

**University of Zimbabwe**



**Exploring Grassroots Technological Innovation: A Study of Informal  
Sector Enterprises Manufacturing Multi-crop Threshers in Harare**

**By**

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*A Dissertation submitted in partial fulfilment of the requirements of the Master in Science  
Degree in Sociology and Social Anthropology.*

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## **Declaration of Authorship**

I Tarisai Kudakwashe Manyati (R082909L) declare that this dissertation is my own work. It is being submitted in fulfilment of the partial requirements of the Master in Science in Sociology and Social Anthropology Degree at the University of Zimbabwe. This work has not been plagiarized or submitted for another degree or examination body elsewhere.

Candidate Signature: Tarisai Manyati .....

**30 August 2013**

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The pain endured for the night but joy came in the morning!!



## **Abstract**

*This study sought to understand the development of technological innovation at Mbare Siya So in Harare. The principal thrust of this research was to establish the causative factors or determinants of innovation, the source of skills and social networks which the informal metal manufacturers develop in the process of innovation. A qualitative methodology was used in the collection of primary and secondary data in bid to address the objectives laid out for this study. The study findings revealed that informal sector manufacturers are motivated to innovate so as to improve the way and speed in which the multi-crop threshers work. Customer prescriptions and changing socio-economic and agronomic conditions also stimulate innovations in the informal sector. The study concludes that innovation is a result of demand driven synergies which are prevalent between the rural farmer needs and the informal manufacturers' skills and knowledge. Interaction and multiple social networks are established by the informal sector manufacturers in the process of innovation based on kinship, friendship ties and manufacturer-client relationships.*

**Key Terms:** *Innovation, Social Networks, Informal Sector*

## **Dedication**

In appreciation of the struggles and sacrifices made on my behalf by my mother Ms Mary Manyati. The completion of this thesis would not have been possible without your unwavering inspiration. To my two nephews Letwinand Wendy Chaya I say this thesis is for you as well.



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## LIST OF ABBREVIATIONS

ATPSN	Africa Technology Policy Studies Network
AU-NEPAD	African Union-New Partnership for Africa's Development
B.O.T	Build and Transfer
d.f	Degree of Freedom
E.S.A.P	Economic Structural Adjustment Programme
$H_0$	Null Hypothesis
$H_1$	Alternative Hypothesis
HIT	Harare Institute of Technology
LRT	Likelihood Ratio Test
MISTRA	Mapungubwe Institute for Strategic Reflection
Z Value	Probability value
ILC	International Law Commission
SEDCO	Small and Medium Enterprise Development Cooperation
S.M.E	Small and Medium Enterprises
S.P.S.S	Statistical Package for Social Sciences
UNESA	United Nations Economic Cooperation Association
UNECD	United Nations Economic Cooperation and Development

## **1.1 Introduction and Background**

Globally, inconclusive contestation and debate has been generated among scholars regarding the ability of people from developing countries to innovate new products (Correa 2002, WIPO2012). Indigenous innovation has been acknowledged in academic and developmental literature as a key stepping stone in facilitating the transformation of transitional and developing economies to full industrialisation (Stone et al 2008, Helmsing 1999, ATPSN 2010). This study was conducted against the background of the critical changes which have occurred in the organisation and the products produced in the informal metal industry since the disintegration of the Zimbabwean economy and its informalisation (Sachikonye 2006). Research conducted so far has not explored the technological innovations which occur among indigenous people within the informal sector.

The economic downturn that occurred starting in 2000 has been linked with multiple factors such as the rural land revolutions, persistent droughts which crippled the agricultural economy, the disintegration of industrial activity and the adoption of authoritarian policies such as Operation Murambatsvina (driving away the filth) (Sachikonye 2007, Gumbo 2013). The closure and downsizing of many manufacturing firms led to a dramatic upsurge of the informal economy to an astronomic level of 87.8% by 2008 (Gumbo 2013, Murisa 2010). All these events led to the interconnectedness between small scale farmers, informal metal manufacturers and the development of agro based technological innovations such as the multi-crop threshers...

Studies conducted at Mbare Magaba among the metal manufacturers so far have focused on urban land contestations between informal metal manufacturers and local authorities policies (Nyamwanza 2010). The study findings from the study illustrate that conflict exists between local authorities and the informal metal manufacturers due to the existing policy frameworks as regulated by the local authorities. Other studies on the informal sector manufacturers have focused on the informal sector as a provider of income and labour (Manyika 2012, Brand 1986). The study findings obtained from these studies indicate that the informal sector is a major source of employment and income.

Mawomo (2013) examined the factors that affect the performance and entrepreneurship of the informal metal manufacturers at Mbare Siya So. The findings from the study indicate that there is demand linkage between informal metal manufacturing and the agricultural sector. Jassai and Jirira (1987) study sought to understand the potential role of women in the industrial development of Zimbabwe in the informal and formal economy. The study findings obtained from that study indicate that women are constrained by the lack of knowledge of credit sources and opportunities for entrepreneurship. The lack of credit institutions was also highlighted as a drawback for women in manufacturing sector in both the formal and informal sector.

This study sought to illustrate the determinants of innovation and the knowledge and skills possessed by the informal metal manufacturers which enable them to develop innovations. For innovation to happen feedback loops and social networks have to be present and these were outlined and scientifically studied. Empirical answers to these major research questions were drawn with particular reference to the informal metal manufacturers producing multiple crop threshers at Mbare Siya- So in Harare.

## **1.2 Objectives of the Study**

The broad aim of this study is to understand the development of technological innovation in the informal sector.

The specific objectives of this study are:

- i. To inquire into the determinants of innovation among the informal metal manufacturers.
- ii. To establish the source of knowledge which guide in the manufacture of the multi-crop threshers.
- iii. To establish the social networks which the innovators develop in the process of innovation.

## **1.3 Research Questions**

This study probed into the following research questions:

- i. What are the circumstances which motivated the development of innovation in the manufacture of a multi-crop thresher?
- ii. How do manufacturers acquire the knowledge which guides their innovations?

- iii. How do manufacturers of threshers interact within the informal sector and with the customers in the design and manufacture of multi-crop threshers?

#### **1.4 Statement of the Problem**

Limited research has been conducted to explore the innovations developed by the informal metal manufacturing enterprises comprising of skilled artisans and informally trained manufacturers. The skilled formal sector labour merged within the informal sector manufacturers with the disintegration of the formal economy in Zimbabwe in the post 2000 era. With unemployment rates escalating to over seventy percent, the collapse of the formal sector culminated in the absorption of the formal into the informal sector economies or the informalisation of the economy (Sachikonye 2006, Luebker 2008, Action Aid International 2005, Manganga 2007, Mpofu 2007).

The inflow of the formal sector employees into the informal sector resulted in an unprecedented growth of the informal sector, the reconfiguration of the informal sector in terms of the internal organisation of the sector, the recruitment criteria as well as the strategies of training. For unemployed formal sector workers domiciled in Zimbabwe, self-employment in the informal sector economy such as metal manufacturing, welding and wood work was the workable alternative for sustaining livelihoods (Chagonda 2010, Mpofu 2007). The informal sector economy therefore is to an extent propelled by formal sector labour with a production ethic and expertise derived from the formal industry with a greater capacity for technological innovation. Limited research has however been conducted with respect to the enhanced capacity of the informal sector and the technological innovations which have occurred within the informal economy due to the integration of skills in the informal sector.

This scenario raises critical questions which this research sought to investigate. What are the determinants of innovation in the informal sector? What are the social networks which the informal manufacturers develop in the process of innovation? What is the source of skills and knowledge which guide the development of innovations? This study explored the mentioned research questions with the view of uncovering the technological innovations which have occurred within the informal sector. The study focused on informal metal manufacturers who are stationed at Mbare Siya So who specialise in the manufacture of multi-crop threshers.

## **1.5 Justification of the Study**

An intellectual gap exists with regard to the micro-processes and interaction which occur within the informal metal manufacturing industry in the production of innovative technologies. The indigenous knowledge systems and skill within the informal sector which propel technological innovations remain under-researched (Were 2011). Studies conducted specifically on the informal sector metal manufacturers at Mbare Magana focused on the informal sector as a source of employment, Manyika (2013), the politicisation and conflict of urban space, Chirau and Chamuka (2013), the role of women in metal manufacturing and the socio-economic determinants which affect production among the informal metal manufacturers at Mbare Siya So, Mawomo (2013).

Throughout Africa, the documentation of innovation by African people has not yet received the importance that it deserves (UNECA 2011). The existing literature has focused on the interactions which occur at a macro level among universities, agricultural researchers, science granting councils, government agencies and commercial farmers. The dynamic linkages and social interaction which occur at a micro level are currently under-researched and they differ from the interaction observed in formal industries and firms from previous studies. In addition limited research has been carried out with respect to the determinants which drive informal metal manufacturers to develop innovative technological designs, the source of knowledge and the knowledge transfers which occur among the informal metal manufacturers and the social networks which the informal metal manufacturers rely on. This study will therefore add to the existing knowledge base by exploring these mentioned issues.

This study deliberately selected the informal metal manufacturing industry from the diverse activities which take place in the informal economy. The reason for choosing this sub group is that the metal manufacturing sub sector is the most important component of the economy which leads to the development and modernisation of the society (Agbu 2006). The study focused on the multi-crop thresher equipment because it is an important post-harvest technology used to process and it reduces grain loss from the harvested crops. The multi-crop thresher is therefore an important tool in ensuring food security. Most studies conducted on agricultural technologies have focused the on cultivation tools such as the agricultural planter. In Zimbabwe, limited research has been done with respect to post-harvest technologies such as the multi-crop threshers. Therefore this study sought to examine innovations in the development of the multi-crop thresher in the informal sector.

## **1.6 Definition of Key Concepts**

The major concepts to be used in this study are innovation, social networks and informal sector. This section defines briefly these concepts.

### **Informal Sector**

A comprehensive yet unstructured definition of the informal sector can be provided as:

*Very small units producing and distributing goods and services, and consisting largely of independent, self-employed producers producing and distributing goods and services, and consisting largely of independent, self-employed producers in urban areas of other developing countries some of whom employ family labour and/ or a few hired workers or apprentices ; which operate with very little capital or none at all; which utilise a low level of technology and skills; which therefore operate at a low level of productivity; and which generally provide very low irregular incomes and highly unstable employment to those who work in them (Mhone 1996).*

Multiple and conflicting definitions have been forwarded by scholars in an attempt to define the informal sector economy. This makes the process of defining the informal sector extremely difficult and imprecise (ILC 2002). The informal sector has been described positively as the seedbed of African entrepreneurship and as an employment provider (Manyika 2013, Hanseene 1991 in Chidoko and Makuyana 2012, Gibbon 1995 in Hayden 1990). The informal sector has also been stereotyped as a hidden economy, a trouble causing economy, underground economy, a vast sea of blackness, hidden etc (Hanseene 1991, Vambe 2008 in Dube , Chirisa 2002).

A synthesis of theoretical, statistical and empirical definitions converge at defining the informal sector economy in terms of size, job attributes, structure and the size of capital investment (International Labour Organisation 1972, Luebker 2008, Mhone 1996). Informal sector enterprises are in some instances licensed but not registered as companies. The growth which was experienced in the informal sector starting in the 1990s led researchers to substitute the term informal sector with small and medium enterprises (SMEs) (Mushipe 2007, McPherson 1991, Daniels 1993, McPherson 1998).

### **Social Networks**

Social Networks can be defined as a set of socially relevant nodes that are tied up by one or more types of relations (Martin and Wallman 2010). They consist of relationships which exist among units interacting together (Wasserman and Faust 1994). The social actors and their

actions are regarded as interdependent within social networks. Social networks depend on the positioning of the individual in a social system as well as contextual needs. Social networks can be single stranded or dyadic where simple reciprocal exchanges prevail (Helmsing 1999). Multiple social ties occur among many individuals (Kleinberg 2007).

## **Innovation**

The concept of innovation encompasses social, economic and technical dimensions which are difficult to merge in a single definition. Precisely, this study adopted the definition of innovation as the implementation of a new or significantly improved product, both goods and services or process, a new marketing method or a new organisational method in business practices, work organisation, or business practices, or extended relations, external relations, scientific, technological, organisational, financial and commercial steps which are intended to lead to the implementation of innovations (OECD 2005, Fan and Zeng 2009). Innovation stems from collaborative action of people coming with different ideas, skills and assets (both tangible and intangible assets) to create new products and services.

Significant changes in the understanding of innovation have occurred due to the integration and interdependency of nation states. Innovation of technology involves co-creation of products through knowledge obtained from the customers, responses to global challenges such as food insecurity as well as through complementing networks and diffusion of global knowledge. Innovation in the twenty first century has been described as user driven, people driven innovation, iterative, frugal or reverse innovation or open innovation to show how it emerges as a process of interaction (Bisgaard and Higenhaven 2010, Vascacelous et al 2001, Kestenbaum 2009).

## **2.0 Literature Review**

A review of secondary and tertiary literature on technological innovations was carried out at the onset of the study. In a contested area as this, works of different authors and researchers were analysed in relation to the focus of this study. This review informed this study on the intellectual gaps in knowledge within the field of technological innovations. The gaps in knowledge provided the basis of carrying out this research. In a contested area as this, works of different authors and researchers were analysed.

A number of country wide surveys have been conducted on the informal sector on the small and medium enterprises (SMEs) in Zimbabwe (McPherson 1992, Daniels 1993, McPherson

1998, GoZ 2012). In these surveys, the research focused on the origins and creation of the unregistered businesses, the size and workforce capacity of the manufacturing small and medium enterprises, the transformations which have occurred within the manufacturing small and medium enterprises and the constraints faced by the manufacturing small and medium enterprises. The study findings revealed that small and medium enterprises arise mostly as a subsistence measure for sustaining livelihoods rather than as a response to new opportunities. The major constraints faced by the small and medium enterprises were identified as lack of adequate capital, lack of inputs and intense competition from similar businesses. No exploration was carried out with respect to the technological innovations prevalent within the informal sector in Zimbabwe.

A baseline survey conducted in Manicaland Province in Zimbabwe provides a detailed account of the experiences of farmers with the post-harvest multi-crop threshing machine (Mvumi 1998). The research findings showed that a limited number of the people of Buhera use the mechanical threshers and preferred manual threshing to avoid the high cost of mechanical threshing. In grain deficient areas, it was observed that the loss of grain is a cause of concern for farmers which therefore explains their preference for manual threshing. The observations of this study are important to this study as they reveal the cost inefficiencies of the multi-crop thresher which are produced in formal industries in terms of cost and efficiency.

Studies conducted in the area of technological innovations have revealed that innovation is a product of interaction. The stakeholders identified in this interactive process are commercial farmers, communal farmers and research institutions. Studies conducted in Zimbabwe, South Asia, Netherlands, South Korea and China have examined how multiple stakeholders such as agents in agricultural education, research and extension, community members and innovation brokers interact in the use of knowledge in the process of developing technological innovations (Spielman 2009, Spielman 2009, Sheik 2010, Laurens et al 2009, Lewis 2004, AU-NEPAD Report 2012, International Development Research Council 2011). The findings in these studies indicate that community innovation is central in the design of new products. The studies also conclude that technological innovations occur as a result of systematic linkages between multiple formal firms involving industrial firms, universities, the informal sector and research councils whose outcome is systematic learning and capacity building. The

findings of these studies are significant to this investigation as they inform this study on the importance of interaction in the development of technological innovations.

Economic factors are critical determinants which enable technological innovations. Mhazo et al (2005) sought to establish the capacity of small to medium enterprises in effectively manufacturing and marketing processed products such as motorised threshers for cereals. The findings from the study indicate that the major constraints that the Small Scale agro processing industry faces include limited access to credit, lack of appropriate technology and lack of capital. In another study, Ajibola (2009) focused on analysing the value chain of multiple crop threshers. The study results indicate that economic factors tend to dominate the evaluation of the technology and much focus seems to dwell on the designing and making of threshers. These studies are therefore relevant to my studies as they indicate that economic factors affect the design and manufacture of technological machinery. Consequently these findings inform my study that economic factors and other unexplored social, cultural and political determinants may be worthwhile studying as they may influence the informal metal manufacturers to innovate and design their products in new and unique ways.

Daniels (2010) conducted a study in Kenya to establish the nature of informal sector skills within the informal sector which determine the capacity of the informal metal manufacturers to innovate new designs. The study findings show that the informal sector skills which enable the informal sector manufacturers to innovate are derived largely from the formal sector and from familial and tribal afflictions. In addition to the formal and informal apprenticeship, training which enable innovation in the informal sector is derived from training institutions like the universities, polytechnics and non-governmental organisations. The findings of this study are critical to this study as they reveal the importance of skill in the development of technological innovations in the informal sector.

In stark contrast to the above mentioned study, other studies have indicated incapability of the informal metal manufacturers to innovate new technological designs. Adegbile et al (2012) analyses the informal metal manufacturing industry in order to establish the skills and knowledge possessed by the manufacturers in the process of innovation. The study findings reveal that innovations within the small scale informal metal manufacturers in South-West Nigeria are weak and lacking. The main sources of innovations for the fabricating firms largely involve copying and imitation from imported products. Another study by the UNECD (2011) sought to establish innovation and industrial development in Africa. The research

findings indicate that African firms and industries have largely been passive learners of imported technologies. The paper also arrives at the conclusion that Africa has not built a significant innovation capability and any technological change which has occurred was minor and adoptive with limited technological creativity. The findings of these studies are important to this current research as they inform on the need to ascertain the authenticity of the technological innovations produced within the informal sector.

The efficiency of the multi-crop thresher in terms of threshing a variety of grain is a critical determinant which prompts new innovations and the redesigning of the multi-crop thresher. Studies conducted on the threshing machine in Egypt and Nigeria examined the effect of food rate feeding pattern, cylinder speed and the performance of a locally fabricated axial flow motorised thresher in terms of threshing efficiency and grain loss (Al Ashy et al 2009, Bonnyimo and Nkankini 2005, Simonyan and Imokhome's 2008, Saniedirad 2008, Simanyan 2006, Osunde 2006 Ogunlowo 2005, Irtwange 2009, Khuntu and Sutu 2003, Bello and Ogunlowo 2005, Askan and Abbaspar 2008, Maunde 2010, Khuntia and Sahu 2003, Sinha and Sinha 2005). The results of the studies indicate that factors such as grain size, feeding pattern and the cylinder speed of the threshing machine are critical determinants which affect the threshing machine threshing process. This has resulted in modifications to the equipment. These research findings are significant to this study as they clearly outline the significance of efficiency in the development of the multi-crop thresher.

Studies on technography or on the usability of crop threshers in Africa have also been conducted. These studies tend to focus on the safety standards of crop threshers and the usability of the crop thresher across gender (Quisumburg and Panolfelli 2009, Ragasa 2012, Kumar et al 2002). These studies were conducted to establish the safety standards in the use of crop threshers, gender gaps in technological adoption, access and interactions resulting in gender differences in agricultural and labour productivity. In Nigeria, a pedestal operated rice thresher was introduced to female processors but was rejected because the thresher exposed women's thighs and wearing trousers was not culturally permissible for women in Nigeria. Therefore the crop thresher was more appropriate for use by the males relative to women. The findings drawn from Uganda, Tanzania, Kenya and Nigeria point to the need for new technological designs which take into account the safety of the crop threshers across all social units such as females, males and children as well as culturally permissible ways of conduct in varying communities in Nigeria. The findings of these studies inform this study on the problems which are present in the crop thresher in terms of its safety and usability across

gender which may also be a critical determinant which drives informal metal manufacturers to innovate new multi-crop thresher designs.

Studies conducted in India and Namibia also provide the social context which brought about the innovation and development of multiple crop threshers (Azouma et al 2009, Virk's 2012, DuPlessis and Mallet 2001). The aim of the study was intended to establish the structural determinants which led to the development of a multi-crop thresher. The research findings indicate that the development of the multiple crop thresher emerged as a symptom of structural challenges in India in terms of labour shortages and the high expense of production and processing of agricultural crops. The creative production of the multiple crop threshers was meant to circumvent the lack of resources required for threshing in India and time required for threshing. The findings of this study are significant to my study as they provide evidence in support of the view that technological shifts and innovations are fashioned by social forces.

In conclusion it can thus be noted that the studies undertaken on technological innovations reviewed in this paper emphasise on the importance of interaction which occurs at a macro level among agricultural researchers, formal industries, community based innovations and farmers. These interactions are critical in the process of technological innovation. Information derived from studies done in Nigeria, India and Asia has indicated that technical determinants such as the efficiency of multi-crop threshers influence technological innovation. Further studies however need to be pursued in order to uncover micro social processes which occur within the informal sector such as the social organisation and interaction which occur in the process of innovation, the source of knowledge and skills within the informal sector and how knowledge is shared among informal sector manufacturers.

## **2.1 Theoretical Framework**

This study used the social interactionism approach in understanding innovations which occur within the informal sector. More akin to hermeneutics and phenomenology, symbolic interactionism is an interpretive approach which is rooted in the teachings of Mead (Allan and Benzies 2001, Mackmann 2005). The roots of the symbolic interactionism were first conceptualised by George Mead and were later developed by Herbert Blumer into a theoretical framework (Baghdadi 2009, Mackmann 2005, Cronk 1973). The symbolic

interactionism theory refer to and describe the nature of human societies and groups, social interaction, objects, human action and the interrelatedness of lines of action (Baghdadi 2009).

The symbolic interactionism theory provided a theoretical perspective for studying how individuals interpret particular objects and how this affects behaviour in a particular situation (Allen and Benzie 2001). The symbolic interactionism framework holds the assumption that people interpret the actions of others rather than impulsively responding to them (Solomon 2013).

In order to understand the human interactions one needs to understand the self-concept of the symbolic interactionism theory. According to Mead (1934) the self-concept consists of the “I” which is the unorganised part of the human self. The “Me” is the social self which arises as a result of the interactions that one has with others. The “Me” represents the generalised other such as individuals, social groups or social class. The generalised other is complex and an individual is expected to have more than one generalised other.

George Mead posited two forms of interaction as the basis of social interaction in the society. Mead believed that social interaction consists of conversation of gestures and the use of significant symbols. On the other hand the society also engages in non-symbolic interaction. This type of action is achieved through immediate, unreflective and direct responses to action. Mead in his triadic nature of meaning model further breaks down human interaction into three main types. Interaction at one level involves the significance of what the person to whom a particular gesture is directed to. The second type involves what the person who makes a particular gesture intends to do at a particular point in time. The third angle involves the joint action that arises out of the initial gestures made.

The concept of self is premised upon the perceptions and responses of social beings (Solomon 2013). Cultural symbols are exchanged in the process of interaction. Meanings are modified and accepted in an interpretive process used by a person in dealing with objects that he encounters. Human beings view themselves as objects. Taking the self as an object depends on taking the role of others. The self involves viewing one from the standpoint of others. The human self is therefore viewed as both the source and the object of reflexive human behaviour.

Blumer expanded Mead's social interactionist analysis by his contribution on the concept of role taking. Role Taking is the process of interaction in which a human being becomes an

object himself. Role taking involves imagining and seeing oneself as one seen by others (Mead 1934 quoted in Adiobat 2011). In summary Blumer suggests that what the other is supposed to do is determined by the viewpoint of the other person of social group.

The object and meaning are important concepts of the symbolic interactionist theory. Blumer (1969) points out that the symbolic interactionist theory categorised the object into three groups which are the physical, social and abstract objects. The human beings consist of the mentioned categories of objects and human beings who interact with the generalised other on the basis of their own social meanings of these objects. Meanings assigned to objects stem out of the social interaction that one human being has with one's fellows. Human beings interact socially based on the social meanings of these objects. Meanings and interpretation attached to objects and stimuli are not static but are subject to relocation, re-alignments and re-definition (Blumer 1969). Human beings plan on the basis of the contingent meaning for the things/ objects that they encounter. Social plans which guide human action are grounded in clear consensual meanings. This culminates in the creation of social objects (Mackmann 2005, Cronk 1973, Blumer 1969 quoted in Allan and Benzies 2001).

Cooley's looking glass self is another concept which illuminates the social interactionist theory. Unlike Mead who viewed the human self as a result of objective factors of interaction in the social world, Cooley viewed the self to be a result of the subjective process of a human being. Human beings define and develop themselves in every situation as a result of their imaginative processes to reflect the attitudes of others.

The symbolic interactionism theory was appropriate for the study of technological innovations as it illuminated on the interactive processes among informal metal manufacturers which resulted in technological innovation within the informal metal manufacturing (Dennis and Martin 2005). The symbolic interactionism theory shed light into how knowledge is obtained and circulated among informal metal manufacturers through the process of interaction and exchange of information and knowledge. The symbolic interactionism approach served as sound theoretical perspective for the triangulation of both qualitative and quantitative methods of data collection used in this study (Allan and Benzies 2001). The ethnographic methodology of the use of observation, interviews and self-administered questionnaires is informed by an interactive process between the researcher and the research participant.

The interactionism theory however discusses interaction among different social units in a detached way. It does not map the linkages or synergies of social networks which occur within the process of innovation both internally and externally. This was addressed through the use of the social network analysis where the linkage among different social units was established. The symbolic interaction theory also assumes that the generation of knowledge culminates as a product of interaction which occurs among social units which coexist in equilibrium in a positive and constructive manner. The social discord, friction and power struggles which may characterise interactive relationships are negated in the theory (Cronk 1973, Dennis and Martin 2005).

### **3.0 Methodology**

Methodology refers to the systematic approach in which research is conducted in order to solve a specific research problem under investigation (Dawson 2002). The methodology or planned action of research also encompasses the methods which are the techniques of conducting research. This section discusses the qualitative and quantitative methodologies used in this study, the research methods used and the data analysis plan.

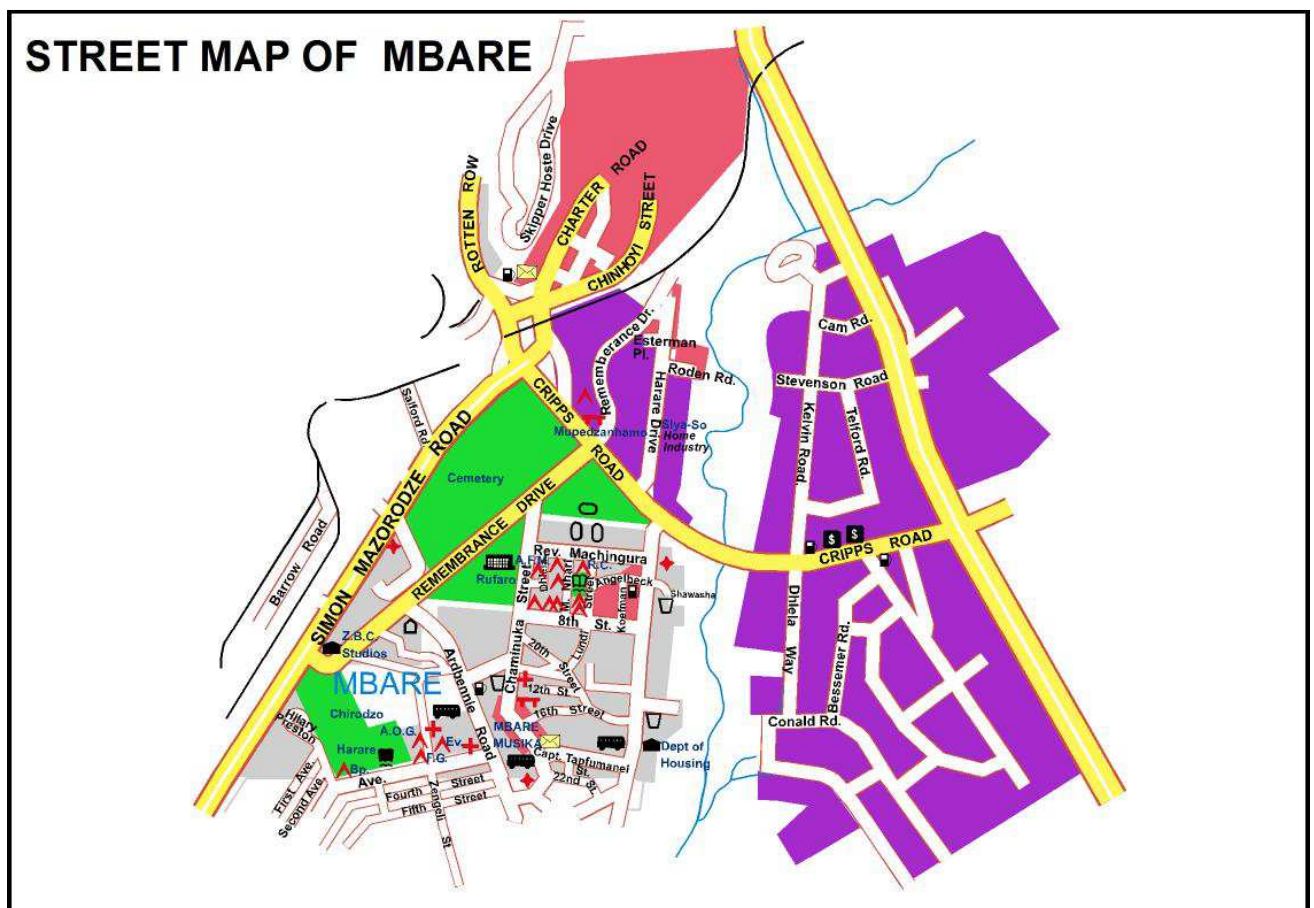
### **3.1 Research Design**

A research design is defined as a detailed plan of the research study to be conducted consisting of the research concepts and context (Dunham 1999). In order to fully explore the innovations which originate from the informal metal industry in the design and manufacture of multi-crop threshers, this research used a qualitative methodology in the collection of primary and secondary data in order to obtain a holistic picture surrounding the knowledge and social networks which guide the informal sector innovations (Allan and Benzies 2001). The symbolic interactionism theory underlies the use of the qualitative methodology in this study.

The primary data collected for this study illuminated on the social networks and relations which are prevalent within the informal sector at a micro level. The secondary data was obtained through the review of government documents and academic journals. This assisted in situating this research within the broader political, social and economic context which has a bearing on the development of technological innovations in the informal sector. An understanding of the existing literature enabled this study to contribute to the existing knowledge on technological innovations.

Qualitative methodology was used in understanding in-depth information from the participants pertaining the social networks and interaction which occur in the process of innovation (Turner 2010). The main qualitative method used for this study was ethnography (Dawson 2002). The ethnographic study was done through conducting interviews, observing the behaviour of the participants in the process of innovation, capturing of photographs and analysing of written texts. The rationale for choosing this research technique in collecting primary data was that the ethnographic approach sufficiently captures the power dynamics, the social interaction and networks which prevail in the informal metal manufacturing industry which occur in the process of innovation.

**Map 1: An Illustrative Street Map of Mbare Siya So Home Industry in Mbare, South of Harare**



**OBTAINED FROM THE CENTRAL STATISTICAL OFFICE (CSO)2013**

From the diagram shown above, Magaba Siya So informal metal industry is shaded with the purple colour in the centre of the picture on the right side of Harare Drive.

### **3.2 Study Area**

This study was conducted at Mbare Siya So home industry in Harare. Mbare Siya So home industry is a product of the colonial administration in Zimbabwe. It is the largest creative cluster of informal metal manufacturers in Zimbabwe with an estimated four hundred operators in the area. A creative cluster is a geographical concentration of small and medium enterprises that come together working in related sectors but not necessarily on the same products. Diverse activities such as tin-smithing, carpentry, leather-work, welding and manufacturing, food canteens and hardware retailing are present at Mbare Siya So. The exact numbers are difficult to obtain as the majority of the informal metal manufacturers at Mbare Magaba are not formally registered. Estimates suggest that they are over 300 informal metal manufacturers at the site (Manyika 2013). Geographically; the study site is situated two kilometres south of Harare central business district in the high density suburb of Mbare.

Mbare Siya So home industry was established during the 1950s as a way of promoting self-help employment for the excess African populations who were not absorbed in the formal industry (Chirisa 2009). The first allocation of stands was made in 1961 to meet the increased demand for working space by the Mbare residents. The structures were maintained in the post-independence era. The home industry concept was later re-established in the post-independence era in Zimbabwe. In 1987, the Harare City Council realised the need for cottage industries for urban workers. The cottage industry was re-established under the name Mbare Siya So. Two factory shells were developed by the Harare City council.

In 2002 the Harare city council in partnership with Small Enterprise Development Cooperation (SEDCO) developed 309 factory shells which are still present up to date. The newly established small factories were disbursed to the Harare home industry association by the Harare City Council under the Build and Transfer (BOT) policy. Under this agreement the Harare home industry association agreed to develop the Mbare Siya So home industry for fifteen years before they transferred ownership back to the Harare City Council.

The reason for choosing Mbare Siya So as the study site was that it is readily accessible to the researcher. A huge population of informal metal manufacturers who specialise in the manufacture of multi-crop threshers is concentrated at Mbare Siya So. An adequate sample for the study could therefore be drawn from the Mbare Siya So home industry. The map

below clearly indicates the positioning of Mbare Siya So informal metal industry in Mbare high density suburb in Harare.

### **3.3 Study Population**

This study targeted forty informal metal manufacturers who specialise in the manufacture of multi-crop threshers at Mbare Siya So as the research population for this particular study. This sub-population of forty informal metal manufacturers who specialise in the manufacture of Multi-crop threshers was derived from an estimated three hundred informal metal manufacturers who operate at Mbare Siya So (Mbare Council 2013). The rationale in choosing this sub population for research was that the manufacturers form a unique group who develop innovations and manufacturer of multi-crop threshers at Mbare Siya So.

### **3.4 Field Entry**

Entry into the research field was done at four levels: town council, district council, cooperative and individual respondent level. An application letter to conduct research at Mbare Siya So was submitted to the director of the Human capital office at Harare Town Council. Upon approval, the researcher proceeded to the Department of Housing and Cooperatives where an application to conduct research at Mbare Siya So was made. The researcher then proceeded to Mbare Siya So cooperative and a formal request to conduct research was made. Permission was subsequently granted and the researcher asked for permission from different individual respondents who manufacture Multi-Crop Threshers.

### **3.5 Sampling Techniques**

For the qualitative interviews, the researcher used purposive sampling. This enabled the researcher to target individuals with information rich sources for in-depth knowledge on the sources of knowledge and social interactions and networks which the informal metal manufacturers rely on in developing technological innovations. The researcher identified the participants who could provide in-depth information during the initial process of the administering of questionnaires to the research participants.

## **3.6 Data Collection Methods**

### **In-depth-Interviews**

The researcher conducted twenty interviews with key informants who design and manufacture multi-crop threshers. An interview entails the administration of questions by the interviewer to the respondent (Bryman 2001). The purposive sampling technique was used in identifying the key informants with in-depth knowledge of the innovation development in the manufacture of the multi-crop threshers. This technique ensured that a detailed description of the determinants of innovations as well as the social interaction which occur within the informal sector (Bezeley 2009). The inadequacy of the use of structured interviews is that it does not provide an objective statistical representation of the phenomena under study. The researcher countered this limitation through administering questionnaires to the informal metal manufacturers.

When conducting the interviews, the researcher translated the language written on the research instruments into Shona. Upon writing of the final thesis the researcher re-translated the collected data back into English. Consequently the danger of loss of the original meaning was apparent. In addressing this problem, the researcher made use of direct quotations in the presentation of the research findings. This approach enabled the descriptions provided by the respondents to be presented in their original sense. The English translation was provided in order to complement the original quotation provided by the respondents in Shona. The researcher noted that some of the participants were not willing to provide information about how they share or not share knowledge among themselves, the power struggles and knowledge control which prevailed within the sector. In complementing the structured interviews the researcher made use of ethnographic techniques of observation and informal discussions over a period of three months in order to explore more fully the social interaction which occurred within the sector.

### **Observation**

The researcher used observation as a means of collecting qualitative data. Observation is a research technique that is used to collect information in a natural everyday setting (Macmillan 1993). The researcher observed the daily activities of the informal metal manufacturers at Mbare Magaba. The researcher was able to gain more information with respect to why they innovate as well as to observe how the informal metal manufacturers interact during their day to day work.

The observation technique approach enriched the inquiry process as it assisted the researcher to fully explore the social networks, power struggles and social interaction which prevail in the informal sector. The approach also enabled the researcher to obtain a nuanced inside view of the daily interactions which occur within the informal sector (Reeves et al 2010). The observation technique was sufficient in capturing the micro social process of interaction and uncovering covert data which the participants were not willing to release during the start of this study. The participants at first put up a falsified front to the researcher coming from outside the study site on issues pertaining conflict and challenges involved in the process of developing innovations. The observation approach is however flawed in appreciating how broader macro social processes impact on interaction at a micro level. To deal with this anomaly, the researcher reviewed secondary literature so as to ground the study within the broad social, economic and political context.

The use of observation had some practical weaknesses. The informal metal manufacturers for some time continued to treat the researcher with caution and suspicion. The behaviour of the informal metal manufacturers in terms of their interaction at first was altered in the presence of the researcher. The passage of time ensured the gradual acceptance of the researcher into the research setting. The gradual acceptance of the researcher by the manufacturers was realised as the researcher was granted permission to observe and participate in the activities of the informal manufacturers such as safeguarding the workshops and carrying of raw materials from the delivery truck.

The use of observation techniques at Mbare Siya So pre-disposed the researcher to victimisation by the members of the home industry aligned to political parties. Mbare Siya So is structured along political lines and intruders such as journalists or researchers who collect information pertaining to the area are treated with suspicion. This scenario occurred despite the researcher having been approved to conduct the research by the Harare Town Council and the Mbare Cooperative which holds usufruct rights of the home industry. To deal with this anomaly, the researcher maintained political neutrality and focused on the research agenda. The researcher therefore gained trust from the informal manufacturers who would defend the researcher in the case where political accusations were levelled against the researcher.

### **3.8 Data Analysis Techniques**

Thematic analysis was used for the logical presentation of the collected data. The qualitative data was transcribed into transcripts of participant's responses against a particular objective. The researcher identified recurrent themes from the transcribed interviews in line with the set objectives of this study. Direct quotations were used in the process of data analysis and this allowed the collected data to speak on behalf of the respondents.

### **3.9 Ethical Considerations.**

This study adhered to the study protocol of observing research ethics to ensure the protection of the research participants (Bazeley 2009). The research objectives were briefly explained to the participants before the data collection process. This ensured that the participants understood the objectives of the study before participating in the study. Confidentiality of the respondents was also assured to the participants and was maintained by the researcher during the entire research process (Bazeley 2005). The participants of this study were hesitant to have their names written in the final document. The researcher agreed with the respondents that the names of the respondents who participated in the study would be kept confidential. The findings were presented through the use of pseudo names.

### **3.10 Delimitation of the Study**

This study site for this research was restricted to the study of informal metal manufacturers at Siya So Mbare Magaba. The study was centred upon innovations of the informal metal manufacturers who specialise in the manufacture of multi-crop threshers.

## **4.0 Presentation of Study Findings**

This section presents the findings obtained for this study. The findings are presented using the thematic approach in line with the objectives set for this study.

### **4.1 Innovators in the Informal Sector**

Forty male respondents who innovate and manufacture multi-crop threshers agreed to participate in this study. The participants were aged between 18-35 years.

## 4.2 Determinants of Innovations

### Efficiency

Innovation in the design and manufacture of multiple crop threshers is motivated by the need to improve on the efficiency of the multi-crop thresher. In an interview held with *Tanga* an innovator and manufacturer, the importance of the efficiency in the manufacture of multi-crop threshers is emphasized:

*[When we design new crop threshers we aim at improving on the efficiency of the machine. We compare our new crop thresher with the old version, observing the shortcomings from the work of the previous engineer's then we improve on the existing crop thresher. So the difference arises due to the fact that we make our improvements. We consider the issue of cost of raw materials and labour when we make our adjustments. The issue of efficiency is related to the time taken in crush one bucket (of seed) from the previous model and the new model].*

From the above quotation, it can be noted that the informal sector cumulatively improve on the existing multi-crop threshers designed by skilled artisans. Using a comparative approach, the informal sector innovators devise means to innovate and to improve on the efficiency of the multi-crop threshers.

Through observation during the three months of ethnographic research, the researcher took special notice of the interaction which occurs between the customers, the *maguma-guma* (Salesperson/ Middleman) and the informal metal manufacturers. The researcher learnt that efficiency is a virtue expected by the customer. In one conversation *Tapiwa* an informal metal manufacturer said to a customer:

*[The crop thresher which you see here is similar to the Hippo type. This one is even more effective than the ones that you know of. The time that is taken to crush one bucket (of seed) with a Hippo crop thresher, you can crush three buckets (of seed) with our machine which you see here.]*

The quotation cited above therefore shows that informal sector manufacturers are driven to innovate multi-crop threshers in order to satisfy the needs of the rural farmers or small scale farmers who require efficient multi-crop threshers.

### **4.3 Reducing Production and Sales Cost**

Through observation the researcher deduced that innovation is done in order to reduce the cost of producing the multi-crop thresher and to make them affordable to customers. In one conversation on the pricing of the crop thresher *Tendai* a manufacturer said to a customer:

*[When you give us some measurements and the specifications of the size of crop thresher that you need we calculate the total cost of the raw materials required for the crop thresher. After that you provide us with the material then we only charge you for our labour. That's how we can reduce the price and you get for your thresher]*

The above quotation shows that informal metal manufacturers innovate multi-crop threshers which are cheaper and easily accessible by small scale farmers.

During an informal discussion with *Kurai* an informal metal manufacturer, the researcher opined that innovations in the design of the crop thresher were important to both the buyer and the respective community where the crop thresher would be used. The narration provided by *Kurai* in an interview exemplified this factor more clearly. In *Kurai's* rural home in Murehwa there are only three grinding mills and no crop threshers. To solve this problem, *Kurai* is in the process of designing a combined crop thresher and grinding mill which is affordable for both the customer and the community paying for the threshing services.

### **4.4 Responses to Socio- Economic and Agronomic Changes**

Qualitative data gathered from an in-depth interview with *Tawona* an informal metal manufacturer revealed that the multi-crop thresher was designed to match the type of seed which was grown in a particular area and season:

*[For us to make changes and innovations, it really depends with the type of seed that is available on the market in the areas that we supply our machines to. For example right now people are harvesting sorghum so we have to manufacture the crop threshers which cater for that particular type of seed. So it really depends on the type of seed that is available at that particular point in time. So you shall see that the crop thresher that we make shall differ from time to time]*

From the above quotation, it can be deduced that socio economic transformations have an impact on informal sector innovations. Further supporting evidence was also gathered by the researcher which supports the idea that innovations are done in order to meet the changing

social context and environment. During the informal discussions held with *Tawona*, an innovator said:

*[The reason why we consider our crop thresher to be a unique innovation is because we improve on the existing one and then we come up with a more effective crop thresher which works in a much better way].*

During an interview with Prince, an informal metal manufacturer, the researcher gathered that the manufacturer develop innovations which are informed by the changing social context. Prince indicated that they changed from the colour yellow of imported crop threshers to green because the former colour attracts bees which could endanger the user of the crop thresher in the rural areas where the crop thresher is used. Therefore the manufacturers choose the colour green which they assumed was more appropriate to the environment where the crop thresher was used.

#### **4.5 Small Scale Farmer Demands**

The researcher opined that innovation among the informal metal manufacturers is also motivated by the prescriptions provided by the customer to the manufacturer. An interview held with Brian a manufacturer revealed the mentioned point:

*[The issue really lies with the customers. The customer usually motivates us to make new designs. In the past we used to manufacture electricity driven Multi-Crop Thresher but electricity power cuts are a major constraint in the rural areas so we had to make adjustments and develop a diesel driven machine.]*

The quotation above illustrates the fact that small scale farmer demands result in innovation. In two separate informal discussions held with *Tanga* and *Tendai* both informal metal manufacturers the researcher gathered that the informal manufacturers innovate new multi-crop threshers in bid to suit the prescription of the customers. Some customers request the manufacture of a multi-crop thresher they have seen somewhere else. The informal metal manufacturers then discuss the proposition and the manufacturers try to manufacture the crop thresher as requested by the customers.

An increase in agricultural production experienced by small scale farmers has also led customers to prescribe for the re-fashioning of the multi-crop thresher. During an interview held with *Tawona*, the researcher gathered that the small scale farmers faced problems with the old type of the crop thresher. The task of pulling out the sacks and replacing them with

other sacks was difficult and slowed down their production pace. The small scale farmers therefore requested that a new crop thresher be designed with the milling outlet put sideways to enable them to increase their threshing pace. Following the customers prescriptions the informal metal manufacturers therefore developed a different crop thresher. This evidence clearly demonstrates the development of technological innovation is motivated by the prescriptions provided by the customers who are rural farmers.

#### **4.6 Marketing**

The researcher also established that the informal metal manufacturers to innovate new crop threshers in bid to enhance their sales. During an in-depth interview, *Tendai* an informal metal manufacturer said:

*[The reasons why we innovate new multi-crop threshers are to distinguish ourselves from copy cats and to enhance the sales that we make. The designing of new multi-crop threshers helps a lot in attracting customers].*

The above mentioned quotation therefore indicates that informal metal manufacturers to innovate new products in order to enhance the sales of their crop threshers. Photograph Four shown below shows how the one manufacturer, *Tendai* modified the crop thresher developed a new crop thresher design in order to allure customers to buy his product at Mbare Siya So. The two crop threshers have the same the same function and they differ in terms of design.

#### **4.7 Source of Knowledge**

Through in-depth interviews the researcher gathered that the older and experienced manufacturers train the younger and experienced manufacturers in the sector. At Joshua's workshop, the researcher observed that Joshua aged 28 was the most experienced worker at one workshop and was responsible for training his younger brother aged 21 and nephew aged 19 in metal fabrication and developing new innovations. Joshua during an in-depth interview said:

*[I can safely say that at our workshop I am the only one with much work experience so I am responsible for training my younger brothers and nephews].*

At *Tawona's* workshop the researcher also observed that there was intensive interaction among informal metal manufacturers. *Tawona* manufacturer trained at Harare Institute of

Technology (HIT) was responsible for training some of the metal manufacturers who work with him and were not formally trained. The sharing of knowledge is however not entirely one sided. The other informal metal manufacturers who are not formally trained also demonstrate great knowledge and skills in the manufacture of the multi-crop thresher and they also shared their knowledge gained through experience.

Informal sector manufacturers also interact to a lesser degree with the formal sector. The researcher opined that vocational training and formal sector experience enables informal manufacturers to innovate new Multi-Crop Thresher. The researcher observed the operations at one workshop consisting of five brothers. All the manufacturers at this workshop are skilled artisans trained at Harare Polytechnic College. In an interview Prince a manufacturer highlighted that the five brothers used to work for Impinge Mine in Guruve before he personally started working at Quick turn engineering along Mvurwi road. Prince also indicated that all the manufacturers at their firm make new innovations without any consulting other manufacturers.

From the in-depth interviews, the respondents denied the existence of conflict in their day to day interactions. One manufacturer *Tendai* indicated that they all work as a family. The researcher during the three months as an ethnographer observed that the interaction which occurs among informal metal manufacturers at workshop level has some problems. In an informal discussion *Tawona* said:

*[A co- worker at our workshop may decide to just refuse to perform his duties which he may claim are difficult. The main reason why they do this is that after being trained they are confident of getting employment somewhere if dismissed from work]*

From the cited quotation cited, it can be noted that conflicts occasionally arise among the informal metal manufacturers as they interact in their day to day activities.

#### **4.8 Inter-Workshop Networks**

The researcher also established that the informal metal manufacturers interact with other informal metal manufacturers in innovating. From personal observations and informal discussions held with the metal manufacturers, the researcher established that the informal metal manufacturers work in distinct workshops. However the informal manufacturers interact and share knowledge on how to manufacture the crop thresher well. In an interview Joshua an informal manufacturer said:

*[We work together especially with respect to sharing knowledge. For instance I might be knowledgeable in a particular area such as arc welding so if I don't give the next person the information I may also suffer the same fate when I am in need of some information. So we share. Even if I need tools I usually go to someone whom I know has the tools]*

From this quotation, it can be noted that the informal sector innovators share tools and machines in the process of innovation. The researcher also observed an amicable working relationship between two manufacturers from different workshops Joshua and Brian. Brian was once called in to share his knowledge on how to machine the multi-crop thresher shaft. The researcher observed Brian demonstrate to Joshua and his two workmates on how the job of fitting in the shaft in the multi-crop thresher was supposed to be done without asking for any payment.

Through an informal conversation with Sam, Prince elder brother the researcher also noted that informal metal manufacturers rely on experienced manufacturers especially those who are formally trained. The researcher held an interview with Prince and established that informal metal manufacturers especially those informally trained rely on the expertise of their experience and the formal training. Sam said:

*[We don't normally receive any assistance from other manufacturers because we were formally trained at vocational training centres. But the other young guys from this complex come to us for advice on how to make designs properly. When we first invented our crop thresher which we termed the Bell Merger Grinding Mill many manufacturers who work in this complex came to befriend us because they wanted to be taught how to manufacture the crop thresher].*

The researcher however established that at times the interactions among the informal metal manufacturers do not always proceed smoothly. A key informant interview held with Sam a *maguma- guma* (salesperson) showed that some informal metal manufacturers at times deliberately withhold specific information and knowledge in order to derail the work of the other manufacturer. Sam had this to say:

*[In terms of sharing knowledge there is usually no problem. In some instances there may arise cases where other manufacturers may deliberately withhold information with the intention of halting the progress at my workshop].*

#### **4.9 Informal Sector - Formal Sector Networks**

The researcher observed that limited interaction occurs between the informal sector manufacturers and the formal sector manufacturers. Quantitative data collected for this study also confirms these observations.

During the research period the researcher encountered only two workshops which manufacture Multi-Crop Threshers that are linked with formal sector employees. During an informal conversation with Prince revealed how they work with James, their uncle who works for Quick Turn Engineering. James is a good machinist and is responsible for the quality control of the manufactured products. James is usually sub contacted for the purposes of machining crop thresher shafts.

An interview with Isaac indicated that their workshop also gained knowledge from informal sector employees. Isaac does not have any vocational training and he works together with two workmates who were trained at Harare Polytechnic College. During the interview Isaac revealed that he also gains knowledge and skills from the formal sector employees who usually come during the weekends to their workshop. In his words Isaac mentions that:

*[We obtain a lot of knowledge from those who work in the formal sector. They came here with a lot of information. Some of them usually come during the weekends and we manufacture multi-crop threshers together].*

During the weekends the researcher observed that Peter and Tom come to Isaac's and they manufacture crop threshers on commission basis. During the manufacturing process Farai and Paul who are Isaac's employees would make consultations on machining shafts from Peter and Tom occasionally.

In a separate interview with Prince a manufacturer, the researcher established that the relationship which exists between the informal manufacturers and the formal sector is reciprocal. Prince indicated that the formal sector employees also rely on the informal manufacturers to do manufacturing work for them. The informal manufacturers are usually sub-contracted when the formal firms have too much work and at annual shut down. The uncompleted work is usually given to the informal metal manufacturers.

Through established relationships with formal sector employees the informal manufacturers have access to advanced and sophisticated machinery through their friends who work in the informal sector. During an interview Sam a manufacturer said:

*[Sometimes we face problems of accessing machines such as the lathe. The lathe is a very expensive machine. Once we have a job which requires the use of the lathe we sometimes have to take some of our work to our friends who work in the formal industries to do the work for us”]*

From this quotation, it can be established that informal sector innovators lack specialised machinery when innovating. The informal sector innovators therefore rely on the formal sector employees for obtaining highly specialised machines such as the lathe.

During an informal discussion held with Prince a manufacturer, the researcher discovered that the informal sector is also engaged by the formal sector for skills training. Prince indicated that they have been contacted by Silveira House, a formal vocational training centre to train community members to complement their use of traditional forges with skills in metal fabrication. Prince and his younger brothers have conducted some training workshops in Guruve, Binga, and Plumtree with rural community manufacturers.

#### **4.10 Informal Sector-Customer Networks**

The researcher also established that the informal metal manufacturers also interact with the customers innovating. Through observation the researcher noticed that at seven workshops those customers indicate the designs of the multi-crop threshers they want. Interviews conducted with *Tapiwa* indicated that customers inform the informal metal manufacturers on the nature and type of the multi-crop threshers that they want based on what they observe in their respective communities and as they travel.

From the informal discussions held with Prince also indicated that customers are a source of knowledge in the manufacture of multi-crop threshers. Prince indicated that customers provide the manufacturers with feedback if any complication occurs. This information then becomes their starting point in effecting any improvements on the working of the multi-crop threshers.

The interaction which occurs between the informal metal manufacturers and the customers is not always smooth. During an interview Prince said:

*[Customers usually come to us requesting that we manufacture a crop thresher of a similar fashion to that one that they have seen somewhere else. So we consider the customer basing on our knowledge of multiple crop threshers then we advise them on the advantages and disadvantages of having such a machine. Sometimes the customer maintains their stance and so we end up manufacturing what they want. But usually in such cases the customers come back complaining about the declining performance of the crop thresher. Old aged customers usually resist our new innovations because they are used to the old Hippo type of cop threshers]*

From the above quotation, it can therefore be established that innovation is developed as a result of interaction which occurs among rural farmers and the customers.

The researcher also observed that the pricing negotiations which occur between the customer and the informal sector manufacturer reduce the returns that the manufacturers are supposed to get. In one incident, the researcher observed conflict occurring between Peter an informal metal manufacturer and a customer. The negotiation process had compromised the amount of money which Peter was supposed to receive. This was due to the inconsistent instalment payment plan by the customer.

The sharing of tools is also a source of problem among the informal metal manufacturers. In an interview *Tawona* said:

*[Problems do arise in cases where you lend someone your spanners. When you try to recover those spanners from him you will be told that I have forgotten them in Murehwa. This means that I have to buy another spanner]*

During my research stay at Mbare Magaba as an ethnographer, the researcher also observed a verbal fight occurring among informal manufacturers working at two adjacent workshops over misplaced tools. *Tonderai* vents his frustration to *Obert* another informal metal manufacturer in the following words:

*[My friend I do not have any tools to give to people. My belongings (read tools) never return when they are borrowed by other people. Get away from here my friend. You better stop talking to me with a raised voice in an attempt to threaten me. You can fight anybody here with your limping injured leg].*

From this illustrative quotation, it can be established that the sharing of tools at times raises some problems among the informal innovators.

## **5.0 Discussion of Findings**

This section discussed the research findings presented in the previous section. The analysis is arranged in thematic form with the intension of answering the research objectives set for this study.

### **5.1 Understanding the Informal Innovators**

Diversity in age exists among the informal metal as summarised in the previous chapter. The informal manufacturer's age ranges from 19 years to 34 years. The average of the informal metal manufacturers is 28.4 years. This indicates that the informal metal manufactures who innovate are relatively youthful and they fall within the economically active group. This indicates the failure of the formal sector to absorb the school leaving age group. The informal sector acts as a social and economic net for the school leaving age group and the semi-skilled age groups who are not mainstreamed into the formal economy. The study findings indicate that the informal innovators consist of a relatively young group within the range of eighteen to thirty five. This indicates that the informal sector has become a major source of employment for young people with the dissolution of the formal sector. The informal innovators also indicated that their work experience in the formal sector ranged from one to fourteen years. Some of the informal innovators have prior experience from the formal sector. This therefore indicates how the informal sector has become a safety net for formal sector manufactures due to the disintegration of the formal sector and the informalisation of the economy (Sachikonye 2012). This correlates well with previous studies conducted on the informal sector which reveal that the informal sector is an important source of income and employment and livelihood sustenance for low income families (Manyika 2012).

The respondents' years of formal training are presented in Table Two in the previous chapter. The minimum number of the years of formal education is seven years and the maximum number of formal education is 14 years. The findings from the survey indicate that the informal manufacturers have some basic formal education derived from formal institutions which enables them to innovate.

## 5.2 Determinants of Innovation Development

The first objective sought to understand the determinants of innovation. This research established that innovation is determined by multiple factors such as efficiency, cost, markets and socio-economic transformations. The principal motivating factor in innovation development is the mutual interaction and learning process involving the customers, the informal metal manufacturers and the *maguma guma*. The interactive process results in the co-creation of the multi-crop thresher involving rural farmers and the informal manufacturers resulting in the development of new innovations. The interaction which occurs among the three mentioned parties resulted in the production of the multi crop thresher which suits the local conditions. Mawomo (2013) also concludes that a demand linkage exists between metal manufacturing and agriculture and a symbiotic relationship exists between metal manufacturing entrepreneurs and farmers.

The development of innovation reflects the broad social, economic and agronomic transformations which are occurring at societal level in Zimbabwe. The re-introduction of traditional crops such as sorghum by small scale farmers due to factors such as climate change has stimulated grassroots industrial transformation and the production of machines to suit the new cropping patterns. The previous machines were specifically designed for bigger grains such as the maize. The shifting social and agronomic circumstances have rendered the previous model of multi-crop threshers inappropriate to the grain produced by small scale farmers. Innovation in bid to reduce production costs has ensured the availability of the multi-crop thresher to customers of varying social class and status, rural and urban households, small and commercial scale farmers. Innovations also occurred in an incremental way as a means of improving the existing technology present at that time. The development of more efficient innovations to enable the small scale farmers to grind more grain reflects the increase in agricultural production which has been experienced by small scale farmers in the recent past.

There is also a relationship between weak intellectual property regimes and technological innovation. The limited enforcement of the intellectual property rights regimes has also paved way for the development of informal innovations. The informal innovators also acknowledged that they do not develop inventions *per se*. They develop further on the existing technologies on the market from the formal sector. This provides insights into the capabilities of the informal innovators who engage in incremental innovation, which is developing on an existing technology. Imported technologies have been re-fashioned to suit

local conditions. The technological innovations are consumed mostly by small-scale farmers and this clearly reflects the differing needs of this category of farmers relative to large-scale commercial farmers. Weak intellectual property regimes have also facilitated the development of technological innovations in China (Jia 2009).

Technological innovation in a bid to reduce production costs has ensured the availability of the de-haulers to customers of varying social class and status, rural and urban poor households and to small-scale farmers. This therefore shows that the interconnectedness of the informal innovators and the community results in the generation of cheap farming implements which are affordable. Incremental innovation is also a dominant feature of the informal sector. The development of more efficient innovations to enable small-scale farmers to grind more grain reflects the increase in agricultural production which has been experienced by small-scale farmers in the recent past.

### **5.3 Knowledge, Skills and Innovation**

#### **Age and Work Experience**

The second objective of this study sought to understand the source of skills and knowledge guiding innovations in the informal sector. This research established that innovation within the informal sector is based upon interaction and the blending of knowledge among informal manufacturers of different work experience and training. This demonstrates that the older manufacturers have more experience in the informal sector than the younger manufacturers.

The discrepancies in age which range from nineteen years to thirty four years and the differences in the length of work experience structure the internal social organisation of the workshops. Skills training and knowledge dissemination therefore occur from the experienced manufacturers to the inexperienced workers. The sharing of knowledge between the experienced and young informal manufacturers with the passage of time turns reciprocal as the newly recruited manufacturers accumulate knowledge and assist the experienced manufacturers in the development of new innovations. The work experience of manufacturing multi-crop threshers also enabled the innovators to improve on the existing crop thresher designed by highly skilled artisans and engineers in the formal sector.

#### **5.4 Kinship Ties and Skills Development**

Social relations based on kinship also guide the way knowledge is circulated among the informal sector manufacturers. Affinal and consanguineal kinship ties structure how knowledge is passed down from family members of esteemed social status such as the uncle, elder brothers, in-laws and from the father down to the children, nephews and younger brothers. The result of such interaction is that knowledge is shared among the informal manufacturers resulting in new innovations. Ethnicity and friendship ties are also the basis through which knowledge is relayed among the informal manufacturers. Informal manufacturers recruit and train kinsmen on how to develop new multi-crop threshers. Friendship ties also facilitate the sharing of vital skills and knowledge among the informal manufacturers who work at Mbare Magaba. These clearly reflect the integration of the Shona social relations and the strong culture of learning which is passed down from the elderly to the young.

#### **5.5 Formal Education and Training**

Skilled artisans who are formally trained in vocational training centres are instrumental in the development of innovation. Trained manufacturers with formal sector experience wield social power and they relay knowledge to other manufacturers. Vocational training and formal sector work experience creates cognitive social capital or values of belief and trust in informal manufacturers who are not trained. The informal manufacturers rely on tapping knowledge from the formally trained manufacturers in a one sided relationship. The manufacturers who benefit from skilled artisans include manufacturers who lack formal training and inexperienced manufacturers. Skilled artisans are principally responsible for the development of innovations whilst non trained manufacturers rely mostly on modifications and copying designs from the formal sector and informal manufacturers. Previous studies also point out that skills in the informal sector economy is largely derived from the formal sector economy, familial and tribal affiliations and vocational training centre are similar to the findings obtained in this study (Daniels 2010, Manyika 2012).

#### **5.6 Social Networks and Innovation**

This study also sought to understand the social networks which the informal sector manufacturers develop in the process of innovation through the use of the social network analysis. Social Network analysis refers to the analysis of formal and informal relationships to understand the structure of relationships (ADB 2010). The method assists in improving innovation and learning as well as identifying the individuals and units who play central roles

in the process of innovation within the informal sector (Breiger 2004, Nooy, Mrvar and Batagely 2005).

This study established that innovation is a product of multiple social networks involving close acquaintance relationships with small scale farmers and informal sector manufacturers. Casual relationships with formal manufacturers also exist. These networks have enhanced social, economic and intellectual capital of the informal sector manufacturers. Friendship, referrals, manufacturer- client relationships and kinship ties enable the informal metal manufacturers to develop social capital and social networks with other informal manufacturers and formal sector employees. Manyika (2012) study points out to the importance of social networks in the recruitment of labour force done in the informal metal manufacturing sector. This study takes a further step and analyses the importance of social networks in innovation development in the informal sector.

This study established that there is a relationship between technological innovation and the mutual interaction and learning process among the customers and the informal innovators. The demand of customers who are small-scale farmers for more efficient de-haulers to meet increased agricultural production has resulted in the development of technological innovation. This is in harmony with the evidence presented recently on the increase of agricultural production among small-scale farmers due to the fast-track land reform programme in Zimbabwe (Scoones et al. 2011). Several studies have also confirmed that more efficient crop threshers are a major determinant for technological innovation (Al Ashy et al. 2009, Bonnyimo and Nkankini 2005, Simonyan and Imokhome 2008, Saniedirad 2008). The scenario of mutual negotiation in the development of technologies is from below as the customers determine the nature of the technologies most appropriate to them. Unlike technologies from the formal sector which are developed centrally by expert knowledge and imposed on commercial markets and communities principally for economic benefit, informal innovators engage the communities in technological development to suit the social circumstances. The power to create technologies has been de-centralised to the local communities by the informal innovators.

The symbolic interactionist theory also helps in understanding the establishment of technological innovation as the interactive process results in the co-creation of the crop threshers. The collective bargain of rural farmers' needs, experiences and knowledge with the informal innovators' skills resulting in the development of new technological innovations.

The end product results in the manufacture of appropriate de-haulers which suits the interests of the small-scale farmers who dominate the agricultural sector in Zimbabwe by increasing production in the sector. The improved de-haulers also have a greater impact on the society in terms of cost-effectiveness. Other studies also indicate that there is a symbiotic relationship which exists between informal innovators and small-scale farmers which has resulted in the development of technological innovations (Manyati 2014, Mawomo 2013).

The informal sector innovators also develop relationships with other informal sector manufacturers in the development of innovations. This clearly demonstrates that innovation is a product of social interaction which occurs within the informal sector. The informal innovators also develop relationships with other informal sector manufacturers in the development of innovations. This indicates that innovation is a product of social interaction which occurs within the informal sector.

Knowledge power dynamics are at play within the informal sector. Formally trained artisans seldom consult other manufacturers who possess industrial experience only. The reverse is true, as the manufacturers who are not formally trained rely on the formally trained artisans. The relationship which exists between the informal innovators and the formal sector manufacturers is limited. This therefore demonstrates the gulf which exists between the formal sector and the informal sector economy in Zimbabwe. The informal sector economy is a largely marginalised sector from the mainstream economy. Tibaijuka's (2005) study findings which demonstrate the marginalisation of the informal sector economy from the formal economy. These findings match with the findings obtained for this study.

The social networks developed by the informal manufacturers with the informal sector manufacturers ensure the inflow of knowledge, economic capital in the form of tools and equipment which facilitate the development of innovation. In a reciprocal manner the relationship between the formal and informal sector manufacturers provides the formal sector employees with a sub sector which can be contracted to perform jobs for the formal sector at cheaper rates during end of year firm closures. Affinal and consanguineal kinship ties, friendship and referral ties cement the web of relationships which are prevalent among the informal sector manufacturers, customers and the formal sector employees.

## **5.7 Summary of Findings**

From the fore-going discussion, it can be noted that innovation within the informal metal industry is socially determined and it is a product of constant interaction between the customer, the *maguma- guma*, the informal manufacturers and the formal sector employees. Summarised below are the objectives of this study and the findings obtained.

The principal objective of the study was to establish the determinants of innovation among the informal metal manufacturers. This research established that innovation is chiefly a product of the constant interaction which occurs between the customers, the *maguma guma* and the informal manufacturers. The need to improve the efficiency of the multi-crop thresher by developing from the older versions is another key determinant which leads to the development of innovation. As a marketing strategy aimed at improving sales, the informal metal manufacturers also innovate designs of multi-crop threshers in order to attract customers in a competitive environment. In response to changing social and economic conditions, the informal metal manufacturers also develop the multi-crop technology further in order to match the changes. The need to reduce the production costs and the selling price also motivates the informal manufacturers to innovate new designs.

The second objective explored in this research was to establish the source of skills and knowledge which guide the informal manufacturers in developing innovations. This study established that formal education and on job experience are the major source of knowledge and skills in the informal sector. The younger and new entrants into the informal sector are trained by the more experienced workers on how to develop new innovations.

The third objective of this study was to understand the social networks which the informal manufacturers utilise in developing innovations. This research established that the informal metal manufacturers rely on social networks based on kinship, friendship and customer-manufacturer relationships. The informal manufacturers interact with other experienced and skilled artisans within the informal sector in the process of developing innovations. The informal manufacturers also interact with formal sector employees in the development of innovation.

## **5.8 Conclusion**

It can thus be noted that technological innovations in the manufacture of Multi-Crop threshers occurs within the informal sector. Social and economic factors such as marketing,

the need to reduce the cost of production and sales are the main determinants of innovation improvements in the development of multi-crop thresher technology evolve from a social process of interaction. Skills development and knowledge transfers also occur within the informal sector. The source of knowledge and skills for innovation is derived through vocational training, on job experience, customer prescriptions and prior experience of the manufacturers in the formal sector. The informal manufacturers also develop multiple networks with formal sector employees, informal sector employees and customers through friendship and kinship ties.

The main social actors involved in the innovation process include the end users, the *maguma guma* and the informal manufacturers. In rare instances formal sector manufacturers bring in their expertise in the production of the multi-crop threshers. The informal metal manufacturers proved capable of re-designing technology to ensure that the multi-crop thresher is accessed by farmers of various social classes. Appropriate multi-crop threshers which suit changing social and agronomic conditions are also produced in the informal sector. To enable technological innovation in the manufacture of multi-crop threshers, the informal sector manufacturers establish multiple social networks involving informal manufacturers, formal sector employees and customers.

## **5.9 Recommendations**

This study proposes that the following areas need further research for a comprehensive understanding of informal sector technological innovations. The perceptions of the small scale farmers or customers of the agricultural technological innovations produced in the informal sector. This information will provide information pertaining the appropriateness of the technologies produced in the informal sector as well as the technography or the usability of the technologies across gender and age. The social and cultural factors which hinder or facilitate the adoption of technological innovations in communities need to be understood.

There is need for investigation into local understandings of the informal sector manufacturers on the issues of protection of intellectual property rights. Unanswered questions with regards to how the innovators understand and protect their innovations in still under researched and warrants further empirical investigation.

The role of innovation platforms which include national institutions, universities, private institutions and society in promoting the technological innovations developed in the informal sector need further investigation. The success of local innovations in the informal sector lies in the support they receive from other inter-professional bodies.

Inter disciplinary research which synthesizes the work of economists, engineers and sociologists for a fuller appreciation of the value chain and efficiency of the technological innovations products developed in the informal sector and the appropriateness of the technologies to the changing social environment.

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**SECTION C: INNOVATIONS AND ORGANIZATION OF THE INDUSTRY.**

C.1 Do you design multi-crop threshers?                      1. Yes      0. No

C.2. If yes, where did you learn the design? (**You may tick more than one answer**).

- 1. Training Institution    2. Relatives or friends    3. Experience
- 4. Other (specify).....

C.3. How did you develop your current designs? (**You may tick more than one response**)

- 1. Inventions.....2. Copying.....3. Modification.....4. Research councils/institutions
- 5. Household Customers    6. Farmers 7. Other (specify).....

C.4 Do you receive any assistance in the design of multi-crop threshers?

- 1. Yes    2. No    3. Sometimes

**(If response to C.4 is no proceed to C.6)**

C.5. Where do you obtain the design skills?

- 1. Formal sector employees    2. Informal sector employees
- 3. Customers    4. None
- 5. Others (Specify)\_\_\_\_\_

C.6 Do you interact with other people in manufacturing innovations?

- 1. Yes    2. No

**(If response is no, end your responses here).**

C.7 Who do you interact with in the process of developing innovations?

- 1. Informal sector manufacturers    2. Formal sector employees
- 3. Customers    4. Other (Specify)

C.8. How do you interact with other people mentioned in C.6? (**You may tick more than one response**)

- 1. Technical Skills    2. Tools and equipment sharing
- 3. Buying and selling among each other    4. Designs
- 5. Knowledge Sharing
- Other (specify).....

## Appendix 2: Interview Guide for Manufactures

**Aim of the Study:**To establish technological innovations which occur within the informal sector focusing on metal manufacturers who produce multi-crop threshers.

### Questions

1. Could you please provide the background of your establishment of your workshop?
2. What motivates you to develop new designs when manufacturing multi-crop threshers?
3. Could you please explain why you consider your crop thresher to be a unique innovation?
4. Please provide details of the educational qualifications and experience of the workers at your workshop?
5. Could you explain how you enhance your knowledge of designing multi-crop threshers?
6. Could you describe your experience in the informal metal industry and in the design of multi-crop thresher?
7. Could you please explain how you relate at your workshop with your workmates in the production of multi-crop threshers?
8. Could you please explain how you relate with other people in developing multi-crop threshers?
9. What problems do you encounter as you relate
  - a) among each other
  - b) with the consumers/ farmers
  - c) from the formal sector players
  - d) other people.
10. Could you please describe how you manufacture the multi-crop thresher?