

# TUTDoR

## The potential of urban makerspaces as commons based peer production in innovation, education and community building in Braamfontein.

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**THE POTENTIAL OF URBAN MAKERSPACES AS COMMONS BASED PEER  
PRODUCTION IN INNOVATION, EDUCATION and COMMUNITY BUILDING IN  
BRAAMFONTEIN**

By

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Submitted in partial fulfilment of the requirements for the degree

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**TSHWANE UNIVERSITY OF TECHNOLOGY**

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February 2018

Declaration and copyright

## **DECLARATION BY CANDIDATE**

“I hereby declare that the mini dissertation submitted for the degree of M Tech: Comparative Local Development, at Tshwane University of Technology, is my own original work and has not previously been submitted to any other institution of higher education. I further declare that all sources cited or quoted are indicated and acknowledged by means of a comprehensive list of references”.

## DEDICATION

Without the Love and Grace of my Lord Jesus Christ, my accomplishments would mean nothing, unto him be glory, honour and adoration forever more.

I take this opportunity to thank the following people who have played a significant part in my journey:

- My mother Jenny and father Maikano, thank you for being supportive all the way. I am truly blessed to have such parents.
- My siblings, Popagano, Duma, Ntswaki and Mmathapelo, thanks for the support guys.
- Grateful thanks to my friend, Mothusi, for accommodating me during the course of this journey.

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## **ABSTRACT**

The report assesses the potential of urban makerspaces contribution to innovation, learning and community building. Without much public attention, the maker movement has gained momentum in South Africa with important implications. The report seeks to understand characteristics of makerspaces that require attention in technology-led economic policies.

The report looks at some of the makerspaces in Gauteng, with focus on Braamfontein. Gauteng is South Africa's most economically powerful province.

The maker movement as a commons-based peer production platform, presents multiple avenues to increase access to tools, with the potential for impacts on the quantity and nature of entrepreneurship. Equipment has been available only to those working within firms and industry or those willing to pay large costs for their procurement. The report will explore the potential contribution of urban makerspaces to innovation, learning and community building.

**Keywords:** hackerspace, makerspace, FabLab, innovation, learning, community, open source, peer-production, sustainability, commons, commons-based peer production,

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# **CHAPTER 1: INTRODUCTION: BACKGROUND OF BRAAMFONTEIN AND ACTORS IN THE MAKERSPACE**

## **1.1 INTRODUCTION**

The maker movement in South Africa is gaining momentum. Maker oriented initiatives are now established in Gauteng, Western Cape and Kwazulu-Natal, coupled by significant maker outreach into Mpumalanga, Northern Cape and Limpopo Provinces (Kramer-Mbula and Armstrong, 2017).

As an outgrowth of do-it –yourself (DIY) culture, the maker movement has the potential of increasing access to industrial tools and escalate people’s desire and capability to use them. As the maker movement is a fairly new and emergent phenomenon in South Africa, very little attention has been paid to the potential role such spaces can play to benefit members or society. The aim of this report is to explore the potential of urban makerspace as commons-based peer production. Using structured interviews with a set of predetermined questions (appendix) I explore the potential role that urban makerspaces can contribute in innovation, education and community building in Braamfontein.

The City of Johannesburg is at the forefront of economic development in South Africa. As a result, it has attracted people seeking economic opportunities. In addition to the pressure, South Africa has a high unemployment rate and therefore places such as Johannesburg become magnets for economic migrants. The report will assess the movement in Gauteng Province paying specific attention to the fourth largest node of the City of Johannesburg, Braamfontein which has been earmarked as the ICT cluster of the city.

## 1.2 BACKGROUND AND MOTIVATION

Braamfontein has now transitioned into a vibrant cultural hub and property investment space offering world class entertainment at the Wits Origins Centre and Planetarium and the Joburg Theatre Complex<sup>1</sup>. This was a result of a regeneration initiative led by the Johannesburg City Council, Wits University and private investors with various projects that made up the overall activity to a sum of up to R 200 million<sup>2</sup>.

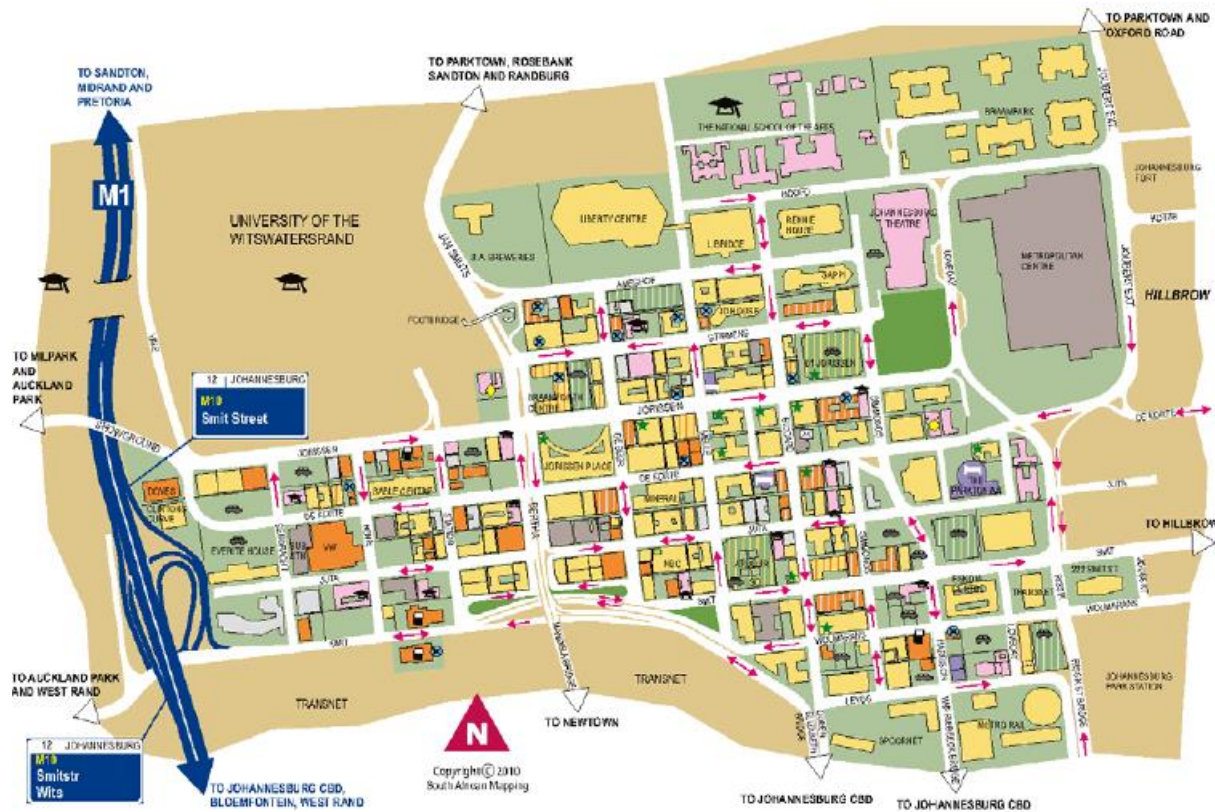
The goal of the regeneration project was to transition Braamfontein into “an attractive, well managed, accessible, well connected, mixed use district which offers state of the art ICT infrastructure (information, communication and technology), providing a competitive location for quality commercial space, the tertiary education sector and the ‘not for profit’ sector, supported by appropriate residential areas and a vibrant retail and hospitality sector”<sup>3</sup>. While defined by the presence of the University of Witwatersrand (Wits) campus, Constitutional Hill, the highways and Mandela Bridge, Braamfontein is an area that is well defined territorially (Broll, 2011). It is easily accessible for motorists via the M1 Highway and Jan Smuts avenue, the Nelson Mandela Bridge links Braamfontein to Newtown whereas the Gautrain Park Station connects the inner city with Sandton, Pretoria and the OR Tambo International Airport. The Rea Vaya bus and Park station have enhanced the mobility of workers who either live in the area or come into the area each day.

<sup>1</sup>see: [http://www.joburg.org.za/index.php?option=com\\_contentandtask=viewandid=2657andItemid=58](http://www.joburg.org.za/index.php?option=com_contentandtask=viewandid=2657andItemid=58)

<sup>2</sup>see: <http://playBraamfontein.co.za/>

<sup>3</sup>see: <http://www.ida.org.za/>

<sup>4</sup>Id



**Figure 1. 1:** Map of Braamfontein. **Source:** Broll, 2011.

The physical configuration of Braamfontein makes it a meeting point between the different places of the city of Johannesburg. Located on the west side is Auckland Park and Milpark, on the east side is Hillbrow which is inhabited by people coming from different places in Africa, above it is the wealthy northern suburbs and on the south side is the City Centre and Newtown connected by the Mandela Bridge.

Braamfontein is the fourth largest node for office space in the city of Johannesburg and is home to a number of multinational corporations based in South Africa. Indeed, it is considered to be on par with other prime office nodes like Sandton and Melrose Arch. It is home to the

<sup>1</sup>see: [http://www.joburg.org.za/index.php?option=com\\_content&task=view&id=2657&Itemid=58](http://www.joburg.org.za/index.php?option=com_content&task=view&id=2657&Itemid=58)

<sup>2</sup>see: <http://playBraamfontein.co.za/>

<sup>3</sup>see: <http://www.ida.org.za/>

<sup>4</sup>Id

Constitutional Court and Wits University which is one of the country's premier universities. The area offers 428 000m<sup>2</sup> of A and B grade office space. It exhibits a strong residential component, offering both executive style apartments which target middle class creatives coming to live in town and affordable student accommodation.

Urban regeneration is seen as a model for urban development intervention, an instrument through which it becomes possible to create a new model of the city which meets the needs created by the redefinition of the global economy (Smith, 2002). Around the world, global cities have emerged as a result of the dramatic financial system expansion based not on productive function, but on capital (Sassen, 2012:13). In global cities, local and national government, as well as local and international investors, share a common interest – that of maximising the profitability and global economy and competitiveness of urban space (Nairos, 2016:52). A similar manifestation has occurred in Braamfontein where similar parties have come together to rebuild Braamfontein as a world class city. The aspiration to be part of a global cities network and the injection of private investments often coincides with the building of a creative hub as if to demonstrate the achievement of a modernity that allows these cities to secure a place among cities of the future (Sassen, 2012:13).

In response to these global demands of smart cities, in September 2016, a digital innovation hub was launched in Braamfontein. It was called Tshimologong Digital Innovation Hub. This was based on a set of partnerships which include the University of Witwatersrand (Wits), industry, government, tech start-ups and tech entrepreneurs (Abrahams and Kedama, 2017).

<sup>1</sup>see: [http://www.joburg.org.za/index.php?option=com\\_contentandtask=viewandid=2657andItemid=58](http://www.joburg.org.za/index.php?option=com_contentandtask=viewandid=2657andItemid=58)

<sup>2</sup>see: <http://playBraamfontein.co.za/>

<sup>3</sup>see: <http://www.ida.org.za/>

<sup>4</sup> *Id*

This is where the makerspace is located within the Tshimologong Digital Innovation Precinct (tech hub).

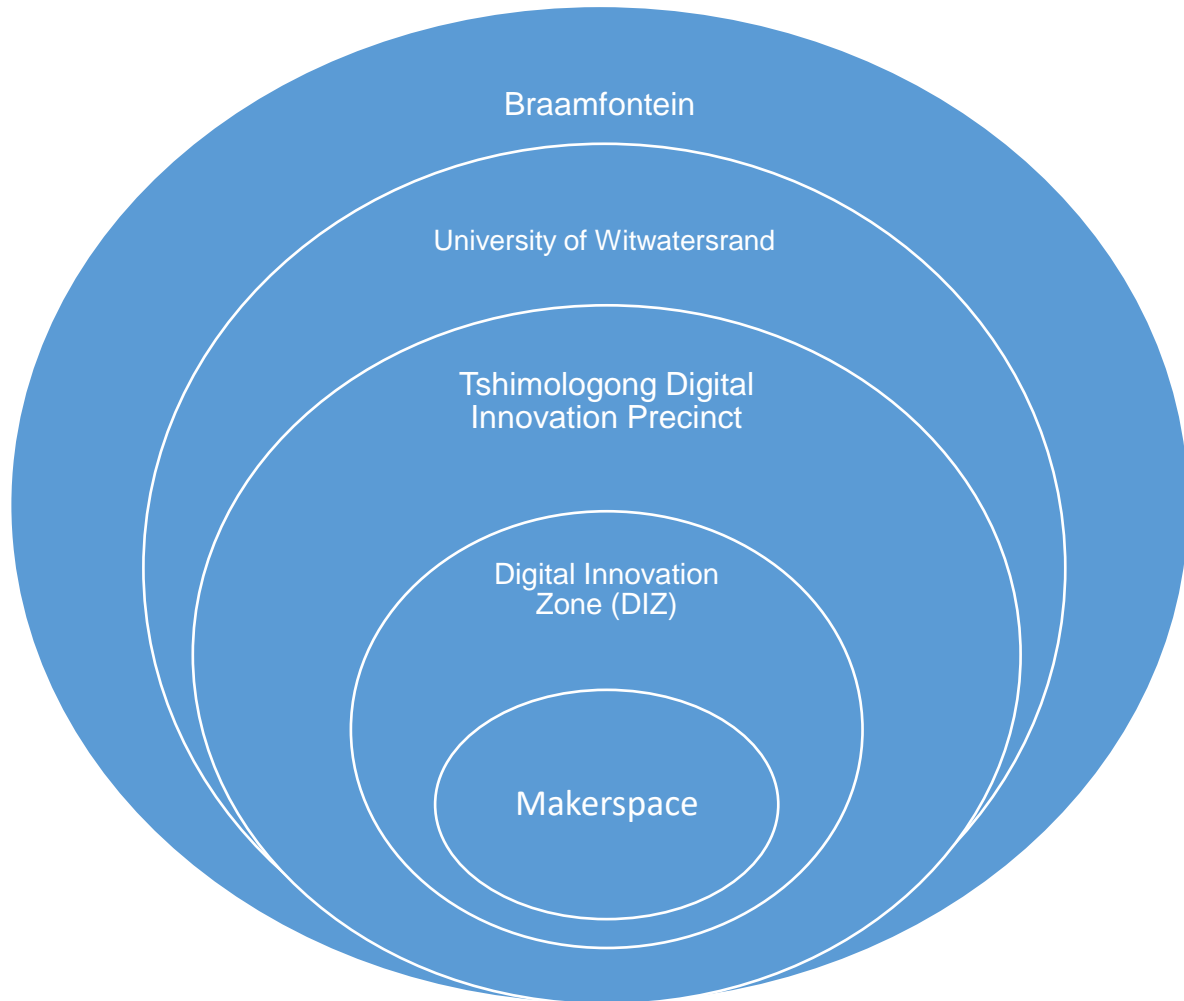
<sup>1</sup>see: [http://www.joburg.org.za/index.php?option=com\\_contentandtask=viewandid=2657andItemid=58](http://www.joburg.org.za/index.php?option=com_contentandtask=viewandid=2657andItemid=58)

<sup>2</sup>see: <http://playBraamfontein.co.za/>

<sup>3</sup>see: <http://www.ida.org.za/>

<sup>4</sup> *Id*

### 1.3 ROLE PLAYERS IN THE MAKERSPACE



**Figure 1.2:** Role players in the Makerspace.

Figure 1.2 above gives a picture of the role players behind the makerspace located within Tshimologong Digital Innovation precinct. Next, I explain their role.

#### **University of Witwatersrand**

Wits is “one of Africa’s premier research universities, which strives to be innovative and is focused on sustaining globally competitive standards of excellence in learning, teaching and research”<sup>14</sup>. “Being bordered by two of Johannesburg’s most prestigious universities,

Braamfontein's start-ups and "ideators" were well positioned to avail themselves of academic skills development opportunities and financial support, which often also included parallel financing from the government. In addition, it was arguable the additional financial resources awarded to TechnBraam by the University of Witwatersrand's Joburg Centre for Software Engineering (JCSE), as well as the university name's halo effect bringing in a multi-million-dollar IBM investment, which also brought the government in as a direct stake-holder in some of TechnBraam programming. JCSE acts as a facilitator, bringing in an influx of financial and technical support from both government and the international private sector firms. Undoubtedly, this has enabled Braamfontein to sustainably continue its trajectory as the vibrant tech hub cluster we see today" (Kelly and Firestone, 2016). According to the World Bank report by Kelly and Firestone, the University of Witwatersrand's role in establishing the precinct was likely limited to an administrative level (2016:11).

### **Tshimologong Digital Innovation Precinct**

An initiative by Professor Barry Dwolatzky and other Academics and Scientists, Tshimologong is a new-age software skills and innovation hub that was developed out of the JCSE's partnership with the City of Johannesburg (COJ), LINK centre, the University of Witwatersrand and other strategic partners.

The aim of the Tech Hub is to promote the creation of successful ICT Start-ups, promote the growth and success of the digital economy in South Africa and on the African continent. One criteria used was that this Tech Hub had to be in an area where there were a lot of skilled people and a lot of business, hence Braamfontein as a district fitted the criteria.

The development of the Precinct involved the renovation of five buildings owned by the University of Witwatersrand, covering part of a block in Juta Street. The creation of the zone is part of the catalyst for urban regeneration in developing Braamfontein as an ICT Cluster.

It was officially launched in September 2016 with a set of partnerships which include the University of Witwatersrand, industry, government as well as tech entrepreneurs and tech start-ups (Abrahams and Kedama, 2017). The funding is in different forms, resource – based partnerships through financial and non-financial means, sponsorship opportunities and membership fees charged to tech entrepreneurs (Abrahams and Kedama, 2017). The precinct provides informal and formal working spaces and broadband connectivity (Abrahams and Kedama, 2017).

### **Digital Innovation Zone (DIZ)**

Within the Tshimologong Digital Innovation Precinct resides the Digital Innovation Zone (DIZ) which is a physical space within the tech hub where creatives, innovators and programmers can come together and collaborate.

## **Makerspace**

The makerspace which was called makerspace X for the purpose of this report is located within this space of the tech hub. The makerspace offers technology services, workshops, training and collaborations with the goal of creating innovative and fresh ideas. The makerspace is involved in 3D printing, making and disruptive technologies.

In the tech hub there is a high level of interaction between the makerspace and other tech entrepreneurs at the physical space. The tech entrepreneurs themselves create products and services which ultimately will be ready for use and taken to market. Some of the tech entrepreneurs focus on video production, gaming development, 3D printing services and App development.

The momentum of maker movement initiatives in South Africa has heightened the need to explore the potential of this phenomenon. For example, there are now established maker-oriented initiatives in Gauteng (Vanderbijlpark, Johannesburg, and Pretoria) Western Cape Province (Cape Town, Knysna), KwaZulu-Natal (Durban) and the Free State (Bloemfontein) (Kraemer-Mbula and Armstrong, 2017). A considerable amount of literature has grown around the theme of maker movement in the developed world but not much has been done in the developing nations especially Southern Africa.

The maker movement, broadly refers to do-it-yourself (DIY) and do-it-together projects and is closely related to the hacker ethic of sharing, collaboration and learning through deconstruction and construction (Van Holm, 2015). By prompting consumers to become originators, and

encouraging tinkering and learning in participatory environments, the movement is re-appropriating production ideals of pre-industrial times (de Beer *et al.*, 2017). This emerging mode of grassroots production named “commons-based peer production” (CBPP) is exemplified by initiatives such as the free encyclopaedia Wikipedia and countless numbers of free/open software projects (Benkler, 2013).

The maker movement roughly began in 2005 with the launch of the online Make magazine (Make, n.d.). The launch of the first Maker Faire in the US, an event that host makers who display products they have created, made or invented using technology or trade tools and openly shared knowledge (Maker Faire, n.d.). Making involves any type of activity of creation of an object in any field. Commonly it is associated with technological projects, 3D printers, tinkering, crafters, hackers, artists, programmers and engineers (Van Holm, 2015).

Making usually occurs in a makerspace, other common names for such spaces being Hackerspaces, Fablabs and TechShops (Kraemer-Mbula and Armstrong, 2017). Despite the presence of three common names, Fablabs and TechShops are distinctive labels for types of makerspaces (Kraemer-Mbula and Armstrong, 2017). Whereas the term “hackerspace” has its origins in software-hacking and to some should not be confused with a makerspace (Kraemer-Mbula and Armstrong, 2017), but for this paper it will refer to space under any of those names. Some of the hardware found at a makerspace includes but it is not limited to microcontrollers and microcontroller software (e.g. Arduino kits), computer numeric control (CNC) laser-cutters, electronic components and 3D printers. Makerspaces are an important component of the rapid spread of the maker culture. These spaces operate in different funding, management and governance model and differ in terms of facilities and equipment they offer (Kraemer-Mbula and Armstrong, 2017).

## **1.4 RESEARCH PROBLEM**

Makerspaces are able to generate dense but diverse networks, creating new ideas and innovative thinking. This raises the need to find out the type of characteristics that these types of spaces take, so that technology led economic policies are able to meet the needs of most people in urban environments. Frameworks gained from the report might give insight on how to deal with some of the socio-economic problems South Africa is facing. The report area were makerspaces located in Gauteng, but more attention will be given to the one in Braamfontein. The preference for the Gauteng province is based on its role as the economic power house both in South Africa and the continent. In this respect, the research findings might be of interest and value to researchers elsewhere in Africa. The province is most suited for the purpose of the report as it views innovation as a key for the regions progression along the developmental path.

## **1.5 RESEARCH QUESTION**

The overall research question is as follows: What are the characteristics of makerspaces that require attention in technology-led economic policies?

The report was guided by the following sub-questions:

1. What is the potential contribution of the urban makerspace in promoting innovation in Braamfontein?
2. What potential role can the urban makerspace play in encouraging creative and innovative learning?
3. What is the potential contribution of the urban makerspace to a sense of community within Braamfontein?

## **1.6 SIGNIFICANCE OF THE REPORT**

Chapter 4 deals with the finding of the report and Chapter 5 deals with the analysis and conclusions. The report attempts to add value to understanding some characteristics of the makerspaces phenomena within the developmental context. This might assist in designing relevant policies for this alternative form of organisation.

## **1.7 LIMITATIONS OF REPORT**

The major limitation with the report is the small sample size, due to constraints the researcher was not able to find a large number of participants who would provide the information for the required report. Nonetheless the data collection method adopted by the report will be sufficient to yield scientific results.

## **1.8 ETHICAL CONSIDERATIONS**

Ethical considerations ensure that the rights of individuals are protected in any research report (Brink, Ross- Kerr and Wood, 2006). This report complied with the ethical requirements as stipulated by the Tshwane University of Technology Ethics Committee. Consistent with the TUT Ethics Policy, the following ethical guidelines were adhered to:

- I. Respondents were advised on the nature of the interview, the aim and importance of the report being conducted, their role in the report, how the information they provided was to be used and the need for their voluntary consent to participate.

- II. Anonymity and confidentiality of respondents were preserved throughout the entire research process and at no stage during the process were participants at any physiological or other form of risk.
- III. The data that was obtained during the research process will be stored and retained for a minimum of five years. The dignity and character of all stakeholders was maintained, and no participant was subjected to embarrassment or unbecoming behaviour.

## **1.9 REPORT OUTLINE**

The research is made up of five chapters. Chapter 1 above already the rationale for conducting this report. The rest of the research will be structured as follows. Chapter 2 is the literature review, giving a brief theoretical background underlying the commons and commons-based peer production, makerspaces, innovation, learning and community building. In chapter 3 the research design and methodology are explained, followed by chapter 4 where analysis and results are tabled. Finally, chapter 5 will conclude by summarizing findings, provide recommendations and scope for further research.

## **1.10 CONCLUSION**

The research problem, research questions and objectives were introduced in this chapter. Furthermore, justification for understanding the research were made and an overview of key concepts pertaining to this report were presented. Finally, the research design and methodology, ethics issues and scope limitations were described. Against this foundation, the report proceeds in Chapter 2 with a detailed review of literature.

## **CHAPTER 2: LITERATURE REVIEW: MAKERSPACES AS A COMMONS**

### **2.1 INTRODUCTION**

In the process of exploring the potential of urban makerspaces as commons-based peer production in learning, innovation and community building in Braamfontein, it is vital to refer to output from previous researchers. This chapter contains a review of prior research studies which relate to this present report. The review provides the theoretical framework for this report. The intention is to highlight issues without a direct reference to Braamfontein. The link between the issues highlighted in the literature and the possibility of them being applied in the reality of Braamfontein will be explored in Chapter 5 through the analysis of data collected. The literature about the commons, commons-based peer production, makerspaces, innovation, learning and community building links to the research questions

### **2.2 THE COMMONS**

To begin with, the emergence of digital knowledge, software and design as new forms of commons has not only recreated the commons-oriented modes of production and market activities, but exemplify that value is now increasingly created through contributions, not traditional labour, to create commons and not commodities (Bauwens *et al.*,2016:1).The commons has its roots in the broad interdisciplinary report of shared natural resources (e.g. forests, fisheries, water resources and wildlife) by a group of people that is subject to social dilemmas (Hess and Ostrom, 2007:4). The resources are not owned but rather held in common by a community, and all members of the community have an equal responsibility to ensure the resources' survival. The concepts have since been expanded from this very specific meaning

to encompass any resource that is owned by a community or to a resource that can be accessed by a broader community of people.

The concept of the commons was highly criticised by Garrett Hardin (1968) in his “tragedy of the commons theory”. In his critique, Hardin argues that it is human nature for self-seeking individuals to degrade non-private property, therefore the commons were ultimately unsustainable, and he concluded that private freedom and the commons were incompatible. However, later on Ostrom, from whom much of the foundational work on commons originated, illustrated how different types of commons can be governed collectively so that the individual’s short-term gains can be compromised for the long-term survival of the common resource.

In her work Ostrom comprehensively highlighted cases of resilient commons practises that have been in operation over centuries. She acknowledged that open access of the common pool resources seemed to confirm Hardin, but her research gave examples of large diverse co-operatively managed resources that disproved Hardin’s argument.).

In contrast to some biophysical commons and fuelled by the internet and social cooperation the “information commons” has emerged over the past two decades. The information commons consist of resources that are non-rivalrous by nature which places a different set of imperatives on the governance of these resources and makes a different set of assumption for the reasons to participate in such commons (Hess and Ostrom, 2007). This movement has enabled participants to share, manage and produce in a collaborative manner (Bauwens, 2005; Benkler, 2006).

As in the biophysical, participants noticed behaviours and conditions on the web such as congestion, free riding, conflict, overuse and pollution that had long been identified with other types of commons (Hess and Ostrom, 2007). Hence the concept of the “commons” assisted scholars to conceptualise new dilemmas they were observing with the rise of distributed, digital information (Hess and Ostrom, 2007). The term ‘commons’ “can be constructive [...] but commons is not value laden – its outcome can be good or bad, sustainable or not [...]”, this is dependent on a particular social dilemma that acts on or arises from it (Hess and Ostrom, 2007:14). This highlights the need for an understanding, not only of the background history and narrative of a specific commons, but also its objectives and motivations, especially the objectives and motivations of its members.

The commons might be small and serve a tiny group, for example, the use of a family refrigerator, or, on the other hand it could extend to international and global levels such as the atmosphere, deep seas, the internet and scientific knowledge (Hess and Ostrom, 2007). According to Bollier (2014:1) the commons may also refer to a discourse, a new/old property framework, social processes and relations or an ethic. The commons consist of a wide variety of self-organized social practices that enable communities to manage resources for collective benefit in sustainable ways (Bollier, 2014:1).

Commons have become an alternative form of institutional space, where participants can be free from particular constraints required for markets. They also offer a significant degree of control and sovereignty over important elements of their daily lives (Bollier, 2014; Benkler and Nissenbaum, 2006). Benkler further highlights that the salient characteristic defining the commons is that no single person has exclusive control over the use and disposition of any

particular resource (2006). The concept of the commons is useful for thinking about informational resources. Given the increasing interconnectivity between people across vast spatial boundaries with the ability to communicate and collaborate in online environments, maintaining a base of commonly held resources that can be used for peer-production remains a central concern for facilitating more open and democratic forms of communication.

### **2.3 COMMONS BASED PEER PRODUCTION**

Benkler coined the term *commons-based peer production* (CBPP) in his book '*The Wealth of Networks*.' He describes it as "a socio-economic system of production that is radically decentralised, collaborative and non-proprietary; based on sharing resources and outputs among widely distributed, loosely connected individuals who cooperate with each other without relying on either market signals or managerial commands" (2006:59). Benkler (2009) places social production in general and peer production in contradiction to market-based production and argues that under these conditions nonmarket collaborations are better at motivating creative people to work on information projects more efficiently than traditional market mechanisms and corporations do.

Concisely, CBPP has three main characteristics that distinguish it from traditional capitalistic practises which are: (i) the decentralisation of the conception of problems and the execution of solutions; (ii) the diversity of participant's motivations; and (iii) the decoupling of governance from private property and contract (Benkler, 2015). These characteristics enable CBPP to become resourceful learning and experimentation centres, which are both innovative and

adaptable in a rapidly changing, persistently uncertain and complex environment. Participants in such projects are intrinsically motivated (Benkler, 2015).

Two key examples of commons-based peer production mentioned by Benkler are Wikipedia and Open Source Software production (2006). Open source is a free online initiative that promotes non-proprietary production and distribution of software and open access to program source codes. Programmers are allowed to collaboratively produce, improve and maintain software programs while encouraging innovation through non-proprietary production and distribution. Wikipedia is the world's largest online encyclopaedia, which allows users to collectively and collaboratively create, maintain and modify its contents.

According to Von Hippel, commons-based peer production shares many elements with his free innovation, but the distinction lies in parsimony vs. inclusiveness of the two concepts (2017:143). The inclusiveness of commons-based peer production makes it useful for rich descriptive studies of complex real-world situations (Von Hippel, 2017:143). In contrast to free innovation, a commons-based peer production framework includes more complexity and richness (Von Hippel, 2017).

In defining peer production, Benkler earlier characterised peer production as loosely connected, whereas Haythornthwaite (2009) later expanded the definition to lightweight and heavyweight models of peer production on the internet:

In a lightweight model of peer production Haythornthwaite (2009) explains that the production of loosely connected individuals contributes effort to accomplishing many small well-defined

tasks. The strength of the lightweight model is that when combined, the massive amount of these tasks adds up to a large, complex and sophisticated technology that could never have been accomplished if it were centrally planned. The strength of a lightweight model of peer-production is that participants are able to self-select tasks and maximize their own skills while simultaneously learning new skills through collaboration. This illustrates Benkler's definition.

On the other hand, the heavyweight model of peer-production diverges from Benkler's definition. It is exemplified by virtual organizations made up of strongly connected and highly committed members whose tasks are loosely coordinated, and their contributions are accepted, based on quality control mechanisms such as peer review (Haythornthwaite, 2009). Heavyweight peer production often includes the development of a technology for a very specific use, by tightly connected individuals. An example of this type of peer production can be seen in basic science research, where labour division can be seen in community model development in the earth sciences and shared genomic databases in biology.

With several successful cases of networked- based collaborative projects like the ones listed above, some view this emergence of new 'technological –economic feasibility spaces' as setting a new agenda for social practise (Benkler, 2006). In line with these feasibility spaces I will in this report consider makerspaces as such. In these technological-economic feasible spaces new social productive models like CBPP are emerging that are different from industrial modes.

Key aspects in CBPP are sharing, abundance of resources, openness, collaboration, community accountability, bottom up innovation, autonomy, communal validation, distribution of tasks

and common ownership of results (Bauwens,2005; Benkler,2006; Kostakis,2012). All of these aspects together create an alternative political economy where economic efficiency, profit and competitiveness are not the guiding principles and community/civil society has a more fundamental role, bringing the notion of mutual cooperation in the heart of the economy (Orsi,2009).

Because of the inherent breadth of its conceptual definition, the take of this report concerning the potential of CBPP – (makerspaces) is in line with Bauwens and Benkler’s view that this mode of production has features that de-commodify both labour and immaterial value and institute a field of action based on peer-to peer dynamics and a peer-to-peer value system (Bauwens, 2009; Benkler, 2015). At the same time, however, they acknowledge that CBPP functions, not only within the cycle of accumulation of capital, but also within the cycle of creation and circulation of the commons (Bauwens 2009).

## **2.4 MAKERSPACES**

Micro-factories, hackerspaces, fab labs and makerspaces are mushrooming all over the world and there is no single term that perfectly captures all these spaces (Sleigh, 2015). Others make clear distinctions between the terms whereas others use them interchangeably. Light and Smith define makerspaces as “community-based design and fabrication workspaces where people meet to share resources, knowledge, build and make things; this might involve computer technology, machines, science, digital arts, electronic arts or any other area involving collaboration and learning” (2015:1).

According to Capdevilla (2015:64), the central philosophical underpinning behind these spaces is open innovation, knowledge sharing and peer-to-peer learning. In these spaces people access networked, digital design and fabrication tools and make almost anything they desire. In trying to understand what a space constitutes, we look at Lefebvre's (1991) idea of space, which includes what he calls the 'triad spatial model' which is the perceived space, conceived space and lived space. Perceived spaces refer to the relatively objective, concrete space people encounter in their daily environment, conceived space refers to mental construction of space, creative ideas about and representations of space (Lefebvre, 1991). Lived space is the complex combination of perceived and conceived space. Lived space is not just a passive stage on which social life unfolds but represents a constituent element of social life. Therefore, social relations and lived spaces are inescapably linked together in everyday life.

Lefebvre (1991) argues that space produces society and simultaneously society produces space. In contrast to other forms of production, social space is produced by and produces power to serve its goals. Lefebvre's (1991) view of a 'triad spatial model' might help us understand makerspaces in relation to the activities manifesting within these spaces. The lived space experience is of critical importance to many community space developments. In the context of a makerspace, the prioritisation of community functions when designing the operation of the space can significantly improve the efficiency and effectiveness of the spatial experience. Thus, it could potentially help avert a mismatch between community's needs and the conceived space functions. According to Lefebvre, producing an urban space should encapsulate reproducing the social relations that are bound up in it, the production of an urban space goes beyond planning the material space for the city as it involves producing and reproducing all aspects of urban life (Purcell, 2002).

Further in his survey of makerspaces, Moilanen, highlights that these spaces can be seen as a development of a new form of “third place”, which highlights urban social settings or surroundings that provide social experiences outside the workplace/school or home (2012). Third places could include anything from libraries, churches, cafés, clubs, parks and cookouts to online communities and virtual places.

From the above information I take note that there is no single definition of the term makerspaces. Makerspaces are all unique in terms of their physical configuration, the workshop culture they implement, governance arrangements, the types of equipment available, the size of their membership, degree and forms of openness, financial models, philosophical positions, political and commercial orientations and whether societal issues are of interest to them or not (Smith *et al.*,2015). However, they do work on common principles, which are: they are organised and run by members; they have open spaces where individuals meet on a regular basis to collaboratively engage in creative commons-based projects and they usually utilize open source software and hardware technologies (Bauwens *et al.*,2016; Kostakis *et al.*,2015). In this report I adopt the term makerspace as an umbrella term to refer to the type of spaces listed above, although not all spaces use this term. Some are called hackerspaces, hackspaces, hacklabs, FabLabs and micro factories among other terms.

## **2.5 DEFINITION OF INNOVATION**

The ability to attract more individuals into product design, creation of diverse networks, new ideas and innovative thinking renders makerspaces as hubs for entrepreneurship and innovation

(Van Holm, 2015). Many start-ups in the areas of ICTs, nanotechnology, arts, culture, engineering, biotechnology and desktop manufacturing technologies, to name a few, are contemporary examples of successful businesses that have developed from these spaces. For this report I will use Damanpour's definition of innovation (1996:694) as "conceived as a means of changing an organisation, either as a response to changes in the external environment or as a pre-emptive action to influence the environment. Hence innovation is here broadly defined to encompass a range of types, including new product or services, new process technology, new organisation structure or administrative systems, or new plans or program pertaining to organisations"

## **2.6 LEARNING**

Education is considered a basic human right which is central to the sustainable development of countries, but it is highly dependent on relevant infrastructures being in place (Geith and Vignare, 2008:). Various fields of computer science, experimental learning, design theory and others have produced literature which explores the educational and pedagogical potential of making (Schrock, 2014). For the context of this report two lines of scholarship in the field of pedagogical studies focusing on making are of interest, in particular, participatory culture and constructionism.

To begin with, participatory culture is highlighted as a robust model of how to think about the emerging practices of learning in digital spaces (Halverson *et al.*, 2016).

The work by Henry Jenkins and colleagues encourages the view of interactions with digital media as an active, social process which enabled by the internet connects like- minded people

around the world in collaborative work and learning (Halverson *et al.*, 2016). Participatory culture developed from Jenkins work of fan culture where he invited people to communicate, produce and circulate content and ideas according to their interest (Halverson *et al.*, 2016). The learning that took place in fan cultures encouraged Jenkins and his colleagues to research a framework for participatory culture that defines the functions of innovative spaces (Halverson *et al.*, 2016). According to Jenkins *et al.*, participatory culture is defined as “a culture with relatively low barriers to artistic expression and civic engagement, strong support for creating and sharing one’s creations, and some type of informal mentorship whereby the most experienced pass along what they know to novices” (2007:10). In some participatory culture members believe their contributions matter and feel some degree of social connection with one another (Jenkins *et al.*, 2007).

The model for learning in participatory cultures is rooted in the concept of apprenticeship and situated learning, where participants learn how to think and act like professionals through sustained cycles of engagement, production, critique and refinement of work (Jenkins *et al.*, 2007). For example, in open source models, projects might involve participants making, giving and getting advice from across the globe. They, even have access to virtual worlds which makes participatory cultures stand out as an accessible way to think about learning and teaching (Halverson *et al.*, 2016).

Participatory cultures tend to grow in third places such as around and outside institutions, from interest-based interactions and established norms for contributions and communication (Halverson *et al.*, 2016). Members bring together digitally driven content in spaces that allow for the exchange of ideas. In a way, participatory culture describes what happens within

makerspaces. Jenkins's findings are in line with the conclusions of Nairos, Giotitsas and Kostakis (2015:565) who through a participatory-action research project exemplified how 3D printing and design can electrify various literacies and creative capacities of students in line with the notion of networked, interconnected and an information-based world.

Within the education discourse, Halverson and Sheridan (2014) argue that making is an educative practice and has the potential to help transform what counts as learning as legitimate. There are different interpretations of what is meant by learning within institutions. Learning is mostly defined in terms of achievement on standardised tests, which captures a singular perspective that provides a common reference for all institutions engaged in education (Halverson *et al.*, 2016). Similarly, focusing on student achievement alone can at times obscure a more comprehensive understanding of the social and material conditions of successful learning (Halverson *et al.*, 2016).

Researchers and educators highlight ways in which making can support the process of learning by encouraging intellectual risk taking and iteration while reframing frustration and failure as fundamental to the recursive feedback that characterises making (Blikstein, 2013; Petrich, Wilkinson and Bevan, 2013). There is a need to transform what counts as learning and making can play a crucial role (Halverson *et al.*, 2016). Hence, the alternative of participatory culture as an emerging practise of leaning in a digital age by Jenkins *et al.*, (2007) might provide valuable insight.

Jenkins *et al.*, (2007:58) goes on to highlight key functions that define participatory culture: affiliations; expressions; collaborative problem solving; and circulation. Affiliation expresses

the interest-driven aspect, expressions define production, collaborative problem solving is the knowledge-building aspect and circulation describes the networks through which interactions and information flow (Jenkins *et al.*, 2007).

In line with many philosophies of education, constructionism maintains that an individual's intellectual growth must be rooted in his/her experience, where knowledge is not seen as a commodity to be transmitted but as a personal experience that has to be constructed (Ackerman,2001). The learning theory of constructionism puts emphasis on personalised production of knowledge artefacts as well as the social nature of learning (Harel and Papert, 1991). Constructionism is the theory of learning that undergirds the maker movement's focus on problem solving and digital and physical fabrication (Halverson and Sheridan, 2014). For example, FabLabs, which originated from the Massachusetts Institute of Technology (MIT), were created as pedagogical environments that allow participants to solve their own problems by producing, rather than purchasing the tools they need (Halverson and Sheridan, 2014).

Papert's theory of constructionism places production-based experiences at the core of learning (Harel and Papert, 1991). Constructionism can be further extended to be "learning by constructing knowledge through the act of making something sharable" (Halverson and Sheridan, 2014). Both formal and informal learning spaces have been using specific tools and programs that are examples of Papert's constructionism. Logo programming language, the Scratch programming languages and Computer Clubhouse programs are examples of this (Halverson and Sheridan, 2014).

## 2.7 COMMUNITY BUILDING

According to McMillan and Chavis (1986:12), a sense of community is composed of four elements: 1. Membership – the feeling of who belongs to the community and who does not; 2. Influence – the ability of members to express themselves and influence the group or, conversely, the ability of the group to influence its members. Both are needed for group cohesion; 3. Integration and fulfilment of needs – the feeling that members are rewarded, and some needs are satisfied by being a member of the community, which includes the extent and quality of interaction between members. 4. Shared emotional connections – the common history of members in a community.

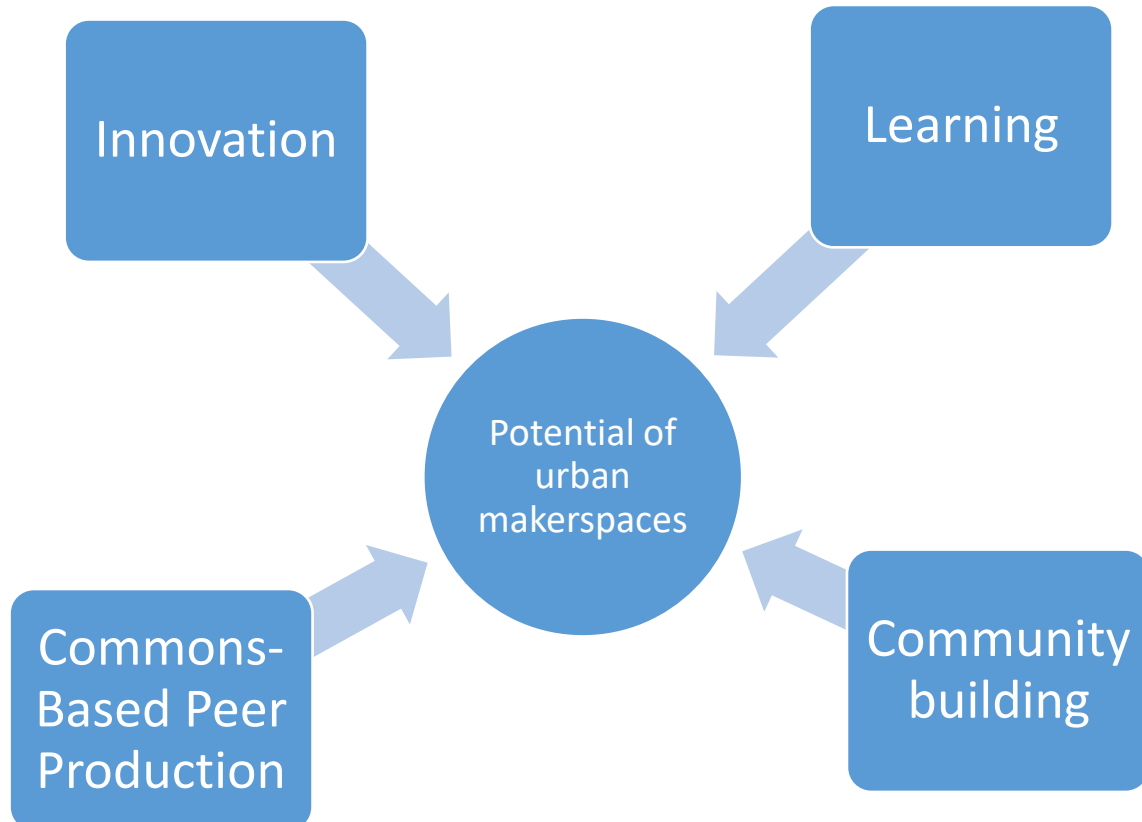
A sense of community is a feeling of belonging and shared interests among members. According to the information gathered in interviews conducted by Hielscher, Smith and Fressoli (2015:12), some members in makerspaces stated that for them a makerspace environment gave them a community, a group of people with whom they could identify. It was a group of people they trusted and wanted to do stuff with. They further explained that they knew they thought alike, using logic to solve their problems in discussions and arguments. The group became something like a second family to them. Most of the interviewees related to finding a group of like-minded people who had a similar way of thinking (Hielscher, Smith and Fressoli, 2015).

Further, a survey conducted by Moilanen (2012), which included 250 members of hackerspaces also confirmed that for 95% of them meeting other hackers and hacker-minded people and having fun were the most important reasons for participating in hackerspaces. In other words,

the social and community factor of peer production seemed to be the key element. Furthermore, he observed that individuals were engaged and committed to one local makerspace (Moilanen, 2012).

## 2.8 CONCLUSION

I have developed an analytical framework Figure 2.1 below which will be used to assess the potential of urban makerspaces. I will begin interviews with members of makerspaces to analyse this framework and its implications.



**Figure 2.1** Framework of potential of urban makerspaces.

In this chapter, a review of prior research studies related to this report was conducted, providing the theoretical framework for this report. The Literature review included a report of the commons, commons-based peer production (CBPP), makerspaces, innovation, learning and community building. All these topics were linked to the research questions. The broader view of CBPP was explored in line with that of makerspaces and concepts were also defined.

The departure point in this chapter was to use literature to define and explore the CBPP, makerspaces, innovation, learning and community building. Against the background the report proceeds to Chapter 3 where I turn my attention to the research design and methodology of the report.

## **CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY**

### **3.1 INTRODUCTION**

This chapter seeks to understand the method to be used in gathering information for the report.

The aim is to ultimately explain the steps undertaken to gain insight on the potential of urban makerspaces as commons-based peer production in community building, innovation and education.

### **3.2 RESEARCH APPROACH**

Qualitative research was used to obtain information for this report. As the report collected data to understand the researched phenomena, the qualitative approach will suit the purpose of this research. Walker (1985) explains that qualitative research yields rich data from a limited number of individuals (as I explain later, the information was gathered from a few people via interviews, workshops and site visits).

The usefulness of qualitative research lies in the fact it affords a broad approach to information gathering. Leady and Ormond (2010) state: “The term qualitative research encompasses several approaches to research that are, in some respects, quite different from one another. Yet all qualitative research approaches have two things in common. First, they focus on phenomena that occur in natural settings. – that is, ‘in the real world’”. And second, they involve reporting phenomena in all their complexity. Qualitative researchers rarely try to simplify what

they observe. Instead, they recognise that the issue they are reporting has many dimensions and layers, and so they try to portray the issue in its multifaceted form.” (2010: 135).

Importantly, they state that most researchers strive for objectivity when undertaking their quest for information. Although one suspects an element of relativism in their thinking: “Some researchers believe that there isn’t necessarily a single, ultimate truth to be discovered. Instead, there may be different perspectives held by different individuals, with each of these perspectives having equal validity, or truth. One goal of a quality report, then, might be to reveal the nature of these multiple perspectives.”

Locke *et al.*, (1993) state that it is the experiences of the individuals involved in a particular setting that are sought and used to explain the issues. Merriam asks the question: “What is qualitative research?” (2009:3). She goes on to describe several activities that could be construed as research. Although she does not give a definitive answer to the question, she concludes the chapter that asks this question thus: “in its broadest sense, research is a systematic process by which I know more about something that I did before engaging in the process. I can engage in this process to contribute to the knowledge base in a field (pure research), improve the practice of a particular discipline (applied research), assess the value of something (evaluation research), or address a particular, localized problem (action research).” (2009: 4).

Lastly, Guest *et al.*, are wary of many of the definitions of qualitative research which they say are constrained by a “dichotomous typology that contrasts qualitative and quantitative research or assumes a particular epistemological foundation” (2012: 5).

They rather prefer a “functional” definition offered by Nkwi, Nyamongo and Ryan that “qualitative research involves any research that uses data that do not indicate ordinal values” (2012: 5). They prefer this as it “outcome focused” and avoids “unnecessary and inaccurate generalisations and dichotomous positioning of qualitative research with qualitative research with qualitative research with respect to its quantitative counterpart” (2012: 6).

This report falls into the broad category of qualitative research as I will be attempting to address a localized problem, i.e., the potential of urban makerspaces in Braamfontein. Specifically, according to Locke et al., I want to find out “what’s going on here?” (1993:99) and qualitative research is the most relevant mode of doing so.

The following extended quotation from Biber and Leavy is also poignant:

“I often think of qualitative research questions involving an inductive approach, which focuses on describing or generating some theories or ideas about a given social phenomenon. The researcher asks open-ended questions such as the following:

- What is happening here? and
- How do individuals make sense of their lived experiences?

In qualitative research, questions are often exploratory and descriptive: to describe social phenomena and their meanings to relevant actors (the questions) and to understand and explain social patterns and processes (the how questions) (2011:37).

In casu, the aim is assessing the potential of urban makerspaces, in contributing to innovation, learning and community building. The policies (the how questions) and the programmes (the questions) are what I aim to explore.

Another confirming voice is that of Flick (2005) who asserts that qualitative research is geared towards analysing phenomenon at a particular time and within a particular locality. Per Leady and Ormond (2010), quoting Pershkin (1993), choosing the qualitative approach is useful for the following reasons:

- Description: it can reveal the nature of certain situations, settings, processes, relationships, systems or people;
- Interpretation: it enables the researcher to (a) gain new insights about a particular phenomenon, (b) develop new concepts or theoretical perspectives about some of the phenomenon, and/or (c) discover the problem that exists within the phenomenon;
- Verification: it allows a researcher to test the validity of certain assumptions, claims, theories or generalisations within real-world contexts; and
- Evaluation: it provides a means through which a researcher can judge the effectiveness of particular policies, practices or innovations (2010: 136-137).

To conclude, therefore, qualitative research is the approach to be used in that it allows for the collection of information directly makers and participants in makerspaces. It will also allow for the assessment of progress made, challenges faced and assess possible solutions.

### **3.3 DATA COLLECTION**

#### **3.3.1 Primary Data**

Qualitative research allows the researcher to gather data from various sources to explain the situation at hand. Through interrogating these sources, I can find out what potential does the urban makerspaces phenomena present within Braamfontein, and the characteristics of makerspaces that require attention in technology-led economic policies. What this means is that through qualitative research we can interrogate the intended interventions of the Braamfontein in creating better strategies. This is done through interviewing the relevant makers.

Data gathering was conducted through a minimum of five structured interviews. The structured interviews was comprised of my research sub-questions. For this report I will interpret participation broadly to include both individuals working directly in makerspaces X and individuals at the physical space the Digital Innovation Zone. The reason for this is that there is a high level of interaction between the makerspace X participants and tech entrepreneur at the physical space. Thus, two of the participants are directly involved at the physical space in the Digital Innovation Zone and one in the makerspace X, while the other two are directly involved in the Gauteng maker collective, UP makerspace and Makers Village respectively. As enumerated below are the predetermined interview questions.

## Interview Questions

1. What is the potential contribution of the urban makerspace in promoting innovation in Braamfontein?
2. What potential role can the urban makerspace play in encouraging creative and innovative learning?
3. What is the potential contribution of the urban makerspace to a sense of community within Braamfontein?

Other information was also gathered by participating in the SA Maker Movement Workshop held by the Institute for Economic Research on Innovation (IERI), Tshwane University of Technology (TUT), attended by 50 participants, including representatives of South African maker communities from three provinces and by representatives from relevant South African government departments, state agencies, and NGOs;

The aim of the workshop was to provide an opportunity for South African Makers and supporting stakeholders to share ideas on current and future elements of the movement which included sustainability, innovation-scaling, outreach, skills development and national networking

On the 2nd March site visits to the University of Pretoria Library Makerspace Hatfield, Geekulcha at The Innovation Hub, and the I Make, Makers Village, Irene Pretoria were undertaken. The reason why the information gained from the workshop and site visits is

important is based on the fact that there is limited literature on makerspaces and CBPP projects in South Africa and developing nations, hence primary data becomes important for this report. With that said, it should also be noted that most of the referred literature stems from the developed countries where innovation ecosystems are different compared to the developing world. Thus, caution should be taken when applying the same principles in a developing world. In this sense, a number of complementary methods are employed to address different facets of research questions.

During the site visits, presentations by makers were made and questions pertaining to the report were asked by the researcher. This complements the research topic. Interviews are useful in that the researcher gets the raw data from the personnel that are responsible for specific activities. The sources are able to give context and “the bigger picture” and to explain challenges encountered in the makerspace.

It is considered useful as participants will include individuals who are likely to have the most intensive knowledge of the phenomenon being studied (Robson: 2007). It is a view supported by Creswell who states that individuals chosen through this strategy can “purposefully inform an understanding of the research problem and central phenomenon in the report” (2007: 125).

Province	Maker	City	Source of primary data
Gauteng	Makerspace X	Johannesburg	Formal interview, online presence, site visit, national workshop,
Gauteng	UP library Makerspace	Pretoria	Online presence, informal discussions, formal discussions, national workshop
Gauteng	I Make, Makers Village	Irene	Site visit, informal conversations, national workshop, online presence
Gauteng	Geekulcha	Pretoria	Site visit, informal discussions, online presence, formal interview

**Table 3.1** Makers studied

Interviewees, involved as they are in the day-to-day operations, may also be helpful in pointing out gaps in policies and practices.

### **3.3.2 Secondary data**

More data was collected from material produced within the JCSE or Tshimologong Digital Innovation Precinct documents and annual reports. Some of these are in the public domain. Where appropriate, permission was sought to use documents relevant to the report but not yet released to the public. The website for makerspaces was consulted.

Journals were another source of secondary information about makerspaces. A preliminary scan of the information available points to the fact that most of the debate is about the maker movement in Africa is work conducted by Open Air.

The importance of the above-mentioned publications is that they offer an insight into the nature of the maker movement, explain the concept of maker movements and make suggestions on areas where policy can have improved. For policy, they are a rich source of information and may assist in filling gaps – where such may exist – on its strategy of technology-led policies.

## **3.4 DATA ANALYSIS STRATEGY**

Data analysis begins with the collection of data. Proceeding in this manner assists with identifying problems and rectifying them which could be problematic if the researcher waits until after the collection of data has been completed.

“Further, during data analysis the researcher will typically discover and notice unanticipated that have arisen early in the data collection. If data analysis is left until afterwards these issues will not be noticed during data collection; they will therefore not be noticed during the data collection and cannot be pursued in any depth during the data analysis” (2002: 61). Among the suggestions he makes, for instance, is that after conducting interviews these should be immediately transcribed, coded, peer reviewed and fact-checked with the subjects and where possible, peer reviewed. This process allows for gaps to be immediately identified and rectified. Guest *et al* suggest that practical purpose of the analysis (to find solutions, develop a solution or build a theory); the analytical purpose (identify, explore, compare, confirm or a combination of these); as well as the connection of the analysis to the research are key (2012: 31).

The analysis of data for this report will therefore have to link back to the research issue (the potential of urban makerspace in Braamfontein). In other words, how much of the data that has been collected is able to give insights into the research problem?

### **3.5 DATA VALIDITY and RELIABILITY**

#### **3.5.1 Validity**

Validity and reliability are central issues in all measurements. Validity is when methods, approaches and techniques actually relate to issues that are explored (Blaxter, Hughes and Tight, 2006). According to Babbie and Mouton (2009:122), validity refers to the extent to which an empirical measure adequately reflects the real meaning of the concept under consideration. The most common and useful classification schemes attempting to categorise

the validities underlying measurement are content, construct, face and external validity (Babbie and Mouton, 2009:119; Welman *et al.*, 2005:55). They are used to measure or reflect true differences in the same individual or group rather than constant or random errors.

### **3.5.2 Reliability**

According to Babbie and Mouton (2009:119) reliability is defined as the” likelihood that a given measurement procedure will yield the same description of a given phenomenon if that measurement is repeated”. Reliability is the consistency of a research measurement, or the degree to which an instrument measures the same way each time it is used under the same conditions with the same subjects (Blaxter *et al.*, 2006:). Using established measures from previous research helps ensure reliability. Reliability in this report was enhanced by examining the trustworthiness of the sources.

According to Johnson, (1997:283) trustworthiness can be maximized or tested so that a more “credible and defensible result” may lead to generalizability, which is the structure for both doing and documenting high quality qualitative research. So, due to the fact that qualitative research is less structured than quantitative research “it has been argued that quantitative research is high on reliability and low on validity while the reverse is true of qualitative research” (Walker, 1985: 191).

### **3.6 ETHICAL CONSIDERATIONS**

Ethical considerations ensure that the rights of individuals are protected in any research report (Brink, Ross- Kerr and Wood, 2006). This report complied with the ethical requirements as stipulated by the Tshwane University of Technology Ethics Committee. Consistent with the TUT Ethics Policy, the following ethical guidelines were adhered to:

- I. Respondents were advised on the nature of the interview, the aim and importance of the report being conducted, their role in the report, how the information they provided was to be used and the need for their voluntary consent to participate.
- II. Anonymity and confidentiality of respondents were preserved throughout the entire research process and at no stage during the process were participants at any physiological or other form of risk.
- III. The data that was obtained during the research process was stored and retained for a minimum of five years. The dignity and character of all stakeholders was maintained, and no participant was subjected to embarrassment or unbecoming behaviour.

### **3.7 LIMITATIONS**

Research in sociotechnical settings like makerspaces will inevitably suffer from a limited view of what are complex systems and this report is no exception. This work has been limited by a number of factors:

- The small sample size of this work limits its generalizability. Given the geographical constraints, the findings of the research may not necessarily be generalized to all urban makerspaces in South Africa.
- Only a limited amount of research has been done on the makerspace movement in developing countries. Although work by other researchers is underway, more still needs to be done.
- The majority of the analysis focused on Braamfontein, innovation, learning and community. Other components briefly described here, such as governance, actor groups or the characteristics of the resource set, may be equally important.

### **3.8 CONCLUSION**

As most of the data collection was done through interviews, makers-workshop and site visits. Moreover, most of the sources of data were from the different institutions and can be easily verified. It is expected that the difference will not so much be in content, but in interpretation. Interviews were noted – with the interviewees’ permission and transcriptions of these was made. Where recordings are not possible, notes were taken.

## CHAPTER 4 PRESENTATION OF FINDINGS

### 4.1 INTRODUCTION

It is clear that the maker movement has a growing presence in Gauteng and in South Africa. It must be noted that the studied space operates under a wide variety of models. For the report I will take one aspect of each makerspace and compare it with the focused makerspace in Braamfontein.

The table 4.1 below outlines the aspects of the research questions that I explored at the makerspace and then compared with other similar spaces within Gauteng.

**Table 4.1:** Research aspects compared

	Learning Potential	Innovation Potential	Community Building Potential
<b>Makerspace X</b>	Learning potential	Innovation Potential	Community Building potential
<b>UP library Makerspace</b>	Learning potential		
<b>I Make, Makers Village</b>		Innovation Potential	
<b>Geekulcha</b>			Community Building potential

#### 4.8.1 Learning potential

A strong sense of collaboration and trust was indicated during the interviews and site visit. This type of collaboration increased the maker's ability in the form of doing ICT applications, as well as analysing and solving problems. Although incubation services prong is provided at the makerspaces, the interviews and observation led me to note that most of the learning process happened between peers. This meant that in some cases members searched for information online or they consulted the more experienced member.

Makers either exchange information and resources or work together or work together to develop their projects. For example, a tech-entrepreneur would work together with other members to develop an app for their business idea. In exchange, the member would benefit from the learning process, as well as increase his set of work experience that improves his potential to get further work.

“[...] the projects within space are self-directed, whereby people learn by teaching themselves, asking questions and helping each other with their individual projects within the makerspace. So definitely I am pro collaboration all the way” (interviewee 1).

In a similar line, another form of learning and collaboration evident is in the form of mentoring, where experts would share their expertise and knowledge with tech-enthusiasts and provide feedback and assist them. A tech-entrepreneur at the space shared his experience:

“[...] when dealing with legal matters like patents and intellectual property, industry experts like lawyers are brought in and give advice to start-ups on how to tackle legal matters that may arise in their businesses. Also, when dealing with finances, they bring in accountants to help

with finance issues or a digital marketing expert to teach the learners how to market their products on different media platforms” (Interviewee 2).

In the literature, learning in participatory cultures is rooted in the concept of apprenticeship and situated learning, where participants learn how to think and act like professionals through sustained cycles of engagement, production, critique and refinement of work (Jenkins *et al.*, 2007). This can be exemplified by the digital arts students from Wits University who make use of the space for some of their projects (Interviewee 2).

The above can be viewed in compared with the University of Pretoria library makerspace which is the first University in South Africa with a formal library makerspace. This makerspace resides within the library of the university with the aim of assisting students to learn by making. According to Interviewee 4, (2017) the founder and manager of the makerspace, students have moved beyond the point of consuming information. Interviewee 4 (2017) stated that students want to apply what they are learning, and a library makerspace is a platform within the university that provides an enhanced learning experience, upskills students with hands-on experience, stimulates research and innovation, assists students in staying relevant and better prepares them for the job market. In this space, students’ creations can be both digital and physical and at most are objects that form part of their curriculum. Students even go further, creating objects, processes, material and designs that are not normal for standard library services. UP has managed to integrate making into its learning and teaching curriculum.



**Figure 4.1.** Winning group with walking stick. **Source:** [www.up.za/en/news](http://www.up.za/en/news).

For example, according to Interviewee 4, as part of their module and in collaboration with the library makerspaces, third year students in the Department of Mechanical and Aeronautical Engineering had to work in groups and use 3D printing to design and build a device that could be used to improve the lives of people or animals. The winners were students who used 3D printing to improve the traditional walking stick (Figure 4.2). Their main aim was not to redesign the stick but to improve it by adding an attachment that alerts the user to possible obstacles on the way. The students further tested their design with students from the Disability Unit who were really impressed by the device. The ‘walking stick’ Project demonstrates how simple work on a single design prototype by collaboration and tinkering with innovative and radical ideas can connect science and the needs of the community.

In this respect, Halverson *et al.*, (2016) reminds us that learning within makerspaces is not interchangeable with schooling, learning within these spaces reaches across the divide between formal and informal learning. It requires us to think more broadly about where and how learning occurs, learning in these spaces occurs as a result of individuals starting as outsiders then participants and moving towards becoming full participants (Vossoughi *et al.*, 2016). The

makerspace thus enhances the capability of members by developing their skills set, as well as pursue their passions and provides a platform for them to contribute to their wider society.

It is worth noting that in this process, learning is not guaranteed nor is it regulated, since the makerspace approach values individual freedom. In this case the freedom to be an entrepreneur or freedom to work in technology. As a result, the unit of analysis is not necessarily the individual learners over time, but what actually happens in the space (Vossoughi *et al.*, 2016). Characteristics of peer collaboration, open learning environments, personalised involvement, experimentation and social learning in makerspaces have gained much interest from diverse educators (Vossoughi *et al.*, 2016). As learning hubs, makerspaces exhibit great promise. The spaces offer a transdisciplinary development process.

#### **4.8.2 Innovation potential**

From its conceptual origins, innovation has mainly been seen in terms of novel objects, processes and technologies and is evaluated in terms of economic success. This area of research goes back to Schumpeter's (1934) seminal work on economic development. Due to these origins, innovation has been framed mainly in its potential for positive economic outcomes (OECD, 2012). Existing literature on innovation has been mostly observed as a catalyst of economic growth and consequently development.

At the makerspace X there are tech entrepreneurs, who already have a certain level of knowledge on technology and want to apply it to create positive change in their community. Some have been part of the space community since inception and have learned several coding

languages as well as software app design. These young tech entrepreneurs are creating mobile applications and video games, and in some cases are mentoring others in their own work.

The majority of the innovations they were developing had a strong social focus. For example, the 'crime prevention/noise detection street light'. This is a smart street light that detects and measures the ambient noise in an area (Interviewee 3). The system allows potential homeowners to see a record of how noisy a particular area is before they move into the neighbourhood (Interviewee 3).

With such a system the municipality will also be able to identify problem areas and intervene in the case where people are rowdy or are playing loud music. The crime prevention element of the street light will be able to recognise noise that could potentially indicate an incident in the area. Within the city of Johannesburg there is a phenomenon called "Vimba" meaning catch him/her. Whereby if the community members are shouting "Vimba" it indicates that they have been mugged, and people must assist in apprehending the thief (Interviewee 3). So, the idea is for the system to detect and track the "Vimba" sound as members of the public shout and chase a thief. The system will then inform the police or security allowing them to track the sound via an application on a mobile device and hopefully apprehend the thief quickly. This system also detect screams, as this usually happens often when people are being mugged or in danger in the early mornings around the Johannesburg CBD. All of these inventions are contextual to some of the challenges the city of Johannesburg is plagued with (Interviewee 3).

According to one the Interviewee 2, when making an object, it is either a replication, meaning a purposeful recreation of something produced elsewhere, or an innovation, referring to any

type of creating, tinkering, hacking or effort to produce a meaningful new form. The internet has enabled an ever-expanding number of guides for individuals to engage in the process of replication. Either type of project can be undertaken communally or by an individual. Pinterest, instructables.com, YouTube, and personal blogs all offer items and descriptions so that people can recreate them for themselves. For members of makerspaces, building something they have been introduced to online becomes meaningful because the personal capital they situate into the item, similar to the mental engagement contained in bringing a process from beginning to end to produce an outcome. In addition, they are able to alter the item to better suit their needs.

From the above I note that innovation can either be an intentional or accidental activity. It can arise accidentally by discovering either a better process or an improvement upon a project intended as a replication. A person can also start a project intending to create something new, either with an idea for how to modify an existing product, exemplified by user lead innovation (von Hippel, 2017).

To replicate or innovate is not the only decisions makers face. Either before or after developing an innovation, makers must decide whether they want to capitalize on their creation by selling it, or whether the item was simply a personal project, which can thus be considered a hobby. Interviewee 3 indicated that he was still in negotiations with a specific security company to commercialise his security product, which is a 'Smart Gate/Door'. This device allows users to stick it on a gate or door, it is then able to detect movement. If an intruder opens the gate or door, the system initiates a call to the home owner to alert them of the intrusion. The technology he is using is readily available, but he was able to contextualise it for the security industry. It indicates that these tech-entrepreneurs are highly inclined towards the innovation end of the

continuum – from idea to innovation, to prototype, to commercialisable product, and finally to scaled, revenue generating enterprise.

One of the prominent technologies being used at the makerspace is 3D printing and it is also popular at the I Make, Makers Village in Irene Pretoria. The Makers Village was started by as a creative space which incubates artists, designers and makers. The Makers Village has a restaurant called Railway Café, an art gallery and a makers’ lab. The makers’ lab provides a platform to gain digital fabrication skills from laser cutting, moulding, casting, milling, digital embroidery and 3D printing.



**Figure 4.2:** The ‘Cheetah’ and the lawn mower printed by it; **Source:** O Maselwanyane (2017) and Interviewee 53dprinting.com.

Housed within the Makers Village is the ‘Cheetah’ claimed to be Africa’s largest (1 Cubic meter) 3D printer created by Interviewee 5 who is considered a guru in 3D printing within South Africa . According to Interviewee 5, this 3D printer is 12 times faster than normal 3D printers and uses ABS granules which are recycled instead of normal 3D filament The ABS granules costs R 30 per kg while the normal filament costs R 300 per kg. It is worth noting that 3D printing technology costs for a developing country like South Africa are quite high. Thus,

the ability to use recycled material and bring the costs of the technology down is innovative in its own right.

According to Interviewee 5, the Cheetah was able to print out a fully functioning lawn mower and only the blades, shafts and electrical switch were bought (Figure 4.2). What stands out is that Interviewee 5 claims it took only 9 print hours to complete using the Cheetah 3D printer. He also printed pot plants which were sold alongside the 3D printed lawn mower. What is evident is that tool availability through a makerspace allows the physical world to be more mouldable, making it similar to the digital one.

### **4.8.3 Community building potential**

The literature on community has established a relevant distinction on the composition of what a community is. According to McMillan and Chavis (1986:12), a sense of community is composed of four elements: 1. Membership – the feeling of who belongs to the community and who does not; 2. Influence – the ability of members to express themselves and influence the group or, conversely, the ability of the group to influence its members. Both are needed for group cohesion; 3. Integration and fulfilment of needs – the feeling that members are rewarded, and some needs are satisfied by being a member of the community, which includes the extent and quality of interaction between members. 4. Shared emotional connections – the common history of members in a community.

I adopt the above composition to evaluate the sense of community that derived from my data. Being part of a collective led member to *be* entrepreneurial and collaborative in their work.

Interviewees indicated about the motivations for their work and the impact the space has had on them. The majority of the respondents said they liked being part of the community of the makerspace, because they felt it was a space for people with ‘out of the box’ thinking in their environment:

*“-I liked the environment, how people think, we are all like in the same mind set.*

*I: what kind of mind-set is that? - driven, I feel like we’re driven.”* (Interviewee 1)

The space was a place where members found different kinds of people with a driven mind set. But also, it was repeated by respondents that the space was a special place because it was difficult to find such a space around. And so, this reflected the uniqueness of the organisation in their context:

*‘[...] For me the makerspace gives me a sense of community, a group of likeminded people that I identify with and want to do stuff with, it’s something like being a part of an extended family’* (Interviewee 2).

The uniqueness of the makerspace encouraged people to feel comfortable to open up and share their ideas and projects. The freedom to experiment and share their ideas was substantial for the creative process that members were immersing themselves in.

*“The great thing about [makerspace] when I first came here and even now is that if you want to try something you just do it. And if that doesn't work, well it didn't work, what do we learn from that?”* (Interviewee 3).

Respondents mentioned repeated times that what they valued most of the space was being part of the community:

*“Anytime you go to an event or something, everybody already knows the organisation and its reputation. And I think the most amazing thing is that... so back in the day a lot of people knew about [the makerspace] but they didn't know what they did. And it's pretty amazing to have such strong brand recognition when nobody knows what you do. I thought that was pretty compelling.”* (Interviewee 1).

The type of community that has been formed at the makerspace is one based on a common identity and set of practices. However, I also identified that this community had a strong focus on ‘working together and solving problems’. Therefore, we partly adopt Fischer’s definition of communities a composition of “[...] *individuals who have unique experiences, different interests and perspectives about problems and who use different knowledge systems in their work.*” This conceptualisation allows us to understand that communities are not necessarily homogeneous in character and practices, something that is evident at the makerspace and the physical space.

With that said, I also view communities as a live experience rather than static organisations, which are configured and reconfigured by its members and the context in which they are embedded. The sense of community offered some support for members, the awareness that a person belongs to a community can in and of itself represent a powerful improvement in a person’s life, let alone the transformative power of the interactions the person has with others in the community, both in person and via virtual means.

All the respondents indicated that the makerspace and tech entrepreneurs at the physical space in the DIZ engage in outreach work around Johannesburg townships in an attempt to make the space more accessible. They give presentations, workshops and lectures around a variety of topics especially in 3 D printing. Currently the makerspace is structuring a partnership with an NGO called Think Ahead, which facilitates outreach programs to high schools. The makerspace will become a service provider in terms of conducting lessons in 3D printing, CAD, Virtual Reality and computer software. The idea is to get high school students excited about learning more about technology, in the hope that some might become the next generation of future makers.

This is similar to what Geekulcha aims to achieve. Geekulcha is a makerspace for ICT students who host workshops, training courses and events. Established in 2013, the makerspace focuses on empowering young geeks through ICT skills development and training. Geekulcha also consults, develops and manages projects for various clients in both areas of software and hardware (Geekulcha, 2017). Located at the mLab in The Innovation Hub in the City of Tshwane, Geekulcha has created a platform where young skilled, creative and ambitious minds meet to connect with each other, collaborate on projects, share knowledge and network with industry leaders. Geekulcha aims to empower young South Africans and improve access to tech careers by providing the tools they need (Geekulcha.2017). For example, one of its most innovative initiatives was SkateHacks which involved the use of skateboards to introduce the youth to the making culture. Through this initiative, young people were taught about the rapid applications development and how to design their own apps. Through this initiative they created a smart skateboard to measure performance metrics on a board. This skateboard enables the skater to measure how high they are able to jump and provides them with data to improve their skating skills (Geekulcha, 2017).



**Figure4.3:** A skateboard enabled with a performance metrics during #SkateHacks; **Source:** geekulcha.com (access 10 March 2017)

SkateHacks hosts events around topics circulating in the fields of technology, arts and design. These include weekend long workshops and conferences that have evolved into Start-Up Weekends and hackathons to name a few. Raeketsesa is a Geekulcha initiative to empower women and young girls in ICT and to create interest in ICT while ensuring competence of women developers within the field (Geekulcha.com, March 2017). Through their initiatives Geekulcha has brought together a larger collective of individuals identifying with open sharing, start-up culture, peer production, social entrepreneurship, human centred design and many more (Geekulcha.com, March 2017). Geekulcha has provided a platform that enables individuals from diverse backgrounds to present new ideas and partnerships within a safe and trusted environment. This aspect of the space highlights the socioeconomic inclusion of the makerspace phenomena which is evident.

In terms of the maker movement in South Africa the makerspace is known and recognised nationally within the maker-community and this community is just gaining traction. The big dream of the Makerspace X, according to Interviewee 2, is to take the makerspace experience to the people by taking an equipped maker trailer to the rural communities. This could be one way to increase the people's access to the makerspace (2017).

According to all respondents, in terms of community building within Braamfontein and surrounding neighbourhoods, much more work needs to be done by the respondents and Tshimologong Digital Innovation Precinct as a whole. One initiative the Tshimologong Digital Innovation Precinct has embarked on is 'Fak' ugesi African Innovation festival' which occurs once a year where the whole block on the precinct is shut down and people, businesses from Braamfontein and Johannesburg get a chance to interact with the activities at the Tshimologong Digital Innovation Precinct. Part of this initiative is to support the digital creative sector while making technology accessible. The festival lasts for one week and becomes a location for learning, making, developing, networking and innovating. Festivals such as Fak' ugesi allows new technologies to be exposed to residents.

At the physical space the DIZ, members pay a monthly or annual fee in order to maintain their membership which might act as is stumbling block in increasing access to the space for those who have an interest but do not have financial means. All the respondents agreed that in terms of demographics, the people who participate at the makerspace X and the physical space DIZ, come from different backgrounds across Johannesburg. The majority are black and are likely to be young people, tech entrepreneurs, tech- start-ups and people who have information about the space and would like to be a part of it. There are those rare serendipity encounters where

people just drop in and become interested in the space. Interviewee 2 gave an example of a hip-hop crew who randomly visited the space and developed an interest in the space which led to them shooting and creating 360-degree music videos at the space (2017).

Within the South African maker community there is a growing community amongst makerspaces locally, regionally and provincially. At the first SA Maker Movement Workshop conducted by Open Air in Pretoria, the need to intensify the network for maker movement community in South Africa was acknowledged.

#### **4.9 CONCLUSION**

From the above responses and observations makerspaces can be seen as CBPP in practise. It is evident that education about the use of various tools, through classic models and informal environments, is a critical cog of makerspaces. These education models offer individuals a means for developing new skills that are central to the process of producing physical goods. Members acquire a vast range of flexible skills and knowledge that can be used on different fields, domains, and projects.

Prototyping is an important component of bringing a product to market. Makerspaces allows members to find design issues early through the active development of the product as its first users and plan accordingly. In addition, going through the process of prototyping in a makerspace provides members the opportunity to gain input from other members, giving them immediate feedback and potentially improving the design. Through this community process,

the member presents a better functioning, better tested model when they seek funding to launch their venture.

From the above it is indicative of the potential such a space can contribute in terms of learning, innovation and community building. In the next chapter I give my analysis and conclusion.

## **CHAPTER 5: ANALYSIS AND CONCLUSIONS**

### **INTRODUCTION**

#### **5.1 CHAPTER OVERVIEW**

The previous chapter was an outline of the data analysis employed in the report in order to answer the research questions. Chapter 5 concludes the report by highlighting the analysis and conclusions. In this section conclusions are drawn from the research results with regards to the objective of the report and compared with research findings that emerged from the literature. Lastly the chapter ends with the report limitations and proposes areas for further consideration in future studies.

#### **5.2 RESEARCH OBJECTIVE REVISITED**

The primary research objectives (section 1.5) of the report are revisited and presented below

##### **5.2.1 Primary objective revisited**

The primary objective of this report is to explore the characteristics of makerspaces that require attention in technology-led economic policies. This was done by exploring the potential contribution of the urban makerspace as commons-based peer production models in promoting innovation in Braamfontein. I then explored the potential role the urban makerspace play in

encouraging creative and innovative learning. Lastly, I explored the potential contribution of urban makerspaces in promoting a sense of community within Braamfontein?

The primary objective of the report was achieved. The participants exemplified the innovation potential of the makerspace by the innovative products and services being produced at the makerspace in Braamfontein. The activities at the makerspace display both a broad understanding of innovation and its social orientation. The projects are originally commons-oriented business models that extend beyond the classical corporate paradigm and its extractive profit maximising practises (Bauwens and Kostakis, 2016). The makerspace offers a creative environment where innovators and designers are able to gather and collaborate in participatory exploration during the experimental phase by prototyping and tinkering and therefore being able to move from a “design-in-the-studio” to a “design-in-use” strategy (Seravalli, 2012). These spaces are networked rather than isolated. As a result, knowledge of innovation practices can be widely evolved and distributed (Fox, 2014). Makerspaces should not be merely viewed as experimentation sites with desktop manufacturing technologies but as places where people are experimenting with new ideas about relationships amongst corporations, designers and consumers. (Lindtner *et al.*, 2014).

The innovations coming out of the makerspace X and the physical space DIZ are mainly user-led, incremental product and process innovations. Some technological infrastructures produced in the space aim to cover specific community needs and might not lead to a new product being commercialised. The drainage system for government could be an example of this. The process itself promotes diffusion of technology within makerspace, which might in turn outline future trajectories of innovation.

Such technologies being based on ICT might provide insights to enable and transform innovations in other industries. The makerspaces contribution becomes valuable since it is the availability of potential innovation as investment opportunities that leads to economic growth (Schumpeter, 1934)

Enquiry into the potential role that the urban makerspace can play in encouraging creative and innovative learning has also been achieved. As learning hubs, makerspaces exhibit great promise. According to Sheridan *et al.*, (2014), makerspaces offer the capacity for informal community activity as well as proper learning spaces which focus on productive process instead of skill sets. The combination of different activities like programming, tinkering, hardware building and manufacturing tools enable a transdisciplinary development process.

Further enquiry into the potential role that the urban makerspaces can play in promoting a sense of community in Braamfontein was achieved. Most of the chosen examples could be considered to be replications of online CBPP in the physical realm with limitations due to the subsequent allocation problems of the material world, compared to the digital world where replication requires a near zero marginal cost (Giotisas, Kostakis and Nairis, 2015). All makerspaces have their own unique flavour and may be very different from CBPP ones, although most of the CBPP characteristics which are also evident in makerspaces, can be seen at the makerspace X in Braamfontein.

In addition, Braamfontein has become a successful neighbourhood in terms of urban development and its social mix of use. It has been able to bring together different social classes of people and has allowed something unique within the reality of Johannesburg, in terms of using the same area for commercial and residential purposes. Currently there is life in the streets of Braamfontein. The evidence for this statement is seen in the many pedestrians seen in the area, not only during the day, but also at night. Adjacent neighbourhoods like Yeoville, Hillbrow and Fordsburg have some street life/use but in Braamfontein this possibility is experienced by users with a greater sense of security. The question or issue lies in how much of the success stems from public and private intervention and how much is the result of a natural evolution of the reality of the area as a social space in continuing transformation (Burocco, 2013). I also note that the type of development and transformation promoted by public and private investors is solely related to the exchange value of the space and almost no consideration is given to the value of use as a commons area. In this regard the intervention within Braamfontein seems to promote social and spatial fragmentation of the neighbourhood instead of reinforcing a socially mixed neighbourhood. Like other urban renewal projects around the world the Braamfontein Urban Regeneration Project has distinct economic interests and goals to satisfy. This can be seen in the increase of standardised consumption spaces, which promote a homogenous environment of consumers more than a differentiated social space.

Furthermore, Braamfontein has different identities cohabiting in the area. These groups have little interaction with each other which determines the weak sense of community. The biggest group is the students, followed by the working class living on the borders of the neighbourhood, then the creative class and corporate working class occupying the corporate areas of Braamfontein.

Developers in Braamfontein have privatised public spaces in the area and created managed public spaces that are highly controlled. This contradicts the notion of spaces opened to differences and supportive of free encounters and exchanges (Burocco, 2013). Instead, a homogenous consumption space is being promoted which neutralises the political function of urban spaces and weakens public participation.

Spaces according to Lefebvre's vision cannot be limited to physical configuration, for, embedded in them are deeper meanings which require active participation and use the core elements that turn a space into a public space are the possibilities of chance encounters and socialisation (Amin, 2010). In this line of thought public spaces demonstrate openness to the unknown and involve reproducing social relations that are entangled within that area (Bremner, 2010). In Braamfontein the public spaces represent an opportunity for a true social mix, which if executed correctly has the ability to produce an inclusive urban renaissance. As a commons-urban-makerspace Braamfontein could become an incubator for developing new solutions to systematic problems that we are facing as a country.

Nevertheless, in its ambition to become a world class district that offers state of the art ICT infrastructure, serious criticism may be drawn to this practise. For example, Sassen (2012:14) argues that some of the problem- solving ICTs are not able to acknowledge the wants and needs of the actual city dwellers, because they are not accustomed to the ways that people use technology. The unchecked distribution of these technologies is based around the motives of the supplier i.e. the commodification of their existing products and services (Hollands, 2015). It stands that the environmentally harmful consumption of ICTs expands without serving the true needs of the citizens or even addressing actual problems. Hence such spaces do not seem

to achieve their mandate, and this is primarily due to the design and implementation of the technology infrastructure (Nairos, 2016).

Hence the promotion of certain technology governance models will partially determine the formation of the neighbourhood. Braamfontein seems to have followed a proprietary-based model in regenerating the neighbourhood instead of a more- citizen engaged model. With that said, it is still early days to judge since the makerspace have only been in existence for about 8 months.

### **5.3 RECOMMENDATIONS**

The historical and social components need to play a central role compared to exclusive economic growth when planning future urban interventions in the city of Johannesburg. It is important to advocate urban development policies which view the city as a social space more than a space of consumption. I advocate for a commons-oriented approach to developing an ICT cluster, whereby citizens are engaged in the decision-making process as this is key to creating a direct link between technology and the needs of city dwellers. This then provides the capacity for open participation and democratic problem-solving procedures. It then becomes important to bring back value of use into the city and understand participation as the possibility of socialisation in such spaces. In this sense, Braamfontein presents a huge potential for interactions and connecting people, but to achieve this it is important not to look at these spaces only as a source of profit.

## **5.4 LIMITATIONS AND FUTURE RESEARCH**

Research in sociotechnical settings like makerspaces will inevitably suffer from a limited view of what are complex systems and this report is no exception. This work has been limited by a number of factors:

- The small sample size of this work limits its generalizability. Given the geographical constraints, the findings of the research may not necessarily be generalized to all urban makerspaces in South Africa.
- Only a limited amount of research has been done on the makerspace movement in developing countries. Although work by other researchers is underway, more still needs to be done.
- The majority of the analysis focused on Braamfontein, innovation, learning and community. Other components briefly described here, such as governance, actor groups or the characteristics of the resource set, may be equally important.

## **5.5 CONCLUSION**

It is clear that urban makerspace possesses a great potential. In order to enhance their functionality policy makers should make sure that ICT vendors do not take control of the technological infrastructure. They should provide appropriate facilities to enable the deployment of participative ways of working. They are encouraged to examine the potential of makerspaces and ideally promote their establishment. This development would offer an alternative of how productive activities could be organised. Contributing to entrepreneurship may not be the primary impact of makerspaces, they also have the potential to contribute to

innovation, education community building and sustainability. I sense that the strength of the maker movement lies in its openness and flexibility, these areas should also be studied in greater detail.

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### **Research Interviews**

Interviewee 1. 2017. Email correspondence interview, 27 March 2017 (Notes in possession of author).

Interviewee 2. 2017. Telephonic interview, 6 March 2017. (Notes in possession of author).

Interviewee 3. 2017. Skype interview, 3 March 2017. (Notes in possession of author).

Interviewee 5. 2017. Site visitation, presentation during Makers Workshop, 2 March 2017. (Notes in possession of author)

Interviewee 5. 2017. Site visit, maker's workshops, 2 March 2017. (Notes in possession of author)

### **Websites:**

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## APPENDIX

### INTERVIEW GUIDE

Interviews were semi-structured. Questions provided here serve as a base from which questions were asked.

General Questions (for all participants):

1. What is the potential contribution of the urban makerspace in promoting innovation in Braamfontein?
2. What potential role can the urban makerspace play in encouraging creative and innovative learning?
3. What is the potential contribution of the urban makerspace to a sense of community within Braamfontein?

**ANNEXURE  
DECLARATION**

I, Mary de Vos declare that the dissertation on

**THE POTENTIAL OF URBAN MAKERSPACES AS COMMONS BASED PEER  
PRODUCTION IN INNOVATION, EDUCATION & COMMUNITY BUILDING IN  
BRAAMFONTEIN**

**OUTLWILE PHILIP MASELWANYANE**

has been edited.



SIGNATURE

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Faculty of Economics and Finance Research Ethics Committee [FREC-ECO]

*The TUT Research Ethics Committee is a registered Institutional Review Board (IRB 00005968) with the US Office for Human Research Protections (IORG# 0004997) (Expires 19 Jan 2014). Also, it has Federal Wide Assurance for the Protection of Human Subjects for International Institutions (FWA 00011501) (Expires 31 Jan 2014). In South Africa it is registered with the National Health Research Ethics Council (REC-160509-21). The FREC-ECO is a subcommittee of the TUT Research Ethics Committee*

15 March 2017

Ref #: FREC 2017/001-ECO  
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Mr OP Maselwanyane  
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Dear Mr Maselwanyane

**Title: The potential of urban makerspaces as commons based peer production in innovation, education and community building in Braamfontein.**  
**Investigator: OP Maselwanyane**  
**Programme: MTech Comparative Local Development (Structured)**  
**Supervisor: Dr R Maharajh**  
**Co-supervisor:**

Thank you for submitting your proposal for ethics clearance.

The Faculty of Economics and Finance Research Ethics Committee reviewed the documents.

This letter is to confirm that the Faculty gave ethical clearance to the study. You are reminded to ensure that proper permission is required should any confidential policy documents be included in the text analysis.

The Committee wishes you well with your research endeavors.

Yours sincerely

Chair

Faculty Research Ethics Committee

*We empower people*



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