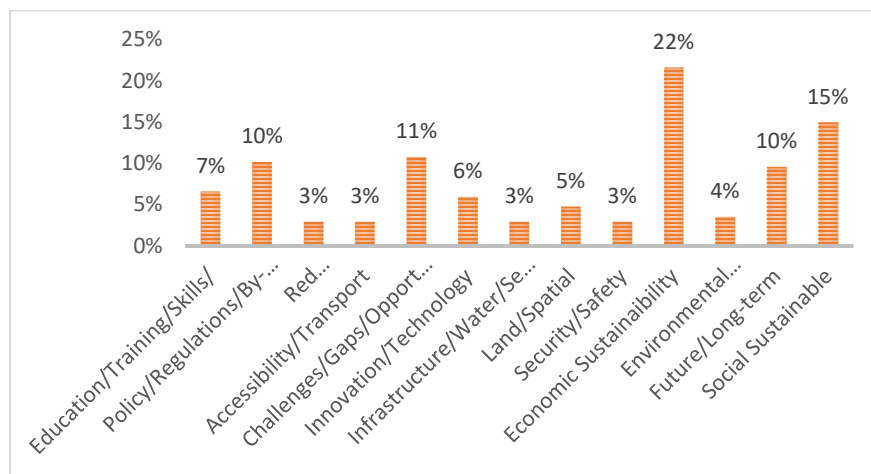

Figure 2. Frequency of Codes Generated During Data Collection

5.3. Proposed Improvements

Throughout the data collection and analysis, the data has revealed potentiality. However, success is difficult due to the obstinate opposition facing urban agriculture and beekeeping. These are interrelated, simple, yet contrastingly difficult challenges that hinder the Metropolitan's progress. Tshwane's best viable solutions are thus, to produce ideas and programmes that are not immediately implementable, nor are they sustainable in the future. What is identified is that governmental processes, financial direction and consistent participation are critical pillars of sustainability. Despite urban agriculture addressing the availability of the land debacle, it is clear that space is the

least of the issues identified in the City of Tshwane. Instead, it is the real impact with which urban agriculture can be experienced. The data suggest that urban agriculture and urban beekeeping are experimental rouges that are too big a risk to support amid more pertinent and immediate issues facing the Metropolitan.

The evidence's interpretation correlates to the thematic nuances identified throughout the research. These distinctions are thus observed as evincing that urban agriculture effectively alleviates poverty and insecurity and promotes environmental awareness and social responsibility. Urban agriculture has various challenges that can be stumbling blocks to further progress. Participants' lack of finances, skill, safety and security, inaccessibility, and lack of impetus could deter all efforts. Furthermore, the research revealed that most of the challenges noted could be overcome with proper coordination and long-term goals from both ends of the spectrum. Key Performance Areas and Key Performance Indicators are excellent tools to measure the outcomes.

The future areas this research study has led to include entrepreneurial dynamics in Urban Agricultural practices. This area would focus on the issues that make urban agriculture a viable solution to economic strides. Other research opportunities include modelling community gardens in state-owned facilities previously classified as unchangeable in the zoning context. These include the Adopt-A-Spot initiative that goes beyond caring for the environment and allowing socio-economic progressions. Moreover, other areas of further study include integrating policies so that conflict of by-laws and regulations is minimised.

5.4. Validation
Quality assurance involves the use of various instruments to ensure validity and reliability. These instruments are essential for gauging the conclusiveness of evidence. In the case of this qualitative study, the following is used to measure the quality of data collected (Adu, 2016; Mouton, 2021).

5.4.1. Credibility
The data and findings reflect the participants' experiences. Due to their years of practical knowledge acquired, the participants' data accuracy could be measured effectively. The findings were derived through background searches into the information given, especially in the initiated programmes. The connection between the data collected and the findings correlates with the detailed experience, observation, interviewing, and secondary data searches. "There are several strategies that qualitative researchers can employ to shore up the internal validity or credibility of a study. "Probably the most well-known of these is triangulation, identifying four types: multiple investigators, multiple theories, multiple sources of data, or multiple methods to confirm emerging findings" (Merriam and Grenier, 2019)

5.4.2. Transferability
Transferability can be seen in full effect in a quantitative study where the sample size is far more significant than that chosen for qualitative sampling, particularly in this study. This study aims to discover the depth in which participants experience the subject matter and subsequently interpret it. Therefore, cases or instances are taken on merit to generalise data and its applicability. This notion of transferability, where current situations are measured against previous occurrences, sought to detail the context of the study in a manner where the researcher could draw substantive comparisons. The detailing and description of the research theme were imperative to allow adequate generalisation measures. Adequacy of data enables the research to match situations and, therefore,

Using multisite designs or maximising variation in a purpose-selected sample is another strategy. The logic behind this strategy is that if there is some diversity in the nature of the sites selected (an urban and a rural school, for example) or in participants interviewed, or in times and places of field visits, findings can be applied to a more excellent range of situations by readers or consumers of the research.

5.4.3. Dependability
Dependability, at times referred to as reliability, relies on the validity of results and "refers to the extent to which research findings can be replicated" (Ibid,). The challenge, however, in this study is that human experiences change or adapt at any given time. Behaviour is difficult to measure, and therefore it was expected that replication of this research would not yield the same results. The process does not seek to bring the results into disrepute, as there are numerous ways in which the data was interpreted. Subsequently, dependability is interlaced incompatible data collected, thus making sense of the consistency found in the results (Aboud 2014)

A qualitative researcher can use strategies to ensure consistency, dependability, or reliability: triangulation, peer examination, investigator's position, and the audit trail. Independent readers can authenticate the findings of a study by following the trial of the researcher. An audit trail in a qualitative study describes how data were collected, how categories were derived, and how decisions were made throughout the inquiry (Ibid, 2018).

6.   Conclusion

"Given the magnitude of challenges that rapid urbanisation leading to unsustainable urban growth poses, building resilience requires cooperative and complementary actions among multiple stakeholders" (GGLN, 2014).

The rapid urbanisation of cities has instigated resilience strategies to extend beyond the natural disasters acknowledged. Resilience tackles the human element, how this element is affected in an unconducive, volatile and limited environment, and asks pertinent questions of sustainability. Resilience transcends the maintenance of the environment, peering into the social, institutional and economic aspects that can be destabilised if adequate cohesion between the interdependent forces is not achieved. Hence, resilience moves beyond disaster management and pre-empts that the lack of "financial, natural, produced, human, and social" (Goodwin, 2003) capital is vital to continue sustainable growth. Having established that resilience is pivotal to urbanisation, this research's exploration of Tshwane's poverty combating strategies of urban agriculture proved to be telling. Tshwane has strong inferences of smart city developments, 4IR technologies and world-class building models. However, these notions are hindered in urban agriculture due to incompatible goals and objectives.

The research aims and objectives determined that Tshwane's current urban agriculture infrastructure is spatially defined, possibly limited to smallholder facilities. This occurrence is neither negative nor positive, ascribing that Tshwane is fortunate enough to help manage the available land resources that its counterpart metropolitans do not have. The peri-urban nature of the agricultural divide thus affords the city leeway into regenerating existing spaces with innovative designs and solutions. However, the space component implies that traditional farming techniques will be used until technology demands change. Therefore, the shift to current urban farming practices may suffer delays that affect the city's adaptability and subsequent progression. However, the above notation is speculatory, as the real focus lies in what the city is doing with what it has.

Tshwane and the Gauteng province have not been complacent, seeking sound practices that boost socio-economic activities in the region. A limiting factor is the generic solutions to food insecurity that have not been adapted to suit participants. Equally so, the beneficiaries of the programmes presented by the city will be limited by zeal, training, mentorship and funding. Thus, it is easier to consider investing in other sectors with higher social and economic impact; however, urban farming ties in the four pillars of sustainability far more successfully than complete industrialisation. With urban agriculture, the environment aspect and institutional reform are constantly evaluated. The adaptability of the sector is thus an advantage and reason for consideration. Farming is a generational occurrence, requiring time and investment – all elements of resilience and sustainability. To that end, it would benefit the city by considering participatory governance approaches to better the field so that IDPs and other related frameworks incorporate implementation plans and not just visionary statements. As previously reiterated, urban agriculture can make Tshwane a self-sufficient metropolitan.

Regulatory adaptations will also assist in the mission of urban agricultural resilience strategies. By-laws, regulations and frameworks from the various government departments will require an overlapping and intertwined approach to balance the objectives of each department. Isolated by-laws that do not appreciate the landscape of interdepartmental bureaucracy will rob any programme devised of its effectiveness. Militant, exclusionary practices adapted from previous governmental structures fail due to their inability to appreciate the sophistication of development, growth and social standing. The governmental progression of considerate by-laws and regulations can be the city's way of ensuring that it plays its part.

On the other hand, benefactors can also ensure that urban agriculture is propelled. An increase in demand, community-based solutions and social cohesion can create an appropriate platform for legacies to be birthed. Agrarian practices consider community, the environment and longevity, which will subsequently address the economic benefits required by people. Poverty reduction and possible eradication can be achieved through the mental shift from dependence on state funding to self-sustained Co-ops, social groups and communities. This ideology will have to be entrenched in curriculums, training and mentorship programmes designed and built on the

principles of transferability, transparency and accountability. These would have already been realised in an ideal world; however, unmanaged social ills and apathy will mean these ideals will remain vision statements on placards.

The research aims and objectives set out in line with the research questions were crafted to determine the resilience of urban agriculture in the City of Tshwane. It is the intention for any government to eventually generate its economy while meeting the needs of those in a less fortunate position. By giving all members a fair advantage and enabling them to contribute economically, a state can reap far greater rewards, including reducing crime and poverty, which are interlinked. Urban agriculture has diverse mannerisms, lending itself to socio-economic and environmental needs while challenging the status quo of directives, policies and regulations. Urban agriculture is broad and can be managed at micro levels to create a sustainable economy, restore the rural lifestyle, and renovate a fragmented city community. Urban agriculture can achieve more resilience in the City of Tshwane, given the right platform, environment, and people that can strategise, implement and maintain the more significant objectives of the city, the country, and those propelled by international standards.

In their recommendations for proposing a critical intervention site and an area for project development, the South African Cities Network's (2015) analysis of urban agriculture entails three strategic approaches:

(i) There must be better monitoring of urban agriculture in terms of who is benefiting, what is being grown, and where the food goes, (ii) There is a need to understand why projects fail to thrive, and (iii) Municipalities should partner with NGOs, where possible, to increase the impact of projects.

The above iterates and summarises the study, denoting that urban agriculture is multifaceted, inclusionary, viable and subject to failure should the due process be lacking. There is a desperate need to make the data available in a quantifiable manner so that there can be simulations that can predict urban agriculture as a resilience strategy. For Tshwane, urban resilience is an ongoing opportunity undergirded by urban agriculture and sustainable environmental, social, institutional and economic practices.

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Acknowledgements

Biography

Dr Jackson Sebola- Samanyanga, PhD, has more than ten years of working experience in the Urban and Rural Planning fraternity. His experience is wide-ranged, consisting of the private, public and academic sectors – specifically including expertise from the Makhado Local Municipality, the City of Ekurhuleni, the Department of Rural Development and Land Reform. His other accolades include his experience with the Isibuko Development Planners, the University of the Witwatersrand; the University of Johannesburg and GoldenGrey Consortium (Pty) Ltd. He possesses a Baccalaureus Technologiae Degree (BTRP) in Town and Regional Planning from the University of Johannesburg; a Master's Degree (MTRP) in Town and Regional Planning, and a Doctorate (PhD) in Development Studies from the University of Pretoria. Jackson is a Registered Professional Planner with the South African Council for Planners (SACPLAN) and a South African Planning Institute (SAPI) member.

Miss Segakweng Khutlapye is a qualified Civil Engineering Technologist in Urban Engineering with UNISA and a Registered Professional Technician with ECSA. Sega was elected as the CESA North-West YPF Chairperson in early 2019. In her nine- and half-year working experience, Sega has amassed private sector experience within the civil, roads & stormwater, structural engineering, and water fields. Her project experiences include (i) Site supervision and administration, (ii) Quality control, (iii) Pavement management systems, (iv) Contractors' contracts procurement development, and (v) Project Management. Sega Khutlapye currently resides in Tlhabane, a township in Rustenburg in the North-West, South Africa, where she lived experience and knowledge accumulated within the Master's graduate programme is assisting in understanding the dynamics of the township ecosystem. As stated

before, Sega is studying her Master's in Sustainable Urban Planning and Development, researching Urban Resilience and Sustainability Through Regenerative Urban Agriculture.