

TELECOMMUTING IN THE DEVELOPING WORLD: A CASE OF THE DAY-LABOUR MARKET

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DECLARATION

I declare that this thesis is my own original work. Where collaborations with other researchers are involved, or materials generated by other researchers are included, the parties and/or materials are acknowledged or are explicitly referenced as appropriate.

This work is being submitted for the degree of Doctor of Philosophy in Computer Science of the University of Cape Town, South Africa. This thesis has not been submitted to any other university or institution for any other degree or examination.

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Date

Abstract

Information and Communication Technologies (ICTs) in general, and mobile phones in particular, have demonstrated positive outcomes in the various social transformation and human development dimensions. As a result, many researchers have focused on ICTs innovations targeting the poor. Among the poor are the low-skilled day-labourers who belong to the Day-labour Market (DLM), which is also made up of employers, job-brokers and intermediary organisations. The DLMs' main activities involve a great deal of travelling in search of jobs by workers and a search for workers by employers. These travels place heavy economic pressure on the day-labourers, hence reducing their net earnings while they struggle with extreme poverty.

The first objective of our study was to find out how and which ICT interventions can be used to alleviate the challenges faced by the DLM stakeholders. The nature of our problem resembled studies that use ICTs to reduce travel distance. Such studies fall under subjects such as teleactivities and teleworking/telecommuting, and advocate for prospects of working anywhere anytime. These studies have not received much research attention in the developing world. They have mainly been done in the developed world, and mostly on white-collar workers and organisations. This brought about our second objective: to find out whether the ICT interventions for the DLM could be studied under teleworking/telecommuting and whether the telecommuting benefits can be realised for the blue-collar workers.

Our research methodology was Action Research applying three case studies. We used participant observation and both structured and unstructured interviews for qualitative data collection and questionnaires to collect quantitative data. Contextual inquiry, prototyping and technology probe was applied as our design technique. The prototypes were evaluated in-situ to assess usability and uncover user experience. We mainly employed qualitative data analysis, but where appropriate, triangulated with quantitative data analysis.

The research outcomes were divided into three categories: (1) the knowledge on the DLM characteristics which depicted different forms of the DLM and shaped our design process, (2) the DLM software designs tested as prototype applications and software artefacts deployed for use by the DLM and (3) the meaning and the state of telecommuting/teleworking before and after our experiments in the DLM. In the first category, appreciating the challenges faced by our primary target users, the day-labourers, helped shape our designs and our inquiry to include intermediation. With regard to the prototype applications, they included the remote mobile applications and the web-based server side software systems. Although most of these applications were meant for proof of concept, some of them ended up being implemented as fully functional systems. Finally, in the third finding, travel reduction using ICTs (mainly the mobile phones) had been practised by some of the DLM stakeholders even before the commencement of our study. After our intervention, we discovered that implementing telecommuting/teleworking within the DLM may be possible, but with a raft of redefinitions and changes in technology innovations. We therefore identified factors to consider when thinking of implementing telecommuting among blue-collar employees, organisations and employers.

Publications

Some ideas, Figures and Tables of this thesis have previously appeared in the following publications:

Chepken K.C. and Muhalia, A. 2011. The Poor and the Mobile Related Spending .International Journal of Computing and ICT Research (IJCIR) Volume 5 Issue 1 June 2011

Chepken K.C, Blake. E., and Marsden G. 2011. Day Labour Mobile Electronic Data Capture and Browsing System. In proceedings of the South African Institute for Computer Scientists and Information Technologists. 3-5 October 2011, Cape Town South Africa.

Chepken K.C, Blake. E., and Marsden G. Software design for informal setups: Centring the benefits. In proceedings of the 14th Southern Africa Telecommunication Networks and Applications Conference, 4th-7th September 2011, East London, South Africa

Chepken K.C, Mugwanya R., Marsden G., and Blake. E. ICTD interventions: trends over the last decade. In proceedings of the international conference on information and communication technologies and development (ICTD 2012) 12th -15th March 2012, Atlanta, USA.

To my dear loving wife, Nelly

To our children, our parents

And

To all our families at all levels

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List of Abbreviations

AR ó Action Research

CBD ó Central business district

DC ó Developing countries

CSCW ó Computer-supported collaborative work

CSVó Comma-Separated Values

DLM ó Day-Labour Market

GSDRCó Governance and Social Development Resource Centre

HCI ó Human Computer Interaction

ICT4D ó Information and Communication Technology for Development

ICT ó Information and Communication Technology

IDRC ó International Development Research Centre

IMS ó Information Management System

IO ó Intermediary Organisation

IS ó Information Systems

IT ó Information Technology

J2ME ó Java Two Micro Edition

LDC ó Less-Developed Countries/Least-Developed Countries

MDGs ó Millennium Development Goals

MIS ó Management Information Systems or Market Information Service

MSR ó Men on the Side of the Road

MSRSA ó Men on the Side of the Road South Africa

MSRNA ó Men on the Side of the Road Namibia

NDLM ó Nairobi Day-labour Market

NGO ó Non-Governmental Organisation

PAR ó Participatory Action Research

PPP ó Purchasing Power Parity

SAó South Africa

UIó User Interface

VO ó Virtual organisation

CHAPTER ONE

INTRODUCTION

1. Introduction

“Information is power. Nowhere is this aphorism truer than in developing countries.”
Reuben Abraham

Information and Communication Technology for Development (ICT4D) advocates for Information and Communication Technology (ICT) innovations which can be used to improve the social and economic status of the poor (Medhi et al., 2008; Toyama and Dias, 2008; Pitula et al., 2010). The potential for ICT in development has now been widely discussed (Walsham and Sahay, 2006; Thompson, 2008, Avgerou, 2010). In these discussions, one salient theme is that appropriate conceptualisation of ICTs use in the developing world can aid in poverty reduction (Walsham et al., 2007) in different ways (Waverman et al., 2005, Meschi and Fuss, 2005; Sridhar and Sridhar, 2007; Dunn, 2008; Dunn, 2009a; Dunn, 2009b).

Among the poor are the non-skilled, low-skilled, illiterate or semi-literate workers whose contracts are on a daily basis. The workers, also referred to as day-labourers, are mainly job-seekers when out of work. They belong to an informal sector referred to as the Day-Labour Market (DLM) (Blaauw and Pretorius, 2007). The DLM, as we shall critically examine in Section 2.3 page 12, is made up of the day-labourers, the DLM employers and, optionally, an organisation which may help in running the DLM by organising workers and employers. A DLM organisation can be either an independent non-governmental organisation (NGO) (DLM intermediary organisations), or formed by the DLM workers themselves. These organisations manage the worker collection points, which are locations where the day-labourers congregate to wait for employers to pick them up.

In this thesis, we describe a study conceived from the technical ICT4D perspective (Dörflinger and Gross, 2010). Our research involved the study of the DLM and how ICTs—mobile phones, computer and Internet applications—can help the DLM stakeholders alleviate some of the challenges that they face in their extreme poverty (Gonzo and Plattner, 2003; Kumar et al., 2008).

When classified (Luff and Heath, 1998; Brodie and Perry, 2001), the DLM workers can be said to be blue-collar workers. In this regard, our research shared the same arguments as Churchill and Munro (2001) and Brodie and Perry (2001) on the need to study the use of ICTs, especially mobile phones, by blue-collar workers. We place our study under the theoretical framework of teleactivities, and more specifically, telecommuting (also referred to as teleworking). A well-known definition of *telecommuting*, used in the developed world, is working from home or having a home office (Nille, 1988a; Garrett and Danziger, 2007). In this study therefore, we looked at what telecommuting might mean in Africa, where there are a number of infrastructural and technological challenges and most of the people are poor, but still have mobile phones. In particular, we focused on the extent to which mobile phones and Internet technologies used to support the DLM (and specifically blue-collar workers) in the

developing world can be framed as telecommuting. A comprehensive description of teleactivities and telecommuting is presented in Section 2.4, page 17.

1.1 Problem Definition

Developing countries in Africa and elsewhere are faced with a myriad of economic and infrastructural challenges such as a lack of roads, electricity and technology (Aker and Mbiti, 2010). The majority of the poor inhabit these parts of the world and mainly the rural areas. There are, however, those who inhabit the urban areas (Wilson, 1996), where infrastructural challenges can have the greatest negative impacts.

Mean commute time tends to increase as cities become increasingly congested (Nilles, 1991). Many third world cities are notoriously congested, facing many hours of gridlock in the morning and evenings. As people allot more time to commuting or waiting for events, their time gets fragmented into numerous small pieces, with most of it being occupied with meaningless, commuting activities (Liu et al., 2011). This can only worsen, especially in urban areas, as the number of inhabitants increase. The infrastructural challenges include, but are not limited to: poor road and railway networks, which lead to heavy traffic congestions and, consequently, air pollution (Nelson et al., 2007); very low electricity penetration; limited internet infrastructure and fixed telephone landline connectivity. These infrastructural challenges mostly affect the poor, and especially those residing in urban areas. For example, poor road infrastructure may increase the cost of transport, which is always passed on to consumers—the poor and the rich alike.

Among the poor urban consumer group is the unskilled or semi-skilled (low-skilled) DLM job-seekers. Other DLM members facing similar infrastructural related challenges are the employers and the intermediary organisations. In the following section, we highlight the problems faced by each of the DLM members.

The Day-Labourers

The day-labour workers are continually looking for employment and hence can be classified as unemployed. Even when they are employed, they might not be the following day and hence are continually faced with the problems of being unemployed. As a result, they have low income, which is not always enough to cover for their daily expenditure (Kumar et al., 2008). Continual job search is also the nature of the DLM; it is one in which an excess supply of job-seekers competes for relatively few jobs (Maxwell, 2006). Each day, a day-labourer commutes to work or to a certain destination in search of work. When travelling to look for work, a day-labourer will be spending money which they can ill afford because during their working periods, they do not earn enough to allow them to save.

In our field work study on the DLM, for example, we found that many day-labourers use a substantial amount of their income and time looking for jobs (Chepken et al., 2011a). We also found that the day-labourers spent up to 10% of their daily income in job-related expenses, such as daily transport costs even when they are not going to work.

When out of work, job-seekers are sometimes forced to wait at the collection points in harsh weather conditions. Other challenges faced by the DLM workers include the lack of proper ways of organising themselves in the absence of an NGO. More often, because job-seekers

are eager to secure a job, they go *en mass* to potential employers, an act which intimidates potential employers, especially if it is their first time visiting the collection point. These DLM challenges associated with its operation model leave the day-labourers jobless and confined to extreme poverty (Valenzuela, 2001; Gonzo and Plattner, 2003; Blaauw et al., 2006).

DLM Employers

The DLM potential employers spend time and money when looking for workers. *“Even though there exists such a large workforce, clients often have trouble contacting them or finding information about their services and their contact information”* (Kumar et al., 2008). Potential employers drive through the heavy traffic congestion in search of day-labourers with the right credentials. Sometimes, employers pick up workers with the wrong skills or undesirable character (for example criminals). This is often because there is either no way of verifying a worker’s skills or personality, or existing ways are insufficient. *“Criminal workers”* may tarnish the reputation of worker collection points, which is crucial for workers to be trusted by potential employers and members of the public.

Intermediary Organisations and Recruitment Agencies

When carrying out the work of efficiently and effectively linking workers and employers, the intermediary organisations face a number of challenges. For instance, they use most of their resources in looking for jobs on behalf of the day-labourers. They employ field officers who accompany the day-labourers to the collection points. In addition, they may fund expensive marketing initiatives.

The intermediary organisations (IO), like work-centres in the developed world, put in place mechanisms for vetting workers. They keep records of their members and use them to verify whether a worker’s skills and character as claimed are correct. This exercise involves having systems (which may include ICT) to manage the vetting of the day-labourers and the allocation of jobs. The challenge here is the cost, considering that the IOs are not-for-profit organisations.

Another challenge is that, for the few jobs that the intermediary organisations are able to find, allocation to workers is sometimes perceived to be unfair and, in some cases, creates acrimony among day-labourers.

1.2. Problem Justification

In this section, we answer the question of why we found it necessary to apply ICTs to address some of the challenges of the DLM. The justification is anchored on the conditions presented by the DLM context and the situation of the ICTs in the developing countries (DC).

The Informal Sector and hence the DLM is Here to Stay

According to Becker (2004), the informal economy was first *“discovered”* in the 1970s and it can no longer be considered a temporary phenomenon *“it may be here to stay”*. The DLM, as part of the informal sector, is also likely to grow further. As a result, there will always be many job-seekers *“meaning many poor people”*. As Blaauw et al. (2006) put it, *“there are 500 places in South Africa (SA) where people are picked up for casual labour on an hourly or daily basis. With an average of 50 to 100 men located per site per day, this amounts to*

between 25 000 and 50 000 men per day. The ages of these men vary between 16 and 25, all unemployed and desperate to find work.

The question we ask is: "Is it possible to use ICTs to help the DLM stakeholders, especially the day-labourers, alleviate some of the challenges they face during their day-to-day activities relating to job and worker search?" Formal research questions follow in Section 1.3.

We believe that the existence of the DLM and its potential to grow requires an urgent need for innovation using readily available and accessible ICTs to address some of its challenges.

Mobile Phone Penetration even amongst the Poor

In most African countries, for example Kenya and South Africa (SA), E-exclusion (measured in terms of Internet access; ownership and access to computers), also described as the digital divide against the poor, is common (Gillwald and Stork, 2008; Tucker, 2009). Even up to the year 2012, a new digital divide in terms of ICT impacts continues (Price, 2012). Given that the Internet and other ICT infrastructure such as fixed land-line telephones are not widespread in the developing world (Heeks, 2009a; Aker and Mbiti, 2010), the mobile phone remains the most viable ICT (ITU, 2009) accessible to the majority of the poor. Indeed, many studies have shown that, while Africa ranks top among the continents that have the largest number of poor people, the mobile phone and mobile phone technology have reached even the poorest. Amid all the poverty and poor infrastructure, statistics show that mobile phone access and use in Africa is rising steadily (ITU, 2009; CCK, 2010; BuddeComm, 2011; CCK, 2011).

Our goal of using ICTs to help the DLM workers was motivated by the literature findings that even the poor can have access to ICT through the mobile phone. The nature of the study context (the DLM) – field based; distributed and mobile in nature – and the fact that mobile phones have been shown to be beneficial to the poor, and especially in developing countries in many ways (Donner, 2006; Abraham, 2007; Donner, 2009; Duncombe and Boateng, 2009; Aker and Mbiti, 2010), was our other major motivation. The other motivation was the intermittent electricity in Africa. Even when the people have computers, lack of other support infrastructure such as electricity, does not help in bridging the digital divide. Electricity in Africa, for example in Kenya, is unavailable to the poor and, if available, it is intermittent. This makes the use of desktop computers problematic. With such infrastructural challenges, the mobile phone remains the only viable computing device for these regions.

The Success of other Initiatives and Research in Similar Contexts

The mobile phone, described as the ubiquitous computing device for voice communication of the developing world, has been, in the recent past, re-purposed by innovating with it as an instrument of personal and economic development (Dunn, 2009a). It has been used to develop personal and economic situations and has been shown to have immense direct, indirect, and intangible benefits (Bhavnani et al., 2008). Thus, a number of studies targeting the mobile phone as an innovation tool have been carried out and have shown that ICTs can have positive economic impacts (Abraham, 2007; Prakash et al., 2007; Medhi et al., 2008; Sharma et al., 2008).

In the world of work (where our interest is), the prospect of working anywhere anytime, as advocated by Churchill and Munro (2001), may become a reality. This prospect has, however, not been the focus of much research in the developing world (Brodie and Perry, 2001). Examples of work-related innovations benefiting from ICTs include teleactivity and, more specifically, telecommuting/teleworking, which can allow people to work away from their duty stations (Niles, 1988; Di Martino and Wirth, 1990; Cowell and Dunn, 2006). From these innovations, employees have saved in commuting costs (money and time). Other advantages include relief from urban traffic congestion and facilitation of Small and Medium Enterprises (SMEs) and self-employment (Cowell and Dunn, 2006). It is because of these successes and many others that we believe innovations in the DLM using ICTs, and more specifically the mobile phone, are necessary.

1.3 Research Questions

Our overall research aim is to *find out the possibility of using ICTs to help the DLM stakeholders and whether the initiatives can be studied as telecommuting in the developing world?*

The specific research questions are as follows:

1. Are there ICT applications that can help alleviate some of the problems faced by the DLM?
 - 1.1 Is it possible to have ICT design innovations to help DLM workers alleviate some of their challenges?
 - 1.2 What are the ICT design innovations, if any, that can help in solving the DLM employer's challenges related to worker search?
 - 1.3 What ICT design innovations can be used by the DLM organisations to run the DLM efficiently and effectively?
2. Can the DLM ICT innovations be studied under telecommuting/teleworking for the developing world?
 - 2.1. What are the possible benefits of telecommuting to the developing world? How do these benefits compare to those reported in the developed world?
 - 2.2. Is it possible to implement and adopt telecommuting in an environment where there is limited access to computers and the landline telephones but with the mobile phone as the dominant ICT?
 - 2.3. Is there a likelihood that telecommuting adoption process will be the same for both the developed and developing world or could it be that telecommuting required the African context to see acceptable adoption rates?
 - 2.4. Can telecommuting models of the West, with its current definition, be applied to Africa or does it need redefinition?
 - 2.5. What other factors can be used to compare and draw lessons from telecommuting attempts in the developing and developed world?

1.4 Research Objectives

- To understand the DLM and their current ICTs usage.
- To find out the key challenges faced by the DLM stakeholders and to isolate those that can be solved using ICTs.

- To collaboratively work with the DLM members to design ICT solutions to solve the identified DLM challenges.
- To implement and evaluate ICT solutions with the DLM.

1.5 Study Outcome

Our study outcome comprised knowledge and artefact contributions. The knowledge contribution included lessons drawn throughout the study process. The lessons are for both practitioners and researchers who wish to carry out similar studies in future. The specifics include the kind of systems suitable for the informal sector, for example the DLM. Related to knowledge contribution was the ICTD context, which is changing the lives of the poor and the meaning of telecommuting in the developing world. Because of a lack of universal access and effective use of ICTs, many ICT4D studies have aimed to reach the less poor resulting in exclusion of some segments of society (Vaughan, 2006). In our study, the aim was to use ICTs to alleviate problems faced by those regarded as the poorest in the DLM. The key challenge of travel in the DLM brought about telecommuting which adds to the novelty of our work which, to the best of our knowledge, is among the first such studies in the developing world.

The second outcome was a number of successfully implemented mobile and Internet based applications to support NGOs working for the DLM. Although most of these applications were intended to be proof of concept prototypes, we implemented some as fully functional applications. The success of the prototype systems developed was evaluated from the micro perspective, where a community or group which is impacted directly by the project or the participants and their socio-organisational context is involved (Ashraf et al., 2008).

1.6 Linking the Study Components: Telecommuting, ICT4D, DLM and AR

We outline the link between the three components of our study, namely: ICT4D, the DLM and the possibility of framing the study as a telecommuting/telework research.

In an effort to define the DLM problems, a critical look revealed that the problem might resemble the concept of telecommuting/teleworking. This was because of our initial findings which indicated that the key problem for the DLM stakeholders was travel. The key agenda was therefore to find the best theoretical framework which would suit the travel-ICT-related problems. The question, hence, was whether telecommuting was relevant to a study aimed at finding out the best ICT design applications for the DLM. Following this question was then finding out the possibility of implementing telecommuting in the developing world. Although it may be surprising that we are applying telecommuting, a transportation problem, as a theoretical underpinning for this kind of study, it was the closest in terms of addressing the problems of our key stakeholders.

The discipline under which this study was carried out is ICT4D, which is a new applied research discipline that advocates for using ICTs to uplift the living standards of the poor. Poverty is what prompted us to use the DLM – an informal sector characterised by poverty and, hence, poor living standards among its members – as our case study.

The reasons for considering the DLM – as members of the informal sector (Blaauw and Pretorius, 2007) – for the telecommuting study were therefore two-fold: The first was that the

blue-collar workers are the majority in the developing countries and are mainly in the informal sector. Whenever they are at work, day-labourers are considered blue-collar workers (Luff and Heath, 1998; Brodie and Perry, 2001). The description of blue-collar workers is presented in Section 2.6.4 page 35. Blue-collar is the closest classification of workers we could find to DLM workers. They form the majority in the informal sector. Therefore, if our results were to be generalisable, we needed to focus on areas where a majority of the blue-collar workers are available. Other studies have emphasised our view before. For instance, Brodie and Perry (2001) emphasised the importance of designing for mobility of blue-collar workers indicating that they form a large group of workers and ignoring them for white collar-workers is a fault. The main reason we focused only on the DLM within the informal sector was because we were interested more in the research rigor as opposed to broadly studying the informal sector and having shallow results (Shin et al., 2000). The second reason for using the DLM as a case is that it could be studied within the ICT4D context. The day-labourers, who are the key members of the DLM, are categorised as the poor (Kumar et al., 2008), hence they can be said to be a potential target group for ICT4D interventions.

In this study, we employed an exploratory research methodology, applying Action Research (AR). Guided by Dickø¹ reasons on why one would do AR and the problem area, we chose it as a methodology because of three main reasons namely:

- (1) AR lends itself to use in work or community situations: Ours was a community of DLM stakeholders and, hence, was fitting this requirement of AR.
- (2) AR increases the amount of learning consciously from the experience: The DLM context is complex and difficult to learn. It is through AR that we would learn as we carried out the study.
- (3) AR is participative: Because we wanted to include the DLM stakeholders in the key decision making, a participative methodology, AR, was necessary.

The exploratory methodology has strengths in situations where very little is known in the area of study (Smyth et al., 2010). We had limited knowledge in both the DLM and telecommuting in the developing world. The challenge of quickly acquiring knowledge in the two areas was hampered by: (1) the different research approaches in telecommuting being scattered all over (Nilles, 1988; Belanger et al., 2001; Campbell and McDonald, 2007); (2) the limited research studies dealing with telecommuting in the developing world; and (3) the limited studies, with a few exceptions such as Sambasivan et al. (2010) and Liu (2011), on the use of ICT to help the DLM. Therefore, the choice to apply exploratory methodology using AR was made because of the characteristics of AR and the challenge of finding a suitable research framework, theory or model for our study.

1.7 Organisation of the Thesis

In Chapter Two, apart from setting the context by defining the DLM and ICT4D, we present an analysis aimed at answering the telecommuting suitability question. The chapter also presents the background information which contains extensive definitions of the main phrases and terms used. Related work is presented in Chapter Three, where we look at related work in

¹ http://www.aral.com.au/resources/arthesis.html#a_art_whyar

the area of ICTD which relates to our study context and those that have applied a similar methodology. Chapter Four presents our research design, including the general methodology and specific methods applied. In Chapter five, the general findings about the DLM, which shaped our research and the theoretical framework and helped us to understand the concepts and the research problem, are presented. Chapter Six presents the results specific to each case study, while discussions of findings are in Chapter Seven. Conclusions and future study recommendations are presented in Chapter Eight. Appendix A presents the extended definition of telecommuting while Appendix B describes the definitions of AR and the methods applied. Appendix C has telecommuting/telework study models while Appendix D presents the full details of the AR cycles that we went through. Appendix E presents examples of the data collected while Appendix F has the structured interview guide. Appendix G is the questionnaire administered to workers by the field officers. Appendix H presents the software prototypes, the design details and the decisions made during the design. It also has the screen shots of the web-based applications designed and implemented for the DLM.

CHAPTER TWO

SETTING THE CONTEXT

∴An activity is a continuous interaction with the physical environment, a service or person, within the same socio-spatial environment, which is important to the respondent. It includes any pure waiting (idle) times before or during the activity (Axhausen, 2000).

2.1 Introduction

This chapter defines and describes the three elements of our study: Information and Communication Technology for Development (ICT4D); the Day-Labour Market (DLM) and Telecommuting. The DLM is our case study while ICT4D is the discipline within which we work. Telecommuting is our possible theoretical underpinning. The definitions and descriptions are from literature and in some cases backed up with our initial and extensive field work findings.

We also present our research scoping and classification process by describing the theory (telecommuting) under which our study fell and why it was the preferred choice. In the description, the key argument is that the telecommuting definition, as it is currently applied in literature and the developing world, is not suitable for informal contexts such as DLM. We argue for an extended definition of work to include any activity that is mandatory and involves daily travel. Consequently, the daily mandatory travels, whether to work or to anywhere else, can be categorised as commuting. Finally, we describe the methodology applied and give brief definitions of some important terms and phrases used.

2.2 Information and Communication Technology for Development (ICT4D)

We reviewed over 500 research papers and articles on ICT4D (Chepken et al., 2012). Although different authors have different study perspectives, one common theme is that ICT4D has two major components: (a) Information and Communication Technology (ICT) and (b) Development. Toyama and Dias (2008) present a comprehensive definition of ICT4D by using the two components. For the purposes of this study, we define ICT4D based on the understanding that it consists of the two components and a study context.

- Section 2.2.1 defines ICT.
- Section 2.2.2 defines development.
- ICT and development are combined in section 2.2.3 to define ICT4D.

These definitions are not necessarily exhaustive; rather they are contextual and scoped for our study.

2.2.1 Information and Communication Technology (ICT)

ICT is used to refer to technologies that facilitate, by electronic means, the creation, storage management and dissemination of information (Tiglao and Alampay, 2004). ICTs are information-handling tools: a varied set of goods, applications and services that are used to produce, store, process, distribute and exchange information (UNDP, 2001). They include the 'old' ICTs of radio, television and telephone, and the 'new' ICTs of computers, satellite and wireless technology and the Internet. It is an umbrella term that includes any communication

device or application, encompassing radio, television, mobile phones, computers and network hardware and software, and satellite systems and the services and applications associated with them, such as videoconferencing and distance learning (Kleine and Unwin, 2009). We adopted the Kleine and Unwin, (2009) definition of ICT. However, we focused on mobile phones and Internet technologies for our interventions. We also explicitly included fixed land-line telephone network, mobile phone networks and the Internet. Their significance to our study deserves an explicit mention and reference because we refer to these types of ICTs frequently.

2.2.2 Development

The acknowledgment by the major international development agencies, such as the World Bank (WB), the United Nations (UN) and International Development Research Centre (IDRC), that ICTs can play a very important role in uplifting the living standards of the poor (Korpela et al., 2003; Pal, 2008) has contributed immensely to the importance of ICT4D both in practice and research. In the various studies, however, there is still debate on what constitutes and what does not constitute development. As Hoet al. (2009a) put it, *what is and what is not development in development studies is contentious*.

In this study, we recognise the diversity in development studies and its sub-disciplines. Different ICT4D researchers get concerned with various dimensions of development. Some look at development within the Millennium Development Goals (MDGs) (Tiglao and Alampay, 2004); others look at development in terms of people's livelihoods (economic development) (Qureshi, 2009), while others look at it as a freedom or capability (social development) (Midgley, 2003; Sen, 1999). A combination of economic and social development is usually referred to as socioeconomics.

The debate on whether development in any form leads to a better quality of life is resolved. *The debate is on what constitutes better quality of life* (Soeftestad and Sein, 2003). The Soeftestad and Sein argument is that development seen from any angle is development and researchers should concentrate on whether they understand how it impacts on people's lives.

Social and Economic Development

The distinction in social and economic development is important in development studies (Qureshi, 2009). Social development activities are designed to raise living standards, increase local participation in development, and address the needs of vulnerable and oppressed groups (Midgley, 2003). Economic development is a means of studying development that considers improvements in the lives of people by giving them a means to generate income which can be done through job creation, trade or enterprise (Qureshi, 2009).

In what seemed to be Poncet's² response to Mookherjee's (2001) question *Why are some countries developed, and others less so?*, Poncet, quoting from Seers (1969), said that *economic development occurs with the reduction and elimination of poverty, inequality and unemployment within a growing economy*. This means that what accounts for the phenomenal disparities in living standards is the poverty, inequality and unemployment in some regions (mainly developing countries) and lack of it in others (developed world).

² http://ces.univ-paris1.fr/membre/Poncet/SciencesPo/Slides_4.pdf

The economic development definitions by [Midgley and Seers](#) can be said to be defining development that can be done at micro-level at the community level while that of [Mookherjee](#) takes the international level the units that form it are countries/nations. This kind of definition is development at macro-level. It is the process or a result of improving living standards of the people nationally and puts the responsibility of developing the people on national governments or international development agencies.

Recently, a redefinition of goals of development has had much greater emphasis on non-economic aspects than economic aspects. Apart from measuring development in terms of economics, it can also be measured in terms of social wellbeing, political structures and the physical environment ([UNDP, 1991](#); [Shirin, 2000](#)). Redefinition of goals of development with much greater emphasis on non-economic aspects, for example ICTs, is taking centre stage ([Shirin, 2000](#)).

In other definitions of development, the objective is emphasised as opposed to the types or the means. Development is being concerned with the achievement of a better life. It is an economic exercise ([Sen, 1988](#)). According to this definition, development involves improving the living standards of the target group. It does not, however, make a distinction between economics and social development. [Prakash and Deo \(2007\)](#), described two perspectives of development:

- a) Development as economic growth, which is driven by economic growth theory ([Shirin, 2000](#)) and
- b) Development as capacity building focuses on building capacities and creating societies where individual potential can be realised. The development as capacity-building perspective can be likened to social development ([Qureshi, 2009](#)).

Development: Adopted definition

We acknowledge that development, both in economic and social development terms, as described in development studies, has different and diverse theories, models and, consequently, definitions ([Midgley, 2003](#); [Vaughan, 2006](#); [Walsham and Sahay, 2006](#)). Since the intention of this work is not to argue against or for any theory or definition, we simplify the definition of development in the context of our study by borrowing from the various definitions highlighted above. Development, as used in this study, will refer to both economic and social development at micro-level as opposed to the macro-level. The micro-level, as used in this study, means providing interventions to small groups or communities on specific conditions which normally contribute to making them live in poverty.

We define the economic development as a way of enhancing some aspects of the living standards of the study participants by improving their net income. The net income can be increased by reducing the cost of operation. The social development aspect, on the other hand, addresses the needs that may not be defined in economic terms but can raise the living standards. For example, in our case study, job-seekers wake up as early as 4am to be able to walk and get to collection points on time. Waking up early and walking long distances to collection points may reduce the living standards of the job-seekers. Another example is discrimination based on facial judgement or any other physical appearance ([Bartley and](#)

Wade, 2006). A job-seeker's living standards may be raised if ICTs are used to avoid such early waking and walking as well as discriminations.

Our attempt to alleviate these and many more social challenges faced by members of the DLM is what we refer to as social development. It may include development as a process of expanding the freedoms that people enjoy (Sen, 1999). We combine both social and economic definitions of development and refer to them as socioeconomic development.

2.2.3 ICT4D

Information and Communication Technology for Development (ICT4D), is a relatively new discipline that focuses on ICT innovations that can contribute to different socio-economical development objectives. These development objectives may include, among others, income growth, health, education, government service delivery or micro-finance in many countries, but mainly in the low-income countries of the world (Prakash and Deo, 2007). ICT4D has a focus on development issues which were presented by the World Bank initiative of 1995 (Hedström and Grönlund, 2008). These issues specifically centred on exploring initiatives of using ICTs as tools to reduce poverty and enhance sustainable development. *The term ICT4D is used to describe a wide range of endeavours with the common goal of promoting the socioeconomic development of disadvantaged communities through the direct or indirect use of ICTs* (Pitula et al., 2010).

There are two approaches through which ICTs can be used to support development. One is the direct method in which the ICTs directly target the intended beneficiaries and mostly links them with their service providers (Reddi, 2010). The second is indirect and supportive where deployed ICTs *target the development of policies, infrastructure, support systems and content, which in turn is expected to benefit the ultimate beneficiaries*. Applying ICTs to support development can be done both at macro- and micro-levels. At micro-level, community based initiatives using ICTs to solve local problems are examples. Macro-level initiatives involve National and international organisations (Vaughan, 2006).

In this study, we define ICT4D by combining ICT and development definitions adopted in Section 2.2. We refer to ICT4D as the use of technologies that facilitate, by electronic means, the creation, storage management and dissemination of information to advance the social and economic wellbeing of their users. In the context of our study, we refer to ICT4D as using Internet and mobile phone technology innovative applications *as ICTs* to facilitate effective and efficient operations among day-labour market (DLM) members (the user). In this definition, we argue that the innovation's impact to members of the DLM can be described in both social and economic development terms and are expected to positively affect the living standards of the DLM.

2.3 Day-labour market

The term *day-labour* refers to a type of employment arrangement not covered or regulated by formal labour laws (Blaauw and Pretorius, 2007; Melendez et al., 2009). Day-labour workers are employees whose job contracts are mainly on a daily basis. Our field studies

(Section 6.1.1, 6.2.1, 6.3.1 and Appendix D) and Stertz-Follett³ showed that contracts may go for one week, one month, six months or, at most, one year.

A day-labourer is someone who gathers at a street corner, an official or unofficial hiring site, or other spots to sell their labour for the day, hour, or for a particular job (Valenzuela Jr., 2001). Day-labourers are non-office workers, working on elementary occupations (Wills, 2009) which include carpentry; electric works; plumbing; driving; nursing and home-health care. In this line of work, mobility is required by the nature of the work activities (Skattør et al., 2007).

The DLM consists of three primary actors: the employers, the job-seekers, (day-labourers) and the intermediary organisations. The day-labourers are considered blue-collar workers whenever they are at work (Luff and Heath, 1998; Brodie and Perry, 2001). When jobless, they are mainly job-seekers and cannot be classified as blue-collar workers because they are not employees at that time. Intermediary organisations are those organisations or individuals positioned between employers and job-seekers (Mehta and Theodore, 2006). They are mainly non-governmental organisations (NGOs), local government agencies, church groups or individuals. The day-labour employers hire day-labour workers, either directly or through intermediaries such as intermediary organisations or job brokers. The DLM provides opportunities for low-skilled, low-literate job-seekers. In a DLM, for workers to accrue benefits, the other two major stakeholders—the employer and the intermediary organisation—must also benefit from the DLM arrangement.

2.3.1 Day-labour Worker Collection Points

Day-labour worker collection points are usually open air places where workers congregate every morning whenever they are out of work and ready to be picked up for jobs by employers. In other places, they can, however, be shaded or in buildings. Figure 2.1 shows examples. The worker collection points are also referred to as worker hire sites, worker centres, worker corners (Valenzuela Jr. et al., 2006) or informally, as ‘open air labour market’.



Figure 2.1 (a): An examples of a day-labour worker collection point with shade



Figure 2.1 (b): An examples of a day-labour worker collection point in an open space

³ Stertz-Follett, E. How to Find a Day Labor Job: http://www.ehow.com/how_5874064_day-labor-job.html#ixzz0y57bTmOh

Day-labour centres are loosely regulated hiring sites where workers may seek employment under relatively structured conditions (Valenzuela Jr. and Melendez, 2003). They are a type of formal hiring site (Valenzuela, 2003; Melendez et al., 2009). Day-labour centres are not employers but rather an intermediary and a regulating authority between job-seekers and employers (Melendez et al., 2009). Day-labour centres are not labour brokers as they do not charge for their services.

2.3.2 Worker Hire Sites in Africa

There are an estimated 1,000 worker hire sites in SA with a minimum of about 45,000 job-seekers, mostly black African men standing at the various sites every day seeking work (Blaauw et al., 2006; Harmse et al., 2009). Our field observations from Kenya, SA and Namibia gave indications of these large numbers of day-labourers and many worker collection points. The database analysis of the DLM intermediary organisation that we worked with had over 19,000 registered day-labourers. Our findings revealed different types of DLMs and different forms of organisations (Section 5.1 page 70).

2.3.3 Day-labour Market as an Informal Sector

One of the relevant concepts to emerge in recent years in the field of development is the *informal economy* or *informal sector*. The informal sector re-defines the nature of poverty, urban poverty in particular, in the developing countries and recognises the poor as actors in development (Portes, 1983). The members of the informal sector are engaged in a myriad of activities that, if not highly remunerative, at least provide for their own subsistence and that of their children (Portes, 1983). Portes defined the informal sector as referring to the activities in which many, if not most, urban workers regularly engage as full participants in the existing economic order. For a comprehensive definition of informal sector or informal economy, refer to Portes (1983), Becker (2004), and Melanie (2004).

The informal economy has been used to describe the informal sector. According to this view, the defining characteristic of informal enterprise is ease of entry, determined by low capital and skill requirements. This leads to the idea that any jobs requiring low or no skills can be classified as part of the informal sector. Informal sector employment includes entrepreneurs and their workers, self-employed artisans and merchants, wage labourers subcontracted by formal firms, and direct subsistence workers (Portes, 1983; Wells and Jason, 2010).

2.3.4 DLM as our Study Context

In this study, we use the case of the DLM as our study context. Before describing how and why we picked the various DLM organisations, we briefly describe the DLMs studied.

We focused on the DLM in four African cities, namely Nairobi (Kenya), Windhoek (Namibia) and Cape Town and Johannesburg (SA). In SA and Namibia, we focused on NGOs working for day-labour workers. These organisations are Men on the Side of the Road South Africa (abbreviated MSRSA⁴ in this study) and Men on the Side of the Road Namibia (abbreviated MSRNA⁵). In Kenya, we did not find any organisation working for the DLM.

⁴ www.msr.org.za

⁵ www.msr.org.na

These DLM organisations are not labour-brokers because they do not charge for their services.

MSRSA is an NGO based in SA, with its headquarters in Cape Town. MSRNA is Namibian, with their only office in Windhoek, Namibia. Both MSRSA and MSRNA were set up in a similar structure and operation model. They were non-profit organisations involved in the organisation of unemployed workers by managing worker collection points through the field officers who are employees of the intermediary organisations. Field officers are representatives of the NGO at the worker collection point. They organise workers and sometimes talk to employers on behalf of the job-seekers. During our study, MSRSA changed their operation model to a self-sustaining NGO (Section 6.1.4 page 99).

MSRSA and MSRNA are examples of intermediary organisations in the DLM. The essence of their activities is to increase the ability of people to earn a sustainable income by being employed even if it is a short term employment. MSRSA and MSRNA do this by registering job-seekers who are unemployed as their members and placing them with employers in an organised manner. Although it was not in their original structure, MSRNA started registering employers after recommendations from our study.

According to MSRSA management, their active worker membership is estimated to be over one hundred thousand. The number of workers in their database in 2010 was 19523, about 44% of day-labourers in SA. The DLM employers were above 100. MSRNA had about 707 registered workers and 47 employers.

Other objectives of MSRSA and MSRNA include carrying out a nationwide assessment of the workers' skills; implementing training for workers and providing mentored opportunities.

In SA and Namibia, we focused mostly on the intermediary organisations and the day-labourers. In Kenya, we studied workers without any affiliation to any organisation or self-organising (Section 5.1). We did not find any intermediary organisation in Kenya. According to the chairman of the self-organising group in Nairobi, their membership was about 600, gathering in a street pavement (Moi Avenue Nairobi) as their worker collection point. The chairman is the elected leader of the workers and in charge of running the collection point. Instead of field officers in a self-organised group in Kenya, contractors or job brokers serve the purpose of looking for jobs on behalf of workers. This model has served to the disadvantage of the workers as most contractors are middlemen and do their work on commission (sometimes earning more than the workers earn). Job-brokers or contractors are individuals who look for jobs on behalf of the day-labourers, mediating between the workers and the employers.

Why we Picked MSRSA, MSRNA and the Nairobi Organisations

After selecting the case study regions (selection process in Section 4.1 page 55), we selected the DLM organisations mainly using convenience selection (Marshall, 1996). MSRSA Cape Town was the most convenient for the researcher who was based in Cape Town. MSRSA was also the biggest DLM organisation in SA. The Nairobi and MSRNA DLMs were added as the need arose through selective sampling (Schatzman and Strauss, 1973). The main reason for adding Nairobi and MSRNA was because AR was our methodology and we were aiming at

in depth study through triangulation using multiple case studies. Nairobi DLM (Moi Avenue), besides being convenient for the researcher, was selected because of the initial findings which showed that it had a different form of organisation from MSRSA.

At a point in our study, MSRSA changed its operation model from a charitable organisation to a self-sustaining, focusing on employers and job-seekers paying for their services. When MSRSA focus changed from workers to employers (because there were few workers who paid for the services), the question of what ICTs can help day-labourers was still unanswered. This is when MSRNA, which was still being run as a charitable organisation, was selected. MSRNA was selected because we had contacts with them and funding for inter-country research.

2.3.5 Case Study Regions; Transport and the Urban Poor

Urban poor are individuals inhabiting the cities and live below the poverty line (Section 2.6.2 page 34). Among the urban poor are the DLM job-seekers, especially the non-skilled. The urban transport, especially in large cities, in most of Africa is inefficient (Calderon and Serven, 2008). This makes the cost of travelling relatively expensive compared to the developed world. Low-income earners and job-seekers, therefore, feel the cost of commuting most acutely. In our field studies, we witnessed this in the three of the four cities that we studied. Before we highlight the commuting situations for common people in the three of the four cities, we describe the three case study areas.

About the Case Study Regions

Africa is the world's second-largest and second-most-populous continent. It is home to over a billion people making up 14.7% of the total world's population. Kenya is a country in East Africa with a population of approximately 41,000,000. Kenya's capital city is Nairobi with approximately 3 million people. Kenya's informal sector is almost three times bigger than the formal sector. It has a literacy rate of 85.1% (CIA World Fact Book Kenya⁶).

South Africa,⁷ had an estimated population of 49,000,000 in July 2012. Daunting economic problems remain from the apartheid era – especially poverty, lack of economic empowerment among the disadvantaged groups, and a shortage of public transportation (CIA World Fact Book SA⁸). It has a literacy rate of 86.4% and an unemployment rate of 48.2% among the youth between 15 to 24 years.

The Republic of Namibia is a country in southern Africa. It has a population of about two million⁹. Namibia has an unemployment rate of 41.7%.

Figure 2.2 (a) shows the three countries in the map of Africa. The cities studied are depicted in Figure 2.2 (b).

⁶<https://www.cia.gov/library/publications/the-world-factbook/geos/ke.html>

⁷http://en.wikipedia.org/wiki/South_Africa

⁸<https://www.cia.gov/library/publications/the-world-factbook/geos/sf.html>

⁹<https://www.cia.gov/library/publications/the-world-factbook/geos/wa.html>

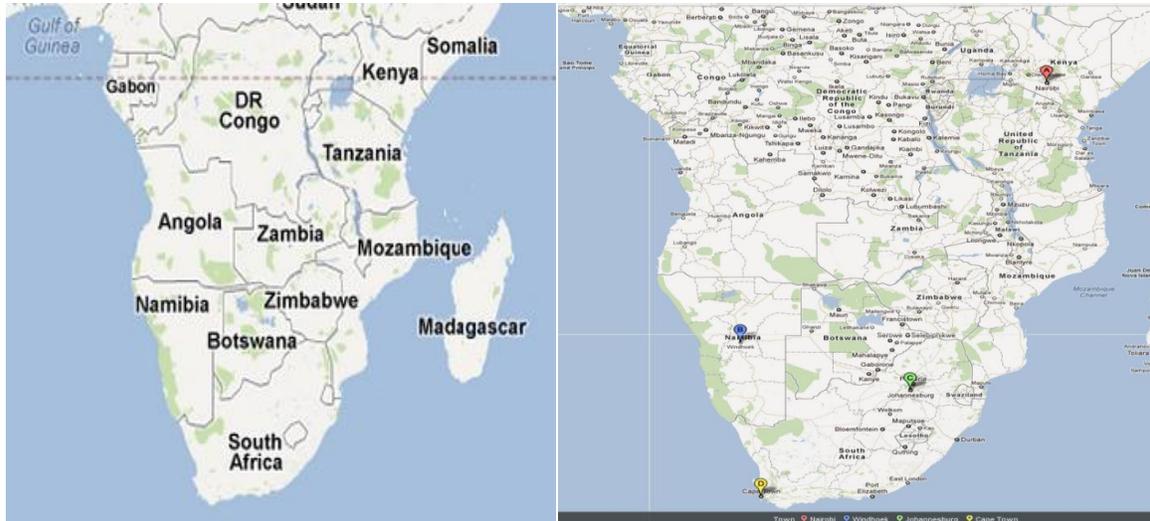


Figure 2.2 (a): Map of Africa showing SA, Kenya and Namibia Figure 2.2 (b): Case study areas represented in a map

Nairobi: *Matatus* (buses and minibuses) are the most commonly used means of public transport in Nairobi. The cost of one way transport to the city centre is ZAR 7 and it takes an average of one hour on a good day and up to three hours on bad a day from the outer suburbs.

Windhoek: The *taxi* (small saloon cars with a passenger capacity of five) is a major transport system in Windhoek. The fare is ZAR 8 one way and takes between 10 to 20 minutes to commute within the city of Windhoek and its suburbs.

Cape Town and Johannesburg: SA runs a Metro train service that crosses many suburbs. Cape Town also has an equivalent of *matatus* (referred to as *taxis*). The commuter fare is ZAR 5 and ZAR 8 using the train and the *taxi* respectively for a single trip.

2.4 Teleactivity

2.4.1. Which Teleactivity?

Overview

The general aim of our study was to use ICTs to reduce the challenges faced by the DLM. The changes we anticipated were meant to help the poor within DLM using some form of virtuality or teleactivity within DLM operations. We choose teleactivity because of the study context (DLM), their key challenges (a lot of travel) and the study contextô ICT4D related. The general area is teleactivity, with the objective of reducing travel by the DLM individuals. However, it was challenging for us to classify the study in a particular type of teleactivity as it seemed to cut across many teleactivity types and other related disciplines.

From our initial literature survey, our problem seemed similar to some of the arguments around telecommuting. Therefore, apart from examining the telecommuting literature to see where it does and does not inform our work, we also criticise the areas of Computer studies and ICT that are close to our study. We then use these criticisms to argue for or against the suitability of our work being classified in each of the areas. The identified areas include

Computer Supported Cooperative Work (CSCW); Computer-mediated Communication; Microworking/crowdsourcing; Market Information Service and virtual organisation.

Our analysis does not include a critical analysis of the fields in question but only provides the definitions and a summary of why we think it is or is not suitable for our study.

a) Computer-Supported Cooperative Work

CSCW can be defined from either a technology (Technology-centric) or work (Work-centric) perspective (Mills, 2003). Technology-centric involves devising ways to design computer technology to better support people working together. Work-centric is about understanding work processes with an aim to better design computer systems so as to support group work (Mills, 2003). Generally, CSCW is a cooperative work carried out by a group of individuals with computer support (Bruegge and Houghton, 1996).

CSCW Suitability to our Work

Our study easily fitted into the work-centric definition of CSCW. The argument would have been studying the DLM in order to design systems to support them which is true. However, CSCW is specific on the use of computers and gives very little about other ICTs. It also looks at groups rather than organisations. Emphasis is on group work and people working together (collaboration). The buyer-seller relationship, the key thing in DLM, is minimal in CSCW.

Although we considered framing our issues around CSCW because of the cooperation that sometimes exist among DLM stakeholders, field studies and prototype testing results showed that, although there was some level of cooperation in the DLM, the use of ICTs to enhance cooperation was going to be challenging. The most pressing problems within the DLM were not of a CSCW nature but of travel.

b) Computer-Mediated Communication

Advancement in ICTs has brought about the emergence of different forms of organisation such as those formed and operated in a virtual space. CMC enables these forms of organisation to take place by offering the potential to overcome constraints on time and distance around which organisational forms have traditionally been designed. CMC consists of communicating using computer applications such as E-mail, instant messaging, etc. (Panteli and Dibben, 2001).

CMC Suitability to our Work (CMC)

We could not classify our work within CMC studies because the context was more than just communication. The DLM operations include marketing, collaboration, commuting, data storage and retrieval. Framing it under CMC would have amounted to limiting the potential of solving other problems within the scope.

c) Market Information Service (MIS)

MIS is provision of market information to interested parties. For the purposes of our argument, we adopt and modify the definition of MIS used by Shepherd (1997) for agricultural products. He described MIS *as involving collection on a regular basis of prices and some cases quantities of widely traded agricultural products and dissemination of this information on a timely and regular basis to consumers*. We generalised it as follows: MIS

involves collection, on a regular basis, of prices and some cases quantities of widely traded products or services and dissemination of these information on a timely and regular basis to consumers.

MIS Suitability to our Work

The collection and dissemination of information to the stakeholders had already been attempted by MSRSA and MSRNA systems but not the Nairobi DLM. Considering an MIS for Nairobi DLM was not, however, seen as a key solution to their problems. Further, we thought the provision of an MIS in the DLM may serve to isolate unskilled, less educated and job-seekers with no ICT means to be able to benefit from the information sharing.

MIS involves collection by a central agent and disseminating it to the clients. Its main concern is price and some advantages include helping in price negotiations. In the DLM, however, the price problem was minimal as it was not mainly negotiations but lack of jobs due to too few employers; commuting; and the cost of operations, among other challenges.

Overall, although a perfect MIS for the DLM may help, it may not address many of the challenges. The MIS is suitable for an ideal market situation, a characteristic lacking in the DLM. For example, the logistics of getting a job are much more complex and challenging compared to the negotiation after landing a job.

Another challenge in the DLM is lack of readily available information. The stakeholders rarely provide the information needed to maintain MIS. An ideal MIS is maintained by a body with the capacity to collect needed information. A perfect system for MIS without information, which was the case in the DLM, would not help in alleviating the challenges. The effort to deal with the problem from an MIS would have gone to waste. In fact, the NGOs running the DLM in our two case studies had previously fallen into the trap of having unsustainable MIS that had failed to provide commercially useful advice but only gathered frequently unused data.

The last issue with MIS is that it is used mainly to analyse historical data and can also be used to make decisions or predictions or for planning (Shepherd, 1997). In DLM, making decisions may not be a major problem. Stakeholders have minimal options. Workers rarely decide whether to take a job or not as they are always hungry for one. The jobs in DLM are unpredictable and may come any time of the day. The workers would rather be at the collection point waiting rather than use MIS to predict jobs.

In the end, therefore, we decided not to consider MIS as a key theoretical underpinning in our study but to include it as part of the modules in the designs for the applications we developed.

d) Microworking or Crowdsourcing

Microworking or crowdsourcing can be described as a means of enabling the public to earn small amounts of money as compensation for completing simple, small discrete tasks (Eagle, 2009; Vukovic et al., 2010). It involves offering tasks to be solved by crowd workers (Alt et al., 2010). Crowdsourcing can also be defined as the act of outsourcing tasks, traditionally performed by an employee or contractor, to a large group of Internet population (the wise crowd) by means of an open call (Liu et al., 2011).

Crowdsourcing/micro-working is a concept that emphasises work that can be subdivided into small jobs to multiple workers not collocated. It requires a specialised software application to allow for administration of the work process and ICTs for communication.

Microworking or Crowdsourcing Suitability to our Work

Although it might be argued that job and worker search related activities are tasks, they cannot be classified as micro tasks. The nature of $\text{\textcircled{work}}$ performed by the DLM stakeholders may not be divided into small pieces of work as is a necessary condition for microworking.

e) Virtuality: Organisation; Collaboration; Community; Teams and Work

The label $\text{\textcircled{virtual}}$ has been employed to label a variety of emergent work forms that differ from traditional work on numerous dimensions, such as the location of the workers, where and how work is accomplished, and the basis for relationships between workers and organisations and between organisations (Watson-Manheim et al., 2002). We describe various types of virtuality as used to describe a situation where the context is not constrained by space or time. They include virtual organisation; virtual collaboration; virtual teams and virtual work.

Virtual Organisation

Like many other ICT related terms and phrases such as CSCW; telecommuting/teleworking, Virtual Organisation (VO) has no universal definition (Reinicke, 2011). Literature showed that the most widely used definition is by Marcin and Wojciech (2005). VO referred to a new organisational form characterised by a temporary or permanent collection of geographically dispersed individuals, groups or organisation departments not belonging to the same organisation ó or entire organisations, which are dependent on electronic communication for carrying out their production process (Marcin and Wojciech, 2005). It is a phrase used to describe new organisational business forms that emerge with the application of information and communication infrastructures (Fisher, 1998; Hoefling, 2001; Guyverson, 2006). VO consists of networks of workers and organisational units lined by ICTs, which will flexibly coordinate their activities and combine their skills and resources in order to achieve common goals (Hughes et al., 2001).

In the varying definitions, there are common themes among them remoteness and dispersion of work. Removal of physical proximity appears to be a key characteristic of VO definitions (Panteli and Dibben, 2001). Also common in many definitions is the use of ICTs as a means to removing physical proximity. For example, Jagers et al. (1998) defined VO as an identifiable group of people or organisations whose use of ICTs is substantially greater, thereby reducing the necessity of their physical presence for the transaction of business or for doing work collaboratively.

VO Suitability to our Work

VO is a homonym with two main meanings: a $\text{\textcircled{virtual organisation}}$ (which can be an online community) and a $\text{\textcircled{virtual organisation}}$ which is a physical traditional organisation with activities supported by ICTs, but differ in the way they operate (Marcin and Wojciech, 2005). The latter are VOs envisaged in most of the literature. For instance, Panteli and Dibben (2001) described them as those that were transformed from conventionally structured

organisation, centring on an office whose purpose was to bring individuals together to communicate through face-to-face and other static communication media. In our study, the DLM organisations were set up in a similar manner albeit individuals are the distributed entities.

In our study, the thought to transform the DLM into a virtual organization, came with challenges. First, in most cases, virtual organisation (VO as a practice) only exists for a short time (Guyverson, 2006). DLMs have a long term relationship among the stakeholders. The only way that we would have studied DLM within the context of VO was to take DLM as a physical organisation, which it was, and transform it to a virtual organisation (as an entity) through ICTs.

Looking at the VO various definitions (Hughes et al., 2001; Panteli and Dibben, 2001; Marcin and Wojciech, 2005; Guyverson, 2006), our study context can be said to fit in with one major positive characteristic. For example, MSRSA had various branches and field officers working outside the office. This could qualify them as a virtual organisation. However, the DLM lacked key characteristics such as: a) They rarely used ICTs to communicate across the different locations; (b) the team work or collaboration was only being seen within a specific location (collection point); (c) individuals would still move/travel from one point to another to meet the objectives.

Transforming the DLM into a VO

During our initial study periods, we thought of using ICTs to make the job and worker search coordination virtual. VO definitions, for example by Hughes et al., (2001), favoured our idea of finding out the extent to which a DLM organisation could be transformed into a virtual organisation. The challenge was however on the scope of the study: VO is a broad field and carrying out a blanket application to an equally broad context such as DLM was going to be challenging. The alternative was to scope the study by looking at different types of applications of VO and virtuality. Therefore, we look at the definitions of various VO types. We then discuss why we thought they were or were not suitable candidates to frame our study.

Virtual Teams

Virtual teams are comprised of members who are located in more than one physical location. This team trait has fostered extensive use of a variety of forms of computer-mediated communication that enable geographically dispersed members to coordinate their individual efforts and inputs (Peters and Manz, 2007).

A virtual team, like every team, is a group of people who interact through interdependent tasks guided by common purpose. Unlike conventional teams, a virtual team works across space, time, and organisational boundaries with links strengthened by webs of communication technologies (Lipnack and Stamps, 1997).

Virtual Collaboration

Virtual collaboration (VC) is the use of ICTs to support collective interaction among many parties involved. Virtual organising is an essential prerequisite for ensuring a higher level of VC (Hossain and Wigand, 2004). To find out if VC was the best match for our study, we

found out if the DLM stakeholders collaborated by trying to understand collaboration. **Peters and Manz (2007)** defined collaboration as a purposive process that results from a desire or need to solve a problem, create, or discover something. It involves decision-making among interdependent parties that involves joint ownership of decisions and collective responsibility for outcomes. Although this definition, to some extent, fits the operations in the DLM, the emphasis is on employees or people working on a similar project. DLM stakeholders are rarely working on a similar project but mostly as a market with a buyer-seller model.

Virtual Community

Virtual community can be defined as consisting of people who interact together socially on a technical platform (**Leimeister and Krcmar, 2004**). The community is built on a common interest, a common problem or a common task of its members that is pursued on the basis of implicit and explicit codes of behavior. The technical platform enables and supports the community's interaction and helps to build trust and shared common feelings among its members.

The Suitability of Collaboration, Teams and Community to our Study

Collaboration: Collaboration is not always between a client and a service provider: it is between members who have a common goal (**Peters and Manz, 2007**). It was clear that members of the DLM were not collaborating at a level which ICTs can boost their performance. Although the general context could easily be seen as requiring collaboration, challenges such as access to ICTs and other more pressing problems would not have easily allowed VC.

Team: Team collaboration is the existence of mutual influence among members that enables open and direct communication, resulting in conflict resolution, and support for innovation and experimentation (**Peters and Manz, 2007**). Teams are primarily formed for a specific purpose and mainly have one central control point. The DLM case is different although the stakeholders can be seen as collaborators, they have no central authority. They are loosely dependent compared to a team. We, therefore, concluded that the DLM model was far from being a team.

Community: A community is based mainly on social interactions and goals. Virtual community is very broad in definition, and hence it was challenging to scope the DLM problem within it.

Virtual Working; Teleworking; and Telecommuting

Virtual Work: In the world of work, "Virtual" is often used to differentiate work environments where individuals are physically or temporally dispersed (**Al-Shammari, 2009**). Such work environments include individuals working at home (telecommuting) or those working on a project, for example software development, from different locations. In virtual work, the work is not constrained by space or time. The virtuality concept involves the use of ICTs to replace or reduce travel among the individuals involved in the virtual space. It brings about teleactivity or tele-substitution.

Teleworking: Telework is a broad term for doing one's job away from the office via telecommunications equipment (Hill, 1998). It is distance working facilitated by information and communication technologies (Martino, 2001) citing (TUC, 1998).

Telecommuting: Di Martino (2001), Di Martino (2004) and Dunn (2009a), citing ILO (1990) described telecommuting as a form of work in which (a) work is performed in a location remote from central office or production facilities, thus separating the worker from the personal contact with co-workers there; and (b) new technology enables this separation by facilitating communication. Telecommuting is a concept of using technology to do work away from the common work site—office (Ritter and Thompson, 1994; Ahmadi et al., 2000).

Are They Three Different Aspects of One Concept?

Teleworking, telecommuting or virtual work have no universal definitions (Eurofound, 1997). Each of these terms/phrases has been defined using the other. For instance, telecommuting is also referred to as teleworking (Smith and Baruch, 2001). Some definitions use telecommuting and teleworking as alternative terms to virtual working. Others argue that telecommuters/teleworkers are examples of virtual workers (Panteli and Dibben, 2001). Alternative terms and phrases also exist (Knoll and Jarvenpaa 1998; Smith and Baruch, 2001; Cowell and Dunn, 2006). Telework and telecommuting also have different forms which include flexiwork and homework. Further, the different forms have more classifications. For example, Nomadic work (NW) (Su and Mark, 2008) can be described as an extreme form of flexiwork. Although there are many instances where telecommuting and teleworking have been used interchangeably (Peters et al., 2002), there are situations where they have been shown to be different (Nilles, 1988a).

Many scholars, though not explicitly, have defined telecommuting in such a way that home, as an alternative workplace, is not mentioned explicitly. For example, many studies define it as replacing or reducing traditional commuting to the workplace. Although the ideal situation dictates that if one reduces their commuting, they are likely to be at home. They may, however, be working from other places. This redefines telecommuting to have the same meaning as teleworking; virtual work or any other terms that describes the situation.

Amidst all these definitions, it is clear that the concept of being able to carry out work-related activities away from the official duty station can be described using many terms and/or phrases. The onus is on the researchers to define the meaning of their terms as used in the research.

In this study, we adopted a definition that uses telecommuting and teleworking interchangeably. Comprehensive definitions are given in Appendix A, page 190 and the objective is to portray an idea where our study participants and objects can use ICTs to reduce their travel and other job- and worker-search-related challenges.

Virtual Work, Teleworking or Telecommuting: Suitability to Our Study

The key problem identified in our study is the commuting or travel challenges among the DLM stakeholders, and mainly job-seekers. The objective, therefore, was to find a theory that suits the problem and still retains the original idea of using ICTs to alleviate some of the problems of the poor. We discovered the concept of being able to carry out an activity away

from the official station. From literature, the closest terms included telecommuting, virtual work and teleworking. Having described the meaning of these terms, albeit not in detail, and shown that they have been used interchangeably, we needed to show why they are the right virtual concept for our study. There was the need to explain how job and worker search in the DLM could be classified as work for job-seekers or field officers and employers respectively.

Why Virtual Work, Teleworking or Telecommuting

The first thing that guided us was the problem at hand. It would have been easier to frame the research as a VO problem. For example, some VO definitions (Guyverson, 2006), describe context that are similar to ours. Under such situations, the question would simply have been how to transform the DLM organisation from an ordinary organisation to a VO. However, we needed to select what would solve the most pressing problem of the participants' commuting. This meant still maintaining the concept of virtuality but being specific on which virtuality' virtual work.

The next question was why we chose teleworking/telecommuting, against all other forms of virtuality. The reason was because the DLM stakeholders were mobile and their travel to different points was a routine, hence commuting. We could, therefore, not ignore the DLM stakeholders' commuting related challenges. Dealing with the problem from commuting point of view (a view supported empirically by our fieldwork data), and following the naming trend in virtuality, the most appropriate term was teleworking or telecommuting. However, the official meaning of telecommuting involves workers doing work from home. The options for us were as follows: to coin another term to describe our DLM context; redefine telecommuting to suite our DLM context and use it as it was and show why its current definition is unsuitable.

We chose the latter. The motivation was the frequency of travel by the day-labourers to the worker collection points and the field officers who made many trips between their residents, collection points and the office. We also defined the whole process of looking/searching for work as work.

We used the term telecommuting to refer to all teleactivities that involve being able to execute an activity with no or minimal spatial or temporal interference. In other words, telecommuting is a type of teleactivity (Andreev et al., 2010), which occurs in a VO environment. However, VO is a broad study area with diverse definitions and, hence, there was need to contextualise our study for the purpose of scoping it.

Job- and Worker-Search: Are They Work or Work Related?

In this study, job-search and worker-search were defined as work meaning that the day-labourers involved in job-search on a daily basis, and hence commuting, can be classified as 'workers'. The field officers and all other employees of the DLM intermediary organisations work for the NGOs and, hence, they commute. The employers, just like workers, albeit with less frequency, are also involved in worker search. It is more visible to categorise worker search as work when the person involved is a job-broker who earns his/her livelihood from work brokerage.

For a formal definition used to classify job- and worker-search as work, we used [Andreev et al. \(2010\)](#) typology of personal activities where personal activities are divided into three main classes:

- 1) Mandatory activities: it is a must for the person to perform and include work and work-related activities (subsistence), which provide the economic basis for the remaining personal activities, including noegenesis (for example, school or university).
- 2) Maintenance activities: refer to purchasing and consumption of goods and services aimed to satisfy individual/household physiological needs or biological needs as well as obligations associated with being a member of a family and of society.
- 3) Discretionary activities: encompasses leisure activities.

Figure 2.3 shows the [Andreev et al. \(2010\)](#) typology of personal activities.

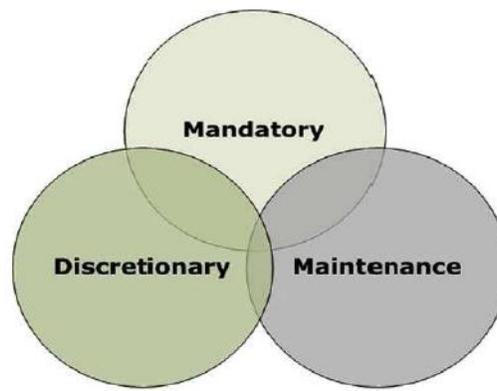


Figure 2.3: Typology of personal activities

Source: Andreev et al. (2010)

Using this typology, we classify job search by workers as mandatory because waiting at the collection point by job-seekers was not voluntary: on the contrary, it was the only option they knew about. Job search by workers is a first point towards working and earning money and, hence, it is a mandatory activity. As for employers and the job brokers, their work is obviously mandatory activities. However, for employers, their worker search activities may also be categorised as maintenance.

We, therefore, modelled the DLM market as a work environment where job-seekers, field officers and employers are workers but with different objectives. Their commuting plans are dictated by the nature of the work they are involved in. Job-seekers' work is to look for jobs, employers search for the right job-seekers and field officers or brokers work for DLM intermediary organisations or as self employed. In this scenario, job-seekers and employers can either work for themselves (can be regarded as self-employed) or may receive help from field officers or brokers. In conclusion, the workers (classified as employees in the current definition of telecommuting) are job-seekers, employers and field officers or brokers. The work is either searching for a job or looking for the right job-seeker.

How Can Job-seekers and Employers be Commuters?

Using the [Andreev et al. \(2010\)](#) typology, the process of looking for work by or for a day-labourer can be classified as work. After all, for a day-labourer, getting employment starts

from a continuous travel to and from the worker collection point. Similarly, an employer or a job broker has a mandatory duty of looking for a worker.

However, the use of the terms 'telecommuting' and 'teleworking' in our study, and any other study, requires the presence of commuting (daily travelling to and from a location). The issues, therefore, are what makes up commuting and who can commute. In this study, we argue that any activity that requires one to travel everyday to a specific location is work and the person travelling, therefore, is a commuter. In our study, job-seekers travel everyday to either worker collection points or to a work station. Although their purposes for commuting are different from a 'normal commuter', the challenges are same. The routine travels made by workers make them commuters. The routine travels by the field officers, who are employees of intermediary organisations working for day-labour job-seekers, makes them commuters. Likewise, employers or day-labour brokers travel to the collection point and work stations.

2.4.2 Defining Telecommuting

Even with the varied forms and definitions of telecommuting and teleworking, the concepts brought out by the various definitions (Appendix A) are still similar. Both can be defined as a concept and each study may require a contextualised definition. Here, we present two main issues identified in the definitions (Appendix A) and show how the adopted definition was shaped by the two issues. Finally, we present the telecommuting definition that we adopted for our study and show how we aligned it to conform to our objective of the need to introduce ICTs to help the DLM stakeholders.

The two issues that came out from the different telecommuting/teleworking definitions are (a) the history and expected benefits and (b) applying different definitions for different contexts or similar definitions for different contexts.

a) History and Expected Benefits

Telecommuting has been conceived in different ways over time since the 1970s. It has, however, retained the same concept of remoteness and using technology to support remote activities. In the earlier stages, interest was driven by concerns about traffic congestion and pollution. In the 1980s, focus shifted to seeing telecommuting as a means to reduce the cost of maintaining office space. In the 1990s, the focus has been of teleworking as a tool to attract and retain top personnel in fields with skills shortage or short labour supplies (Leung, 2004; Nortje et al., 2009).

b) Applying Different Definitions for Different Contexts or Similar Definitions for Different Contexts

Scholars still have varied opinions in the applications of a standard telecommuting definition to a specific study context Sullivan (2003). The consensus, however, is that there has to be a contextualised definition of telecommuting.

Adopted Telecommuting/Teleworking Definition

With the history and expected benefits issue, we found limited telecommuting research in Africa. We were unable to find any history of telecommuting in a context such as ours. The expected benefits issue was addressed by our research question two. Therefore, the position

we took for telecommuting was that taken in the 1980s in the developed countries. The difference, however, is that the cost reduction concept in the 1980s was more of organisational and less of individual. In our study, the cost saving was targeted at both organisations and individuals.

With regard to the definitions and contexts issue, the justification by [Sullivan \(2003\)](#), who advocated for a project-specific definition of telework considering the dimensions such as transportation; ICTs; work locations; proportion of work time that is decentralised; and contractual arrangement, was convincing.

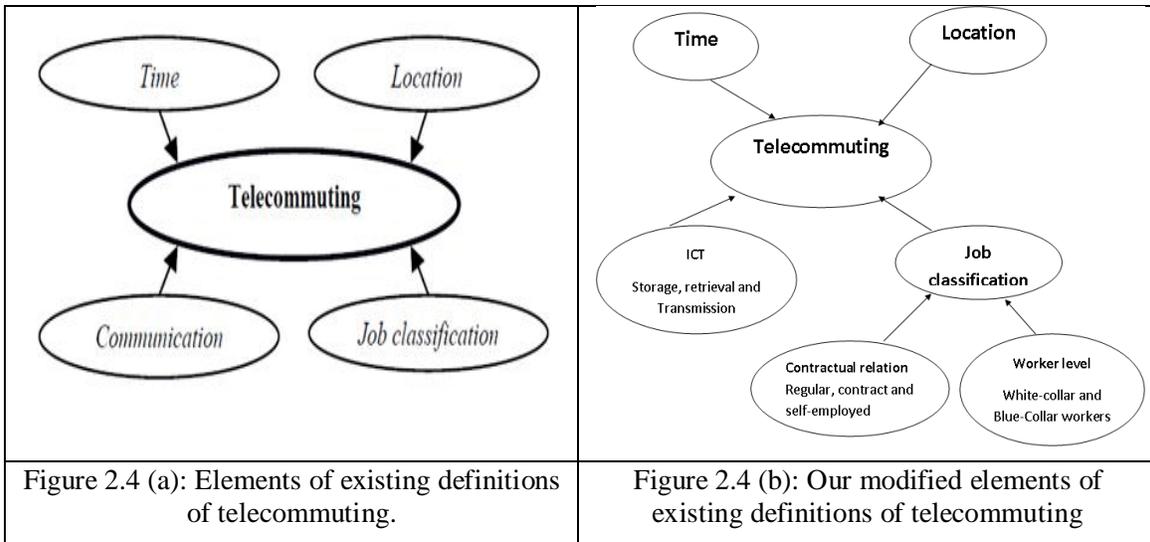
We contextualised our telecommuting/teleworking definition to the DLM. The contextualisation was inspired by [Sullivan \(1997\)](#), who pointed out and argued that it is important to identify and apply definition criteria which are not arbitrary. The other inspiration was the existence of a range of definitions that make it difficult to agree on a standardised one. As [Di Martino \(2001\)](#) put it, *“the range of existing forms of telework is so varied and the emergence of new forms of telework so continuous to make a commonly applicable definition difficult to achieve”*.

In contextualising our telecommuting definition, we found that the definitions rely on three main concepts: organisation, location and technology ([Di Martino and Wirth, 1990](#)) and can also be described using telecommuting elements, which include: ICTs, distance/remoteness, work, official duty station (traditional office) ([Hill et al., 1998](#)). To retain fundamental and original concepts, we included the telecommuting concepts and elements in our definition.

Using the telecommuting concepts and elements, together with [Garrett and Danzigerø \(2007\)](#) classification of teleworkers (1. home or satellite office workers; 2. field workers; and 3. combination of home, work, and field contexts), we identified four dimensions of telework for application in our study.

1. Work location describes the concept that telework happens in a remote place away from the traditional office.
2. The importance of ICT current telework activities are mediated by ICTs.
3. Location-time distribution describes the percentage of work-time spent in the office versus the work-time spent outside the office.
4. Employer-worker Contractual relations dictates whether a teleworker is a regular, contract or self-employed employee.

The above four listed dimensions, make up the main elements of existing definitions of telecommuting as presented by [Vu and Vandebona \(2007\)](#). See Figure 2.4(a).



We adopted the [Vu and Vandebona \(2007\)](#) definition of telecommuting with slight modification to the communication component and job classification. The location element describes the type or form of telecommuting. We used the location element to describe the -anywhereø concept without being specific to any possible location. This enables activities to be carried out away from the official location. It brings about the remote execution of activities from any of the telecommutersø possible locations. The reason we did not categorise locations, as has been done by other studies ([Nilles, 1988a](#); [Vu and Vandebona, 2007](#)), was because our study did not assume a classic employee-employer relationship which requires that the employeesø major telecommuting decisions are dictated by the employer. In our study, possible telecommuters had different characteristics and their commuting requirements were different. The commuting was also flexible given that the commuters were not strict employees. In our adopted definition, the official duty location is not necessarily a physical organisationsø officeø also shown by other studies ([Hardill and Green, 2003](#)). Our preliminary findings showed that our participants had more than one official location. These locations and travel routes are described in Section 5.2 page 72.

Like in many telecommuting definitions, the time element indicates the frequency of commuting by the telecommuters. The communication component was replaced by ICT to include information storage and retrieval, and the technology, which are central to our study. On job classifications, workers were classified as regular, contract or self-employed and white-collar or blue-collar workers (and not necessarily employees). Figure 2.4 (a) and 2.4 (b) shows the modifications.

Our working definition of telecommuting is therefore: *being able to leverage any form of ICT to be able to accomplish some or all of mandatory duties (work/activities) from a remote place away from your official/traditional work station any time*. Although this definition is similar to standard ones, the difference is in the three elements which include official station, work definition, and contractual relationship.

We used the [Andreev et al. \(2010\)](#) definition to justify the inclusion of job search as a mandatory activity. They defined telecommuting as a type of teleactivity which enables mandatory personal activities. An activity is a continuous interaction with the physical environment, a service or person, within the same socio-spatial environment, which is important to the respondent ([Axhausen, 2000](#)). It includes any pure waiting (idle) times before or during the activity. Figure 2.5 shows how telecommuting can be classified as a type of a teleactivity among other types.

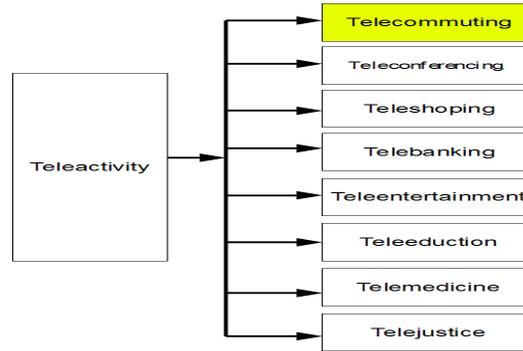


Figure 2.5: Classification of telecommuting as a form of teleactivity.

A teleactivity, therefore, can be defined as the use of any form of ICT to perform an activity remotely. The three main reasons that make using ICTs in the DLM to reduce travel to be classified as telecommuting are:

- The job- and worker-search are mandatory DLM activities
- The job-search process for day-labourers involves commuting
- The work for the day-labourers involves a long process which includes job-search. A day-labourer is most likely to be in a situation where the sum total of their work is work-search plus doing the work itself.

Limitation of Our Telework/Telecommuting Definition

We acknowledge that our definition of teleworking or telecommuting may be limiting in other application contexts. For example, because it has been done within a limited context of job search in the DLM, our definition includes only aspects found in this specific context and not other application areas. However, as [Sullivan \(2003\)](#) and [Haddon and Brynin \(2005\)](#) put it, it is inevitable for researchers to contextualise telework definitions depending on their research questions and objectives. [Sullivan \(2003\)](#) and [Haddon and Brynin \(2005\)](#) agree that simultaneous use of various definitions of telework that are project specific is useful and inevitable.

2.5 Methodology and Methods

The methodology and the methods applied for our study are presented here. Research methodology is a way to systematically solve the research problem and research methods constitute a part of the research methodology ([Sivasubramaniyan, 2012](#)). Method refers to an approach to, or general type of investigation, while technique refers to investigative tools employed ([Long et al., 2000](#)). Here, we describe AR as our methodological framework. In Section 2.5.2, we briefly describe methods used for data collection and analysis.

2.5.1 Methodology Applied

The methodology of choice for our study is Action Research (AR). Here, we present a justification for AR choice. We present its various definitions followed by the adopted AR model.

Why Action Research for Our Study?

The main reason for choosing AR was our need to take action, at the same time gaining understanding of the DLM context. We needed a methodology that allows for acquisition of knowledge as the research and action taking progressed. AR is one such method; it allows learning during the research process. The second reason was our participants. We were looking for a method that would give us the chance to have our study objects as participants and co-researchers (Baxter and Jack, 2008). On the same note, AR provides for use of user centred design (UCD) methodologies (Hayes, 2011). In our study, our users were central and, therefore, we needed a method that could accommodate them.

Our third reason for applying AR was its use in real situations, rather than in contrived, experimental studies. The primary focus for AR is on solving real problems. As a democratic and participatory approach that focuses on practical problem solving, AR has been proposed as particularly the appropriate methodology of new media (for example mobile phone technology) projects (Hearn et al., 2008).

Developing software for informal setups is challenging because of the difficulty associated with user requirements. As a result, the design process does not usually follow ordinary software development processes. This brings out the fourth reason why a cyclic methodology, AR, which supports a cyclic process, was necessary for our study. The fifth reason was that AR has been successfully used in related areas of research (Lakshman et al., 2000; Polkinghorne, 2005; McLeod et al., 2011). Further, AR has been reported to be an effective research method for technology implication studies involving economically and digitally marginalised populations (Hartviksen et al., 2002; Chetty et al., 2003, Lennie et al., 2005). It has characteristics that can be corrective to deficiencies of positivist science (Susman and Evered, 1978).

AR Strengths and Limitations: Our Trade Off

In our study using AR, we considered trade-offs. For example, replicability and responsiveness are difficult to achieve at one time. The trade-off here was to get a responsive stakeholder (the DLM players) and risk the study outcomes not being replicable if a similar study was to be carried out somewhere else. AR, as a change technique, values responsiveness at the expense of replicability (Dick, 1993).

AR has been used in research contexts where subjects of study are difficult to access or may not be willing to be studied. In such cases, using AR, the subjects can be made co-researchers for easy access (Van der Meulen, 2011). In our preliminary study, we found that day-labourers and intermediary organisations were difficult to study particularly once they discovered that the researcher was neither an employer nor a Government employee or a representative. This necessitated a methodology that would deal with the challenges and unforeseen issues. Our only viable option, therefore, was to engage the DLM organisations as

partners on the basis of their benefits being the applications we were to develop and ours would be the research output.

The disadvantage we found with AR at the start was convincing the NGO with our methodology. As we later learnt, through [Baskerville \(1999\)](#), who wrote that AR 'looks like consulting, our initial explanation might have sounded like a consultancy. As a result, we had difficulties in convincing our stakeholders that our interest was helping them 'for free' and getting knowledge out of it.

AR and the Credibility and Integrity of the Research Results

While scientific research requires that the quality of research results produced can be generalised, AR has greater emphasis on transferability than generalisability ([Hayes, 2011](#)). Table 2.1 summarises the actions carried out to ensure our research credibility and integrity.

Table 2.1: Actions taken to safeguard our research resultsøcredibility and integrity

	Action	Description
1	Data Triangulation	Collected data from different regions/case study areas: four collection points in Cape Town on short term and two on a long term basis; two worker collection points in Johannesburg; one in Nairobi; and four in Windhoek, Namibia.
2	Method Triangulation	The data collection was done at different times (Table 5.1) using different methods described in Section B.2 page 197.
3	Long duration	Collected data and engaged the DLM stakeholders for over two consecutive years.
4	Solution outcome	We used the rate of success of our interventions to measure the understanding of the context we were working in. Large degree of workability (adoption of applications) is considered as one way of proving the credibility of research.
5	Number of case studies and amount of software	We designed software systems for three different case studies.

Validating Our Field Findings

In ensuring that the data collected was validated, we applied three mechanismsø summarised in Table 2.2.

Table 2.2: A summary of validation mechanisms for the data collected

	Validation	Description
1	Engaging participants	Every time we had a finding or information about the DLM, we went back to the DLM stakeholders to confirm the correctness of the information with them.
2	Using database	We compared some of our field findings with what the NGO had already captured in their database for over five years.
3	Using tactical means	At some point, we realised that it was difficult to find out factors such as mobile phone ownership and usage. For example, it was difficult to know how much airtime one had on their phone or whether someone really had a mobile phone by just asking them. For such situations, we, for instance, requested them to show us their phone model or asked them to send us an SMS.

Adopted Model of Action Research

The different AR models (Appendix B, page 193) indicate that the difference between AR and other research methods is in the way the enquiry/research process is carried out. Figure 2.6 shows our adopted AR model which is based on the three models presented in Appendix B page 193. In Appendix D page 207, we present how the model was applied.

Our adopted model (Figure 2.6) is cyclic in nature, and captures the key stages of AR: (1) Diagnosis, (2) Planning, (3) Action taking (4) Observation and (5) Reflection. The model has two non-repeatable stagesø conceptualisation/pre-diagnosis (before the diagnosis) and artefact and/or knowledge generation (the last stage of an AR process).

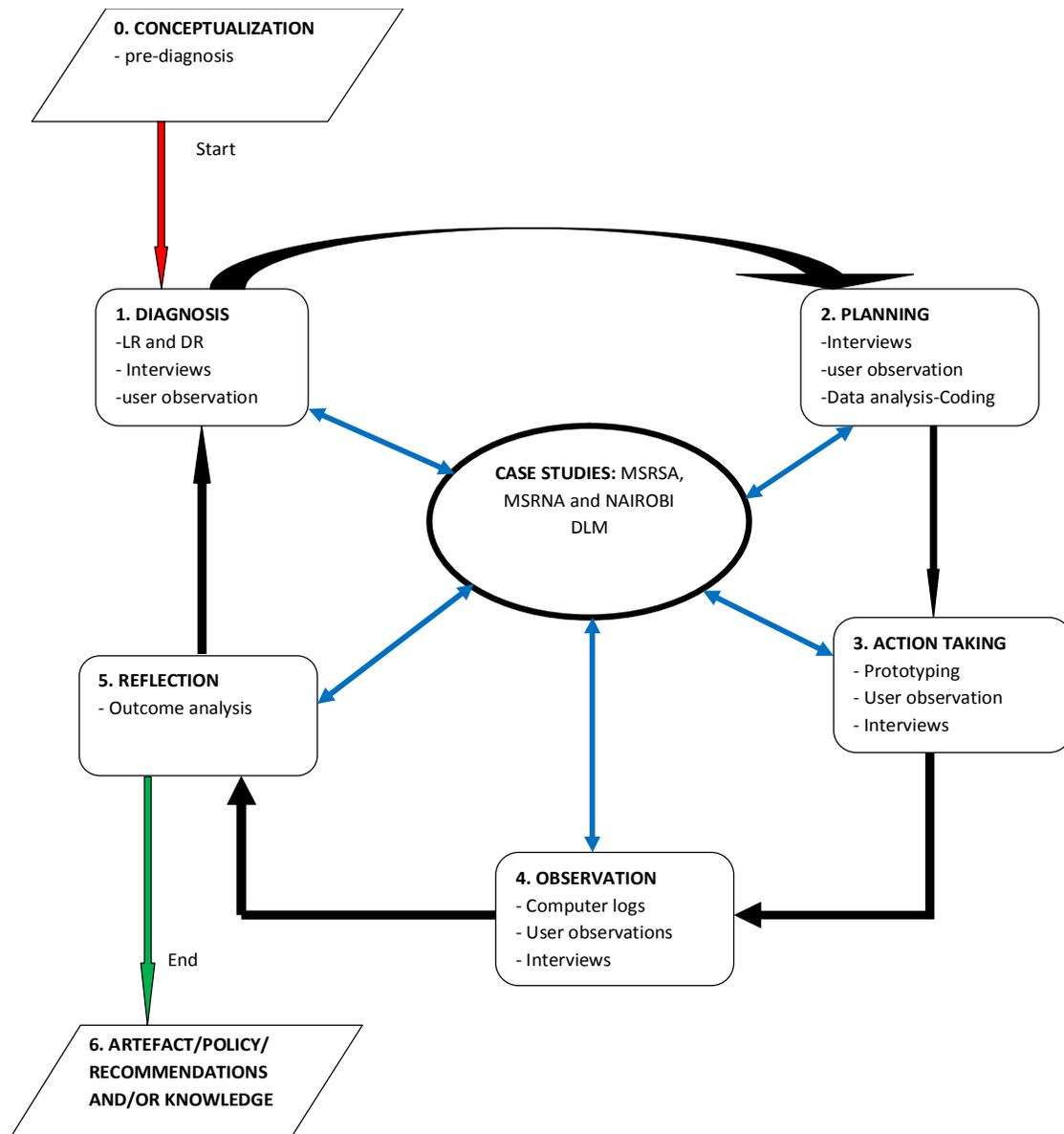


Figure 2.6: Our adopted Action Research model

Conceptualisation/pre-diagnosis—the researcher identifies the general area of study. Research question formulation is not taken into consideration. Obvious feasibility obstacles are likely to be identified. It is the initiation and the genesis of the AR project (Avison et al., 2001). This stage is not part of the AR cyclic steps. The research does not come back to it once it moves on to diagnosis stage. The outcome is un-scoped set of problems. If the community to be studied (Client-System Infrastructure) (Baskerville, 1999) is an organisation, it may opt for a consultant at this stage.

Diagnosis—is an exploratory stage described as a preliminary data gathering and understanding stage. In the first cycle of AR, it is a fact finding stage with research questions formulation (Hearn et al., 2008) and reconceptualisation (Dickens and Watkins, 1999) in the subsequent cycles.

Action Planning involves the following actions: (a) clarifying questions asked in the diagnosis stage (b) identifying actions to be tried out by developing an action plan (Hearn et al., 2008) (c) Defining more specific goals which can later be used to assess the success or failure of the initiative in question and (d) Depending on the initiative, extensive data collection and analysis. The objective is to clearly understand and refine research questions. In the subsequent AR cycles, modification of the action plan may also be done at this stage.

Taking Action Plan implementation and research questions testing in practice are the activities of this step of AR. Action taking as a function may include software development or evaluation of use of a technology (Hearn et al., 2008). The action taking stage is iterative in nature. In disciplines such Computer Science and Information systems where systems development is mostly involved action taking stage of AR involves system building, testing and deployment.

Observation stage Documentation of the effects of the action stage is done here. Also carried out here is a description of what has happened. At this stage, the action researcher first describes the situation following the first action steps and then beginning to explain the situation. It may also involve more data collection.

Reflection stage This is an evaluation stage of AR. It is a process that involves making sense of problem issues and processes, interpreting a variety of information and perspectives and negotiating meanings (Hearn et al., 2008).

Artefact and/or knowledge commissioning At this stage, the outcome is shared among the researcher and the client. For cases where the outcome is an artefact, this stage will allow for a final deployment and a plan on how to leave the research site.

2.6 Specific Definitions

Many of the terms and phrases used in this study may have different meanings depending on the use context. Hence, we define them as used in our study.

2.6.1 Literacy/Illiteracy

The terms literacy and illiteracy have different meanings (Scribner, 1984; McKenna and Robinson, 1990; McMillan, 1996) and are difficult to define (McMillan, 1996). Although literacy has no universally accepted definition, it is defined in terms of years of schooling completed (Hillerich, 1976). For the purposes of our study, we define literacy and illiteracy based on the number of years one attended school (Hillerich, 1976) and, hence, the ability to process information using text (McMillan, 1996). We defined illiteracy as the opposite of literacy and it means the inability to process information using text. Those who could read and write were regarded as literate while those who could not were referred to as illiterate.

2.6.2 The Poor

The poor are those people living on less than USD two per day, per capita at purchasing power parity (PPP), while the extremely poor live on less than USD one per day (Banerjee and Duflo, 2006; Kumar et al., 2007; Heeks, 2009a; Nissilä et al., 2009). Although we could not find the exact average day-labourer's earnings because of the difficulty of knowing the number of days they were employed, our field studies showed that they lived on less than two

USD per day whenever they were out of work. Previous research has also shown that the day-labourers are poor (Gonzo and Plattner, 2003; Blaauw et al., 2006; Blaauw and Pretorius, 2007; Medhi et al., 2008).

2.6.3 Developing World

Developing world¹⁰ also poor countries; underdeveloped countries; less developed countries (LDC) or least developed countries (LDC); developing economies or generally developing regions¹⁰ has been described using many different terms and phrases which are often used interchangeably. These countries are found in Africa, Americas (excluding Northern America), Caribbean, Central America, South America, Asia (excluding Japan), Oceania excluding Australia and New Zealand (UN statistics division¹⁰). In this study, we used the terms 'developing' or 'underdeveloped country' to describe regions where the poor inhabit and have infrastructure and economies that make survival for the poor challenging. For the purposes of this study, developing world means Africa and more specifically the countries in which our case studies were conducted.

2.6.4 White-Collar and Blue-Collar Workers

We use the term 'white-collar worker' to refer to a worker who does not perform manual work and mainly works in an office. White-collar workers are mainly employees of a service industry and earn a salary. Blue-collar workers are workers who perform manual labour most of the time and earn hourly or daily wages¹¹. In our study, we described day-labourers as blue-collar workers whenever they were employed. A typical day-labourer is otherwise unemployed.

2.6.5 White-Collar and Blue-Collar Workers

Field study in this research is used to mean all the field work done during the course of our study. It combines all the observations, interviews, shadowing, questionnaires and any other way of collecting data from the stakeholders.

2.7 Setting the Context Conclusion

We have introduced the concepts to be used in our study. The objective was to make clear the meaning of each of the components of the study. This chapter is a definitions chapter with the aim of setting our study context. We described what makes up our study context (DLM) and explained the specific cases which we refer to in the rest of our study. The definition of ICT4D serves to contextualise the definition for our study. We have also introduced telecommuting/teleworking whose definition will be referred to throughout the study. Also introduced are working definitions of specific terms and phrases which have no acceptable universal definitions.

¹⁰<http://unstats.un.org/unsd/methods/m49/m49regin.htm#developed>

¹¹<http://smallbusiness.chron.com/bluecollar-worker-whitecollar-worker-11074.html>

CHAPTER THREE

RELATED WORK

3. Introduction

In this chapter, we present literature about the day-labour market (DLM), telecommuting, ICT4D and ICT4D interventions. We also briefly discuss systems that have attempted to solve employer-worker problems. Since we used Action Research, (reasons in Section 2.5.1 page 30), we also review AR literature. Finally, a discussion of the literature review findings is presented.

The purpose of the literature review is to contextualise the study. Although not many of the studies reviewed are similar to our research, the review gives us insights into the different areas of our study. Since we had no prior research experience of the DLM, there was need to fully understand it before engaging with it. Telecommuting has different contexts or study perspectives. Our review of literature in telecommuting, though mainly from the developed world, will help us in scoping our research. We reviewed literature on mobile phone and development related studies because of our study context and the interest of mobile phones as the technology of choice, especially in the developing world.

3.1 Day-Labour Market (DLM)

Here, we review research that has been done on, or about, DLMs. Most of the research studies regarding the DLM have been done in social science and economic studies, with little ICT related studies. Reviewing literature from other disciplines on the DLM aided in understanding its context.

3.1.1 Studies About the DLM

A study by [Valenzuela Jr. \(2001\)](#) used day-labourers as a case study to challenge what she called "the narrow and conceptually problematic definitions of entrepreneurship". The study was empirical with 481 randomly surveyed day-labourers at 87 different hiring sites throughout Southern California in the USA. The study found that a significant segment of the day-labour population comprises survivalist entrepreneurs. The study concluded that day-labourers are not entrepreneurs but are just survivors who work to maintain themselves and their dependants. Day-labourers are in the day-labour job arrangement because they do not have many other economic options ([Valenzuela Jr., 2001](#)), a finding echoed in our field studies.

To describe the characteristics and the suffering of day-labourers, [Blaauw et al. \(2006\)](#) used day-labourers in Pretoria, SA as a case study to investigate the employment history and income earned by day-labourers. The study gave a vivid description of the characteristics of day-labourers as mainly male, young, low skilled, earning low and uncertain levels of income and working under harsh conditions. Still in SA, a study by [Harmse et al. \(2009\)](#), revealed that, even though local governments reported no day-labourers in their municipalities, counting by the researchers showed otherwise. In Namibia, [Gonzo and Plattner \(2003\)](#), by detailing quantitative results of various aspects of the day-labourers, described the problem of unemployment and how day-labourers experienced psychological problems due to challenges

in the DLM. The studies by [Harmse et al. \(2009\)](#), and [Gonzo and Plattner \(2003\)](#) validate our knowledge and field findings on the suffering and poverty levels of the day-labourers.

In the informal sector, [Wells and Jason \(2010\)](#), studied informal labour in the construction sector in Dar es Salaam, Nairobi, Cape Town and Nepal. The study indicated that the function of an intermediary, also referred to as a labour-broker or labour agent, is to bring labour to the construction site when it is needed and taking it away when it is no longer required. [Wells and Jason's](#) study relationship with our work was the common cities (Nairobi and Cape Town) of study. The difference with our study is that [Wells and Jason's](#) work was mainly on construction workers who are in most cases more skilled than the majority of general day-labourers, most of which were found in our field study. From [Wells and Jason](#), we learnt that intermediaries are not employers.

Day-Labour Centres

Worker centres serve the workers by organising, building on-going institutions and engaging in leadership development among workers to take action on their own behalf for economic and political change ([Fine, 2006](#)). In another similar study, [Bartley and Wade \(2006\)](#) used qualitative and quantitative evidence to uncover the informal order of the day-labour hall (a kind of day-labour centre), as experienced by homeless workers. The main finding by [Bartley and Wade \(2006\)](#) was that the dispatchers, who decide who gets a job, were being discretionary and discriminative. As a result, workers had started adopting tactics for being anonymous to avoid being discriminated against. The study also pointed out equitable and efficient distribution of jobs as a benefit of labour market site. The significance of the two studies was the understanding of the difference between worker centres and intermediary organisations that do not operate the worker centre model. The concept of intermediary organisations was emphasised by [Bartley and Wade \(2006\)](#) and [Fine \(2006\)](#).

Similarly, [Camou \(2009\)](#) examined the efforts to organise day-labourers towards a day-labour centre. The key issue was the efforts required in transitioning of day-labourers from street corners to worker centres. The finding was that, when considering worker organisation, questions about the meanings and purposes of day-labour centres are critical. [Camou](#) found that day-labourers were interested in material gain when moving to worker centres, while the organisers were interested in solidarity and collective action by workers. This study confirmed that economic gains are what drive day-labouring ([Valenzuela Jr., 2001](#)).

In a study by [Melendez et al. \(2009\)](#), we encountered the different definitions used and understood the operations of worker centres and, by extension, intermediary organisations. It confirmed that the informal sector may be here to stay and even expand. [Valenzuela Jr. et al. \(2006\)](#) profiled the national phenomenon of day-labour in the United States and found that the DLM was rife with violations of workers' rights and denied payment for work done. They also found that workers are subjected to hazardous job sites, and most of them endure insults and abuses by employers. These studies confirmed our field study findings, presented in Section 6.1.1 page 79, 6.2.1 page 100 and Section 6.3.1 page 110.

In an all inclusive study describing the DLM, [Valenzuela Jr. and Melendez \(2003\)](#) asked the following questions: who are day-labourers? What are the earnings and work conditions?

What do day-labourers do? Why work day-labour? Who hires day-labourers? Are day-labourers abused? We found this study all inclusive in describing the DLM. The [Valenzuela Jr. and Melendez \(2003\)](#) research seemed to summarise other findings that came before. Just like [Wells and Jason \(2010\)](#), it clearly described the relationship among day-labour stakeholders and confirmed some of our findings (Section 6.1.1 page 79, 6.2.1 page 100 and Section 6.3.1 page 110), on earnings, work arrangements and poverty levels among day-labourers.

Although the above studies describing the DLM were not ICT related, they gave insights on the meaning of worker centres and the DLM. Some of the insights include:

- The DLM consists of day-labourers who earn very low wages and, hence, can be classified as among the poor in the society.
- The organisation and collaboration structure of the DLM stakeholders. This insight of how DLM stakeholders relate brought about an aspect of the possibility of using software applications, for example mobile phone applications to design systems that can allow the DLM stakeholders to collaborate better.
- The day-labourer sufferings reported by the review confirmed the problems presented in our problem definition (Section 1.1 in page 2).
- The confirmation that the DLM may be here to stay justified the fact that there is need to think of solutions to some of the most pressing problems of the DLM.

These insights shaped our study by giving a guide on the variables to use for data collection. For example, the average wages, the number of days that a day-labourer was out of work; the distance they travel in search of work and the average spending. The lessons also led to understanding the relationship between the DLM stakeholders.

Their limitation, in relation to our study, is that none of the studies reported on technology, for example mobile phones, was for use by the DLM stakeholders.

3.2 ICT4D

ICT4D is a relatively young discipline. Research has been directed in ICT application areas such as health, food security, education, environment and entrepreneurship. Little relate to DLM studies. Section 3.2.1 gives a review of example studies done under the ICT4D umbrella. We then review ICT4D interventions in Section 3.2.2, where we find that mobile phone pervasiveness, poverty and cost saving are the key pillars of the various studies.

3.2.1 General ICT4D-Related Studies

We used the phrase “general ICT4D related studies” to refer to those studies that do not involve building of any hardware or software artefact/intervention. Mostly, these are studies which describe ICT4D interventions or potential of the existing technologies to positively change the lives of their users. Studies about design issues and challenges in the context of ICT4D are reviewed. Only a few examples of these studies are presented because of the large pool of the research articles describing non-artefact studies.

Mobile Phone and Economic Related Studies

Mobile phones can act as bridges for low-income users from their present voice-dominated usage to more advanced uses such as teleworking (Dunn, 2009b). There is empirical evidence of the strategic role that mobile telephones are playing in the economies of developing countries (Frempong, 2009). The Dunn and Frempong studies used telework as an example of what can be achieved by the mobile phone technology innovations. A similar study is by Plauché and Prabaker (2006) on a speech-driven agricultural query system. Though not mobile technology based, it showed how it is possible to send queries to remote systems, hence proving that it is possible to innovate using telephones for use in remote-related actions even with low-literate levels.

Abrahams (2007) and Eggleston et al. (2002) show how mobile phone technology has improved the trading activities of fishermen and agricultural sectors and their traders. Abrahams notes that mobile phones ought to lessen the information asymmetries in markets, thereby making rural and undeveloped markets more efficient. Eggleston talks about information technology venturing into poor communities and being valuable commodities that can enhance the functioning of markets critical for the well-being of the poor. According to the UN study (2010), the main potential benefits of ICT use are twofold: (a) a reduction in information search and transactions costs; and (b) improved communications within supply chains leading to benefits for individual enterprises and overall improvements in market efficiency. Job-searching and worker-search can be modelled as a selling and a buying activity respectively. Donner (2006) describes how people can use mobile phones to improve their social and economic status. The contribution of these studies is the role played by the mobile phones in improving efficiency and, hence, the economic and social development of the users. The difference with our study is that our approach was designing ICT applications for the DLM while the above studies were not software systems design related.

Studies Focusing on Development Aspects

There are two ways in which ICT4D can affect the user (Pal, 2008):

- Users get in contact with the technology itself and
- Users benefit from services provided by technology infrastructure.

We applied Palø (2008) concept (Section H.1) to decide whether we could design directly for our target users (workers) or have them access services through intermediated interaction (intermediary organisation).

In his work, Sturm (2009), in his argument that ICT can help in economic and social development, describes some ICT4D solutions, such as *Mashups*, that use internet and mobile phones to serve the underprivileged. Kuriyan et al. (2008) gives the challenges of having ICT4D benefit the poor. The Kuriyan study, and other studies such as Heeks (2008); Aker and Mbiti (2010); GSDRC (2010), emphasised the importance of taking into consideration socio-economic issues of our target users.

3.2.2 ICT4D Interventions, Software Application Design, DLM and AR Related Studies

We are specific to AR because it is our main methodology (Section 2.5.1 page 30). Since we did not find work fitting directly to our review category, we resorted to ICT systems that were intended for work-related interventions and with similar organisational arrangement such as NGOs.

Context and AR Related Work

The use of AR in systems design and development, both in Computer Science and other related disciplines is limited (Byrne, 2005). In his work to review literature on the use of AR in Information Systems (IS) studies, Lau (1997) found that out of 600 articles retrieved, only about 11% used AR in IS. Also showing the scarcity of AR literature in IS is Baskerville (1999). The informal sector or DLM related studies were not found in our search. As a result, we present the closest studies in terms of characteristics of the target group/case study, ICT4D context or AR in systems development. We categorised these studies based on their relationship with our work. They included research that had:

- a) Both similar research context and methodology
- b) Similar contexts and organisational arrangements only
- c) Methodology similarity only

Examples of research work that fall under each of the categories are presented next.

a) Research Context and Methodology

A closer related work by virtue of the organisational arrangement, methodology and intervention is by Chang et al. (2010). Applying the cyclic nature of AR, they reported work on design and implementation of information systems to overcome inefficiency and frustration in connection with legacy systems and improve the dissemination of mission critical information at an NGO in Taiwan. The NGO provided supported employment for people with severe mental illness. Their target was for social workers to improve the quality of their services. The first similarity with our work is on use of an NGO and NGO's employees (social workers also called Job coaches in their case) to aid in improving the services of the disadvantaged. The second similarity is the application of AR as a methodology while the third is the target usage context - employment. The fourth similarity is with the tools built. Chang et al. (2010) introduced an online forum system to facilitate NGO programs as a computer mediated communication tool. In our case, we introduced a number of mobile and web-based applications to aid in worker and employer management by the DLM NGOs. The difference, however, was in the kind of disadvantages that the target end users faced. In our case, the people we were dealing with are unemployed; have low literacy levels and lack technical skills. Chang et al. (2010) were dealing with people with severe mental illness and it was not clear whether they were looking at long or short term employment.

A similar study, in the category of using intermediary organisations and applying AR, is one by Raman et al. (2011). The work explored the idea of using a knowledge management system to support disaster planning and response (DPR) efforts for social workers involved in

such efforts in Malaysia. This work is among the most recent and one of those close to ours in a number of aspects. One, it is working with a similar set up as ours - The Malaysian Association of Social Workers (MASW) as the client organisation (intermediary organisation), with social workers as employees of the organisation. In our case, the DLM intermediary is the organisation with field officers as their employees. The Raman et al. (2011) development of software (web-based system in an intermediary set-up) as their intervention is the second reason why it is related work. The third reason is the use of AR as a research method. Fourthly, although it was not reported to have been done under the context of ICT4D, the study was done in Malaysia, a developing country. The difference from our study is that Raman et al. (2011) study had only one case study as opposed to three for our case.

b) Context Related: Poverty, illiteracy, NGOs, Work Search or Mobile Technology

Job Search-Related Studies

In a closely related work in the context category, Medhi et al. (2007) describe work to design job search and a generic map for a community of illiterate domestic labourers. The job search application was meant to be used by domestic labourers to look for jobs. Our study context resembles the work of Medhi et al. in many aspects. One, the study was done in a city slum with domestic labourers, who have similar characteristics with the majority of the labourers who can be, for example, illiterate or semi-illiterate and constantly on the lookout for jobs. Another similar characteristic is the use of NGOs to gain access to the community. We used NGOs working for the DLM while Medhi et al. worked with an NGO working for women. (Medhi et al. did not indicate specific areas where the NGO was working in). The point of departure of our work from Medhi et al. is the study objective. While Medhi et al. were testing the user interface for illiterate or semiliterate workers concept, we were studying the viability of ICT - mobile phones - applications that can reduce travel in developing world.

Another closely related work is by Ghayur (1994), who describes how a Labour Market Information System (LMIS) can be developed for the Informal Sector (IFS). The study was done in Pakistan and describes labour information systems and how they can help in minimising the imbalances of supply and demand of labour. The study provides guidelines on how to develop LMIS for IFS. In our study, we associated with Ghayur (1994), as its main aim was building LMIS for informal labour, where the DLM belongs. The importance of LMIS was emphasised with discussions on limitations of existing LMIS. This helped us in conceptualising the kind of systems to design. In yet another study on low income domestic workers, Medhi et al. (2008) described work done in implementing a paper-based system that provides the intended functionality of helping match low-income domestic workers from an urban slum with potential middle-class employers in Bangalore, India. This work is close to ours in that the study contexts are similar in some aspects. For example, the employer-worker relationship existed and the idea was to match the two. Domestic workers who were being studied could be classified as day-labourers, a group that was central in our study. Another similarity with the Medhi et al. (2008) study is the low-level of literacy among the workers. From the work of Medhi et al., we gained knowledge on how to weigh design options for illiterate users. A study by Findlater et al. (2009), which reported work to compare semi-

illiterate and illiterate users in system design, is another study that helped in understanding our target users. The study showed the need to treat semiliterate users differently from illiterate users in the interface design.

Although [Kishore \(2009\)](#) work gives close arguments to ours in terms of possible ways of using ICTs to help reduce the number of lower-class job-seekers, it emphasises on using ICTs as a training platform to increase the employability of job-seekers. This study gives many options of using ICTs to impart skills on job seeking. [Kishore \(2009\)](#) further looks at cases in which ICTs have been applied for employability in India. Examples given include job portals, mobile job services, freelancing platforms and social networking. This study, even though it was mainly geared towards university graduate job-seekers, aided us in understanding how different organisations model the job search environment for different contexts.

An SMS-based job matching application developed by Palestinian-Canadian NGO *Souktel* was described by [Houssian \(2009\)](#). This application was for giving young job-seekers real-time information about local jobs, and connecting them directly with employers. The system provides a typical model that can be used to build systems for the DLM. It shows a simplified way in which workers and employers can be connected remotely. However, it ignored the low-skilled illiterate day-labourers. The simplified way in which the work is presented was found not to be ideal in the DLM where intermediation is needed and where workers still commute to collection points even when they have mobile phones. It also ignores the cost of using the system by the low-wage workers.

A study by [Kumar et al. \(2008\)](#), on unorganised skilled workers, which they referred to as an unorganised workforce within the micro-business segments, aimed to identify the pain points in operational model of the day-labourers. They proposed an approach for delivering benefits of IT solutions to the workforce. The specific IT solution for the labourers was the *VoiAvatar* system which could be used by micro-businessmen (who include job-seekers) to create their own virtual avatars by making a phone call. The virtual avatars could then be accessed to get information about them and their work. The [Kumar et al. \(2008\)](#) study only considered workers that possessed trade skill and illiterate, with most of them having less than five years of elementary schooling. Similar to the *VoiAvatar* is the *VoiKiosk* system ([Agarwal et al., 2009](#)) that provides a voice-based kiosk solution for people in rural areas to create and manage information. The *VoiKiosk* system was meant to be affordable and allow illiterate users to comfortably use it. Although we think that the *VoiAvatar* and the *VoiKiosk* systems are valuable, for example the *VoiAvatar* in organising labourers, our field work findings and understanding indicate that such systems are bound to have numerous challenges. For example, it is possible for a criminal to create an avatar for themselves. The second challenge could be that of cost effectiveness. In SA where phone call charges are high for example, creating an avatar can be prohibitively expensive for a day-labourer.

A study targeting illiterate users and interested in information sharing was reported by [Putnam et al. \(2009\)](#). It described a mobile social software (*MoSoSo*) directory that enabled users to access listings for local businesses rates, view ratings of local businesses, and create password-protected shared directories that could contain business listings, ratings, and message boards. The *MoSoSo* design was done by applying user centred design (UCD) and

targeted users, who were typical of our target group i.e. the poor, semi-illiterate and those above the poverty line (the employers). Similarly, a directory service for multi-literate users made specifically for rural communities and for users with low written and computer literacy was reported by [Sin et al. \(2004\)](#). The directory service was reported to support an interface design that allows users to perform directory searches for people across a number of dimensions without requiring written literacy or keyboarding skills. The lessons we gained from the [Sin et al.](#) and [Putnam et al.](#) studies include design lessons in a poor resource contexts. These studies also showed the buyer-seller model in information sharing.

Non-job Search-Related Studies

With the goals of improving the efficiency and increasing the accountability of various stakeholders for internal control at a coffee cooperative, [Schwartzman et al. \(2010\)](#) presented the motivation, design and evaluation of an automated mobile data collection, evaluation and reporting system. Just like our study, the [Schwartzman et al.](#) study involves transitioning from paper based to mobile phone based data collection and reporting. Coffee farm inspectors, who capture data in the farm, are comparable to field officers in our study. It is also concerned with measuring the savings in time and cost of the operation. The difference with our study is in the context, where [Schwartzman et al.](#) is working with coffee farmers.

The *Warana Unwired* project ([Veeraraghavan et al., 2007](#)). The work presents an experiment to find out the dynamics of replacing a PC-based system in a PC kiosk with a mobile phone-based system. Though in a rural setup, a number of contexts could be related to our work. For example, for farmers to query the system remotely was significant. In the *Warana* project the cost of using the new mobile system was a concern. One of the advantages we expected in our study, also seen in the *Warana* project, was flexibility in mobility. Kiosk operators, who doubled as agriculture extension aids and worked with their districts agricultural extension field staff, frequently made rounds in the village. Empowered by the mobile application, the kiosk operators would provide farmers with their account information in their field. The same was possible for the field officers in our case, where they share workers and employer information from the field.

c) Methodological Relationship: Action Research and Related Research Methods

In this category, we look at research that applied AR and related methods. We start with research done in SA. Studies dealing with illiterate and semi-literate users and applying AR using UCD were reported by [Blake et al. \(2001\)](#) and [Blake \(2002\)](#). In these studies, a field computer for animal trackers was build to empower semi-literate animal trackers. As an AR project, apart from benefiting users, community benefits had to be factored in. The community stake in the project was that it gained from access to the knowledge of the trackers on animal behaviour. The need to benefit both workers and the community in our study was motivated by AR research themes some of which were articulated by [Blake et al. \(2001\)](#) study. Findings from the animal tracker study were used as lessons to guide our study. Insights from methods applied and the context were important. A key context characteristic in our study was the field officers who could be comparable to the animal trackers. The animal trackers in the [Blake et al.](#) work were employees of the wildlife service, which was the benefiting organisation and comparable to the DLM intermediary organisation in our study.

Work by [Byrne \(2005\)](#) to design and develop a paper based and orally communicated child health IS was equally relevant to our study. It involved working with an NGO with a population which was ðmainly rural, poor and relatively under-resourcedö [Byrne \(2005\)](#). The fact that they exhaustively described what AR is and applied it made [Byrne \(2005\)](#) work particularly relevant. It showed the process of applying AR in a community served by NGOs. Still in health, a study by [Chetty et al. \(2004\)](#) presented the experience of developing a telemedicine application for a rural village in SA. Our work, though not in rural areas, shared methodological, contextual and socio-economic issues as those of [Chetty et al.](#) The poverty levels among our target group (day-labourers) and that of [Chetty et al.](#) (rural patients) were comparable. Our method is cyclical participatory AR while that of [Chetty et al.](#) was participatory, iterative and cyclical software development lifecycle. Another work in clinical research is by [Gregory et al. \(2011\)](#), who presented an AR study to evaluate and improve preoperative education for patients awaiting colorectal surgery. The AR process involved three cycles of planning, acting, observing and reflecting. The studies by [Chetty et al. \(2004\)](#), [Byrne \(2005\)](#), and [Gregory et al. \(2011\)](#) are relevant also because of the methods they used for data collection. Another study, done in Kenya and applying AR, is by [Nissilä et al. \(2009\)](#). It discusses the development of a Management and Member Information System (MMIS) for co-operative societies and producer organisations in developing countries to improve their business efficiency.

The experiences described by [Braa and Hedberg \(2002\)](#), [Thompson \(2002\)](#) and [Mosse and Sahay \(2003\)](#) shaped our study, first because of the AR process and the context under which it was applied. We gained the insights of applying AR in environments where the way of operation changes in the process of studying. In the [Braa and Hedberg](#) study, there were scenarios where software implementations failed because the organisation they were working with changed their way of operations. We were also dealing with an evolving NGO. The [Thompson \(2002\)](#) project applied AR in two South African townships in Cape Town. The objective of [Thompson](#)'s work was to roll out an action-led district based health MIS which allows health staff in local clinics to take control of, and benefit from, their own health information. Yet another Health information system applying AR is by [Mosse and Sahay \(2003\)](#). These studies, apart from using AR as a methodology model, the circumstances can be closely related to our study context. First, the subjects involved are distributed. Secondly, they are in many different groups that need to cooperate, i.e. doctors, nurses and community nurses, and third is the fact that the study context is a resource limited in terms of network connectivity and the primary beneficiaries (patients) are mostly poor township dwellers.

Still in health, the study by [Bjørn and Boulus \(2011\)](#), who, in an effort to provide solutions for dealing with dilemmas and uncertainties related to AR's roles, described two studies carried out in Canada. The studies were (1) a three-year study of the implementation of electronic medical records (EMRs) within a community health centre, and (2) a two-year study of the design and configuration of an electronic triage (allocation) and tracking system within a paediatric emergency department (ED). This study was particularly relevant as the lessons put forward helped us deal with a specific case where a DLM intermediary organisation changed their operations policy and consequently changing their underlying information management systemsö the change process is described in Section 6.1.4 page 99.

Reflective monitoring concept described by Bjørn and Boulus (2011) was particularly very helpful in dealing with the change in organisational operation of the NGO. The other significance of this study is that it describes a study involving a software system intervention over a long period of time, a scenario in which we were.

Work by Dörflinger and Gross (2010) using AR described the use of mobile phone applications by a virtual group of *spaza* shop owners to order their stock. The application has an architecture that could be compared to ours as the suppliers, who are the middlemen or mediating organisation, and the *spaza* shop owners could be related to the day-labourers, intermediary organisations and employers in that order. The study has the supplier-consumer relationship with a middleman setup. A glaring difference in our study is that all the three stakeholders of Dörflinger and Gross (2010) work have some level of guarantee to make money. In our case, day-labour workers are not entrepreneurs (as is the case for *spaza* shop owners) and, therefore, are likely to be poorer than *spaza* shop owners.

Other studies that applied AR and, hence, were relevant to our study include Susman and Evered (1978); Baskerville (1993); Henfridsson and Lindgren (2005); Davison (2001); Iversen et al. (2004); Raman et al. (2006); Schaffers, et al. (2008). Baskerville (1993) described a technique for improving the semantic consensus of conceptual database designs. In their study to design and implement a web-based knowledge management system for enhancing emergency preparedness efforts, Raman et al. (2006) applied AR. Schaffers, et al. (2008) discuss how the AR paradigm provides guidance to implementing living labs. Such work, dealing with ICT and rural development, providing software as interventions and introducing change through or using AR, can be matched one to one to our study except for the context. In studying software process improvements (SPI) in four Danish software companies, Iversen et al. (2004) applied collaborative practice research (CPR) a form of AR. This study is relevant to ours in that it uses AR and is in the area of software design. The Iversen et al. (2004) study also lists and explains clearly the processes of AR. Davison (2001) reported work which applied AR to explore how a Group Support System (GSS) can enrich the training of police officers in Hong Kong Police force. The application of AR to Davison's work used an existing windows group support system application. The similarity with our study is with the use of AR as a methodology and the application in IS. The Davison study, however, took only five months and did not involve any software as compared to ours which took close to three years and involved development of various prototype applications. A study by Henfridsson and Lindgren (2005) applied grounded AR with the objective of developing and testing design principles for handling the multi-contextuality associated with mobile device use in cars. The study had a clear description of AR steps adapted from the Susman and Evered's work (1978). Henfridsson and Lindgren (2005) study also applied prototyping mobile phone applications to test their concepts. In our study, prototyping played a key role in designing software application for the intermediary organisations.

Non-IS Studies

We found non information systems projects that were relevant by their methodology. L'Etang and Theron (2011) applied participatory action research (PAR) in the development of cognitive-behavioural based counselling intervention programme for youth living with

HIV/AIDS in a rural South African town. The design process resembled PAR in software development except that it was not a software project. [Luckett et al. \(2001\)](#) gave an elaborate view of using AR in a South African context. Similar elements between our work and [Luckett et al. \(2001\)](#) include: The context – the poor, referred to as under-resourced; the use of AR and use of an organisation that works on behalf of the target group. The differences lie in the fact that our context is mainly in the cities while that of [Luckett et al.](#) was in the rural setup and the fact that it was dealing with management as opposed to ICT-related interventions.

In the use of AR in policy-making, a case in the dairy industry in Gujarat, India, ([Mehta et al., 2004](#)), conducted a study focusing on staff function and relayed improvements that can influence policy related to decision making. Their outcome was a model for giving a clear picture of how important the role of staff function is in a dairy co-operative for improving efficiency and effectiveness. In production, [Brandt \(2004\)](#) described work that used AR to introduce a new product program for two companies producing components and temperature control system solutions. [Lev-Wiesel \(2009\)](#) describes work in sociology where an AR approach was used in enhancing potency among male adolescents at risk to drug abuse. Though [Lev-Wiesel](#) is purely a social study, it has one similarity with our work in that she is working with poor youth in urban towns. [Rhodes \(2009\)](#) applied PAR to explore the impact of network translations on the actor-network of a South African rural women's development organisation. [Kim \(2009\)](#) focused on developing a mobile learning model of literacy development for underserved migrant indigenous children in Latin America. This work applied the cyclical action model of AR and uses mobile phones. The context of study is also that of disadvantaged (economically, educationally, geographically, and technologically) groups. Other application areas include education, for example ([Riding et al., 1995](#); [Jove, 2011](#)).

3.3. Other Related Studies

Table 3.1 summarises work conceptualised in a way that shares some study concepts with our study. These include transition from paper to mobile data capture-related; CSCW and mobility and remoteness concept studies.

Table 3.1: Other related work

Work	Concepts; Similarity/difference to our work
(Ho et al., 2009b)	<ul style="list-style-type: none"> Organisational relationship between the health workers, patients and the clinics is similar to that of DLM stakeholders. The prototyping tools (J2ME and MySql/PHP) and the general system architecture were similar to ours.
(Eagle, 2009)	<ul style="list-style-type: none"> Had the concept of distributed workers. Is different in that it is a platform for doing work but not for facilitating searching for work.
(White et al., 2010)	<ul style="list-style-type: none"> The remote concept <i>Designing Enterprise Applications that Connect Employees on the Go</i>. Its employees were not restricted to a particular class e.g. low-skilled. Concentrated less on the connectivity of employees but more on user interfaces.
(O'Hara, et al., 2001)	<ul style="list-style-type: none"> The conversion of the paper-based data capture to mobile phone based data capture application. Did not differentiate between different levels of professionals
(Luff and Heath 1998)	<ul style="list-style-type: none"> Remote mobility: paper-based allocation sheets were replaced with an electronic system in a construction site. Was done under CSCW and used PCs only. The context is similar to ours: about builders (who may be day-labourers), the organisation, and the person in charge of the building site (field officer or employer for our case).
(Skattør et al. 2007)	<ul style="list-style-type: none"> Mobile services supporting mobile work among non-office workers, a case of construction workers. Non-office workers definition used suits the day-labourers and the field officers. Concentrated only on work execution and not work search. Was done in the developed world.
(Tamaru, 2005)	<ul style="list-style-type: none"> Describes how cellular phones have changed the working style and communication patterns of mobile workers. It is also concerned with mobile workers already working and not the jobless.
(Brodie and Perry, 2001)	<ul style="list-style-type: none"> The study process and the argument for the design of mobile applications for blue-collar jobs instead of concentrating on white-collar jobs was important to our study. Done in the UK.

3.4 Commercial/Proprietary Day-Labour Systems

We looked at IS systems implemented for the DLM. The first examples have a search portal for either workers, employers or both. Examples include SMS2work¹², Kazileo¹³, Kazi560¹⁴; dreamworker¹⁵; the babjob portal¹⁶ and Souktel¹⁷. Their limitation is that they are either too

¹²<http://www.sms2work.com/>

¹³<http://www.kazileo.co.ke/>

¹⁴<http://www.kazi560.co.ke/>

¹⁵www.dreamworker.org.za

¹⁶www.babajob.com

¹⁷<http://www.souktel.org/>

expensive to use or are meant for interactions between white-collar or higher level blue-collar workers (Chepken et al., 2011b).

The second examples are those that give workers/job-seekers a voice. They include Mobile voice¹⁸; Migrant Voices¹⁹, Communication for Social Change with Garment Workers and Day-Labourers in Los Angeles²⁰; and migrantvoice²¹. All these are systems in the developed countries and assume that users have access to technologies such as computers with Internet.

3.5 Telecommuting

3.5.1 Background

A search on telecommuting literature in the developing world, and specifically Africa, yielded very little. This confirmed a similar finding by Nortjé et al. (2004) who reported no teleworking research in SA—the economic giant of Africa. Even telecommuting literature review articles yielded nothing. To obtain knowledge to help in situating and scoping our study, we resorted to reviewing literature from the developed countries. We needed to understand the different perspectives of telecommuting/teleworking studies.

Since most of the telecommuting studies and practices are in the west—mainly the USA and the United Kingdom (Daniels et al., 2001; Safirova, 2002; Sullivan, 2003; Cowell and Dunn, 2006)—most of the related work comes from these regions. Many of the studies, for example those of Nortjé et al. (2004) and Dunn (2009a), do not involve building ICT applications to support telecommuting. Rather, they investigated the extent of the phenomenon; pilot implementations; perceptions of remote work from non-telecommuters; lists of advantages and disadvantages, or work-family conflict issues (Belanger et al., 2001).

Even in the developed world, literature on telecommuting is still thin (Nilles, 1988a; Hill et al., 1998). As Hill et al., (1998) puts it, *“A traditional literature review yields little empirical information about telework in any form. Most of the limited scholarly research available has focused on telecommuters—those with a fixed alternate worksite at home—not those who work in the virtual office with the flexibility to work from a variety of locations”*. With the work of Nilles (1988a) and Hill et al. (1998), one can easily argue that the reporting are old, and by this time, there must be enough research in telecommuting. Even though this may be true, what remains to be dealt with is telecommuting research with a variety of locations as alternate worksites as opposed to a home office. Further, telecommuting research may have grown in the west but still lacking behind in developing countries.

In this Section, we look at some of the telecommuting/telework literature mainly from the developed world. The literature presented is mainly empirical and perception studies. This is because we found it to be the widely studied area of telecommuting.

¹⁸<http://vozmob.net/en/about> and <http://mobileactive.org/mobile-voices-part-i-development-process>

¹⁹<http://www.migrantvoices.org>

²⁰<http://mediaresearchhub.ssrc.org/grants/funded-projects/migrant-voices-communication-for-social-change-with-garment-workers-and-day-laborers-in-los-angeles/migrant-voices-communication-for-social-change-with-garment-workers-and-day-laborers-in-los-angeles>

²¹<http://www.migrantvoice.org/>

By reviewing literature and borrowing from review studies done by other researchers, we found patterns, here referred to as study models, based on specific study themes. The details of these study models are presented in Appendix C and summarised in Table 3.2.

The review also attempted to look at telecommuting systems, an activity which yielded very little.

3.5.2 Empirical and Perception Studies

In the example of empirical and perception studies, [Asaari and Karia \(2001\)](#) did a study on the acceptance of telework concepts by Malaysian employees. The views of respondents from the service industry workforces were collected about telework concepts and the outcome used to gauge the Malaysian employers in preparing themselves towards the new workforces in the country. A similar work is by [Navarrete and Pick \(2003\)](#), which was done to test the impact in differences in culture on telecommuting in Mexico and the US. It was based on a questionnaire sample of 204 employees. In another example, [Nortjé et al. \(2004\)](#) did work to investigate the South African teleworking environment. They made an attempt to identify the differences and similarities between the information environment of an office worker and an employee in an alternative work situation such as teleworking. They mentioned cellular telephones as one of the communication media available for teleworkers. [Nortjé et al.](#) used questionnaire interviews for their data collection mechanisms and mainly contacted big organisations.

In discussing the concepts of telework [Dunn \(2009a\)](#), argues that telework can be a means of creatively utilising ICT, specifically using cellular phones in bridging technology to encourage more advanced usage of broadband applications by marginalised groups in a wide range of work related activities. He uses Jamaica and Trinidad and Tobago as examples of countries where mobile phones are pervasive and can be used for telework. He argues that more wide-scale and selective adoption of the heavy infusion of the mobile telephony could help make the Caribbean region more competitive and enhance the lives of the poor and marginalised. In relation to our work, the [Dunn](#) study fell short of identifying specific target groups, instead grouping them as marginalised and poor, and innovations that can take advantage of the ICT technology.

Another study done by [Lal and Dwivedi \(2008\)](#) in the UK investigated how the mobile phone may be used by the home-workers to avoid feelings of professional isolation caused by working away from the traditional office place. Data was collected from 25 respondents working in a telecommunications organisation using in-depth, semi-structured interviews. Similar to [Lal and Dwivedi's \(2008\)](#) work is by [Brodie \(2003\)](#), who investigated what mobile workers do when they are *mobile* to achieve their communication goals. The [Brodie \(2003\)](#) work studied both white-collar and blue-collar workers with the aim of designing applications for them. The challenge with such work is that considering both mobile workers, white and blue-collar, might not be ideal as they always have different requirements. The other weakness we noticed with [Brodie \(2003\)](#) work is that it was not being specific on the kind of applications they were designing. A study to examine the current state of telework in Hong Kong, identify factors that inhibit it, and explore important indicators that may influence the intention to adopt telework was done by [Leung \(2004\)](#). The author indicated that the outcome

of the study echoed past work on the adoption of new media technology such as computers and the internet.

Work presented by [Cowell and Dunn \(2006\)](#) had the goal of determining the potential of telework in enhancing the competitiveness of Caribbean economies. Their methodology included documentary research, in-depth interviews and focus groups. The kind of studies such as this by [Cowell and Dunn](#) look at impacts to the organisation, employees and the society as a whole by analysing the impacts/implications of telecommuting to organisations and, to a large extent, government agencies ([Di Martino and Wirth, 2009](#)).

3.5.3 Telecommuting Systems

In all the articles reviewed for literature on telecommuting, there was limited mention of ICT systems built to support telecommuting. Even those that talked about systems only mentioned that it was built with no further explanations about the process and the type of system. For example, [Venkatesh and Johnson \(2002\)](#) indicated that the company they used for the experiment built an in-house system to support telecommuting. What can explain the lack of concentration in ICT systems may be the contexts and the disciplines under which the studies were carried out. With regard to the study context, the developed world is well connected with various ICT services. The connectedness may be making the researchers to rightfully assume that the ICT component of telecommuting is well established. The discipline under which many telecommuting studies fell was transportation and, therefore, most of the work did not concentrate on the ICT systems to support it. As a result of the context and the discipline of study, the telecommuting research trend in the developed world has concentrated at policy and organisational level, leaving out the technological (especially design) and contextual enquiries. Our study is mainly a contextualised one in the sense that it looked at a specific community—the DLM—sharing some characteristics with any other typical workers, but with extra unique characteristics. This, therefore, required a specific emphasis on the kind of ICT systems to support the context.

3.5.4 Summary of Telecommuting Literature Review

The telecommuting/telework studies we reviewed had less direct impact to our study but guided us into understanding the general study areas of telecommuting. Since our study of telecommuting was from a user point of view (where the intention was to alleviate some of the problems faced by the target group—the DLM—by modelling the problem as a telecommuting), the most significant sets of studies were those dealing with telecommuting definitions, impacts, and benefits and demerits of telecommuting. We used these studies to gauge the potential impacts of introducing any form of telecommuting. For example, in analysing the impacts of the prototype applications, we used the telecommuting impacts presented by [Di Martino and Wirth \(1990\)](#).

Other telecommuting study issues which shaped our study include those presented in Table 3.2.

Table 3.2: Telecommuting study issues which shaped our study

Telecommuting issue	How they shaped our study
Impacts of telecommuting (Baruch ,	Used as preliminary understanding on how telecommuting

2001; Khalifa and Davison, 2001; Virick et al., 2010).	could affect the DLM stakeholders.
Definitions of telecommuting (Dunn, 2009a; Nilles, 1988a).	In trying to classify our work to a form of telecommuting, the various definitions of telecommuting and teleworking contributed.
Elements and dimensions of existing definitions of telecommuting (Di Martino and Wirth, 2009; Vu and Vandebona, 2007).	We used these to identify the various elements within the DLM and our study context. The elements were related to the DLM stakeholders and were used to analyse the results of our study.
Benefits and demerits of telecommuting (Ahmadi et al., 2000; Daniels et al., 2001; Polycom, 2010).	In discussing the benefits and demerits of the prototype applications used for our experiments, the studies which had tackled these issues were used as guidelines on what to look for.

Summary on Telecommuting Study Models

We found that a majority of the papers fell under more than one category as they tackled different aspects (Appendix C, Table C.1). For example, Stephens and Szajna (1998) could be classified in both advantages/disadvantages and drivers of telecommuting categories. As a result, it could easily empirically find out the motives underlying the decision to telecommute and at the same time, empirically understand the advantages and disadvantages of telecommuting from the worker's perspective.

We also found other studies which we could not categorise because of their small number. For instance, case study research was found to be limited. An example that falls under case study is by Watah and DiSanzo (2000) which described a successful telecommunication program implementation in a company involved in marketing and sample distribution services. Another category is a study by Sridhar and Sridhar (2003) which looked at the effect of telecommuting on suburbanisation.

In our study, we found that a lot of the studies reviewed are country or region specific and findings are contextualised. It, therefore, becomes difficult to generalise findings to other regions. Because of the difficulty to contextualise telecommuting study findings, the apparent need to do a contextualised telecommuting study, especially in a different context like Africa is necessary. However, as stated earlier, our telecommuting literature review was not in vain. It helped contextualise the study, understand the different study themes of telecommuting and even guided in scoping our study.

Overall, there was limited literature on the study of telecommuting in Africa (only two studies). One of the two studies was specific to telecommuting using mobile phones. Because of the limited literature, and consequently limited knowledge of telecommuting in Africa, we were applied an exploratory study method using AR.

Summary on Study Topics versus Telecommuting Research Orientation

To validate our review, we compared what we found as study areas of telecommuting with the four telecommuting study orientation by Siha and Monroe (2006). We noted that whether

empirical study, literature review or reflection studies, many telecommuting studies cut across multiple orientations shown in Table 3.3.

Table 3.3: Telecommuting/telework study orientations

	Samia M. Siha and Richard W. Monroe	Major topics found in literature.
1	Description- Articles that overview the practice of telecommuting, and its benefits and drawbacks	<ul style="list-style-type: none"> • Definitions of Telecommuting or teleworking • Advantages and disadvantages of telecommuting • Drivers of telecommuting • Types of telecommuting / teleworkers
2	Conceptual- Articles that present a theoretical framework, propositions, and models for implementing telecommuting	<ul style="list-style-type: none"> • Telecommuting frameworks and models for study; implementation, evaluation; adoption and use; main elements of existing definitions; • Constraints on the choice to telecommuting and telecommuters • Types of telecommuting / teleworkers
3	Empirical- Articles that present results from surveying and analysing a large number of companies.	<ul style="list-style-type: none"> • Telecommuting impacts • Telecommuting trends and issues • Drivers of telecommuting • Success or failures of telecommuting
4	Case study- Articles that analyse the implementation of telecommuting to a particular company	<ul style="list-style-type: none"> • Benefits of telecommuting
5		<ul style="list-style-type: none"> • Telecommuting trends and issues
6		<ul style="list-style-type: none"> • Literature review studies
7		Impact of technology design on the Acceptance and long-term use of telecommuting systems (Venkatesh and Johnson 2002).

Note: We did not find any relations between Samia M. Siha and Richard W. Monroe orientation and the reviewed literature for point 5,6 and 7.

3.6 What is Different in Our Study?

In this subsection, we describe things that make our study different from what was seen in the literature reviewed.

The contextô our study context was the informal sector, made up of the low-literate, low-skilled individuals as a community. It is among the most complex setups to study as there is no formal organisation of the stakeholders.

The theoretical underpinningô Telecommuting, as seen in literature, has had little attention in Africa and the developing world. Studying telecommuting in an environment where we have a mix of white-collar worker insights (mostly propagated in the theory of telecommuting) with low-literate, low-skilled organised and non-organised resource limited environments is novel in itself.

The technology Most of the studies we reviewed assume existence of technology that supports any teleactivity. In our study, we take a holistic approach by considering all the elements of telecommuting including communication which we have modified to include technology and information to make up ICTs. We do not assume the existence of software applications as is always done in developed world teleactivity studies.

Extent of the case study a majority of the studies reviewed in the literature had only one case study area. In this study, we studied a case of DLM with three different instances covering four major cities in Africa.

The study process and outcome we took an exploratory study applying AR. We did not see any telecommuting study that has applied AR. Our study outcomes are the possible ICT designs for the DLM and the possibility of telecommuting in Africa and the implementation guidelines. Though our study outcomes were interpreted based on existing frameworks such as that by [Belanger and Collins \(1988\)](#) which showed that the outcomes associated with telecommuting are societal, individual and organisational, our context was different. Because of the differences in context, outcome reporting was focused on the unique characteristics of the individual and the organisations which were under study.

3.7 Related Work Summary

The following is a summary of how the reviewed literature is shaping our research:

- Design lessons in a developing world context we picked up the considerations for designing for and with illiterate and semi-illiterate users. One key lesson is that working with the NGOs is viable and important in resource limited contexts ([Medhi et al., 2007](#); [Gitau and Marsden, 2009](#)).
- The existence of the problems in the DLM Literature confirmed that DLM exists in Africa and the rest of the world, faces challenges and is likely to be there for a long time. This confirmed our problem as defined.
- Variables and participants to investigate the literature about the DLM gave us the starting point on the information to collect when doing research in the DLM. For example, the education level, the average wages and travel distance for job-seekers; travel routes and distance and the cost of job search for the field officers and the intermediary organisations. The review also confirmed the stakeholders (workers, employers and the intermediary organisation) that make up the DLM and their roles. For instance, the field officers non-office or mobile workers help the workers in searching for jobs. The DLM studies also provided insights on the meaning of worker-centres and the DLM in general.
- The Mobile phone as an intervention tool The mobile phone-related studies showed the prospects of using the mobile phone and related technology as ICTs to innovate and solve some of the problems facing the poor. Because our aim was to use the mobile phone as the main ICTs in our study because of their almost ubiquity, the confirmation by literature that it can be used for such purposes was important for our study. Other studies confirmed that blue-collar workers can be able to use and benefit from using mobile phones and their related applications. This showed the potential of mobile phones to help in alleviating some challenges faced by the poor. As an example, the

relationship between our study and that of [Plauché and Prabaker \(2006\)](#) is on the study proving that it is possible to innovate using mobile phones for use in remote-related activities even with low-literate levels.

- ICTs for development – Studies focusing on development showed that ICTs can be used to bring development. For example, there are studies which showed how farmers or fishermen can benefit from using mobile phone applications.
- Methodology and methods – we drew lessons from the process of applying AR as a methodology. Although the contexts may have been different, the general AR methodological framework was applied in the reviewed studies, hence giving the general guidelines on how to use AR as a methodology. Similar contexts also confirmed that AR is ideal for our context. Many of the studies reviewed also applied the methods, such as observations, which we used in our study. From this, we learnt about which methods and how to apply them for which specific reasons.

The Design Decision

After we found out that majority of our participant job-seekers in Cape Town were either semi-literate or illiterate, we looked for design guidelines which considered such groups. Studies such as [Medhi et al. \(2007\)](#) and [Kumar et al. \(2008\)](#), which indicated that non-text based applications are ideal for semi-literate or illiterate people, would have driven us into designing voice applications or other alternatives as our initial prototypes. However, we discovered that we were facing another problem which was lack of mobile phone ownership and use by our target users. Hence, they would still not benefit from our design interventions. At this point, the decision to use intermediaries to design was reached.

Another challenge was that none of the studies we reviewed within ICT4D, CSCW, and the methodology context had any explicit mention of teleactivity or telecommuting/teleworking in general. This left us with a continuous process of searching for a way of positioning our study in terms of related theory.

CHAPTER FOUR

RESEARCH DESIGN

“In action research, the emphasis is more on what practitioners do than on what they say they do”.—Michael Myers.

4. Introduction

Section 4.1 presents and justifies our three case studies and show how they were selected. Section 4.2 presents how our study progressed and the data collection methods. The selection of information sources is discussed in Section 4.3 while Section 4.4 discusses the evaluation process of the prototype applications developed. Section 4.5 gives the actual designs and the design rationale. The whole study process involved all the three case studies applying AR. Appendix D where we present the detailed process and show how we applied the specific research methods.

Case Studies

Our case studies were drawn from four cities in three countries, namely: Cape Town and Johannesburg, SA; Nairobi, Kenya and Windhoek, Namibia.

4.1 Case Study Selection and Getting into the Research Space

South Africa: In SA, we selected two major cities namely Cape Town and Johannesburg. Besides being convenient for the researcher who was based in Cape Town, it was the headquarters of our main partner organisation, MSRSA (Section 2.3.4 page 14). Johannesburg, being the largest city of SA, was picked to validate some of the findings from Cape Town. Johannesburg also served in triangulating DLM findings from SA.

Kenya: We chose the Nairobi, Moi Avenue DLM organisation as the only collection point for the Kenya case study. The choice for Moi Avenue was out of convenience (Section 2.3.4 page 15) but also served to clarify a key finding on the difference between self-organised and intermediary-organised DLMs.

Namibia: The Namibian case study was done through an intermediary organisation, MSRNA, with four worker collection points. Namibia case study, MSRNA was selected for two main reasons: The first and the major reason was that we needed to clarify our findings on the difference between worker-centered (not-for-profit) and employer-centred (self-sustaining) DLM intermediary organisations. The second reason was out of convenience of having had prior links with the head of MSRNA.

4.1.1 How We Entered the Community and the Exploration

As one of the AR good practices (Mehta et al., 2004), we started by informing the stakeholders about the intended partnership and how each of the parties was going to benefit. As researchers, we were going to benefit by the research outcome and, hence, a thesis. The DLM stakeholders were going to benefit from the ICT interventions and the lessons learnt throughout the research.

Here, we describe how we selected the case study areas. We also describe how we planned the study, more specifically about the day-labourers and, hence, the day-labour market (DLM).

Figure 4.1 shows our study routes. It starts from an informal observation and curiosity in Nairobi in September 2009. During this time, the researcher had not developed any idea on ICT4D or AR. Being a Computer Scientist, the idea in mind was to understand the DLM context with the intention of designing ICT applications to alleviate some of the day-labourers' challenges. Neither the study theory nor the methodology had been thought of. This part is indicated by the arrow marked 0 in Figure 4.1.

Following the objective of alleviating some of the challenges faced by day-labourers by designing software applications, was the need to find out more about the job-seekers. To fulfill this need, we collected preliminary data by observing and carrying out unstructured interviews with 14 day-labourers in one of the biggest day-labour worker collection points in Nairobi—Moi Avenue. Our key objective then was to understand their operation model broadly and check their technology (mainly mobile phones) ownership and use.

Initial brief findings, collected within one week, indicated that majority of the job-seekers owned and used mobile phones both for job search and social related activities. On literacy, it showed that majority of workers had above grade eight education, which is assumed to be a literate grade according to UNESCO definition of literacy (Hillerich, 1976). Although these findings may have been limited in scope because of the short duration of data collection and the small number of participants interviewed, we used them to understand the context under which we were to formulate and define our research problem. During this time, we had not selected Nairobi as a case study but only a place where we identified the problem.

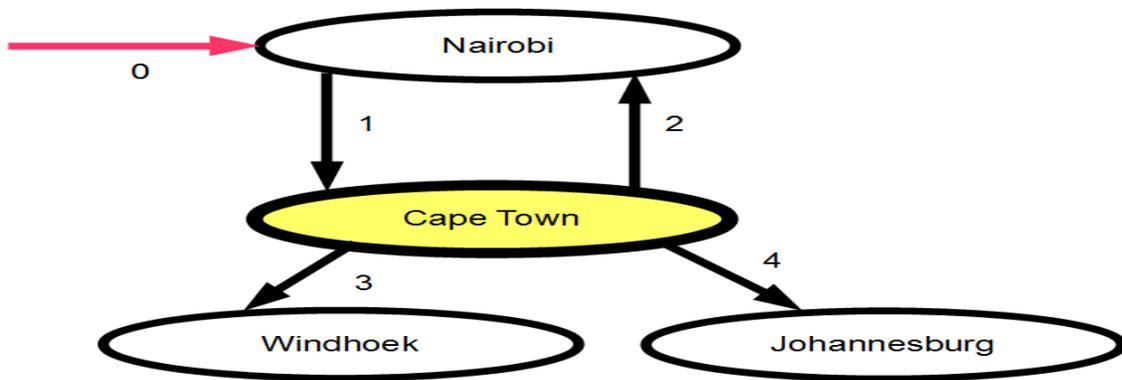


Figure 4.1: Our Research Journey

The arrow marked 0 indicates our first encounter with DLM in Nairobi. 1 shows our selection of MSRSA in Cape Town as our first case study while 2 shows the inclusion of Nairobi as our second case study. Arrow 3 indicates our selection of MSRNA in Windhoek as our third cases study. 4 shows a further study of the MSRSA in Johannesburg and Pretoria.

Edge 1 in Figure 4.1 indicates the proposal writing and, consequently, the move by the researcher to study for his doctoral degree. Because the programme was full time, we decided to find a similar case study in Cape Town and use the preliminary findings from Nairobi to guide the study process. While in Cape Town, we identified an NGO, which later became our DLM study focal point. Cape Town and, hence, SA, therefore became our first case study country. The booking of appointments with the managers of MSRSA was done through E-mail and later followed with a phone call. Although we had no prior communication with MSRSA, they were willing and ready to listen to what we had to offer.

4.1.2 Defamiliarisation

Our initial data collection and analysis in Cape Town contradicted those from the Nairobi DLM. For instance, only 30% of the day-labour workers interviewed owned mobile phones. The majority of the workers from Cape Town worker collections points had education level of up to grade eight and below. Further, we discovered a difference in the forms of organisation. While the Nairobi DLM was self-organised, the Cape Town DLM was intermediary-organised.

After a comparison of the findings from the Nairobi preliminary study and that of Cape Town, a doubt on the Nairobi initial findings arose. The next move was to go back to Nairobi and observe the DLM with an unbiased eye. We assumed that the DLM was strange (Sapsford and Jupp, 1996) and that we were new to it. This was a classic case of what Bell et al. (2005) referred to as de-familiarisation – a literary device that compels the reader to examine their automated perceptions of that which is so familiar that it seems natural and so unquestionable. In our study, the de-familiarisation was not on automated perceptions but on the basic knowledge of the DLM and their characteristics. The next move was, therefore, to be inquisitive of the Nairobi DLM to the details.

With this outcome, we had two choices: the first was to ignore the Nairobi findings and contextualise the research process in Cape Town. The second was to go back to Nairobi for further investigations. We chose the latter and it is depicted by edge 2 in Figure 4.1. The data collection process is presented in diagnosis II Appendix D. The main reason for choosing to go back to Nairobi was to be sure about our preliminary findings, hence avoiding wrong conclusions. We also needed to compare the self- and intermediary-organised DLMs. Moreover, we were starting to think of using AR in our study. Therefore, the idea was the need for research results – credibility (Shenton, 2004; Hayes, 2011) (measured by transferability and generalisability of research findings and processes) in AR. This brought about the idea of data triangulation (Hayes, 2011). The Nairobi case study was going to provide the triangulation of data by bringing the cross-country study which is always better compared to single country study. This led the researcher to go back to Nairobi for field work and, therefore, made Nairobi the second case study.

Having made Nairobi and Cape Town our two case studies, we continuously collected data in Cape Town. As for Nairobi, the researcher was there in June/July and December of 2010 for more data collection. We also elicited the services of a research assistant based in Nairobi. In the meantime, we needed to find out how representative the Cape Town findings were of South African DLM. This necessitated us to look for another region within SA. Johannesburg was our best option. First, the NGO we were working with had a strong presence in Johannesburg. It was, therefore, going to be easy for us to get audience from those who were in charge of running the worker collection points. Secondly, the majority of the DLM studies that had been done in SA were carried out in Johannesburg and Pretoria. Finally, Johannesburg is the biggest city of SA. Route 4 in Figure 4.1 shows Johannesburg as the fourth city where our field work took place.

The final case study for our study was Windhoek, Namibia. Our engagement in Windhoek was through MSRSA contacts. Our reason for engaging with Namibia came about when

MSRSA changed their operation model. They changed from serving workers free of charge to charging a minimal fee (ZAR 20) for every successful placement. The field officers, who were mainly in charge of helping workers in getting jobs, were turned into marketing agents. Worker payment would be done through MSRSA which was responsible for supervising the work process. Initially, MSRSA did not manage any work nor did they handle any payments. The change process brought in questions as to whether subsequent findings would be generalisable for a DLM or it would be similar to those of a labour-broker. We thought that initial findings were likely to be in conflict with new findings. As much as we continued implementing the change that we had started, we needed a new DLM context. We chose Men on the Side of the Road Namibia (MSRNA) because of the following two main reasons: (1) MSRNA was formed using MSRSA's initial model. In fact, the two NGOs were still consulting which meant that getting in contact with our newly found NGO would be easy. The second reason was that we had research funds for SA Namibia ICT4D cooperation. The Edge 3 and Windhoek in Figure 4.1 shows this move of making Windhoek our third case study.

4.2 Research Process and the Data Collection Methods

Although we had three different case studies, the study process was not exclusively divided based on the specific case studies but on AR cycles presented as study steps, i.e. how the actual study progressed. At each step, one, two or all the three case studies were under study in one way or another. The key reason for doing it on a step by step basis rather than case by case was for comparison and clarification purposes (as has been discussed in the case study selection process). The other reason was that the study process on the various case studies was not done sequentially, but concurrently in some cases (because of time and the locations). Table 4.1 shows the period within which the four AR cycles were carried out with the design process of the different prototype applications. As shown in Table 4.1, most of the design's prototypes were being done concurrently across different case studies.

Table 4.1: The design process of the prototype applications within different AR cycles

Prototype applications				
Time line	2009-2010	2010-2011	2011-2012	2012
Case study	<i>AR cycle One</i>	<i>AR cycle Two</i>	<i>AR cycle Three</i>	<i>AR cycle Four</i>
South Africa—MSRSA	<ul style="list-style-type: none"> • Mobile application: Field registrar I. • Web verification module. 	<ul style="list-style-type: none"> • Field Registrar II. • Verification module. 	<ul style="list-style-type: none"> • MSRVoice 	<ul style="list-style-type: none"> • MSRVoice • Field Registrar II. • Download upload module.
Kenya—Nairobi DLM		<ul style="list-style-type: none"> • Integrated web-based Database. • Worker/employer mobile applications. 	<ul style="list-style-type: none"> • Integrated web-based Database. • Worker/employer mobile applications. 	
Namibia—MSRNA			MSRNA integrated web-based Database	<ul style="list-style-type: none"> • Mobile application: Field registrar.

Following our adopted AR model (Section 2.5.1 page 32), we ended up with four cycles. Appendix D presents a detailed step-by-step description of the AR cycles. The presentation combines and triangulates the processes from three case studies (four cities) and describes what we did at each stage of the AR process. We also show the application of the various methods, techniques and tools within the cyclic nature of AR. With regard to results presentation, we present a summary for the AR cycles and give a forward reference for the long-standing findings presented in Chapter Six. Figure 4.2 shows how the results emanating from the AR process are reported.

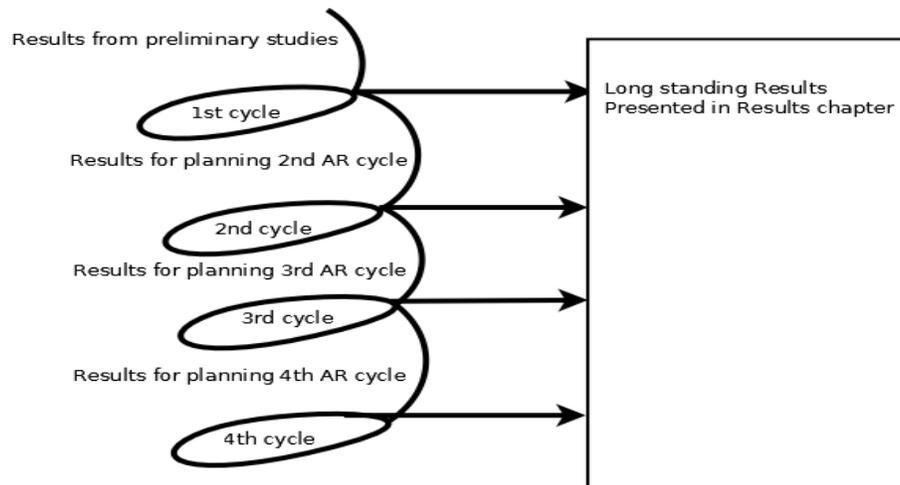


Figure 4.2: How the results of the AR cycles are reported

The 1st, 2nd, 3rd and 4th cycles are AR cycles. Each has a summary of results presented and is depicted by, for example in cycle one, Results for planning 2nd AR cycle. The arrows from the AR cycles indicate the long standing results presented in the results chapter

4.2.1 Setting the AR Cycle Context

Table 4.2 summarises issues that cut across our study process.

Table 4.2: Issues cutting across the study

Issue	Description
Data collection methods	Interviews; observation; shadowing, questionnaires and data logs
Data analysis methods	Qualitative analysis with coding as a method to extract quantitative data
Application designs and development.	The design process applied prototyping and technology probe for the mobile phone and the web-based software systems.
Data collection process	The process was continuous throughout the study. Most of the interview and observation sessions were audio recorded and photographed.
The participant population	During the entire study period, we interacted and talked with over 100 day-labourers; 23 intermediary organisationsø employees (MSRSA Cape Town=11; MSRSA Tshwane=3; MSRSA Gauteng=5; and MSRNA= 4); and the employers (Cape Town=3; Nairobi =5). Other stakeholders included (Wiwallet ²² =1; Author of Day-labourers in Namibia (Gonzo and Plattner, 2003)). We also talked to many friends, colleagues and family members who were employers of the day-labourers.
Other sources of information	Throughout the study period, we had access to the MSRSA and MSRNA database.
Systems development	All the web-based applications were build on apache web server toolsø <i>MySql</i> and PHP while mobile phone based applications and prototypes, except for the MSRNA (developed on an android platform), were build using java J2ME toolkits. The researcher prototyped and built all the prototypes and applications shown in Table 5.1.

Type of Data Collected and for What Purpose

For the data collection process for different cases studies, all or some of the information summarised in Table 4.3 was collected. The information was collected for:

The understanding of the general context of the DLM: The objective was to have an understanding of the DLM. Questions included asking the participants about their general operations, the advantages and the challenges. We also asked them to tell us about any other experience they may have seen or heard about the DLM in general. Other information collected for the general understanding of the DLM included workersø skills; age, gender and years of experience.

Commuting characteristics: We collected information that would help in understanding whether the DLM individual stakeholders conformed to commuters characteristics. For example, the approximate number of days that the day-labourers travelled to the worker collection points per week even when out of work. We collected data on their earnings and spending on transport and other job search related spending. To further understand the commuting characteristics, we endeavoured to find out the possible routes for the DLM stakeholders (Section 5.2.2 page 72). There was also the need to know the cost of travelling around (both in money and time). This was to be used to prove the existence of DLM

²²Wiwallet was the organisation which was running the MSRSA payments systems.

problems besides checking the extent to which the prototype interventions impacted on the users.

Expected impacts of the ICT innovation: There were specific information collected to gauge whether the prototypes deployed had any impact on the users and the general DLM organisation. These types of information include use of technology before and after the interventions; travel/commuting patterns; the cost of using ICTs.

Table 4.3: Information collected and for what purpose

Type of information collected	Purpose
Workers' literacy	Compare the text literacy levels among the day-labourers in the three case studies. This would help us in making key design decisions.
Mobile phone ownership	Make decisions on whether to directly design mobile applications for the DLM and for the comparisons across the case study DLMs.
Mobile phone use	The use of mobile phones, whether sharing or otherwise, would help understand the dynamics of designing in such environments.
Amount of airtime on phone	Gauge the affordability of day-labourers in using the mobile phone applications we had as design concepts.
Job search strategies	To find out whether job-seekers used any other strategies such as making or waiting for phone calls; going office to office or any other.
Worker search strategies	To understand how employers searched for workers. To find out whether they used any form of ICTs including those provided by the NGOs.
Job allocation formulas	For purposes of understanding, and hence designing remote applications that would allow field officers allocate jobs to workers remotely.
Commuting frequencies	To know how frequently workers and employers travelled in search of jobs and workers respectively. The idea was to use these frequencies to check if ICTs affected travel.
Commuting means	To find out whether job-seekers used any means of transport or walked to the collection points. The purpose was to link it with the cost (time and money) of travelling associated with job searching.
Commuting costs (money)	To find out the workers' cost of commuting to the collection point. This was to be used to measure the impact of the ICTs interventions.
Commuting time	To find out how long it took a job seeker to travel to the collection points. The purpose was to check if travel time was one of the challenges of job search and if it would be reduced by using ICTs to reduce travel.
Commuting distance	To find out the average distance to the collection point from a job-seeker's home. The purpose was to see if it would be reduced by using ICTs.
Job seeker's earnings	To find out how much a DLM worker earns. The purpose was to find out if they would be regarded as poor.
Job-seeker's daily spending	To find out how their average daily spending. The objective was to compare it with the earnings to see whether they had any savings.
Worker's out-of-work	The average number of days in a week that a day-labourer would be out

frequency	of work. The purpose was to know how frequently a worker would be job hunting.
Operation mode of NGOs	Finding out whether the NGO was self sustaining or charity dependent in order to understand the design requirements for the individual intermediary organisations.
The cost of job search	To find out the operation expenditure of a job search for workers and the NGOs. The purpose was to use it to find out whether the prototypes had any impact by comparing the costs of operation before and after our interventions.
System usage data	A log of usage records was kept to find out the number of users for the deployed applications.

In all the types of data collected, we also looked at the ‘why’ side of it. For example, we asked the job-seekers why they did not move from office to office in search of jobs.

4.2.2 General Data Collection Methods

Here, we present the specific data collection methods applied. A detailed list of information collected for the whole study was presented in Section 4.2.1 Table 4.3, while the full process of our AR is presented in Appendix D. The data informing our initial findings in the DLM came from literature and document review and field studies at different stages of our study process.

Literature and document review: Literature survey on DLM and document review of the MSRSA user manual; MSRNA and MSRSA websites; and the MSRNA and MSRSA web-based databases. The database had over 19,000 registered day-labourers and employers.

Field studies: We applied various data collection methods for our field studies. In the field, we took photographs of the situation, did voice recording, and used field notes to capture data.

The types of information related to the preliminary findings are: the operation models of the DLMs and the travel routes and the locations where the DLMs stakeholders could be at any given time. We were also looking at understanding the kind of DLM activities.

Face-to-face Interviews

In Nairobi, we interviewed a total of 33 day-labour workers. In our first interview session, we talked to 5 workers in an unstructured informal interview. In the second session, we did a structured interview with a total of 14 job-seekers (a sample list in appendix E). Our third interview was a face-to-face interview with 10 job-seekers. We also interviewed five employers from Nairobi. More than half of our interviewees in Nairobi were interviewed more than once.

In Cape Town, MSRSA, we carried out structured interviews with a total of 11 intermediary organisations employees; three MSRSA DLM employers and 20 day-labourers. Throughout the study, we had many unscheduled informal discussions with about 50 workers in Cape Town.

In MSRSA Johannesburg and Pretoria branches, we conducted face-to-face interviews with two regional managers. We also interviewed four MSRSA office employees (two from each branch/region) and ten randomly selected day-labourers.

In Windhoek, Namibia, we applied structured face-to-face interviews to the head of MSRNA, one field officer, one office worker and a total of 20 day-labourers were interviewed. We also did a face-to-face interview with Mr. Gonzo, the co-author of *Day-labourers in Namibia* (Gonzo and Plattner, 2003), who summarised the Namibia DLM based on his book.

Telephone Interviews

Before and after visits to Windhoek, we used telephone (using Skype) interviews and E-mails to collect data. Through Skype calls, we interviewed the head of MSRNA (once) and the office worker several times. We exchanged many E-mails with the head of MSRNA and the office worker on how they operated. The same information as those collected using MSRNA website, E-mails and Skype call interviews were collected during face-to-face interviews. The details of the findings are presented in Section 6.3.1 page 110.

Shadowing and Observation

We shadowed and observed the many day-labourers at the various collection points, six MSRSA office employees and three MSRSA field officers for four consecutive months in Cape Town. During the entire study period, we interacted and talked with over 100 day-labourers; 23 intermediary organisations' employees and eight randomly selected DLM employers.

Our observations involved two days of field work per week for over four months in Cape Town, a total of eight days observation in Windhoek, two days in Johannesburg and two months in Nairobi. We were observing:

- How the workers approached the employers: To find out if employers came to pick workers at the collection point or request for them through the mobile phone calls and whether the job-seekers scrambled for jobs (as we had seen in Cape Town during our pilot study) or they were more organised.
- The worker collection point organisation: To understand how the job-seekers were being organised. We were looking at how the DLM stakeholders interacted and their relationships.
- The movement of the DLM within and outside the collection point and the role of the field officers in the collection point and finding jobs: we observed how the job-seekers and the field officers related in terms of job-search related activities. The objective was to confirm the existence of intermediation, or lack of it, among job-seekers for the DLM in the South African case studies and, hence, justify the design.

Questionnaires

Because of the limited resources to extend the field work in Windhoek, Pretoria and Johannesburg, we used a short basic questionnaire (Appendix G) administered by three field officers in Pretoria and Johannesburg and the office employee in MSRNA.

The field officers from Pretoria and Johannesburg were trained on how to administer them. The questionnaire for Pretoria and Johannesburg was a kind of guide for the field officers to carry out a structured interview with the worker. The main data captured included commute distance; time, cost and technology use. A total of 90 workers answered the questions by the field officers.

The questionnaire for MSRNA Windhoek was intended for workers themselves. They would answer the questions with the help of the office worker. The information collected was age, phone type, communication, airtime, cost of transport, means of transport and daily earnings. A total of 12 day-labourers filled the questionnaire.

The questionnaire's objective was to capture basic information about the day-labourer. The questionnaire, just like the structured interview questions used in the three case studies, was developed guided by existing DLM and ICT4D literature and the telecommuting models (Belanger and Collins, 1988; Vu and Vandebona, 2007). The analysed results are presented in Section 6.4 page 119.

Other Methods

As a method for collecting information, we also analysed the MSRSA and MSRNA database which had information about workers, employers and job allocations for the last five years. And to understand the DLM, we also discussed our objectives with many friends, colleagues and family members who were sometimes employers of the day-labourers.

4.2.3 How the Study Progressed

Figure 4.3, shows a summary of the activities carried out and their corresponding outcomes. It depicts a step by step progression of our study drawing data from the three case studies. The actions to subsequent steps were being informed by knowledge gained from preceding steps. For instance, the need to do separate studies on self-organised and intermediary-organised DLMs was informed by our field findings and the literature which revealed that the two groups operated differently. The study was unexpectedly evolutionary. The direction was continuously guided by the understanding and changes that took place in the course of the study. Equally evolutionary is the development of the theoretical framework of telecommuting, which developed as the study progressed. In Figure 4.3, the conceptualisation stage, carried out in Nairobi, describes the time when we were thinking of studying DLM with a view of providing ICT interventions which could support their activities. The objective of this stage was to understand how the DLM operates.

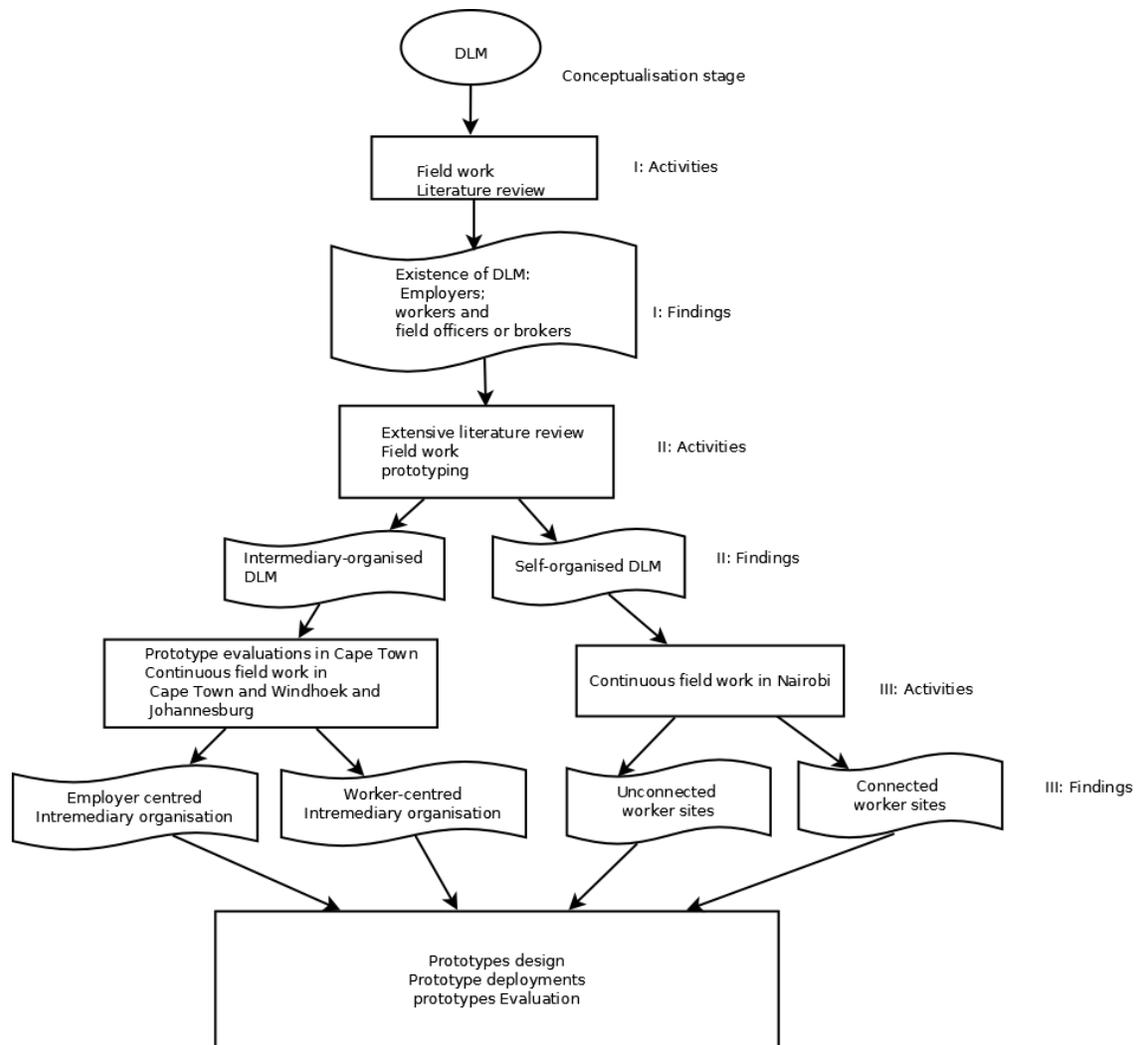


Figure 4.3: The steps followed in our study

The conceptualisation stage is the time we were thinking of ICTs interventions for the DLM. The findings follow from each activities carried out and which culminated into prototype designs and evaluation for various types of the DLM

The second step was an initial review of literature on the DLM and ICTs use among the poor. At the same time, further field work was ongoing. This is shown by I: activities in Figure 4.3. The findings (Section 5.1 page 70) for the literature review and the field work was a description and understanding of the composition of a typical DLM.

Through an extensive review of literature and documents and further field work that applied different data collection methods and simple prototyping, we discovered (II activities in Figure 4.3), that the DLM can be categorised into two: intermediary organised and the self-organised. We identified MSRSA and MSRMA as running intermediary-organised DLMs while the Nairobi DLM worker collection point was identified as self-organised. II findings in Figure 4.3 indicate these scenarios.

The next step was more data and information collection in Nairobi and prototype designs and implementations for Cape Town, Johannesburg and Windhoek. The studies were at this point being carried out separately but looking out for any similarities or differences. Findings from

these activities showed two different types of self-organised worker collection points. It also showed two intermediary organisations/operations models. An intermediary organisation can either focus on employers or workers (for example MSRSA and MSRNA respectively).

The last step was to leverage the information collected and use it to come up with the prototypes for the specific DLM models. The process of building the prototypes were in the form of AR cycles. Figure 4.4 gives a summary of how the AR steps proceeded. The target group is represented as NBO (Nairobi DLM); CPT (Cape Townô MSRSA); WDH (Windhoekô MSRNA) and JNB (Johannesburg and Pretoriaô MSRSA). Although the places indicated may refer to the case studies, they mostly represent the group of DLM we were studying. For example, diagnosis NBO/CPT means data was collected from DLM stakeholders in the specific Nairobi worker collection point and the Cape Town MSRSA organisation and its members (workers and employers). Action CPT/NBO/WDH means that interventions were being designed, prototyped and/or tested for the specific community of DLM we were working with.

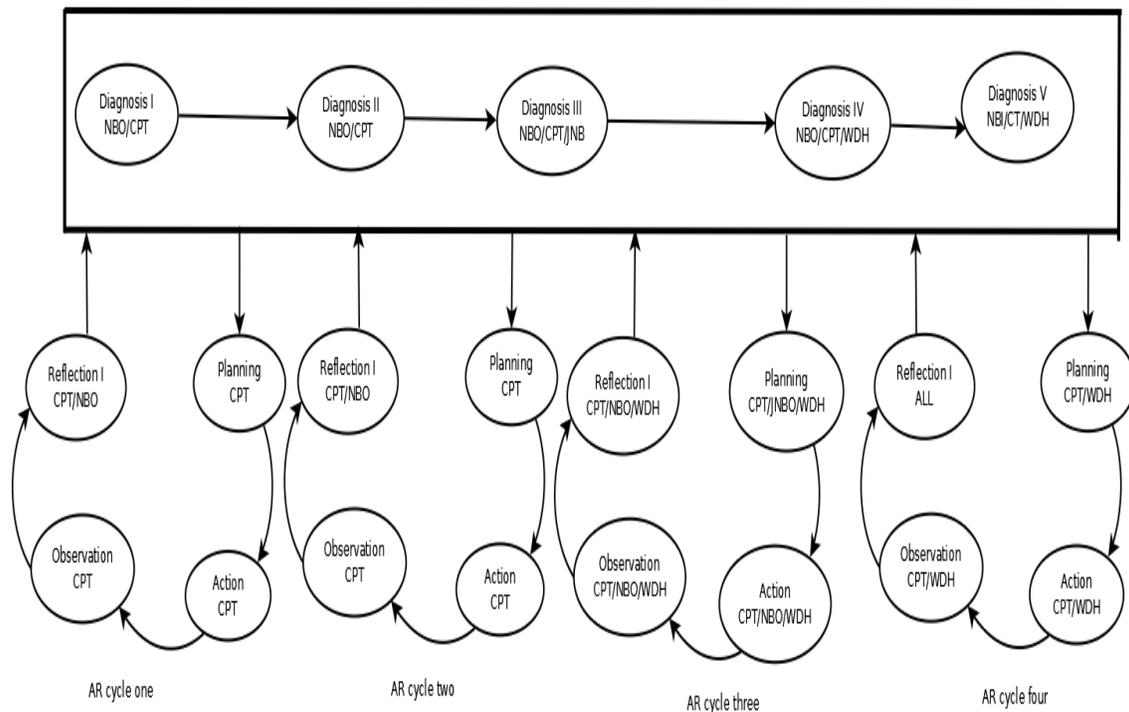


Figure 4.4: How our action research proceeded

The case study is represented as NBO (Nairobi DLM); CPT (Cape Townô mainly MSRSA); WDH (Windhoek MSRNA) and JNB (Johannesburg and Pretoria). The ICT design and prototyping took place at the action stages of AR cycles.

The four AR cycles that we followed, detailing the process, the data collected, the data collection methods, the design processes and the outcomes of each cycle, are presented in Appendix D.

4.3 Selection of Information Sources

According to Polkinghorne (2005), the goal of qualitative research is enriching the understanding of an experience. Researchers, therefore, need to select fertile exemplars of the

experience for study. Such selections are purposeful and sought out; the selection should not be random or left to chance. Polkinghorne further notes that the concern is not how much data was gathered or from how many sources, but whether the data that was collected is sufficiently rich to bring refinement and clarity to understanding an experience. The selection of the case study areas (Section 4.1) was based on the need to clarify information about specific items of the DLM. It, therefore, ended up being purposeful selection of case studies. The selection of the second and third case studies was guided by initial findings from the first case study. The case selection process was looking for information-rich cases defined as those from which one can learn a great deal about issues of central importance to the purpose of the research (Polkinghorne, 2005). Because we did not have enough knowledge of the DLM, we were not able to know from the start which cases to pick. That is why our case studies were picked as the study progressed and as need arose. Whenever a need arose and could not be clarified within the same case study, we found a suitable case study. For example, we went back to Nairobi because we realised that there was another form of DLM organisation self-organised. We could not study it within the Cape Town context because it was not clear who were and were not members of an intermediary among the day-labourers. As for Nairobi, this would be easy as we found no intermediary organisation.

4.4 Evaluation Process of the Systems Developed and Telecommuting Process

Our evaluation process was two-fold. The first one was on evaluating the prototype applications for the purposes of experiments. This was necessary because we needed to meet the Human Computer Interaction (HCI) standard of applications design i.e. making sure that the software applications are designed in such a way that it meets all the user needs and perceptions. For the prototype evaluation, all the deployed applications went through a real usage experience evaluation. The evaluation was on ease of use; the cost of using and maintaining the applications and the change involved; whether it met the implementation objectives; and overall user satisfaction. The methods employed during evaluation were (a) watching users use the systems (Jones and Marsden, 2006, p.199); (b) after-usage interviews; (c) user usage logs; and (d) evaluating the actual adoption of the systems over time.

The second evaluation was with regard to telecommuting where we were evaluating on the elements and dimensions of telecommuting (used to define telecommuting/teleworking) and the possible impact of telecommuting/teleworking.

Definition elements/dimensions: These elements were discussed by Vu and Vandebona (2007) and are more often used to define telecommuting/teleworking. Location, time, job classification, and ICT are described as key in defining telecommuting.

Telecommuting/teleworking Impact variables: We used the concepts of Belanger and Collins (1998); Shin et al. (2000) and Senbil and Kitamura (2003). In the Belanger and Collins (1998) concept, outcomes associated with telecommuting are societal, individual and organisational. Senbil and Kitamura (2003) concept describes a typology explaining direct impacts of ICT on personal activities and travel, while Shin et al. (2000) presents the variables used in telecommuting /telework evaluations. According to Shin et al. (2000), frequently studied variables in evaluations of telework effectiveness are: satisfaction of employees, management and customers, productivity changes, and cost-benefit effects. In our

study, the variables presented by [Shin et al.](#) were still applicable but to different subjects. Satisfaction of employees and management were to the intermediary organisations while customers were the day-labourers who were being served by the field officers. Productivity changes were measured on the amount of work that the field officers would be able to do before and after the adoption of the applications developed to support their telecommuting. The discussion on the outcome is presented in Section 7.1.5 page 133.

4.5 The Software System Designs

We present functional and user interface (UI) design rationale and describe the actual designs for our software systems in Appendix H (Sections H.1 and H.2). In this section, we only describe the high level design of all the systems. The proposed DLM design had three main and two minor (supportive) software systems. The main applications were aimed at supporting DLM activities for efficient and effective operations and to include functions that would reduce travelling by the stakeholders. The minor applications supported the implementation of the MSRSA main application without disrupting its operations.

The Main Applications

- (a) The Web-based integrated database (b) The remote mobile applications and (c) MSRVoice

The Supportive Applications

- a) The verification module, as an interface to the external payment database (*Wiwallet*)
- b) The update/upload module as an interface to the external MSRSA database (*placementpartner*).

The High Level Design

The high level design describes how the applications interact. Figure 4.5 shows the client-server architecture depicting the arrangements of the applications we developed.

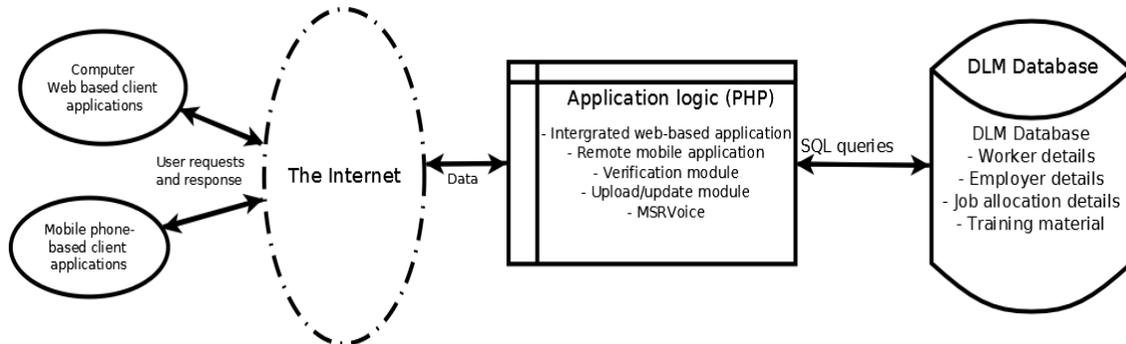


Figure 4.5: The Proposed DLM design architecture: The high level design

The computer web-based and the mobile phone-based client applications are the user interfaces which applications are made accessible through the web browser and the mobile phone respectively. Data transmission to and from the server is through the Internet. The application logic interprets the request from the client applications and responses from the server. The applications had minimal application logic at the client side and most of it at the PHP server side because most of the decisions relied on the data from the database. The DLM

database, implemented using MySQL, has data about the DLM needed by the various applications.

CHAPTER FIVE GENERAL RESULTS

5. Introduction

In Chapter five and six, we present the results of our study. Overall, we found that the three Day-Labour Market (DLM) case studies had many similar characteristics. However, there were aspects that made them operate differently. To present the common characteristics, we first present the general types and forms of DLM and the commuting patterns, locations and telecommuting practice of our participants in this Chapter. The details of the specific findings on a case study by case study basis are presented in Chapter six Sections 6.1.1, 6.2.1 and 6.3.1 starting from page 79.

5.1 Types and Forms of DLM

Many of the DLM studies in the developed world have found that a majority of the DLM organisations are worker-centres (Melendez et al., 2009). In our study, however, we discovered that all the case studies that we studied were made up of DLMs which are not organised as worker-centres. The equivalent of a worker centre was worker hire site (or a worker collection point). A collection point can either be connected or non-connected. *Connected sites* are those that are created or located near employment premises such as factories, construction sites, home improvement and related stores while *unconnected informal day-labour sites* are often busy intersections such as street intersections, roundabouts or roadsides where employers can go and gather individuals available to work for the day (Valenzuela, 2003; Melendez et al., 2009).

After analysis of our field work findings, we found out that connected and non-connected worker hire sites (or worker collection points or simply collection points) in our case studies could be further categorised into two. One type is made up of those collection points run and controlled by intermediary organisations—mainly NGOs. We referred to these collection points as intermediary-organised. The DLM associated with the intermediary-organised worker collection points is categorised as intermediary-organised DLM. In the intermediary-organised DLM, employers may interact directly with workers or through the NGOs. The latter is the most common practice. Figure 5.1 shows the different types of DLM. It does not show the connected and non-connected distinction mainly because there is no difference in terms of commuting by the workers in connected and non-connected collection points and, hence, does not add value to the discussion.

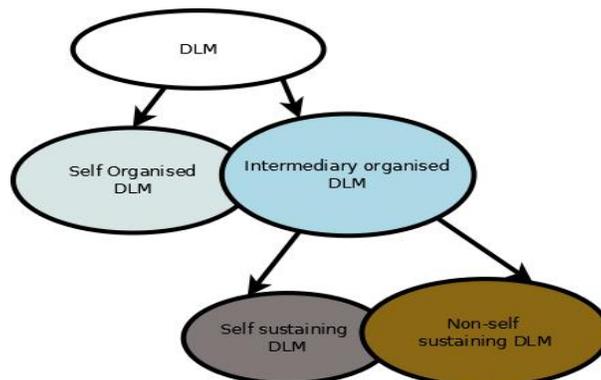


Figure 5.1: Different types of the DLM

The DLM is the general DLM as seen in our case studies. Intermediary-organised is run by an organisation, mainly NGOs and can either be self-sustaining or non-self-sustaining. The DLM can also be made up of a self-organised DLM

5.1.1 Self Sustaining Versus Charitable Intermediary Organisation

In an intermediary-organised DLM, we further found that an intermediary organisation can either be a charitable NGO working for workers and employers free of charge or a self-sustaining working for workers and employers for a fee. The charitable NGOs are mainly sustained by well-wishers. Charitable organisations running a DLM would concentrate on workers in terms of finding them jobs free of charge. We referred to such organisations as worker-centred intermediary organisations and, hence, a worker-centred DLM.

The self-sustaining DLM NGOs, on the other hand, charged a fee for every job placement. Their objective is to minimise the dependence on donations. The fees can be charged to the worker, employer or both. The key concentrations of such NGOs are employers and are referred to as self-sustaining intermediary organisations. The DLMs that they run can, therefore, be referred to as self-sustaining or employer-centred DLMs.

5.1.2 Self-organising DLM

Our findings revealed that the second type of a DLM is run and controlled by the day-labourers themselves. These DLMs have no association with any intermediary organisation. The DLM worker collection points are controlled by workers through an association of workers. We refer to worker collection points run by workers as *self-organising*. A DLM associated with self-organised collection points is referred to as a self-organising DLM. In a *self-organising* DLM, employers interact directly with workers or through contractors (who sometimes double up as job brokers).

Triangular Relationship

In either of the cases (intermediary or self organised), a triangular relationship (Figure 5.2) between the three major DLM stakeholders exists.

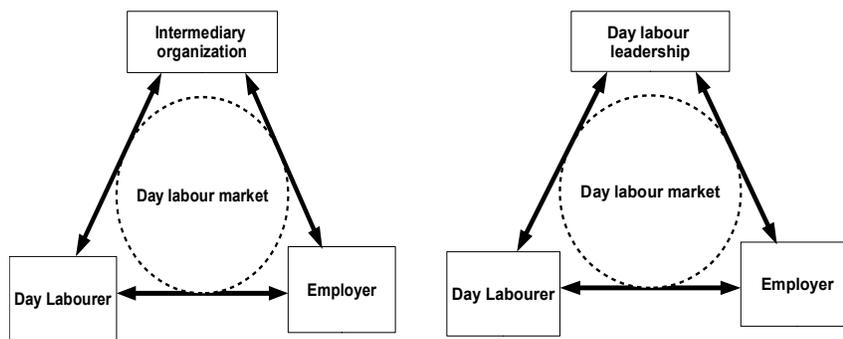


Figure 5.2 (a): Intermediary organised DLM

Figure 5.2 (b): Self-organised DLM

The triangular relationship for the DLM stakeholders. Figure 5.2 (a) shows a relationship where an intermediary organisation comes in between the day-labourers and the employers. In Figure 5.2 (b), a *self-organising* day-labour stakeholder relationship is shown. The day-labour leadership is optional in some DLMs.

5.2 Commuting Patterns, Locations and Telecommuting Practice

From our field study, we discovered many challenges faced by the individual DLM stakeholders (Section 1.1). Among the major challenge is the cost (money, time and energy) of travelling around in the process of job or worker search. In our study, we sought to investigate, among others, ways of using ICT applications, especially mobile phones, in reducing the amount of travel by the DLM individuals. Following this was then the need to understand the possible travel routes and the possible locations where the DLM stakeholders (job-seekers; employers and the field officers) can be during the course of their job or worker search activities. This, therefore, is the main reason why we present the travel behaviours of the stakeholders in detail.

5.2.1 Locations

Figure 4.3 shows the possible locations relating to job and worker search where the DLM stakeholders can be found. The arrows indicate possible routes which are described in Section 5.2.2.

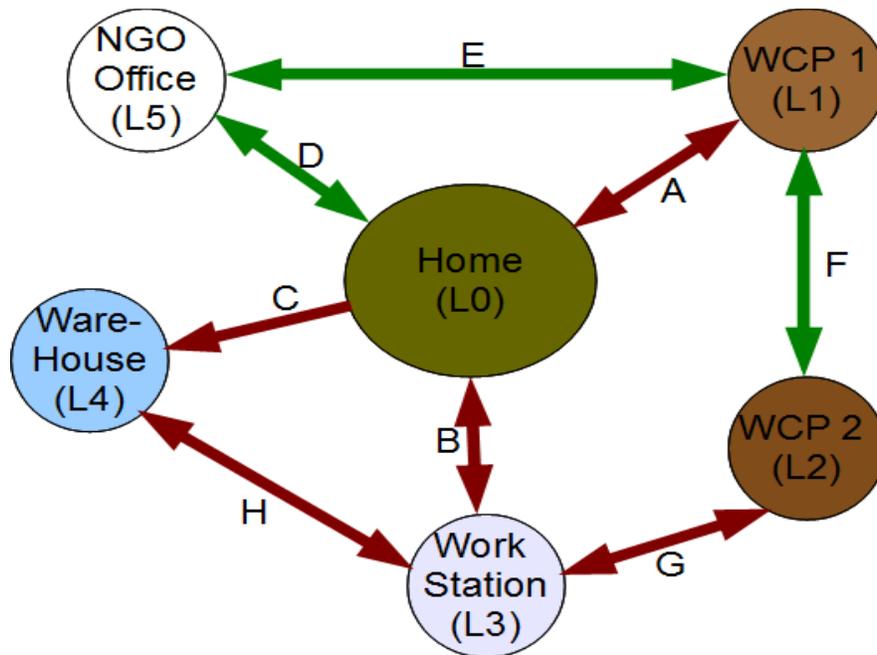


Figure 5.3: Possible locations for DLM stakeholders

The home is at the centre of all the locations and it is marked L0. The movement from one location to another is indicated by the arrows. Green arrows shows possible movements by the field officers and red is by the workers. L0 to L5 indicates locations one to five. Home depicts where the stakeholder resides. A home for a day-labourer can be a typical city home; a shanty under a city bridge or a flyover. The warehouse is where the work materials (for example paints) are bought, while the work station is where workers do the actual work, for example a construction site. The NGO office represents the offices of the intermediary organisation, for example MSRSA offices. WCP 1 and WCP 2 are worker collection points one and two respectively.

5.2.2 Travel routes

Following the possible locations where the DLM stakeholders can be and the activities that they carry out, there are possible travel routes. These routes are described next.

Field officers: Their possible route options were:

- a) Home office home
- b) Home collection point home.
- c) Home collection point office home
- d) Home collection point 1 collection point 2 office home

Office represents the NGO office while $X>1$ depicts a location visited more than once. Because we were not able to witness any visits to the warehouse by any of the stakeholders, we decided not to represent it in the possible routes.

These routes are summarised in Table 4.1 and described thereafter.

Table 5.1: DLM field officers possible routes

Route	Home	NGO office	Collection Point	Work station
a	X	X		
b	X		X	
c	X	X	X	
d	X	X	X>1	

The route (a) was mainly for the NGO's office employees. Field officers, however, sometimes take this option especially when they have special agendas, for example all-day meetings in the office. Route (b) is similar to (a) with the only difference being that the collection point(s) replaces the offices in the locations that could be visited. Routes (a) and (b) are less common for a field officer. Routes (c) and (d) are examples of how the office and the collection point visits can be combined by the field officers. They are the most common routes and remained among the key subject of our study. We found them as the routes that could be influenced by technology use. The field officers can go to two or more collection points. When they leave the collection point, they either go home or to the office. They do not return to a collection point once they leave. Field officers rarely went to the work station. It is only in MSRSA, after they changed their operations model (Section 6.1.4 page 99), that field officers, now turned job brokers, were required to supervise workers at the work station.

Workers: Their route options, also summarised in Table 5.2, are as follows:

- a) Home work station home.
- b) Home collection point work station home.
- c) Home collection point home.
- d) Home collection point work station collection point work station home.
- e) Home collection point work station 1 work station 2 home.
- f) Home NGO office home.
- g) Home work station NGO office home.

Table 5.2: DLM workers' possible routes

Route	Home	Collection Point	Work station	NGO office	Scenario
a	X		X		A worker gets a job and gets to be informed in advance. The information can be passed on face-to-face or through a phone call. Alternatively, the worker may be returning for an incomplete assignment
b	X	X	X		A worker gets a job at the collection point without prior information.
c	X	X			A worker does not manage to get any work and, hence, goes back home from the collection point.
d	X	X>1	X>1		A worker commutes to the collection point, gets a job and, hence, commutes to a work station. Upon arrival at the work station, because the information about the job had not been passed on in advance, a worker may realise that he/she forgot some tools. Hence, he/she may go back to a collection point to borrow from colleagues or go back home to pick the tools. Thereafter, he/she returns back to his work station and eventually back home.
e	X	X	X>1		Is similar to (d) except that the worker will have to proceed to another work station to borrow tools
f	X			X	A worker only visits the NGO's office and returns back home without going through the collection point or the work station.
g	X		X	X	A worker gets a job through the NGO's office.

The overall assumption is that workers carry their tools to the worker collection point. In some occasions, they may forget them at home. Other factors may include having to go to buy materials that may be needed. Another assumption is that whether a worker gets to be informed of a job in advance or not, there exist equal chances that they may still be required to go and buy the materials. The assumption in (d) is that the borrower is only required to return borrowed tools the following day. This scenario in (d) can happen due to many other reasons including the worker going to pick a colleague because of lack of mobile phone access by both or by one of the workers.

Employers: Their possible routes are summarised in Table 5.3.

- a) Home → work station → home
- b) Home → collection point → home.
- c) Home → collection point → work station → home
- d) Home → collection point 1 → work station → collection point → home

Table 5.3: DLM employers' possible routes

Route	Home	NGO office	Collection Point	Work station
a	X			X
b	X		X	
c	X		X	X
d	X		X>1	

Employers' routes were found to be complex and unpredictable because it was unpredictable whether they had work at home or somewhere else. The possible worker-search related routes are depicted in Table 5.3 and described next:

- The employer has work at a different location from home and has already made arrangements with the worker(s) to meet at the work station.
- The employer has work at home but travels to pick the worker(s) at the collection point.
- The employer has work at a different location from home and that he has not made any prior arrangements with the workers. This was the most common route for the employers.
- The employer has work in a location different from home and has to pick up and drop workers at the collection point. Since employers rarely went to the NGOs' office, the field officer was the main contact person.

The possible routes for field officers, day-labourers and employers are summarised in Figure 5.4.

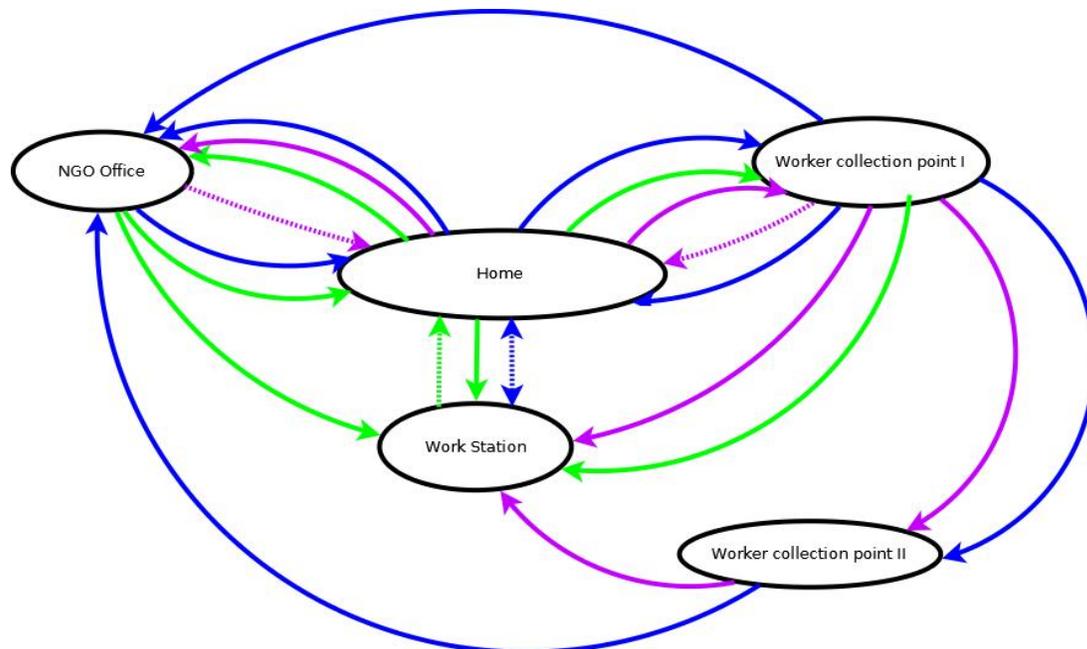


Figure 5.4: Possible commute routes for DLM stakeholders

The green arrows depict possible routes for the day-labourers. Blue represents routes for the field officers. Purple represents the employers. The dotted arrow indicates that return to home is not an option and that the travel may have not involved going to look for work or a worker.

5.2.3 Commuting

In the DLM, the people who travel around the most are the field officers. They are followed closely by the job-seekers and the employers in that order. We discovered that commuting patterns depended largely on whether prior arrangements were made between the meeting parties. This brings out the need to have a means of coordinating the parties in advance. From our field findings, the most viable coordinating option that we saw was using the mobile phone and face-to-face communication. Therefore, the possibility of teleworking or doing work remotely within flexible hours could only be guaranteed by using the mobile phone. We found that most of the groups that practiced some sort of teleactivity, for example MSRSA field officers and the Nairobi DLM members, used mobile phones.

The field officers are the DLM intermediary organisations' employees and, hence, required to commute to work every day' hence, commuters. They, however, have other extra travel routes brought about by the DLM set up. These routes can be as frequent as the normal home-office travel. The field officers' extra routes can contribute to the commuting. Given the locations; the travel routes and the frequency of the travel by the DLM day-labourers and the employers, they can be said to be doing more than commuting too.

5.3 Summary

The DLM is made up of the job-seekers; employers (or job brokers) and the field officers as individuals. A DLM is also made up of an intermediary organisation or an organisation of workers heading the DLM forming the intermediary- and self-organised DLMs respectively. Also presented were the possible locations and travel routes for the DLM individuals. From these routes, we concluded that the day-labourers and the field officers can be categorised as commuters.

The information shapes our next study process by identifying the potential users of our proposed ICT applications and who to engage when designing. The findings also support the idea of using ICTs to reduce travel as it shows that the DLM operations involve a lot of travelling. It directs us towards teleactivity. The understanding of how the DLM engages also gives the organizational understanding, which had a client-server system of operations, supporting the client-server architecture common in most ICT designs. The different DLM organisations also contributed to the need for different case studies to understand the various DLM set ups.

CHAPTER SIX

SPECIFIC CASE STUDY RESULTS

6. Introduction

This chapter organises the specific findings description on a case study by case study basis. Thereafter, we give a summary highlighting their key differences and similarities. For each case study, we present (a) the data collected about a specific DLM on workers; worker collection points and the organisation (b) application/prototyping testing outcome and (c) direct or indirect telecommuting practice of the DLM stakeholders. In the discussion chapter, we will describe how each application/prototype affected travel among the DLM stakeholder.

With the data collected about specific DLMs on workers and worker collection points, we detail the experience of workers as job-seekers; their demographic details; their engagement within the DLM; economic status expenditure versus earnings; the DLM telecommunication and the DLM stakeholders commuting aspects, among others. On the organisation of the DLMs, we describe the various organisational structures (while relating with Section 5.1 findings) found and how they operate.

The prototype testing outcome gives a full description of what was observed during the testing of all the applications and prototypes deployed. Each application test outcome is looked at in terms of usage experience in relation to their support for everyday operations of the DLMs and their stakeholders (impact on the users) and support to remote task execution telecommuting. Both successful and failed systems are reported and possible reasons for failure presented (Section 7.1.5 page 140).

The telecommuting practice section describes the workers, employers and intermediary organisations telecommuting related practices. Using telecommuting models, we highlight whether or not workers, employers and intermediary organisations were practising any form of telecommuting knowingly or unknowingly.

Important Concepts used in this Chapter

First, we recap important concepts, terms and phrases used for the reader.

Telecommuting/Teleworking

In reporting our findings, we were guided by the telecommuting definition elements (Section 2.3.2 page 26). Although the overall definition is about reducing travel by using ICTs, the definition was mainly guided by the four elements: ICTs, location, time and job classification. These elements are also used as themes to discuss the results in Chapter seven.

Case studies

- a. Cape Town and Johannesburg, SA was our major case study. It was referred to as Men on the Side of the Road South Africa (MSRSA).
- b. The Nairobi, Kenya case study was referred to as Nairobi DLM (NDLM) and was carried out in one major collection point (Moi Avenue).
- c. Windhoek, Namibia case study was referred to as Men on the Side of the Road Namibia (MSRNA).

Literacy and Illiteracy

For the purposes of our study, we define literacy and illiteracy based on the number of years one attended school (Hillerich, 1976) and, hence, the ability to process information using text (McMillan, 1996) (Section 2.6.1 page 34).

6.1 Case study I: Men on the Side of the Road, SA (MSRSA)

6.1.1 Field Work Findings on MSRSA Workers and Worker Collection Points

In this section, we describe MSRSA findings from our field studies. The description is largely qualitative with minimal quantitative data being presented. The quantitative data was mainly derived from the questionnaires and structured interviews. Although most of the data being presented is from Cape Town, there is some from Johannesburg.

About MSRSA

Here, we describe information about MSRSA (the organisation) as obtained by interviewing and talking to MSRSA field officers, office employees, regional manager and the general director. In some cases, the discussion was carried out by having an open non-scoped discussion.

MSRSA Membership

From our conversation with the MSRSA officers, we learnt that MSRSA membership numbers about 10,000 workers and 600 employers per year. However, the database showed that they had 19,523 registered workers over five years. In Cape Town, worker members consisted of both South African citizens and non-South Africans. They included citizens of other countries such as Namibia; Zimbabwe; Democratic Republic of Congo; Swaziland; and Lesotho. Cape Town MSRSA regional manager approximated that 70% of the workers were South Africans while the rest were from other countries. In this thesis, we refer to non-South African job-seekers as foreign job-seekers. This was a phrase widely used by members of MSRSA.

Communication

MSRSA field officers reported that, of the ten thousand plus day-labourers, only about 20% of the South African citizen workers owned a mobile phone. On the other hand, they reported an almost 95% mobile phone ownership by the foreigners. According to the field officers, the mobile phone usage by job-seekers for job search related activities was limited to skilled workers. Office based MSRSA officials reported a low probability of getting a non skilled worker by calling the phone numbers that they provide during registration. When asked to give an approximate percentage, they gave a less than 5% success rate for non-skilled workers and over 90% for skilled workers.

According to the MSRSA director, the mobile phone as a marketing tool had not been an option for MSRSA. Instead, they had been using traditional marketing methods such as face-to-face marketing and distribution of fliers. Occasionally, they would use e-mail to communicate to registered employers (members of MSRSA and, hence, members of the DLM community). The director blamed the minimal use of e-mail and Short Message Service (SMS) on the category of employers. The DLM employers are mainly contractors and private

home owners. He indicated that, according to their experience, such employers rarely use e-mail or SMS. Further, with SMS, he gave a lack of a budget for SMS by MSRSA as another reason. From the same discussion, the director reported that their most effective way of marketing has been construction site visits (to have face-to-face conversation with employers) and distribution of fliers.

Asked about the MSRSA website, he said that, when used solely, it had not produced any adequate results. He indicated that the website hit rate was dependent on other marketing strategies such as distribution of fliers.

Significant Findings on Communication

A minority of the DLM day-labourers from South Africa, especially from Cape Town, owned mobile phones. Skilled workers were the ones using mobile phones mostly for work search related activities. They could easily be reached through their mobile phones compared to non-skilled workers. The minimal level of use of SMS and other ICT services among DLM stakeholders directly impacted on the use of technology for job and worker search related activities. The lack of a budget and hence the push by MSRSA on using SMS as a means of communication may have also impacted negatively on its use. It was seen that the use of ICTs among the MSRSA DLM job-seekers and employers was minimal. The field officers were relatively better when it came to using ICTs to execute the worker-employer matching activities. This, therefore, meant that they were the best for any ICT intervention.

Cost of Finding Jobs

The amount of money spent by the intermediary organisation in looking for a job on behalf of the job-seekers was important to our study because of two reasons. One was to justify the significance of the intermediary organisation in the DLM and show that they had challenges in running a DLM. The cost of finding jobs formed the key expenditure of the NGOs and, therefore, knowing it would give an idea of the extent of the problems faced by the intermediary organisations. Secondly, we used it as a metric for measuring the impact of ICT systems introduced to reduce the cost operation by the intermediary organisation.

According to information on the MSRSA website, the cost of looking for a job for a non-skilled worker was about ZAR 20 per day, regardless of whether the job search is successful. The ZAR 20 is the cost of the field officers and running the collection points. The amount does not include the cost of commuting and other expenses by the day-labourer and the cost of transport and time by the employer. This means that the total cost of searching for a job may exceed ZAR 20.

While confirming the job search cost information, the director said that MSRSA recommended a daily earning of ZAR 110 for a worker in 2010. MSRSA, however, estimated the average earning to be ZAR 90 per day, with slight variations, depending on the employers and the skills possessed by the worker. The estimated amount spent looking for a job for a skilled worker, he said, was less than ZAR 20. On a good day, a skilled worker earns ZAR 110. On top of the wage, the workers get picked up from their collection points or have their commuting costs refunded by the employer. On a bad day, worker earnings will come down to as low as ZAR 60 and, to add on it, they get no free transportation to the work station. The

general director and the field officers agreed that anything in between the highest (ZAR 110) and lowest (ZAR 60) worker earnings could be regarded as fair. They also estimated the average round trip distance for a worker to be about 20 Kilometres. Commuting costs were estimated at an average of ZAR 12 for a round trip.

In essence, a worker who commutes to the collection point and fails to get a job will go at a loss of ZAR 12 or will have walked more than 20 km in a day, which is well above the 30 minutes walking time recommended per day (Pate et al., 1995; The Better Health channel, 2012). This will be on top of ZAR 20 incurred by MSRSA in running the collection point and expenditure by the field officers. A worker earning ZAR 110 will, therefore, have a take home of about ZAR 98 if they are picked and dropped at the collection point. However, if they are not picked, the take home will reduce. With the earnings of ZAR 98 per day, a day-labourer would still earn above the minimum wage²³ (ZAR 8.34 per hour) prescribed by the department of labour, South Africa.

Other direct expenditure (increasing the cost of job search) for MSRSA branches outside Cape Town include the faxing of the worker information from various branches to the head quarters office in Cape Town. The MSRSA branches were found in Johannesburg, Pretoria, Nelspruit, Durban, George and Port Elizabeth (MSR, 2009). Some of these branches are depicted in Figure 6.1. Faxing was reported to be costing about ZAR 600 in two weeks.



Figure 6.1: MSRSA branches in South Africa (Google maps)

Cape Town, George, Port Elizabeth and Durban are along the coast while Johannesburg, Pretoria, Nelspruit are in the inland North-east

The cost of finding jobs, for both the worker and the NGO, in terms of time, emotional drain and money confirms the challenges in a DLM. These challenges call for the need to look for

²³ <http://m.mywage.co.za/main/salary/minimum-wages>

solutions of reducing the costs. More specifically for the day-labourers is to reduce their losses incurred by travelling to collection points and not getting a job. What we thought was the most feasible option for us was to have mobile phone applications that would allow workers to wait or search for jobs virtually. On the other hand, the job search cost incurred by the NGOs need to be reduced. This could be done by having their field officers being in charge of more worker collection points than before.

According to interview information from four MSRSA field officers, they place about 20% of all the unskilled workers who turn up at collection points each day. However, they reported that an unknown percentage of workers get jobs by virtue of being at MSRSA branded collection points²⁴. Such placements, just like subsequent placements, are not included in the 20% reported. In one of their proposals for funding, MSRSA indicated that they placed about 6500 men which generated about 120000 work days in 2009 (MSR, 2009). MSRSA reported that most skilled workers get jobs by themselves and rarely depended on MSRSA. Skilled workers were more likely to be referred by an employer to another compared to a non-skilled. There were, however, skilled workers at the collection points.

Quality of Information

MSRSA maintains a worker and employer member database. According to its operation manual, their key concern is the accuracy and quality of information on worker members. During registration of workers, potential worker members are requested to provide evidence of their skills, training, police clearance and any other documentary evidence. Further, for every skill claimed by workers, references (contact details of previous employers) are required.

Worker reference information is confirmed by contacting three known employers listed as referees (MSR, 2009). However, the majority of workers, according to the MSRSA database and evidence from the field officers, fail to provide references for their claimed skills. To verify the skills, MSRSA adopted a way of verifying workers without contacting employers. In this method, a newly recruited worker is required to do his first few jobs under the supervision of an experienced worker. This is verification through an actual assessment. The skills claim verification outcome is used as proof of skills possession and, if in the affirmative, used to update the worker's skills in the database.

The interviewees told us that the worker skills claim verification is meant to protect the reputation of MSRSA by avoiding situations where employers may pick up the wrong skilled workers. We were not able to establish the exact number of cases where workers have wrongfully claimed skills. This was mainly because MSRSA employees indicated that they never got any complaints on the workers they linked with employers. MSRSA, however, received occasional employers who picked up wrong skilled workers because they did not use MSRSA services. The director of MSRSA also indicated that he believed that those who get to pick wrong skills fail to report and, instead, stop going to collection points for workers. Overall, it was difficult to ascertain how often wrong skilled workers got picked, but the indications were that the practice existed. It was indicated by the MSRSA general director

²⁴Are collection points with a tent in MSRSA colors and branded MSR; an example is shown in figure 2.1 (a).

that the picking of wrong skilled workers was likely to be more common among employers who were not using MSRSA services than those who used MSRSA services.

Employers are usually encouraged to give references or general comments about workers whom they have employed. Employer satisfaction was said to be key to the survival of MSRSA especially from those employers returning back for MSRSA or individual worker services. The field officers reported that employers who normally come back for the services reported higher satisfaction than those who do not.

Job Allocation

According to MSRSA's operation manual and interview data from the regional manager, a fair method of job allocation is applied to all workers. For non-skilled workers, no one worker will be placed twice before another unless explicitly requested by an employer. It was mentioned that non-skilled workers were likely to be in the queue longer before any placement. Although lack of jobs is the main reason why non-skilled workers wait for some time before the next placement, there are other reasons. They include illiteracy-related challenges and the cost of commuting to work destination. For instance, workers may not be able to travel to job stations as a result of their inability to read a map, identify and/or read street names, and so on. Communication barriers with the employer or even lack of transport were other reasons propagated by the field officers.

When placing skilled workers, different factors are considered. Skills requested for by an employer are prioritised. Last out last in (LOLI) criteria is used where many workers with requested skills are on the queue. It was noted that South Africa, particularly Cape Town, lacks enough skilled workers. As a result, and in rare occasions, the demand for skilled workers becomes more than the supply.

Member's Privacy

According to MSRSA director, MSRSA is a responsible organisation which respects member's privacy. Apart from demographic information such as age and gender, skill is the only other piece of information collected during registration. MSRSA does not ask for information on race, medical information or any information that may be discriminatory. On the contrary, according to the field officers, employers sometimes ask for workers with specific characteristics. For example, an employer may prefer a foreigner to a South African citizen.

Workers and Worker Collection Points

This section reports findings on specific components of MSRSA. The main components are the workers and worker collection points. Data was collected through observation, interviews and document review.

Worker Collection Points

MSRSA had six active and five inactive collection points in Cape Town when we commenced our study. Each collection point was being manned by a field officer, who was an employee of MSRSA. According to the MSRSA's director, there existed hundreds of collection points in Cape Town and thousands of others across the country. MSRSA ran only

a few of those collection points. Other collection points were being run by job-seeker members themselves. Figure 6.2 is a Google map showing locations of the various sites that were being run by MSRSA during our study. Figure 6.3 (a) shows a picture taken of a field officer manning the Fish Hoek worker collection point.



Figure 6.2: Worker collection points initially run by MSRSA in Cape Town

Table 6.1: MSRSA Worker collection points

	Collection point	Address
A	Woodstock	66 Albert Road
B	Wynberg	Prince George Drive
C	Fish Hoek	Kommetjie Road
D	Somerset West	Schapenberg Road
E	Muizenberg	Vrygrond Avenue
F	Cape Town	Buitengracht
G	Mitchells Plain	Eisleben Road
H	Durbanville	Vrede Road
I	Khayelitsha	Baden Powell, Drive
J	Table View	Blaauwberg Road
K	Kuilsriver	Van Riebeeck Street

Compared to collection points in Nairobi, Kenya and Windhoek, Namibia, worker collection points in South Africa were seen to be having different characteristics. It had job-seekers

from other nations, mainly Zimbabwe and other Southern African Development Community (SADC) member countries such as Malawi, Namibia and Tanzania. We observed worker collection points which were made up of small groupings. Each of these groups was made up of job-seekers from the same country. For example, during our first interview visit to Wynberg worker collection point in Cape Town, we found two major groups. The first group was made up of job-seekers from Zimbabwe with six men. The second group was made up of job-seekers from South Africa and had over 10 men. The Wynberg collection point had no less than 20 job-seekers during that first visit. Figure 6.3 (b) shows day-labourers waiting at the Wynberg worker collection point.



Figure 6.3 (a): A field officer in Fish Hoek worker collection point



Figure 6.3 (b): Workers at the worker collection point in Wynberg

The MSRSA field officer who also did job placements confirmed that, on average, there are between 30 and 40 job-seekers on a good day and 60 to 70 on a bad one. On further enquiry about that particular day, it was found that the reason why the number of job-seekers was less than the average was because the Metro²⁵ train from Khayelitsha township did not operate on that day. Khayelitsha, about 10 km from the collection point, is a township in Cape Town where the majority of the workers reside. The collection point is about 0.5 km from Wynberg railway station and taxi rank.

Another worker collection point that we studied closely in Cape Town was the Fish Hoek worker collection point. It is about two km from the Fish Hoek Metro train station and taxi rank in Cape Town. It is located along a road junction close to traffic lights. On average, we were told there are about 30 to 60 job-seekers waiting for jobs per day at Fish Hoek worker collection point. The site type was, therefore, classified as a small to large medium site according to [Blaauw and Pretorius \(2007\)](#). In fact, the majority of sites in South Africa are small to medium sites. Just like other collection points in Cape Town, Fish Hoek had job-seekers from different countries within the SADC region.

Information about Workers

The findings presented here were collected through individual face-to-face interviews, informal discussions, shadowing, field observations and MSRSA worker database analysis.

²⁵A railway commuter service in South Africa- www.metrorail.co.za

Demographics

All the job-seekers in South Africa who we interacted with directly or through their field officers were men between 21 and 55 years of age. The youngest was 21 years old while the eldest was a 55 year day-labourer. The average age obtained by analysing the MSRSA database stood at 35.8 while 35.6 years was the average age obtained from field data collection. Figure 6.4 shows the average age of day-labourers from four cities studied.

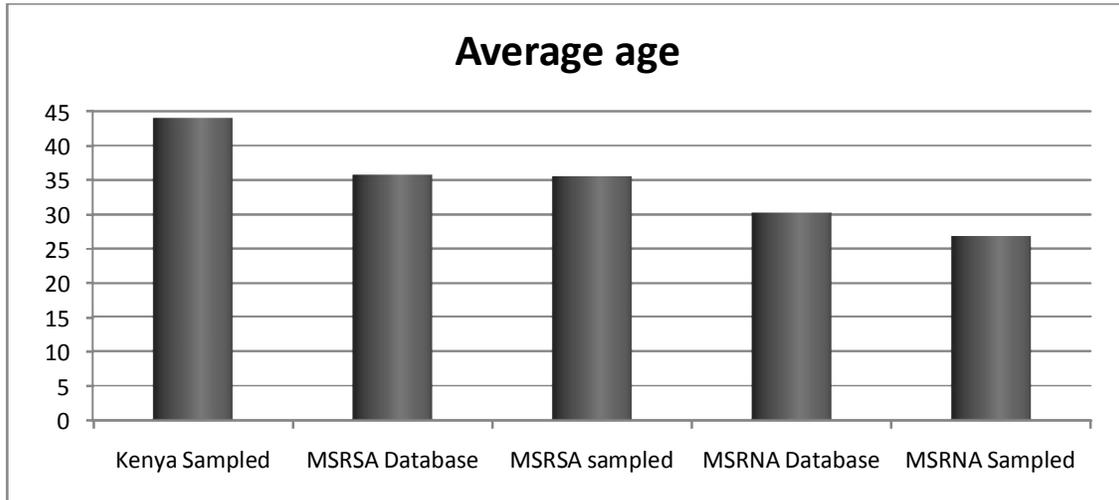


Figure 6.4: Average ages of day-labour workers for the three case studies

The average age was obtained from either using a sample of data collected in the field work using questionnaires or face-to-face interview or by analysing data in the databases. Kenya did not have a database and, hence, has the sample data only

Worker Skills

Over 60% of all job-seekers interviewed claimed some skills. The most claimed skills included carpentry, painting and brick-laying. Most of the skills were acquired through experience. Only less than 10% of the workers said they attended apprentice or vocational training school on any of the skills. When asked if they could do any kind of job apart from one requiring their skills, they all responded in the affirmative. However, all of them preferred doing jobs that need their skills.

The study also sought to find out how long job-seekers had been at the collection point and their work experience. A correlation between age and years of experience was found. Older members (over 35 years of age) had more years of experience (over five years) than younger ones (below 35 years), who had between six months and two years.

Language

Forty-six per cent of all job-seekers interviewed from two collection points could speak in English, albeit some with difficulty. In addition, they could also speak in their local languages such as *Zulu* or *Xhosa* for South Africans and mainly *Shona* for the Zimbabweans. Less than 10% of the workers could speak in more than two languages. Multilingual speakers could speak in English, *Afrikaans*, *Zulu*, *Shona* or *Xhosa*. The number of years that a worker had spent in Cape Town or Johannesburg had a direct impact on language literacy. Those who had been staying in these towns (Cape Town or Johannesburg) for more than two years

could speak in English. Job-seekers who were immigrants had been in South Africa for between 0.5 to 7 years. In our interview and observation, it turned out that the language barrier was not among their challenges. The exception, however, was when an employer requests for one worker with specific language requirements. This scenario, according to the field officers, happened on rare occasions and when it happened, they had to comply. In most cases, employers who had had poor communication experience with a worker before because of language barrier would request for a worker with specific language skills.

Literacy

Among the day-labourers interviewed, 70% attained an education level of grade eight and below. Only 15% had completed grade 12. However, on analysing the MSRSA database of about 20000 registered workers, we found that 47.78% of all the workers had not gone to school above Grade 10.

In the Wynberg worker collection point, where we visited numerous times, we sought to directly find out if our interviewees could read or write. We sent them SMSs and asked for a reply. However, this test did not succeed as only 18% of all the workers at the testing time had mobile phones. Because our interviewees did not have airtime on their mobile phones, we decided to give them airtime worth ZAR 10. The airtime was given in the form of vouchers. The purpose of this was so that we could ask them to reply our SMSs and act as an incentive. All those who had mobile phones replied successfully after being given airtime.

On map usage, only 20% of those interviewed preferred to use a map when finding a new location. Sixty two percent (62%) preferred to be picked by employers and did not see the need for a map. As a surprise finding, a few of those who did not have mobile phones likened it with the map and said that, just like one does not need a map, they also do not need a mobile phone. Their argument was that, if an employer needs certain skills, he/she would look for it at collection points. However, taking directions from the employer through the mobile phone was still the preferred way of locating a job station.

In the two worker collection points (Wynberg and Fish Hoek) that we focused on, 90% of non-South African job-seekers interviewed could read and write in English compared to 20% of South Africans.

Ownership and use of Technology

The question here was whether the day-labourers owned or had access to technology and how they used it. The technology we were looking at includes mobile phone, fixed line telephone, computers and internet. Findings from Wynberg and Fish Hoek collection points showed that 30% (about one in every three) of the workers owned mobile phones. Mobile phone ownership was biased towards workers of other nationalities and had a direct correlation with education level and skills.

Most of the mobile phones were low end, also referred to as feature phones. These are mobile phones that have limited programmable features i.e. their operating systems do not provide even the most basic programming interface. They are basic mobile phones used mainly for calling and writing SMSs. Some of these mobile phones do not support some advanced USSD applications such as M-PESA applications. Examples of these mobile phones include

Nokia 1202 and 1200; MTN-ZTE, Vodafone and basic Motorola phones. The then market price of such mobile phones was between ZAR 130 to ZAR 200. To confirm the kind of mobile phones owned by job-seekers, we developed a short questionnaire which was administered to 90 day-labourers by the field officers in Johannesburg (Johannesburg and Pretoria MSRSA regional offices). The mobile phone ownership in Gauteng and Tshwane was found to be 50%. Majority of those who did not own mobile phones had access to them through their spouses and reported that they could be reached through them in the evenings.

We also administered a similar questionnaire to workers in Nairobi and Windhoek. Overall, the 90% of the mobile phones owned by the sampled day-labourers were non-programmable mobile phones, usually referred to as low-end devices. Figure 6.5 shows the share percentage of mobile phone models.

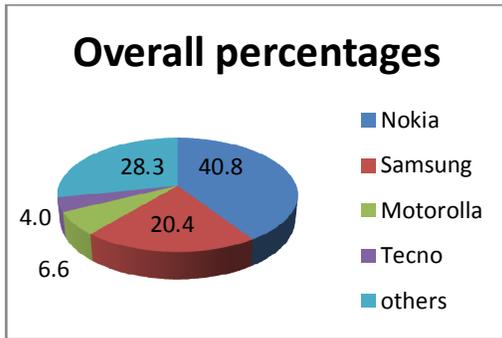


Figure 6.5 (a): Mobile phone models among workers

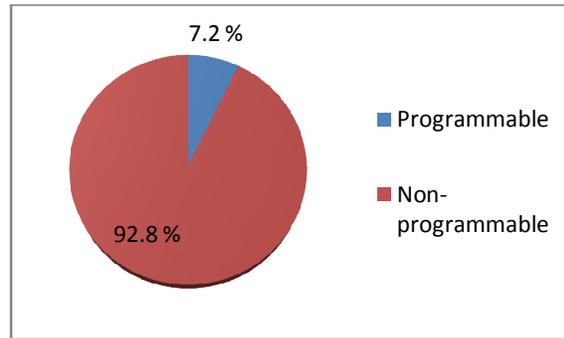


Figure 6.5 (b): Percentage of programmable mobile phones among workers

Those who did not own mobile phones reported having access to one in the evenings or morning hours at home or through their colleagues during the day. Those who had mobile phones reported knowing how to use SMS and voice call services. However, they did not have enough airtime. As a result, calling or sending an SMS remained prohibitive for them. While the average airtime on the phone was found to be ZAR one in Cape Town, through questionnaires administered to 90 workers by the field officers, we found that the average airtime on the phone for job-seekers in Johannesburg was ZAR 9.76. Figure 6.6 shows the average phone airtime for all the four cities during the time of interview or questionnaire filling.

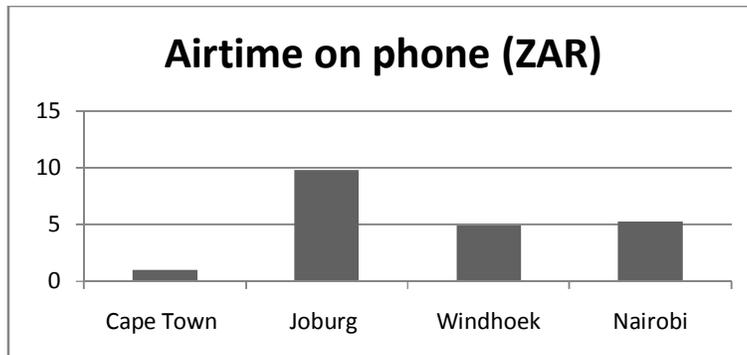


Figure 6.6: The amount of airtime on phone the job-seekers had during data collection

Table 6.2: The average calling rates per minute for Kenya, South Africa and Namibia

Country	Average cost of calling per minute (pre-pay)	Number of minutes for ZAR 10 airtime
Kenya	0.0335	29.85
South Africa	1.58	6.33
Namibia	1.5	6.67

From Table 6.2 and Figure 6.6, workers in Nairobi will have about 15 minutes calling time with their ZAR 5 airtime compared to about 3.1 minutes for South Africans and Namibians for the same amount of airtime.

None of the job-seekers interviewed had access to fixed landline telephones at home. They would only use the landline telephones at the calling booths. Similarly, none of the interviewees knew anything about other mobile phone services or applications provided by mobile service providers in South Africa. For example, MXIT²⁶, which is a free online instant messenger that runs on close to 3000 mobile handsets²³, and has been adopted by many South Africans, was found not to be popular among the job-seekers in Cape Town. Another example of what used to be a favourite service but not adopted by job-seekers is WIZZIT²⁷, which is an internet banking facility allowing customers to check balances online, view statements online and make online payments.

For those interviewed at the Wynberg and Fish Hoek collection points, except for one worker, the rest had only heard about the Internet and e-mail but did not know much about it. The one exception had an e-mail address and reported using it whenever he had time and money. Surprisingly, the man with an e-mail address did not own a mobile phone. When asked if they knew about MSRSA website or any other such web-based service, none of those interviewed in Cape Town responded in the affirmative. In Johannesburg, out of over 10 workers interviewed during our visit, only two workers reported having used the MSRSA website.

Income and Expenditure

According to job-seekers, earnings fluctuated depending on the employer, job type, skills required and even time of the year. On average, the job-seekers reported the daily income earnings in Cape Town to be ranging between ZAR 150 and ZAR 350. Daily expenditure averaged about ZAR 12, a bulk of it being fare to and from worker collection points. Those with mobile phones would spend less than ZAR 2 per day to call or SMS. The data collected on earnings and expenditure by interviewing job-seekers varied with that collected by interviewing MSRSA employees. We could not establish any reasons for the disparity. We, however, made the assumption that the workers were probably reporting what they had earned or had seen their colleagues earn before. It could have also been that they were reporting what they wished to be earning. Because of the fact that the intermediary

²⁶<http://mxit.com/>

²⁷<http://www.wizzit.co.za/>

organisation (MSRSA) had been collecting data about worker earnings for a long time, we chose to stick with their figures.

Commuting

We found that commuting for job-seekers involves using public transport means or walking to collection point. We used both interviews and questionnaires to find out their commuting means, times, distance and the cost involved. Some workers in Wynberg and Fish Hoek worker collection points indicated that they always walk to the collection point. However, a majority of them indicated that they used the Metro train. A few of them reported using the public transport taxi services. Because of time and distant constraint, we used a questionnaire to collect data on commuting of the DLM workers from Johannesburg and Pretoria.

Out of the 90 workers from Johannesburg/Pretoria who were asked their means of commuting through a questionnaire administered by field officers, 55 of them said that they used the taxi, train or a bus, while 35 indicated that they walked to the worker collection points. Commuting time was reported to be approximately one hour 20 minutes while walking to collection points. In an interview with the MSRSA regional manager for Pretoria, we were informed that there are workers who are poor to an extent that they decide to sleep on the streets as they cannot afford to pay for their commuting costs. While the average cost of daily commuting was ZAR 10 in Cape Town, the questionnaire analysis gave ZAR 12.2 for Johannesburg. The difference can be explained by the fact that more workers use the train, which is relatively cheaper in Cape Town while those in Johannesburg mostly used the taxi services.

6.1.2 MSRSA Application and Prototyping Test Outcome

The applications and prototype applications built for MSRSA are presented briefly. We also present their field test results.

a) The Field Registrar

The final prototype application (product), for remote use, was a mobile based application for registering workers and employers in the field. Its users were MSRSA field officers. It also had a module for searching for workers and employers. The initial design had separate applications for job-seekers, employers and field officers. The field employer and worker mobile prototypes did not get to the final implementation level (Section 4.51 and Appendix D).

Field Testing of the Field Registrar

Even though we are reporting findings from testing the MSRSA mobile application, we note that it was not easy to observe the use of the application in isolation. We observed the use of the field registrar together with the supporting server side applications (Section 6.1.2 page 94), in terms of six mission areas. The areas were: (i) Accuracy of data captured; (ii) Data entry time; (iii) Office visit frequency; (iv) Number of phone calls by field officers to the office; (v) Ease of use and (vi) The cost of using the system. In this section, before we summarise the outcome of the six areas (Chepken et al., 2011b), we give the reasons for collecting the information and the context under which the experiment was done.

Field Registrar Observation Context

The findings reported are from doing an after-usage face-to-face interview with six MSRSA field officers, the general director, and four MSRSA office employees. The experiment also involved observing the usage for two weeks for five days each week. The usage achieved 100 records of worker and employer registrations done from the field by the field officers. We also used log files to analyse the database for any important information.

The Objective of the Field Registrar Observation

The overall objective of observing the usage of the software and the prototype systems was to find out whether they had any impact on the users and, more specifically, whether it had any impact on their travel plans. We were also observing other system characteristics that would determine the adoption of the system by users. Table 6.3 gives a summary of the mission areas observed during the MSRSA field registrar observation.

Table 6.3: Mission areas observed during the field registrar evaluation

	Variable	Purpose
1	Accuracy of data captured	The number of errors in the registration data was used and compared to a parallel registration process that used paper based forms. The aim here was to satisfy user requirement from MSRSA which had indicated that their challenge was data accuracy.
2	Data entry time	The objective was to measure whether the prototype met the acceptable registration or search time according to the users.
3	Office visit frequency	Our overall objective in the study was to reduce the amount of money and time spent in travelling. We used this variable to compare the number of visits made to the office by the users after the intervention. The objective was to find out if the frequency of office visits by the field officers reduced.
4	Number of phone calls made by field officers to the office	Since the field registrar had a registration and confirmation functionalities, our aim for monitoring the number of calls to the MSRSA office was to find out if the field registrar had had any impact. The phone calls were mainly used to confirm a worker or an employer from the field.
5	Ease of use	Here, we aimed to get the perception of users on how easy or difficult it was to use the field registrar compared to the paper based registration or making a phone call.
6	The cost of using the system.	One of the key issues we were dealing with in trying to help the DLM was investigating the possibility of using ICTs to reduce the cost of job or worker search. In testing the field registrar, therefore, we were looking at how much it costs and whether it was cheaper compared to the paper based or the voice calls.

In observing the field registrar, except for an expected observation where over 90% of the dates of birth entries were wrongly entered in the first round of testing, each of the areas was identified based on its perceived effect to travel and by extension telecommuting.

Data accuracy: There were early indications of a reduced error rate on worker and employer registration. During the after usage interview, the MSRSA director and all the four office based employees reported that the verification module reduced the amount of erroneous data captured. Evaluating accuracy of data by soliciting comments from users may not be rigorous. In the subsequent tests, therefore, we compared records captured on the system and those on paper. We could only ascertain the correctness of the data based on what was on paper filled in the field and was captured in the database. The outcome was that all the other data in the paper forms was captured correctly in the systems.

Data entry time: We observed that registrations using the field registrar took a field officer the same amount of time as filling out the paper form. We took the average of 100 registration entries and found out that it took an average of four and half minutes to register an employer or a worker.

Frequency of office visits: Prior to deployment and use of the field registrar, a typical week for a field officer would see them commute to and from the office for a minimum of two and a maximum of five days in the six days of a week. Findings from interviewing field officers

and a two week observation showed that the office visit frequency had reduced to a minimum of one to a maximum of two days a week.

Number of phone calls by field officers to the office: Worker claims verification was a common activity of an MSRSA field officer. With the field registrar, a single confirmation took less than a minute for a user who had already mastered its usage. It took a naive user about two to three minutes. Compared to the old way of confirming worker details, where phone calls were used, the worker confirmation module was found to be the most accepted and valuable. This is according to the opinions of the six field officers and what was observed.

Ease of use: The users reported no serious usage challenges of the system. The same was observed during our close observation of three field officers. However, field officers found it difficult to enter the correct date of birth field by selecting from a date picker. Over 90% of the entries were wrong. The application was seen to be challenging for those who were using Nokia E63 for the first time. They had difficulties keying in data mainly because they were not used to QWERTY keyboards on mobile phones. This was true for two field officers and one office employee who were issued with E63 phones specifically for this trial and were using it for the first time. This did not concern us much as there are studies such as [Clarkson et al. \(2005\)](#), which have shown that typing speed is not largely determined by the keyboard layout. Some studies, such as [Arif and Stuerzlinger \(2009\)](#), reported a result showing that thumb-keyboard is the fastest text entry method after the standard QWERTY keyboard.

The cost of using the system: Initially, the cost of using the system was a major concern to users. A confirmation that the cost of using it was minimal and a few trials eliminated the doubt. It was possible to confirm worker details with as little as ZAR 0.20 (USD 0.014) using the search module, compared to a phone call that cost at least ZAR 2.8 (USD 0.333). This is over 90% reduction in the cost of confirming worker details. A similar method of measuring the cost of using the system compared to the cost of travelling and phone calls in the absence of the mobile application had also been applied by [Salomon et al. \(1991\)](#).

Table 6.4 gives a summary of the findings from the six mission areas that we were examining the MSRSA field registrar.

Table 6.4: Field registrar observation mission areas outcome

Mission area	Findings
Data accuracy	Compared to the data that had been captured in the MSRSA for five years, the data captured using the field registrar showed reduced error rate on worker and employer registration.
Data entry time	It took the same amount of time to register an employer or worker using the field registrar as it took to do it manually. The advantage of the field registrar would then be because it needed less work to update the database at the office.
Frequency of office visits	The number of days that a field officer would travel to the office was reduced by the field registrar from a maximum of five days to a maximum of two days.
Number of phone calls by field officers to the office	A reduction in the number of phone calls for the purpose of confirming worker details was seen with the usage of the field registrar. According to the field officers, this was the most valuable functionality of the field registrar.
Ease of use	Overall, there were no major usage challenges in using the field registrar. The challenges were seen with familiarisation with a QWERTY keyboard by the first time users.
The cost of using the system	The cost of using the field registrar was a major concern to us and the users alike. It turned out that registering one worker or employer would cost an average of ZAR 0.2.

b) MSRSA Web-based Data Update and Verification and Payment Application

The MSRSA data update module was developed as a helper application primarily to allow the registration of workers from the field. In the course of our study however, MSRSA started a mobile based worker payment method. The payment system was being run by an independent organisation and needed worker and employer data from MSRSA. Before our intervention, MSRSA had a web-based system for manually entering data into the payment system. This meant that there was a need for MSRSA officers to enter the same data more than once to the payment system and to the worker and employer database. To allow them to enter data only once, we designed the verification module with an extension that would allow them to save the same data into the payment system while saving it into MSRSA main database.

The Field Test of the Verification and the Payment Module

As indicated in the research design (Section 4.5), the verification web-based application was meant to be used by the MSRSA office workers to verify field data. The field data was mainly collected using our mobile application (field registrar) and paper-based form. Data could come from different MSRSA branches. The verification was needed because the MSRSA management needed the erroneous data problem in their database to be corrected. Although we tried to explain that it was possible to validate the data entry on the mobile phone application, MSRSA management insisted on the verification module because of the manual data collection that was still going on.

The training session with the MSRSA office employees on how to use the verification module was carried out within an hour. All the four MSRSA office workers adopted it

without any difficulty. For the four users that we observed for one hour after training, none of them had any major usage errors. This may have been because of two reasons: first, the application was being pushed from the top management (Director) and, secondly, the workers were already using another web-based database system. During our test period, we recorded over 100 records being received from the field, corrected/verified and saved to the MSRSA main database. Figure 6.7 shows a snapshot of the data being verified.

Worker ID:	NAM0441
First Name:	
Surname:	
dob (yyyy-mm-dd)	1962-11-11
Cellphone Number	0
Address	
MSR Office	Olympia
Area Name	Cape Town
MSR site	Cape Town
MSR ID	Cape Town
Email	
Gender	M
Schooling	primary
Drivers license	
Learners permit	
Skills	no skills

Figure 6.7: A screen shot of the MSRSA snapshot of the data verification process

This is an example of data captured from the field using the field registrar. The interface allows for verification by the user. The data is basic details of a worker being registered

As system designers/programmers, we did not think of verification module as a necessary application. However, during testing time, we discovered that it served more to have field officers remember to check their data before sending it to the database. One of the field officers reported having to enter correct data to avoid being asked later on about it. We learnt that field officers believed that there was no way an MSRSA employee in the office would verify the data if entered directly from the mobile phone to the main database. They, however, believed that once the data went through the verification module (which was showed to them) then the MSRSA office employees would get to see it. This forced them to check the data before submitting.

Interfacing with the Payment Modules

The verification module became important because it allowed transmission of data captured from the field to the payment module. During testing, users, including the MSRSA director, agreed that the verification module can be used to save the same data to the payment module, thus providing an interface between the MSRSA data and the external payment application (*Wiwallet*²⁸). The need to design the payment module interface required that we consult the providers of the system.

Testing of the payment module was not successful. The main reason for the failure was because *Wiwallet* required that correct and functional national identification (ID) numbers

²⁸www.wiwallet.co.za

and mobile phone numbers. These details, especially the mobile phone numbers, were not available for most of the day-labourers in Cape Town, South Africa. The data entry officers, using the verification module, as a result, reported nine failures out of every ten attempts to update *Wiwallet*. The update failure was due to either the IDs or the mobile phone numbers being rejected.

MSRSA Web-based Data Upload/Update

During the course of our study, MSRSA adopted a new proprietary web-based database application, *placementpartner*²⁹. The new database application provided no external programming interface. The MSRSA data upload/update application was, therefore, needed as a synchronisation module meant to synchronise data between the proprietary web-based cloud application and the searchable MSRSA database that was accessible to our remote mobile applications.

At this stage, the continued usage of the mobile phone application (the field registrar) by the field officers was dependent on the MSRSA database. The data upload/update was implemented with its input and output being *CSV* files. The module was for populating the MSRSA local database accessible by the mobile applications and occasionally uploading the verified data captured from the field into the proprietary application.

The usage testing of the MSRSA upload/update module was done by observing the general director using it for one week. It was then used by two office based MSRSA employees. In the end, we regarded it as successful due to the fact that it managed to continue the usage of the field based mobile and the verification module applications. Figure 6.8 shows an example of a *CSV* files downloaded from the proprietary (*placementpartner*) application. The *CSV* files would then be uploaded to an MSRSA database that was accessible to our remote mobile applications. The ID numbers were obscured to hide the identity of the workers. Figure 6.9 shows the data upload/update module in use.

²⁹www.placementpartner.co.za

A	B	C	D	E	F	G	H	I
	Candidate	Surname	Name	ID Number	Cellp' one	Rating	Status	Job Sector
1	2_3363		A am Mri e	8.0 1405	7 31095	*****	Unemployed	Constructio
2	2_3399	aham	C rist in .br	4.9 1821	7 3 383 2	*****	Unemployed	Constructio
3	2_3457	ams	Je isic. A am	8.1 110	8: 3 17 4	*****	Unemployed	Restaurant
4	2_3464	ams	N tasl a .ee	9.3 1617	74 3 1615	*****	Unemployed	Domestic : I
5	2_3789	Arts	E rico An o	8.1 1607	71 3 3614	*****	Unemployed	Constructio
6	2_3315	oni	A ele nre	8.0 1609	71 3 1674	*****	Unemployed	Domestic : I
7	2_3469	eni	E nele	8.5 1805	7 8 16 15	****	Unemployed	Constructio
8	2_3401	ollis	' icho' : Cha	4.7 1405	7 16 9 18	*****	Unemployed	Constructio
9	2_3592	l	ionc il isio	8.0 1429	7 384 254	****	Unemployed	Domestic : I
10	2_3612	rc ii	one v a Aro	8.1 1324	7 17 3 32	*****	Unemployed	Domestic : I
11	2_3144	ries	ran us	7 1093	8 31 2 5	***	Unemployed	Constructio
12	2_3669	tie	' ep n Ebo	7.1 1507	78 3 3303		Unemployed	Temp
13	2_3197	uluabushi	P py achulu	7.1 1203	39 2350	*****	Unemployed	Constructio
14	2_3546	ey	N za i	8.3 228	82 24992		On contract	Constructio
15	2_3494	E ioyi	Ti ab iric	7.9 521	7322 109	**	Unemployed	Constructio
16	2_3213	E iupa kabong	De l Bamp	7.8 111	713 121	*****	Unemployed	Constructio
17	2_3696	E da	Fr it Fra a	7.9 131	7 1 1152		Unemployed	Logistics,
18	2_3328	E ide	il'	7.1 105	7 1 161675	****	Unemployed	Constructio
19	2_3443	Be li	Func le	8.7 112	736 1		Unemployed	Logistics,

Figure 6.8: An example of a CSV file from the proprietary MSRSA application

For purposes of remote searching, the CSV file would be downloaded to the MSRSA local database accessible to the field registrar. Records entered directly to the placementpartner would be synchronized with those captured from the field

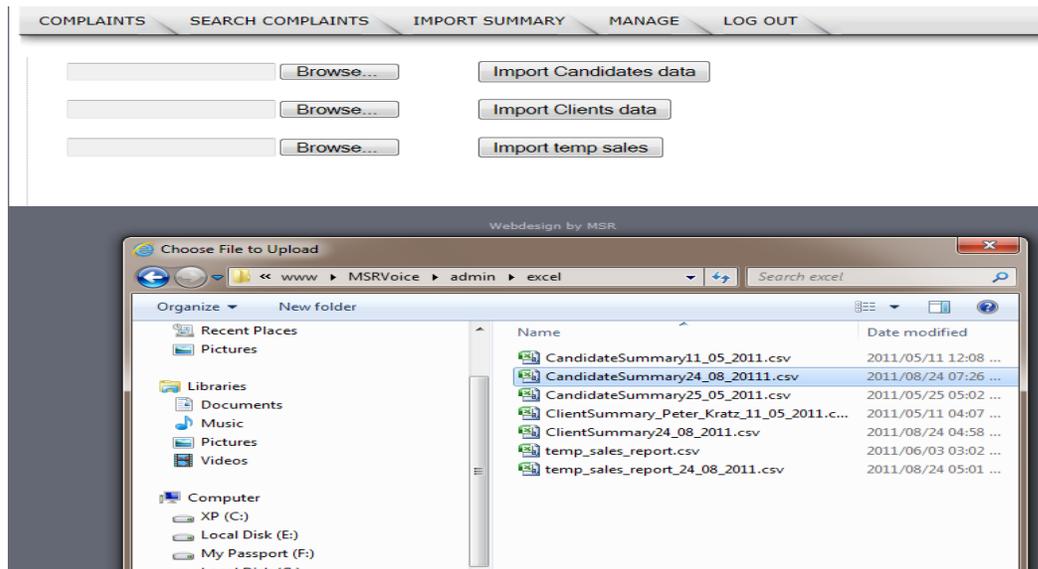


Figure 6.9 (b): Data update module for MSRSA

The CSV file with data downloaded from the *placementpartner* would be uploaded to the MSRSA database accessible by the field registrar. The upload happened through the web-based download upload module.

The *MSRvoice*

The testing process of the *MSRvoice* involved deploying the mobile application for use by MSRSA field officers. We created a scenario where field officers would ask the workers to report any form of abuses to them. The field officers would then capture the data into the mobile application. *MSRvoice* system was tested in Cape Town for six days with two field

officers. The outcome for the test was a set of complaints saved into the MSRSA database. As a contribution towards our study, we considered the complaints stored in our test database as not being the ultimate outcome for the *MSRVoice* application, but it is proof that remote applications, mainly aimed at reducing travel, was possible among the poor. Figure 6.10 shows examples of data information captured over the mobile phone during the testing of *MSRVoice* with field officers.

Complaints

#	Date	By	Type	Description	Emp Name	Emp address	Emp car	Emp Telephone
1	2011-08-08	msr1026	1	paid me by less 20 rand			Blue car	
2	2011-08-12	07892626363	3	Calls people names	Sammy			
3	2011-08-22	5678	5	Over working				
4	2011-08-22	0893738000	2	Less money				
5	2011-08-22	07893738372	2	Does not pay on time				
6	2011-08-22	08033783833	3	Two people, you share the money for one person				
7	2011-08-24	08926337722	2	Can let dogs fight you	name	address	car	telephone
8	2011-08-24	07239388484	2	Comes late				021637484
9	2011-08-24	07378372636	2					
10	2011-08-24	072390283373	1	Pays three months only	Hilltop	Hill 1	Hikk 2	
11	2011-08-24	0783762727722	2	Heavy work				
12	2011-08-24	0790267363553	3	puts at the back of his pick up				
13	2011-	07247495959	4	no money	134455	55555	66666	7777

Figure 6.10: *MSRVoice*- example of information captured during the testing phase

6.1.3 MSRSA DLM Stakeholders: Telecommuting/Teleworking Practice.

MSRSA's field officers commuted to and from their assigned worker collection points each working day of the week. They were also required to travel to the office to deliver field reports. Workers alike commuted to and from their worker collection points. In Cape Town for example, we found that the majority of the job-seekers had no choice except to commute to worker collection points if they needed to look for a job. This was because the majority of them had no mobile phones or could not access any other means of looking for a job. Even those who had mobile phones did not have enough airtime to either make phone calls or send SMS.

The field officers, however, had a practice (or would have liked to practice except that in some cases they were forced to go to the NGO's office) of some level of telecommuting. They preferred to make phone calls to workers whenever they needed to allocate them jobs. Field officers would link workers, employers and even find out information from the database through calling the MSRSA office employees. A field officer would coordinate a job allocation or information verification from home, office or the collection point albeit with a lot of costs. Field officers would not, however, perform all of their duties outside the office or collection point. For example, they would have to be at the collection point to train workers on personal relations skills; report to the office to return registration forms and maybe do a thorough search on a particular case of a job seeker.

MSRSA employees in Pretoria and Johannesburg were required to submit worker and employer data captured on paper to the MSRSA headquarters in Cape Town. This would be

done by scanning the papers and forwarding them via E-mail. The employees reported the whole process as tedious and expensive. MSRSA employees in Johannesburg and Pretoria were already practising some sort of teleworking albeit with inefficiencies. Because of cost implications, their perception about our field registrar tested and used in Cape Town MSRSA branch was positive. The field registrar, however, did not replace paper based form but was used in parallel. The advantage is that the field officers would return the forms even after three days unlike before when they returned the same day. In summary, there was a minimal level of telecommuting among members of the MSRSA DLM. Discussions on how our systems introduced telecommuting aspects are discussed in Section 7.1.5 page 133.

6.1.4 MSRSA Operational Changes and Effects on our Study

Six months into the study in July 2010 MSRSA started a gradual change in their operations. Field officers were trained on how to concentrate on employers rather than workers. The organisation was gradually changing to becoming self-sustaining. By the end of December 2010, MSRSA was fully an employer oriented intermediary organisation.

Field officers would do field trips to search for employers and, consequently, jobs. This is the time MSRSA started the paint project, where MSRSA would act as work contractors. MSRSA experimented with a model that would allow them to take full responsibility of the work including receiving money from the employer and paying the workers. Its argument for the change was the need to maintain excellent customer relations between the employers and workers. MSRSA indicated that customer relations were at risk whenever a worker had a direct link to the employer. They blamed bad customer relations for poor performance on its part to link more workers and employers.

Reasons for Transforming MSRSA to an Employer-centred Organisation

Although not all the MSRSA stakeholders were for the transformation, the general director argued that it was in the interest of all the stakeholders. To find out why MSRSA needed the change and how it would affect our study, we carried out a face-to-face interview with the director. The following are the three main reasons:

1. **Workers limited personal relations:** Due to inability of most workers to express themselves, the relationship between employers and MSRSA was dwindling. He argued that having employer-worker direct relationship was to blame for the deteriorating MSRSA's image. He blamed this on workers not being able to adequately sell MSRSA agendas. Although he did not directly mention intermediation, we saw the change as strengthening intermediation as it was cutting any direct business between workers and employers.
2. **Self sustainability:** MSRSA needed to be self sustainable by being able to fund its operations without depending on donors. Until the time of change, MSRSA depended on donor funding from well wishers and the Government of South Africa. The board of directors, however, thought that it was time for it to be sustainable by generating income through their work placement activities. This necessitated new ways of attracting more employers.
3. **Sufficient worker pool:** MSRSA felt that they had done enough on worker registration and verification. There were far much more workers with different skills than employers

would accommodate. This time, MSRSA had over 19,000 registered workers and less than 50 employers. Therefore, the need to concentrate on employer search was key to sustainability of MSRSA, the general director argued.

4. **ICT support skills:** MSRSA reported having had poor support services from the provider of the web-based database. The provider was offering the services on a voluntary basis. The director reported that the board of directors agreed on a paid up service to improve the quality of services.

How MSRSA Affected our Study

The first effect was the need to build extra applications to our earlier systems and to continue our investigation. The upload/download web application and the payment module interface (Section 4.5 and Appendix D) were two systems build to aid in the continuous use of the field registrar and the verification module.

Before MSRSA changed to focus on employers, we did not know that DLM intermediary organisations can work in two different forms: charitable and self-sustaining NGOs. However, their mediations are not different. To have a second opinion on intermediation, we identified our second intermediary organisation case study MSRNA.

Apart from bringing up the need for a third case study, the change by MSRSA made it difficult for us to conceptualise the idea of telecommuting by making it difficult to design systems for the NGO because they introduced a closed proprietary software application.

6.2 Case study II: Nairobi Day-labour Market (NDLM)

NDLM was our second case study. Its organisation is self-organised (Section 5.1.2 page 71). NDLM workers gather along Moi Avenue, one of the major streets of Nairobi, the capital city of Kenya. The collection point is along the Moi Avenue Street. Although we have knowledge of many other worker collections points in Nairobi, we refer to the day-labourers in Moi Avenue as NDLM. This was to differentiate them with day-labour workers from South Africa (MSRSA) and Namibia (MSRNA).

According to our interviewees, the Moi Avenue worker collection site has been in existence since 1932. One of the oldest members of the collection point indicated to us that he has been visiting the point since 1965. The establishment of the NDLM collection site was traced to the existence of a big paint shop which was in the same street as the collection point in question. The paint shop has since been relocated to a location that is about 15 kilometres away.

In the sections that follow, we describe findings from the field studies, design exercises and attempted implementation and testing of various systems with the NDLM stakeholders.

6.2.1 Field Work findings: The Nairobi DLM Workers and Worker Collection Points

General Findings

As the job-seekers in Moi Avenue worker collection point in Nairobi wait for clients, they hold painting brushes and other tools for identification purposes. When one passes along their waiting points, it is common for them to think of all the job-seekers as painters. However, we

found this to be untrue because, during our stay with them, we were informed that those who did not have painting brushes possessed other skills such as carpentry, wood sanding, electrical and so on. Overall, their waiting style is casual as can be seen on the picture in Figure 6.11 (a). A typical client (potential employer) either calls or visits the site. According to one of our interviewees, clients who come to the site normally do so as though they are passing by. Eventually they identify one person who will be his contact person for the others. Figure 6.11 (b) shows a typical approach that a client would take. The man on the extreme left in figure 6.11(b) is a passer-by, but depicts how a client would approach the site.



Figure 6.11 (a): Members of Nairobi DLM watching on a potential client



Figure 6.11(b): Showing how a typical client would approach the collection point

Training and Skills Acquisition

Out of the 33 workers that we interviewed and worked with for 18 months, 71% had painting skills. Electricians were 14% while the rest were carpenters, plumbers and fitters. Most (above 70%) of the job-seekers acquired their skills through experience. A small percentage went to youth polytechnic and vocational schools. To find out what ordinary citizens knew about the day-labourers, we asked friends and workmates about day-labour workers in Moi Avenue. For the reason that the majority of the workers carried painting brushes, many of our friends and workmates knew the site as consisting of only painters. As a result, the site has attracted the attention of the most known paint manufacturing companies in Kenya. Interviewed workers informed us of most of the paint manufacturing companies regularly training them on new paint products. This practice has been seen by the job-seekers as a marketing strategy rather than an attempt to help them get more jobs.

NDLM Site Organisation and Leadership

NDLM is self-organised. It is based on tribe or ethnic affiliation hence, their leadership is tribal. The site has about four major groups each affiliated to the four major tribes in Kenya. Smaller tribes join the big ones depending on how close they are to them with regard to language dialect, friendship or any other kind of relationships which make them feel comfortable in the group. Unless one studies the NDLM keenly, it is not easy to notice the tribal groupings. This is because they are always not far from each other and that the waiting point is not spacious enough to allow them to fully separate. Associations are in a hierarchy: one at the tribal level and another at the overall level governed by elected DLM leadership drawn from all the represented ethnic groups. Each ethnic group represented has a team leader who is in charge of the members' registration.

Member registration is paper based and is free of charge. We were, however, informed that, in the past, new members were being charged a fee of KES 200 (USD 2.5) for registration. During that time, they had a general office (virtual) officiated by an overall chairman, the vice-chairman; the secretary and the treasurer. Generally, NDLM had a weak functional leadership whose work is to arbitrate and solve disputes. The workers engage the city council of Nairobi (CCN)³⁰ on matters of job-seekers' rights and safety. Their informal organisation has a set of conventions, codes of conduct and norms which serve as platforms for behaviour.

NDLM Population Size

The chairman of the NDLM association informed us that, on average, one can count up to 100 men within the pavement at any given time. Collectively, the total number of all the men that hang out at Moi Avenue can be up to 1000. This means that, at one time, there are about 900 absent; either working, out of job search activity or away on personal trips.

6.2.2 Specific Findings and NDLM Members

In this section, we outline specific findings with regards to Nairobi day-labour workers. These findings include: the demographic information, social dynamics, technology use, work skills, literacy levels, language, income and expenditure, and general issues. We came up with the issues based on the elements and perceived benefits of telecommuting. The objective was to (in the end) see how the day-labourers fared towards adopting/benefiting from telecommuting. We also needed to identify factors that work against telecommuting.

Demographics

We found that the Moi Avenue day-labour workers were all male³¹. Their ages range from thirty (30) to seventy years (70), with the average age being 44 years. They are all Kenyan citizens from different parts of the country.

Social Dynamics

In general, there is a weak link among NDLM members. However, there exist small sub-organisations within the bigger one. The sub groups are constituted on tribal basis. The link is stronger between members of a sub group than it is among members of two different sub groups.

We asked the question: "Since when did you start being a member of NDLM?" The youngest members had been there for an average of three years, while the oldest had been there for over 35 years.

The Moi Avenue day-labourers have no formal linkages with any formal organisation. Their relationship with paint manufacturing companies is informal and temporary. We also noted that the group had a weak link with the City Council of Nairobi where the latter has allowed them to wait at the back street of Moi Avenue and have put up seats for the job-seekers.

³⁰www.ccn.co.ke is a local government running the city of Nairobi

³¹A word of caution: there exist other worker collection points in Nairobi that serve both male and female workers.

Skills

Moi Avenue collection point is rich in skills. All its members were skilled, with some of them having high skills such as being fully qualified electricians and certified painters. Available skilled workers include, but not limited to carpenters, painters, electricians, brick layers, glass and general fitters, welders. Other skills may be classified as general skills.

Asked about their work experience, the responses were more or less similar to the number of years they have spent on the waiting point. The range was between three (3) to over forty (40) years. The majority of the interviewees had worked in a formal employment at some point of their experience time.

The experience we had from MSRSA is that skilled workers were willing to do general work in cases where skilled jobs were unavailable. This was not the case with the Moi Avenue workers. All the workers interviewed preferred not to do any general work even when skilled jobs were not available. In fact one interviewee indicated that he would rather travel upcountry to see his family instead of doing manual jobs requiring no skills.

Except for one worker who possessed plumber and electrical skills, we found that specialisation was encouraged within the Moi Avenue collection point.

Language

About 100% of Kenyans can speak Swahili³² ([Kenya Information guide](#)³³). A majority can read or write in Swahili too. English literacy in Kenya depends on school level attained. Those who attained grade eight and above can understand and speak Basic English. The language scenario among Kenyans reflected in the NDLM group is that 100% of those interviewed would speak in Swahili. A few would speak both Swahili and English.

Speaking Swahili in Kenya means you can communicate with virtually every other Kenyan. What this means is that there is no communication barrier among job-seekers and their potential employers.

To find out about workers' writing capacity, we requested the interviewees to write down their personal details. The results were that majority of them, at above 97% (32 out of 33), could read and write their details in English. We also asked them how they get to any location they have never been before. The response was that they normally ask to be picked up by employers or get directions via a mobile phone call. None of the interviewed workers reported having used a map as an aid to getting to a new location. This tallied with the researcher's experience that maps are rarely used in Kenya for finding directions to places.

Literacy

A large percentage of Moi Avenue day-labour workers (over 90% of those interviewed) attended school, with some of them attaining (over 30%) O-level grade 12. The highest education level attained by majority of the workers interviewed was between standard eight (grade 8) and O-level (grade 12). The average schooling level is grade 10.2. In the interview carried out by the research assistant, four out of the five interviewees had gone to either

³² Swahili is a Bantu language spoken in Kenya.

³³ <http://www.kenya-information-guide.com/kenya-language.html>

national or local polytechnics. Going to National and local polytechnic is an equivalent of attaining grade 13 and 9 respectively. According to UNICEF³⁴, the total adult literacy rate for Kenya between 2005 and 2010 was at 87%. Going by these figures and our findings in the field, it can be claimed that all the job-seekers that we interacted with in Nairobi can be classified as literate. This is according to UNESCO classification of literacy (Hillerich, 1976), which classifies those who have gone to school beyond grade four as literate.

Technology Ownership and Use

In the Nairobi DLM, 100% of all our respondents reported owning and using a mobile phone. According to our interviews and observation data, there was a 100% mobile phone access among our participants. The majority said that they used their mobile phones to make and receive calls, mainly from their peers; their clients (potential employers); family and friends. People in such economic classes, as day-labourers, would be expected to use their mobile phones to only receive calls and not for making calls. This was, however, not seen among the NDLM job-seekers. As presented in the NDLM findings (Section 6.2.3 page 106), workers would also make phone calls. There was emphasis on mobile phone ownership. In fact one interviewee lamented that being on the roadside without a mobile phone is *õdoing useless workõ*.

Three out of fourteen interviewees in our first visit had the equivalent of ZAR 10.2 (USD 1.2) worth of airtime in their phone at the time of the interview. When we checked the airtime on the day-labour workers' mobile phones over a number of sessions (which included those by the researcher and research assistant), it averaged ZAR 5.2, which is about 15.5 minutes of talk time.

Many of the phone calls made were said to be proactive and mainly used to enquire about potential jobs. Social calls, such as those to family and friends, were also part of the call list of the respondents. All those interviewed reported that they always receive calls from potential employers, friends and family members. The scenario in our first interview played itself during subsequent observations and interviews both by the researcher and the research assistant.

Out of fourteen job-seekers interviewed during our first interview, one, a senior citizen aged 64, could not use SMS. All the interviewees admitted carrying their mobile phones with them all the time, except when they had taken it for charging or when it gets stolen.

In addition, all the 14 respondents in our first interview had heard about computers. A majority had seen and even touched one, but none of them had used a computer or was computer literate. With the exception of one person, none of them reported having an E-mail address account. Asked about the internet, no single respondent had knowledge of the internet. Majority of them were, however, aware of the existence of other technologies.

None of our respondents had landline telephone at home. The only experience they had with landline was using the public telephone booths.

³⁴http://www.unicef.org/infobycountry/kenya_statistics.html

With regard to using SMS based job search services, none of our participants reported having used any of these services. They all responded to this question by reminding us that it was expensive to use such systems.

Further Study on Technology Use for Nairobi DLM

Because our objective was to introduce ICT designs that would reduce travel, and especially of workers commuting to collection points, there was need to understand how workers used the technology (the mobile phone) before starting the design process. We anticipated a situation where workers in Nairobi, who had mobile phones (over 90% ownership) would leverage mobile phone services such as SMS and voice calls, and later our prototype applications, to reduce the frequency of travelling to the collection points. However, our initial field work findings indicated that this had not happened. Throughout our study in Nairobi, we could not establish any good reason why the majority of the workers had not adopted the mobile phone texting and other mobile phone services involving the use of text, for example *WhatsApp*³⁵. We expected the use of SMS, for example, to be high because the cost was lower compared to voice calls. In addition, the job seeker population is relatively educated to a level where one would expect them to adopt SMS. To find out more on what held back the use of technology to reduce commuting frequency, or any other position missed, we carried out a further field work study on technology use, especially the mobile phone, among the day-labourers in Nairobi. Although, the findings from this particular study did not change our initial design, it served to give us a deeper understanding on technology use among the day-labourers.

Income and Expenditure

The results reported on the earnings and expenditure for the NDLM day-labours were accumulated through the various field studies. The daily earnings ranged between ZAR 60 and 100 (USD 7.5 and 12.5) and an average of ZAR 80. Skilled workers earn more than less-skilled workers. For instance, the daily earnings for a painter was about ZAR 100 (approximately 12 USD), while that of a general labourer was about ZAR 60. Wage payment for workers are done either on a daily basis or per job completed. Workers preferred the latter because it earned workers more while helping them accumulate earnings to a reasonable amount.

Average daily commuter cost was between ZAR 8 to 15, averaging ZAR 10.3. The average weekly airtime cost was found to be between a minimum of ZAR 20 to a maximum of ZAR 150 (USD 0.25 to 18.75). Mobile phone battery charging at a commercial kiosk cost ZAR 2 per charging. The other major expenditure, rent for home, averaged ZAR 170 (USD 21.25) per month, about ZAR 5.7 per day.

The best case scenario, where one gets jobs throughout the month and earns over USD 335 per month, would see a typical day-labourer meet all the basic needs expenditure. This is by the Kenyan standard where the average wage was between ZAR 517 (BBC, 2010) and ZAR 884 (WageIndicator.org, 2012). The worst-case scenario is where a job-seeker does not get a job for a whole month.

³⁵ <http://www.whatsapp.com/>

Commuting and Job Searching

With regard to commuting, we were interested in two main issues. The first was the commute time to and from home to the collection point and work station. We were also interested in commuting cost implications to workers. The reason for the interest in this information was the need to understand and prove the existence of a problem, and later on use the information to find out whether the interventions reduced the travel time and distance. A typical commute time in Nairobi would take anything from one to three hours depending on time, location and the day of commuting. We found that, to reduce the cost of commuting, job-seekers commuted during off-peak hours. The majority of those who use *matatu* (motor vehicle public transport) or train services arrive at the collection point between nine and ten AM and leave for home early (at between three to four PM) or late (between seven to eight PM).

The second issue was to find out how the workers spend a typical day at the collection point. We found that discussing (informally chatting) with colleagues and being vigilant for a potential employer takes a lion's share of the day. In few occasions, workers use part of their waiting time during the day to catch up with friends (either via phone calls or physical visits) who are not job-seekers in the day-labour industry. The friends were either within or outside Nairobi city.

To ascertain the cost implications of job searching, we tried to find out the chances of a day-labourer getting a job. According to the chairman of the NDLM, the average number of regular customers/companies (employers) visiting the collection point per day was estimated at 20. To find out the same from the job-seekers, we asked our interviewees the longest time they have been out of a job and still come to the worker collection site. The responses were diverse with a few workers saying they had spent up to six months without any job. It was, however, encouraging to hear that some workers had stayed in a job for between six and twelve months without any disruptions.

6.2.3 Moi Avenue Nairobi DLM General Issues and Challenges

We asked the Nairobi day-labourers how they felt about their current setup. We also requested them to share and discuss their benefits and challenges with us. The objective for this field work was to get the respondents to tell us anything else that we would have missed out. Specifics included:

- To prove the existence of a problem in the DLM
- To understand the problems faced by the DLM workers with the intention of isolating those that can be solved using technology
- To understand the general setup of the DLM in a self-organised context
- To understand the benefits of the DLM and isolate those which we could take advantage of in making the design decisions.

Feelings about the Day-Labour Setup Then

All the interviewed day-labourers indicated that they were at the collection point not by choice but because of circumstances. The respondents indicated that their current organisation was the best available option. They believed and admitted that there were no other ways of looking for a job. We asked about the time *wasted* at the worker collection

point during those days of going back home without any job. The workers indicated that socialising with fellow job-seekers would compensate for the time. The other reason is the fact that there would be nothing to do whenever one is out of work – after all, *“what would one do?”* seemed to be the impression.

Knowledge of the Internet

With the aim of trying to find out how much our participants valued advertisement of their services, we asked them what they thought about being advertised on the internet. One day-labourer responded by explaining a case where the Nation newspaper³⁶ featured them. *“In fact when nation came to photograph us and put us on the paper, we got many jobs”* said the day-labourer. Many other workers agreed with the idea of publicising their worker collection point and their work. The perceived support of advertisement idea by the workers encouraged our efforts of having an online based matching and publicising system.

The workers that we interviewed blamed lack of publicity for poor turnout of clients. At least five of the workers interviewed admitted having heard passers-by questioning what they do along the worker collection point. This showed that, if an awareness campaign is set up, it might improve their search.

Nairobi DLM Challenges

After analysing interview data from Nairobi DLM, we summarised the challenges faced by the day-labourers as follows:

- Lack of publicity: Indeed, many passers-by did not know what the day-labourers were doing at the worker collection point. Lack of publicity reduces the chances of workers to increase their clientele. A small clientele means that workers will be out of work most of the time, hence having to commute to worker collection site. The chances of workers being informed of jobs in advance reduces as this can only be done by some customers (only those who know about the waiting point).
- A crowded and congested worker collection point: There was not enough space set aside for the job-seekers. They usually waited behind Moi Avenue where other activities (for example, taxi rank activities) take place. This reduced their chances of getting a job.
- Theft of workers’ experience benefits: For example, middlemen requesting for quotations from the day-labourers, which they later sell or use with other workers with no proceeds to the original drafters.
- Underpaying or exploitative employers: often, employers request workers to go to a certain place for a job. In such situations, workers mainly use their money as fare and sometimes for airtime. In some cases, where the employer and the worker disagree on the amount to be paid for the work, job-seekers end up spending more money returning to their worker collection point.

³⁶ One of Kenya’s leading newspapers – www.nation.co.ke

- Wages fluctuation, which results to workers not being able to predict how the future will look like in terms of wage earnings. This makes it frustrating for workers as most of them have dependents.
- The presence of conmen, petty thieves and illegal labour-brokers: Thieves would steal workers' tools and equipment while conmen and labour-brokers would masquerade as potential employers and use job-seekers details to acquire contracts which eventually do not benefit the job-seekers.
- Breach of contract by employers, for example in situations where workers get paid less than what had been agreed on before starting the job.
- The existence of less qualified workers: According to interviewed workers, there are workers who wrongfully claim skills that they do not have or are less qualified in. These workers were said to be cheaper to hire but end up spoiling for the qualified ones.
- The availability of poor quality materials was reported as one of the things that had the capacity of ruining workers' careers. Two workers reported having been accused of incompetency because of using poor quality materials.

Benefits of being at the Collection Point

We asked workers to tell us some of the benefits they get from being a member of the collection point. The following are some of the things they said:

- Training and exposure opportunities. Examples of training include those provided by painting companies. Some skilled workers from the Nairobi DLM had been taken to work abroad in countries such as Saudi Arabia and Democratic republic of Congo (DRC). Others have had a chance to work for big organisations such as Kenya Airports Authority (KAA) and the Kenya Defence Force (KDF).
- Moral and financial support from their colleagues during hard times.
- Social support and the sense of belonging to a community.
- Proximity of the worker collection point to Nairobi CBD, where other services such as shopping malls can be found.

6.2.4 Nairobi DLM Application and Prototyping Test Outcome

We did an extensive field work study in Nairobi about the DLM. From the field study, data analysed and the lessons from MSRSA case study provided us with what we thought was sufficient information to building successful ICT systems for a self-organised DLM such as the NDLM. Despite using this information to design and build the systems, there was less success in deployment compared to what we saw with MSRSA and MSRNA. We attempted three times to deploy the systems for testing. However, none of the attempts succeeded. The three types of systems designed and built for Nairobi DLM were: (a) A fully functional web-based application based on MSRSA and MSRNA experience; (b) a modified web-based application based on the findings from Nairobi field study; and (c) a mobile application for remote use based on the Nairobi field work findings and MSRSA. The mobile application would do registration and searching of workers and employers, updating of worker details such as skills and references. The mobile application was also designed to allow for posting

of complaints by both workers and employers. We added the module allowing the posting of complaints after *MSRVoice* showed positive results.

Deployment Attempts for the NDLM

The first attempt was the deployment of the web based application as was done for MSRNA, with a few modifications to allow support for a self-organised DLM. In this experiment, 20 day-labourers and five employers were trained on how to use the application. First, they were shown how to do online registration and search of workers, jobs or employers. They were also shown how to post jobs online. After a two day training, the research assistant asked the 20 workers and five employers to register themselves online within a two-week period. The participants would do the registration at an Internet cyber-café. Employer participants were also asked to use their office or home computers as alternatives to register. After two weeks, none of the participants had done the online registration.

Our second deployment attempt was on the remote mobile application for worker and employer registration, and job and worker search which was designed based on the Nairobi findings. The deployment attempt involved installing the J2ME mobile application on the mobile phones of the five selected workers. We then asked them to use the application to register and to search for jobs. Again, none of the five workers managed to complete the tasks on their own. Only five out of over 50 workers that we found during the test period had mobile phones supporting J2ME application. This was, therefore, the only selection criterion.

In the first and second experiments, the participants reported that one of the challenges was too much information to fill in when searching or registering. They also complained of having to type too much information when registering. Before our third experiment, we modified our prototype applications by reducing the number of entries that needed to be entered. We also provided for as many selections as possible rather than text entering.

In the final attempt, after modifying the prototypes based on the user feedback, from the first and the second experiments, we deployed the customized web based database and mobile applications. In the third experiment, we gave the 30 plus workers and five employers the option of using the mobile phone or the web application. Only two employers tried the system once. Once again, none of the workers succeeded in using the system within another four weeks of observation with close supervision by both the researcher and the research assistant.

6.2.5 Nairobi DLM Stakeholders: Telecommuting Practice

Despite the waiting point being in the Nairobi CBD, the day-labourers had their work stations within and outside the city. The work stations may also be thousands of kilometres away; even outside the country. The majority of the Nairobi DLM workers were able to perform or secure multiple jobs in a single day by using the mobile phones.

The main reason for turning up at the worker collection point everyday was to secure a job and, preferably, from new clients. However, most of the jobs were found through previous connections via the mobile phone. Even when employers were around the collection point, most would still call to find their preferred day-labourer. There are also those who called from their offices or homes to request for a worker.

The evidence for remote job search and organisation manifested itself in the findings. Workers would call employers to confirm jobs. They would also call their colleagues to offer them a job that they could not accommodate. The phone calls were reported to reduce commuting and allow executions remotely. Being able to organise activities outside the normal business hours was also evidence of teleworking as it met the time element of teleworking's definition.

Some of the advantages of telecommuting as reported in literature played out within the NDLM workers and will be discussed in the discussion chapter.

6.3 Case study III: Men on the Side of the Road, Namibia (MSRNA)

In this section, we present the data collection stage and the experiment results for MSRNA, our third case study. These results are grouped into two main categories. The first one has the field work findings consisting of the general findings on job-seekers and a description on how MSRNA operates. We also show how MSRNA differs from MSRSA. The second part has the testing outcome of the two main systems built and deployed to test telecommuting concepts. The mobile phone android application and the web-based database system were the two systems.

6.3.1 Field Work Findings on MSRNA Workers and Worker Collection Points

Job-seekers

Literacy

A majority of workers (90% of those interviewed), were grade eight and below graduates. The workers interviewed barely spoke in English but could speak in other languages such as Afrikaans. The workers were text illiterate – could not write or read. Since the Namibian teaching language is English, it is probable that those who could not speak English had not reached Grade 10 in school (Gonzo and Plattner, 2003). Two out of over 40 job-seekers that we interacted with could speak English. Namibian literacy rate is estimated at about 85% (CIA fact book³⁷). This means that the majority of illiterate Namibians are found among the unskilled and the unemployed. Data from the MSRNA workers database showed that the average education level was grade 10.25.

Language

Because of their level of education, language barrier was found to be common among the MSRNA job-seekers. The field officer told us that majority of the workers hail from the previous disadvantaged areas (mostly economic migrants from the northern Namibia) and can only speak in their local languages. As a result of the language barrier, majority of the workers require translators during job search processes, especially when dealing with employers who can only speak in languages not understood by the job-seekers.

Earnings and Expenditure

Despite Windhoek being a relatively expensive city in terms of cost of transport, food and housing (compared with Nairobi, for example), unskilled labourers in Windhoek, Namibia

³⁷<https://www.cia.gov/library/publications/the-world-factbook/geos/wa.html>

earned almost a similar amount to those in Nairobi. Data from our interviews with both job-seekers and MSRNA employees showed that the daily average earning for a non-skilled worker was ZAR 100 and ZAR 150 for a skilled worker. The cheapest transport cost in Windhoek is ZAR 16 for a round trip. Using a questionnaire administered to 12 job-seekers by the field officer, we found that the average earning per day for a worker is ZAR 112.85, while the cost of commuting was reported to be ZAR 8 per day. We assumed that majority of the workers who participated in the questionnaire walk one way and use a taxi or train the other way, hence bringing the commuting cost to an average of ZAR 8. None of the workers we interviewed lived alone and, hence, the cost of renting a house was not a factor.

Commuting

In an interview with the head of MSRNA, she informed us that majority of the job-seekers walk to the worker collection points. This was confirmed by the majority of the interviewed labourers. They reported walking to and from collection points, a distance of up to 15 km. We associated the walking by workers with the cost of transportation in Windhoek which is relatively high. As a result of walking to and from collection point, a job seeker's typical day starts at 5am and ends at around 5pm. They leave the worker collection point at around 10pm and arrive as early as 7am.

Demographics

All the 40 job-seekers that we interacted with during our study period were men. In an effort to find the most correct average age, we used three different methods: The first method was interview with the workers who reported the ages of between 22 and 30 years. In the second method, we asked them their age in the questionnaire and we found that the average was coming to 26.75 years. The last method was analysing of the MSRNA worker and employer database with over 700 workers and we found the average age of 30.3 years.

Technology Ownership and Usage

For all our three case studies, technology uses and ownership, and particularly mobile phones, was a key concern in this study. The MSRNA case study was not an exception. In our field interview with MSRNA day-labourers, we asked workers if they had any kind of access to a mobile phone or landline telephone; Internet or e-mail services. Findings showed that mobile phone ownership among the workers was minimal—of all the 40 workers sampled in three different worker collection points, only about 10% reported owning a mobile phone. None of the workers interviewed reported any home landline telephone. Nevertheless, accessibility to technology, especially the mobile phone, was said not to be a problem. Workers reported having contact numbers that belong to family members and friends (mainly girlfriends). Accessibility through third parties accounted for over 80% of those who were asked this question. None of the workers interviewed had used Internet or e-mail before. The majority of them had, however, used computers at the MSRNA offices.

In the questionnaire, we asked the workers to report their average airtime on phone at that particular time of the interview. The analysis showed an average of ZAR 4.87, which would sustain a local phone call for about 3.2 minutes. We also asked them for their daily average expenditure on voice calls and/or SMS which they reported as ZAR 4.5 on average.

MSRNA Membership

Only six out of the 40 workers that we asked about their membership to MSRNA reported not to be members. The rest were either members or at one point have become members of MSRNA. In their model, MSRNA does an annual worker registration. This keeps their records updated and clean compared to MSRSA. During one of the field days, we witnessed new registrations for the year 2011.

6.3.2 About MSR Namibia (MSRNA) as a DLM Intermediary Organisation

The information we report here about MSRNA was derived through face-to-face interviews; online interviews (Skype voice calls and e-mail correspondence); six days observations; MSRNA worker database analysis and literature and document review.

The head of MSRNA informed us that MSRNA runs four worker collection points with a total of approximately 700 members. The current member number according to their worker database was 744. Although MSRNA also supports women, 90% of their members were found to be men. The organisation has three full time employees consisting of an administrator, a field officer and an office assistant. It is run by a board of directors which is made of prominent people in the society.

MSRNA Services

With a view of increasing job seeker opportunities, MSRNA had adopted a number of programmes and services. These programmes are described below:

Language Programs

As a result of language barrier among the job-seekers, MSRNS responded by starting a program called *“English for the world of work”*. This was a unique initiative, as it was not seen in Cape Town where a similar problem was found. English for the world of work is a program meant to train illiterate job-seekers in speaking Basic English. It was dubbed *“English for the world of work”* to encourage workers to attend. According to the head of MSRNA, prior experiences showed that inviting workers for ordinary Basic English lessons failed. The phrase *“for work”* was, therefore, being used to attract workers.

Record-Keeping

MSRNA keeps a clean and updated job seeker database. It also enforces an annual registration renewal to keep the database up to date and to ascertain the number of active members. Prior to the introduction of our web-based system, MSRNA was not keeping any records on employers. MSRNA policy requires that job seeker registration be exclusively done in the field. Those who turn up in the office are denied registration for the simple reason that they have to be known from the field. The reasoning by MSRNA about worker registration in the field was that, if they did not know a worker from the field, then there was no other way they could know him or her. After all, they are an organisation which supports unemployed people who look for jobs on the side of the roads. This is different from what was observed in Cape Town. MSRSA does a one-time worker registration, maintains a database of all the employers engaged. It also does both office and field registrations of workers and employers.

Job Search Initiatives

Although MSRNA helps its members in finding jobs, their area of concern is providing job search resources and support to workers. The provision of the resources and support is part of an initiative by MSRNA's vision of finding opportunities for workers to find themselves work. This is made possible by programs such as training on simple job skills. An example of the resources includes an initiative by MSRNA to buy two leading newspapers. The papers are expected to benefit members by way of giving access to job adverts. The head of MSRNA noted that availing of newspapers to workers seemed a viable option on the strength of the fact that MSRNA office is within the township where majority of the workers reside. Job-seekers were also provided with a job search starter pack consisting of protective devices such as aprons and boots. Other services provided by MSRNA include CV creation and photocopying.

MSRNA encourages employer-worker relationship building, something that MSRSA was seen to be moving away from after supporting it for some time. It also held *community forums* among workers and all members of the public every six weeks. The forums are expected to encourage interaction between employers and workers. Members of the general public are also expected to be educated on why job-seekers, especially those on the side of the road, stand/wait there. General public concerns are also raised in the forums. Compared to MSRSA, MSRNA was seen to be having more job search programs.

Worker Referencing

Worker referee, (used as references by MSRSA and MSRNA), are described as employers who have used the services of the MSRNA job-seekers. To confirm a reference, MSRNA employees used to make phone calls to the day-labourer's referee. The process of using phone calls to confirm references was reported by the head of MSRNA as a difficult exercise. She said that the process fails most of the time. As a reaction, MSRNA started a program where workers create their own CVs with full work references. Using a Word document CV template, they take interested workers through a process where they create their own CVs. Even day-labourers who had never used a computer were reported to have been able to produce their CVs. This was done through a concept called drop in center, where workers could also learn basic computer skills. Computer, photocopy and printing services were being provided free of charge to registered workers. Through this program, some workers had had chances of producing their own business cards.

Career Progression

MSRNA partnered with a vocational training center (an NGO) in a programme where they do initial/preliminary basic recruitment process that involves drilling of workers who are interested in joining a vocational training course. The drilling process is done by having interested job-seekers undergo a repeat exercise in a particular skill area. Successful candidates get funded by the vocational training NGO. This model is aimed at creating opportunities for the job-seekers to acquire new skills or improve their already acquired skills.

MSRNA Challenges

Based on the data collected through interviewing the head of MSRNA and the other three employees, we identified the following points as the challenges facing MSRNA.

- Job offers by employers through MSRNA are always on short notice. This means that finding workers, with specific required skills, becomes challenging. In most cases it translates to extra expenditure (in terms of time and money) by MSRNA.
- The worker referencing process is often unsuccessful. Employers neither return nor pick up calls from the MSRNA office.
- Budgetary constraints to the organisation do not allow it to have enough personnel. This limits the intermediary organisation on the number of job-seekers that it can support.

6.3.3 MSRNA Application and Prototyping Test Outcome

The MSRNA experiment study was easier compared to Nairobi DLM and MSRSA. The deployment was also more successful. This was because of the following two reasons: first, the organisation was formed in a similar model with MSRSA, on which we had already done extensive studies. Secondly, the organisation allowed us to start developing systems from scratch based on our mutual understanding through our field work study and consultations with them. We describe the systems test outcomes. The systems developed for MSRNA included a fully functional web-based database application and an android mobile field application.

a) The Web-based Integrated DLM Application

The web-based application testing was done through a live deployment. After its deployment, we trained two MSRNA employees through Skype (both video and voice calls). The system had login and logout logs to check the frequency of login by the users (see Figure 6.12 for a screen short of the login-logout log file). We also monitored the use of the system based on the records being added, edited or deleted from the system. Most of the support was also done through Skype calls because we could not afford to travel to Windhoek frequently. Also, the Skype voice calls support was successful because the participants were proactive in the design, implementation and the support process.

Test results obtained by the process described in Section D.3, step fourteen, showed 100% adoption of the web-based system by MSRNA. We thought that the reasons for adoption included the fact that their old system had been out of support for some time and, therefore, their requirements were not being met. Follow up interviews with the head of the organisations confirmed our thoughts. In the design, we took up a number of functionalities that the organisation wished to see in their system and implemented them. We think the inclusion of these features aided in our adoption rate.

Within our test and evaluation period, we helped to upload the 700-plus worker records from the old system to the new MSRNA system. Within a month, the users (MSRNA employees) had updated the same 700 records by filling information that was missing. They also entered about 100 newly registered workers and registered over 50 employers.

There were two main users and one administrator. One of the users, trained via Skype calls on how to use the web application, told the researcher that the web application was a better

version of what they were using before and was far much flexible to use and with more and relevant functionality. The trained MSRNA user later reported having trained the second user. Judging from the number of queries from the two users and the user logs analysis, we concluded that, compared to the other prototypes with MSRSA, the adoption for MSRNA web-based database application was relatively quicker. It took only an hour of training to have the two users to start using the application. The curiosity from the users on how to use various functionalities was also seen as a sign of successful adoption. Through E-mails, Skype voice calls, support was directly provided by the researcher (who also served as the designer and developer). In summary, two participants were trained to use MSRNA. Thereafter, the organisation used the system and we monitored them for more than six months after the deployment. More than 600 user logs were scrutinised and the database observed as it grew with worker and employer details.

Figure 6.12 shows a log of usage records by MSRNA employees while Figure 6.13 shows a screen shot of searched registered employers. Prior to our system and our advice, they were not registering any employers. MSRNA was a purely worker-centred intermediary organisation.

For our study, the purpose of the web-based database application was to set up the server side infrastructure that would support mobile applications. On the other hand, the purpose of the web-based system for MSRNA was to allow them to run their operations effectively.

MSRNA Login Log

#	User ID	Type	Login Time	Logout Time
1	tomas	User	2012-09-12 15:10:17	0000-00-00 00:00:00
2	tomas	User	2012-09-12 15:10:04	0000-00-00 00:00:00
3	tomas	User	2012-09-12 15:09:56	0000-00-00 00:00:00
4	hilya	User	2012-09-12 09:52:33	2012-09-12 10:33:10
5	tomas	User	2012-09-11 16:26:46	0000-00-00 00:00:00
6	hilya	User	2012-09-07 15:50:17	2012-09-07 15:53:38
7	tomas	User	2012-09-07 12:07:11	0000-00-00 00:00:00
8	hilya	User	2012-09-07 10:55:26	2012-09-07 11:04:19
9	tomas	User	2012-09-06 14:10:01	0000-00-00 00:00:00
10	tomas	User	2012-09-05 15:34:27	0000-00-00 00:00:00
11	hilya	User	2012-09-05 08:22:55	2012-09-05 08:30:42
12	tomas	User	2012-09-04 15:27:18	0000-00-00 00:00:00
13	Tomas	User	2012-09-04 15:02:57	0000-00-00 00:00:00
14	hilya	User	2012-09-04 12:43:55	2012-09-04 12:54:09
15	hilya	User	2012-09-04 11:38:11	2012-09-04 12:02:11
16	HILYA	User	2012-09-04 10:43:53	2012-09-04 11:16:16
17	tomas	User	2012-09-03 14:32:48	0000-00-00 00:00:00
18	hilya	User	2012-09-03 11:48:09	2012-09-03 11:59:37
19	officer	User	2012-09-01 10:10:54	0000-00-00 00:00:00
20	tomas	User	2012-08-31 15:33:59	0000-00-00 00:00:00
21	hilya	User	2012-08-31 15:25:58	2012-08-31 15:30:26
22	tomas	User	2012-08-31 13:36:37	0000-00-00 00:00:00
23	hilya	User	2012-08-31 12:42:16	2012-08-31 12:44:29
24	hilya	User	2012-08-31 10:08:47	2012-08-31 10:12:37
25	HILYA	User	2012-08-30 13:07:20	2012-08-30 13:11:03
26	hilya	User	2012-08-30 10:54:45	2012-08-30 12:17:44
27	tomas	User	2012-08-29 15:53:26	0000-00-00 00:00:00
28	hilya	User	2012-08-29 12:01:54	2012-08-29 12:42:31
29	hilya	User	2012-08-29 10:33:05	2012-08-29 10:34:00
30	tomas	User	2012-08-28 17:19:31	0000-00-00 00:00:00

Figure 6.12: A user login log.

There were only three users for the MSRNA web-based application: the officer in charge of MSRNA, and the two other employees

www.msrr.org.za/msrna/user/userhome.php?page=searchempresults

Employers Workers Vacancies Diary My account Reports Log out

OFFICER: Search Results

#	Emp ID	Company	Contact	Reg No	Email	Town	Address	Tel No.	Cell No.
1	0811247818	Private			vanrooyen@bankwindho	windhoek	5 Grand webster road, olympia	0811247818	0811247818
2	0812305710	Private				Windhoek	Helldoor street 67, Eros	0812305710	0812305710
3	0811295560	Private			pur@windhoekcc.org.n	Windhoek	Eros	0811295560	0811295560
4	0811288289	Private			andrew@multisafe.co.	Windhoek	8 hugo street.klein windhoek	061-400920	0811288289
5	0811299219	Engine Service station				Windhoek	Engine service station. Pioneerspark	0811299219	0811299219
6	225411	John Meinert Printing				Windhoek	Snyman Circle, Box 56 Windhoek	061-225411	061-225411
7	257210	Private			hospitality@panduka.	Windhoek	windhoek	061-257210	0812079911
8	234561	Private				Windhoek	windhoek	061-234561	0811490900
9	2942321	Standard Bank	Hilya		andrevannyk@standard	Windhoek	Standard Bank,Independence Avenue	061-2942321	0811223133
10	0811293384	Private			rsidi@naankuse.com	Windhoek	Windhoek	0811293384	0811293384
11	0811228138	Private			vein@pointbreak.com.	Windhoek	14 Albert street,pioneerspark,windhoek	0811228138	0811228138
12	0811285321	Private			mzide@gmail.com	Windhoek	Barck Street.Springbok suidenhof,windhoek	061-402546	061-402546
13	061-244944	DB Audio			hanneke@dbaudio.com.	Windhoek	19 Reger street,Southern Industrial Area, windhoek	061-244944	0813644926
14	0812618043	Eros Primary School			mrensia@yahoo.com	Windhoek	Cm Eros road and robert mugabe	0812618043	0812618043
15	0812739774	Private				Windhoek	Bock street 39,Klein windhoek	0812739774	0812739774
16	0813666779	St Pauls College				Windhoek	windhoek	0813666779	0813666779
17	061-371551	Rhino park				Windhoek	Rhino park, windhoek	061-371551	0812206175
18	0811243629	Checkers, Hidas Centre				Windhoek	Hidas centre, windhoek	0811243629	0811243629
19	0814466728	Private				Windhoek	Brusberg	0814466728	0814466728
20	0816575351	Private				windhoek	8 springbok street, olympia	0816575351	0816575351
21	0811244559	Private				windhoek	2 mitje street,klein windhoek	0811244559	0811244559
22	061_6001	Private			frank@slydancer.cc.c	windhoek	pvc	061	061
23	061-2841155	Private					1 Nissenlass street,		061-2841155
24	0811276663	Private				Windhoek	Ludwigsdorf	0811276663	0811276663
25	0812604378	Private	Henry Kruger			Windhoek	11 hamerkop street,hockland park	0811285698	082604378
26	0811292934	Private			oumama@dbn.com.na	Windhoek	Windhoek	0811292934	0811292934

Figure 6.13: A screen shot of searched registered employers

These are employers registered in the deployed MSRNA web-based application. They had registered more than 50 employers by the time we left the study. This was evidence for the system adoption

b) Remote Mobile Application for MSRNA

Unlike the web-based application, we had to be in Windhoek, Namibia physically for deployment and testing of the mobile phone application for MSRNA (the mobile application equivalent of the field registrar for MSRSA). We realised that it was going to be challenging to guide the users online as it was done with the web application. The challenge was because our users had no prior knowledge of the concept we were introducing. The mobile phone application made use of the web-based database by accessing data through the Internet connectivity.

The deployment was done exactly one year after web-based application deployment. That, for us, was an advantage as our users had understood the concept of relying on a system to manage day to day activities for a DLM. MSRNA had also got to be free and open to us compared to when we started engaging them. The deployment was done within an eight-day visit with three days of user training and observation on the use of the mobile application.

Findings

In an observation done for three consecutive days and further monitoring, MSRNA employees used the application to register job-seekers. The first deployment occurred at the collection point with one field officer. The researcher asked him to test the system with the worker registrations that he had manually done on paper. The first case was challenging as he was still learning how to use a touch screen mobile phone. He did the subsequent six registrations without any difficulty. After three registrations, the researcher then asked him to

search for the same records using the mobile application. He was excited to get the records that he had entered displayed. However, he was not sure whether the displayed records were from the mobile phone or the server. The field officer was concerned about what would happen if the phone got lost. His concern was how to find the records should they disappear with the mobile phone. It was explained that the records would be stored in the database and not on the phone memory.

The next deployment was in the office with the same field officer and the office employee carrying out a few registrations and searches as the researcher observed. The deployment in the office was also done first with the researcher's help. Thereafter, the users used the prototype without any help from the researcher. This second training was seen as the most successful as evidenced by the participants' excitement. The excitement stemmed from the field officer who had been excited when he found the records of the registrations that he had done from the field in the database. Figure 6.14 shows images captured during field training and user observations.



Figure 6.14 (a): Worker manual registration by the field officer



Figure 6.14 (b): Field deployment and training MSRNA mobile phone application.



Figure 6.14 (c): Office deployment and training of MSRNA mobile phone application.

In this deployment period, the researcher held a discussion about the mobile phone application and the database with the head of MSRNA. She was happy with all our efforts and assured us of her support. She also thanked us for the web-based system that they were already using. The researcher also had a meeting with the field officer, office based-employees and the head of MSRNA to discuss the overall engagement when it came to dealing with the new mobile application. The researcher explained his goals (which were to get experimental results) and the NGOs advantages. The meeting was successful having agreed on how to monitor the performance and execute support for users.

Finally with the mobile application, we trained the users on how to download new versions of the mobile applications. This was because we were not going to travel to Namibia every time we needed to release a new version.

Just like the MSRSA registrar, the MSRNA Android application was supposed to be observed using the six mission areas namely: the accuracy of data captured; data entry time; office visit frequency; number of phone calls made by field officers to the office; ease of use

and the cost of using the system. We were, however, unable to observe it for all the mission areas because of the distance between Cape Town, South Africa and Windhoek, Namibia. As an alternative, we carried out an after usage interview with the two users of the system. The interview was done via Skype calls and it involved asking the users questions about the mission areas. The outcome of the after usage interview is summarised in Table 6.5.

Table 6.5: MSRSNA field registrar after usage Interview outcome

Mission area	Outcome
Accuracy of data captured	The two users unanimously agreed that the accuracy of data were comparable to when they were using the manual paper form.
Data entry time	The data entry time reduced by half as the users used to record data twice (on paper and data entry to the database) before our intervention.
Office visit frequency	This did not change because the MSRNA users worked as both field officers and office workers. It was mandatory for them to report to the office.
Number of phone calls made by field officers to the office	The users did not have the exact numbers because they reported that they had not been keeping track of them.
Ease of use	The users reported that the system was easy to use. We had also not seen any usage challenges during our training and observation for the two days.
The cost of using the system	This was not an issue as the users had already found out that the cost of using the system was minimal compared to using SMS or making phones calls. They both agreed that the system was cheaper.

To follow up on the usage of the mobile application, we had developed a usage log which would differentiate between users logging in using the mobile application from those using the web application. The log analysis indicated that the MSRNA users logged in to the web-based application more frequently compared to the MSRNA remote mobile application.

6.3.4 MSRNA DLM Stakeholders: Direct or Indirect Telecommuting Practice

Here, we describe the practice of MSRNA stakeholders as we look at the possibility of any telecommuting practice that existed before our interventions. From our field work study, MSRNA employees were not practising any form of remote job accomplishment practice. The field officer would visit two out of four worker collection points per day. He would not manage to visit four of them in a day as they were geographically far from each other. Some sites were also located in different directions. The third place where the field officer would go is to the office to deliver any reports and work on office duties if any.

Just like the field officer, the job-seekers, commuted between home, collection point and job station. The best that would happen to workers as far as doing a remote job search was being called by the field officer to report for a job. This would likely save the job seeker commuting distance and time for they would have to go directly to the work station. In general, little or no telecommuting happened among the MSRNA job-seekers and their field officer.

As much as many employers would still visit the worker collection point, some still preferred to call MSRNA office employees or even the field officer when requesting for a worker. Our interviewees reported minimal use of SMS or E-mail by employers to request for workers.

Overall, MSRNA stakeholders practised no or minimal telecommuting. As a result, the significance of the two MSRNA systems in investigating applicability of telecommuting in Africa was important in finding out the extent in which a non-practising community/organisation can go as far as adopting it.

6.4 Summary of the Findings

In this section, we summarise the findings from the three case studies. We categorised the findings into three major sections: Workers and intermediary organisation; Telecommuting practice and commuting patterns; and Systems usage outcome. Discussions of the various items follow immediately in Chapter Six.

6.4.1 Workers and Intermediary Organisation

Intermediary Organisations

The intermediary organisations showed similarities in organisational structure and their objectives. However, there existed some fundamental differences which included how MSRNA and MSRSA operated as intermediary organisations. While MSRSA was moving to *know your employer strategy*, MSRNA was busy thinking of different ways of strengthening their *know your worker and engage them* strategy. The MSRNA strategy emphasised on linking workers and employers freely and empowering workers to find themselves a job. On the other hand, MSRSA emphasised getting jobs for workers. On how day-labour intermediary organisations operate, we discovered that they do not act as employers. Their work is to link up workers and potential employers. This brings about the triangular relationship among the three major stakeholders.

The day-labour intermediary organisations had the need to meet their objective and be sustainable while, at the same time, working for day-labour workers for free. In a self-organised DLMô the case of Nairobiô the organisers, who are job-seekers themselves, have a sole objective of protecting the interest of their members. The officials also mind about their welfare and especially with regard to security and relationship with city council.

Education Level

On workers, we found that, except for minor differences in the characteristics displayed by workers, the job-seekers from different regions shared a lot of similarities. Education level among day-labourers in Cape Town was found to be relatively low compared to that of day-labourers from Nairobi, Johannesburg and Windhoek. The skills set and language/communication issues followed from education (See Figure 6.15 for a comparison of education levels). Workers in Kenya reported more skills compared to those in Namibia and South Africa. Further, workers in Kenya did not experience any language barrier as was seen in Cape Town and Windhoek. Language barriers were, however, found not to be a problem during job search. The job-seekers worked in groups leading to having translators among themselves.

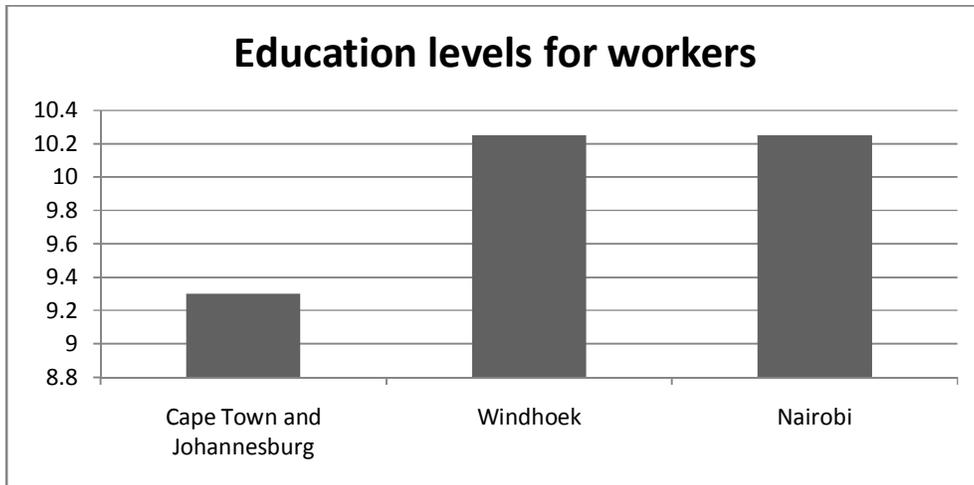


Figure 6.15: Education level comparisons from the three case studies

Windhoek and Nairobi had the highest education levels (average of grade 10.2) compared to Cape Town which had an average of 9.3

Technology Ownership and Use

Regarding technology use and ownership, the difference was not in regions but in cities. More job-seekers owned mobile phones in Nairobi and Johannesburg than in Cape Town and Windhoek. Figure 6.16 shows a graphical comparison of the airtime on phone. The amount of time it takes is compared in Section 6.1.1 page 79.

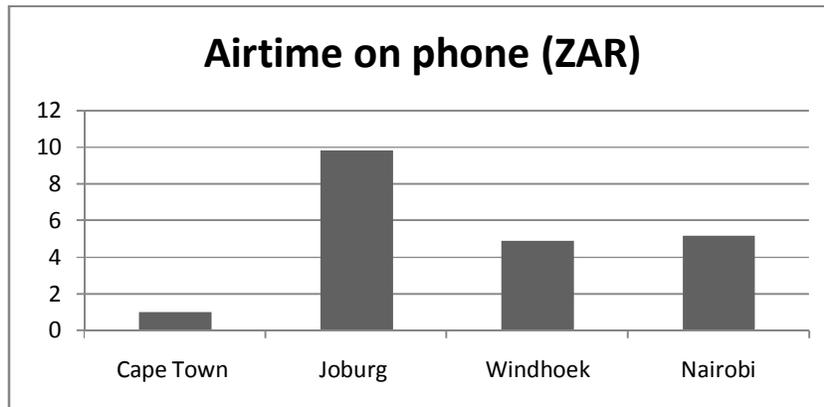


Figure 6.16: A graphical comparison of the airtime on phone during the interview

The average airtime on the mobile phone owned by workers from Johannesburg was the highest at 9.8.

Earnings and Expenditure

The average earnings for day-labourers were also similar. While workers in Cape Town and Johannesburg earned slightly more than their counterparts in Nairobi and Windhoek, their cost of living was found to be high. For example, looking at the cost of commuting, Johannesburg comes top, followed closely by Cape Town. As much as Windhoek has the high cost of transport, interviewed workers gave half the cost of commuting as they normally walk one way. That explains why the commuting cost is low in Windhoek.

Figure 6.17 shows the earnings and the commuting cost for workers in the three case studies.

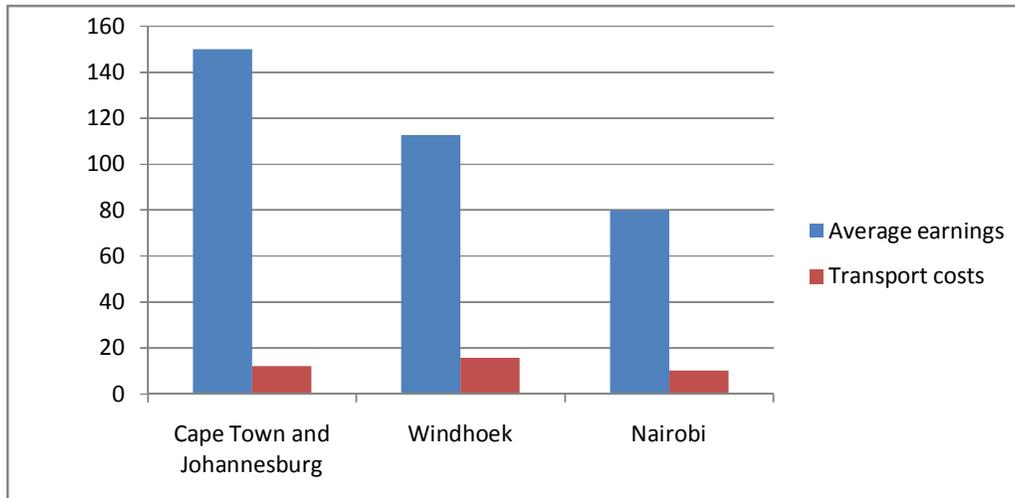


Figure 6.17: Average earnings and commuting costs (in ZAR) for workers

Figure 6.17 shows average earnings and transport costs (for Nairobi, Windhoek and Johannesburg and Cape Town). The average transport costs are comparable in Nairobi, Johannesburg and Cape Town. The daily average earnings are higher in Cape Town followed by Windhoek.

Demographics

Just like many other characteristics displayed by day-labourers, age and gender were consistent. The maximum average age was 44 years and was found in Nairobi. Although MSRSA and MSRNA supported women job-seekers, all the job-seekers we interacted with at the collection points were men. We did not see any woman job seeker at the collection points that we were studying. We did, however, meet women job-seekers at the MSRSA offices. Figure 6.4 shows the average ages of workers from the four cities.

Challenges and Complaints

The major complaints among day-labourers from different regions included non-payment or delayed payment; underpayment and threatening by either workers or representatives. We found that our findings on the DLM could be generalised for other poor regions. For example, findings from other studies such as those by [Lang et al. \(2010\)](#), which profiles young migrant workers in China reveal that workers live in stressful and unfriendly urban centres. In South Africa, a study by [Harmse et al. \(2009\)](#), confirmed the suffering of day-labour workers in the streets of South Africa. They also confirmed the presence of many worker collection points both in rural and urban areas with thousands of job-seekers within an informal DLM. In Namibia, [Gonzo and Plattner \(2003\)](#) showed how the day-labour workers suffer because of poverty. Our interviews with job-seekers and MSRNA management revealed similar findings.

One other general finding that cut across all our four study regions/cities showed that day-labourers are not in the day-labour job arrangement by choice, but because they do not have any other economic options. This was also a finding by [Valenzuela Jr. \(2001\)](#).

Systems Usage Outcome

For the web based database applications, we tested them based on the following aspects:

- a) Overall adoption by all the stakeholders of DLM and mainly by the organisation: As reported, MSRNA adopted the web-based system fully. Similarly, except for the *MSRVoice* which went only as far as testing, MSRSA adopted all the server side systems. On the contrary, however, the server side systems built for Nairobi DLM were not successful. At the time of writing, none of the system had been used directly by workers or employers.
- b) Ability to support internal operations: For the systems adopted, those deployed in MSRNA were the most widely accepted by users as serving the internal operations of the organisation. MSRSA server side systems had mixed results. This was as a result of the confusions brought about by constant operational changes by the organisation.
- c) Ability to support remote applications and time elements of telecommuting: Because MSRNA server side application was designed from scratch with MSRNA stakeholders, it had remote support concepts from the start. MSRSA systems had to be modified (as specified in the methodology) to support remoteness.

With regard to remote applications (mobile phone applications) or prototype systems, we evaluated them by looking at their performance in relation to telecommuting elements and the impact.

On the telecommuting elements, we were looking at the significance of the systems in relation to time; location; job classification and ICT. On the other hand, the impact of telecommuting to society (community), the individuals and the organisation examined the change that our interventions brought.

In our study, the organisation together with the individuals (DLM workers and employers and the employees of intermediary organisations) formed the society/community. This was because we could not scope the study to include other members of the society affected by DLM, for example shop owners near the worker collection points.

CHAPTER SEVEN

DISCUSSIONS

7. Overview and the Discussion Context

Our study agenda was to find out how and which ICT interventions can be used to alleviate day-labour market (DLM) challenges and to investigate the possibility of implementing telecommuting in the developing world using a case of the DLM. Before discussing our results, we describe our discussion model made up of telecommuting/teleworking components discussed in Section 2.4.2 page 26. The telecommuting components are divided into two categories, namely, the impact areas and the elements.

- a) The impact areas: consists of the individuals; the organisation and the society.
- b) The elements: consists of the location, time, job classifications and ICTs.

In the software system design (Section 4.5), the ICT designs suitable for the DLM are presented. Here, for our first research question, we discuss whether these applications impacted (helped) the target users who are the impact areas. To discuss the possibility of implementing telecommuting, we look at how the various elements of telecommuting played out in relation to the ICT impacts. Finally, we present a general discussion.

Setting the Discussion Context

As shown in our literature review, (Section 3.5 page 48), many studies have neglected the technology part of telecommuting studies. Our assumption was that since many (if not all) of the studies have been done in the developed world, researchers have assumed readily available technologies that can support telecommuting. As a result, they only concentrate on other study areas of telecommuting. Furthermore, many of the studies have assumed already existing and formally organised institutions having a formal organisational structure where employees report to their immediate bosses. The assumption of the existence of formally organised institutions lead to only white-collar and higher level blue-collar workers being considered for telecommuting.

Considering that our study context was different from the developed regions, we could not have made any assumptions on the above issues. Instead, we took an exploratory approach, but scoped the study by using the elements of telecommuting definition as a guide. However, even as we explored, we took cognisance of the fact that the mobile phone has been declared the computing device of the developing world. We therefore were biased towards building and testing mobile based software systems to test the concept of ICTs for the DLM and test the telecommuting concepts in developing world.

We shall discuss our experiment results based on the elements of telecommuting definition, combined with the impacts. (Figure 2.4 (b) shows our modified elements of existing definitions of telecommuting). The telecommuting impacts are organisation, society and individuals. In the impact, the society has less advantage apart from reduction in air pollution and traffic congestion which is negligible if few people telecommute (Kurland and Bailey, 1999). In our discussion, therefore, we do not independently discuss impacts on the society

because we did not have mechanisms for evaluating the impact of our study on the society. We, however, relate some of the organisational impacts to the DLM society.

Figure 7.1 shows the relationship between the various elements of telecommuting and the impact objects. It forms the model for discussing our results. The intermediary-organised and the self-organised DLMs formed our organisations. These organisations can be impacted by ICTs and/or telecommuting as the product of using ICTs. The employers, workers and field officers formed the individuals.

Job classification and the individual day-labourers are discussed together because the discussions touching on the day-labourers also touched on the kind and level of work they do and vice-versa. Location; time and ICTs are the key pillars of telecommuting and, hence, are discussed separately. Furthermore, our area of interest was introducing ICTs that can support telecommuting in developing world.

On location, we look at what our results say about providing an environment for telecommuters to work remotely. Closely related to location is time where we discuss the possibility of telecommuters being able to choose when to commute and when not to commute. With regard to job classification and individuals, we look at the classes of workers and jobs. We interrogate the possibility of telecommuters who are not affiliated to any organisation (self-employed) and possibility of low-level blue-collar workers to telecommute.

The ICT element sums up everything in terms of being an element of defining telecommuting. We discuss how ICTs, in the context of our study, can support telecommuting. We also look at the effects of our systems to telecommuting dynamics in the DLM. Because ICT was the key study factor and contribution in our study, we show how the various prototype applications faired and how they impacted travel and other activities among DLM stakeholders which were under study. The impact on the various DLM activities measure how the ICTs impacted on the stakeholders.

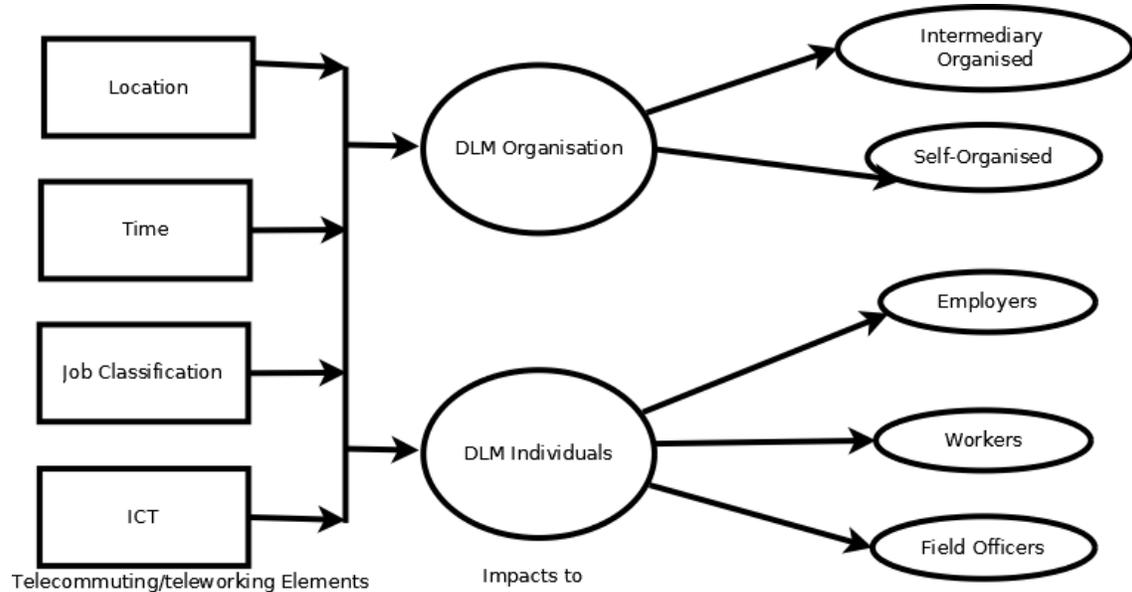


Figure 7.1: Our discussion model

In Figure 7.1, the telecommuting elements are used to define telecommuting or teleworking. The impacts are to the stakeholders on whom telecommuting implementations can have an effect. The types of organisations in our study are self- and intermediary-organised DLM while the individuals are field officers, workers and employers

Finally, in our discussion, we do a general discussion, which covers any special issues about our interventions and those that were not part of the elements of defining telecommuting.

7.1 Discussion of the Results

For each telecommuting element, we discuss whether the applications introduced helped the users (the individuals and the organizations) or not. This is used to answer our first research question, which is to find out ICT applications that can help alleviate some of the challenges faced by the DLM. The society/community, as discussed in Section 7.1.3, can be described as made up of the individuals and the organizations combined, and as a result, we discuss it separately from the other elements. This gives the overall picture of how the interventions impacted on the DLMs as organizations. The outcome of how our interventions dealt with the telecommuting elements helps in answering our second research question of whether this study can be classified as telecommuting.

7.1.1 Location

Our results showed that DLM employers did not adopt the web-based systems. The mobile phone applications were not designed for direct use by job-seekers (Section H.1 and Appendix D). As a result, our interventions did not directly change any mobility patterns for the employers and workers. Our interventions impacted mostly on the field officers and, hence, the intermediary organizations and by extension the worker and employer members of the DLM through mediated interaction.

The key objective of telecommuting is to be able to complete an activity remotely. Remoteness is a key element of telecommuting which is aimed at reducing commute time, distance and, consequently, cost. Our study findings revealed possible routes that can be taken by DLM stakeholders during the course of their job search and workers' search routine. Figures 5.3 and 5.4 in Section 5.2 show a diagrammatic representation of the possible locations and routes respectively. These routes and locations proved how mobile the DLM stakeholders were. These routes and locations are important because they show how ICTs, as seen in our study, can be used to reduce or even eliminate some of the DLM individuals' routes or locations.

Why we did not Design for Workers Directly

We were unable to design for the DLM job-seekers directly because of the diverse reasons depending on the case study. In Cape Town, the low-literacy rates and low ownership and use of mobile phones were the main reasons. Our field findings (Section 6.1.1 page 87) showed that majority of the less-skilled workers in Cape Town were text illiterate and could not use text based mobile applications. Besides literacy, the majority of the workers in Cape Town did not have access to mobile phones. Even those few workers who had access had the non-programmable (low end) mobile phones (Section 6.1.1 page 104 Figure 6.5 b). We could not, therefore, build systems for these non-programmable mobile devices, hence, another reason for not building applications that would be used directly by workers. Indeed, the problem of participants not having the technology or being illiterate has been cited as some of the main

reasons why it is challenging to design directly for the primary user (Parikh and Ghosh, 2006; Medhi et al., 2007; Sambasivan et al., 2010).

The Location Element and our Applications

For telecommuting to occur in DLM, some travel routes need to be eliminated or re-routed by having the individuals not travelling to some locations. We considered only locations which could be removed from the routes. The challenges of literacy and technology aside, day-labour workers showed an unexpected behavior where even those with mobile phones (mostly seen in Nairobi) and can be called by employers or field officers for work still went to collection points. Our interpretation of this observation was that simple technology intervention may not eliminate the visits to collection points by workers. On further enquiry, we found that there were other secondary reasons for visiting the collection point.

Employers were found to be middle class people who would afford to use the Internet and the mobile phones for worker searching. However, they had not adopted e-mail, SMS or web-based services for searching workers. In MSRSA for example, the adoption rate for their web-based service was low among employers. To check the validity of the field findings, we built the integrated web-based systems, which also served as the back end database for remote mobile applications build for MSRSA and MSRNA field officers. The campaign carried out by MSRNA intermediary organisation in an effort to encourage workers to use our system to access DLM services was unsuccessful. Employers exposed to the web applications did not adopt it within the 18 months of our study. The possible reasons why the MSRSA employers did not adopt the web-based applications that came up during discussions with the DLM stakeholders included:

- The majority of the employer representatives were contractors who were not mainly office-based, hence not being able to easily access the web applications.
- The majority of the individual employers were old-age retired citizens who had not embraced technology.

Like in any telecommuting practice, our applications did not, and were not planned to eliminate, but to reduce the number of locations visited by the DLM members. In summary, the DLM employers did not adopt the web-based systems; the mobile phone applications designed for direct use by job-seekers did not succeed and the field officers adopted the remote mobile applications. The use of the mobile applications to register, search and confirm worker and employer details changed the field officers' mobility patterns. Most of their routes changed to starting from home through one or two collection points and ending back at home. The field officers would do most of the things that they would do at the office remotely. Hence, the need to go to the office reduced significantly. This reduced the cost of commuting and the time taken to move through the various locations.

The MSRSA and MSRNA individuals and the organisations were indirectly impacted through the field officers. Employers were assured of real time response from the field officers anywhere. The workers would get enough time with the field officers compared to when the field officers had to go back to the office. In an ordinary situation where the field officers had to go back to the office to deliver the manually filled forms, they would have to

leave the collection points early, a practice which would leave job seekers with minimal contact hours with the field officers. According to MSRSA and the job-seekers, having enough time with the field officer meant getting better training in personal relations, which would result into better chances of securing a job. The presence of the field officer also improved fair distribution of jobs to workers. Normally, workers who bullied the others got the attention of employers whenever the field officers were not around. The number of workers registered per day increased because the NGO could control more workers, hence having well-organised collection points. The time it took to confirm a worker reduced significantly and, as a result, the chances of employers leaving the collection point without a worker, because a specific job seeker was missing, reduced because they tried others after being confirmed by the field officers as genuine job seekers.

The intermediary organisations saved on transport costs for the field officers. They would afford to have one field officer serving more than two worker collection points compared to before when they would visit at most two collection points. As a result of the introduction of the mobile application for the MSRSA field officers, the NGO reduced its field officers to only three. The three, with the help of the mobile application, would manage to support the activities of the six collection points by being in at least two locations in one day. The MSRNA field officer, who was serving four worker collection points, was the most excited by the remote mobile application. Although he still used the paper based registration forms in the field, he preferred the mobile application because he would enter the data in the field while having discussions with the workers.

The indirect benefits through intermediation findings were not unique to our study. [Parikh and Ghosh \(2006\)](#) and [Sambasivan et al. \(2010\)](#) talked about cases of secondary users being able to conduct a task without direct access to technology because they are not capable of using the system independently, but still being able to benefit. This is referred to as intermediated interaction and the intermediating agent can either be an individual or an organisation ([Parikh and Ghosh, 2006](#)). For our study, the intermediating agent was the DLM organisations, MSRSA and MSRNA, which used the field officers as secondary users.

Back-end Web-based Database Applications

Although we were building the MSRSA and MSRNA web-based applications mainly to support the remote mobile phone applications, the efficient working back-end application gave users the confidence in the entire system of doing things remotely ([Hawkins et al. 1999](#); [Churchill and Munro 2001](#)). For example, MSRSA users who had used their original web-based database had more doubts on our systems compared to those who had used our new data upload/download modules together with their new proprietary system. We used minimal effort convincing MSRNA to use the mobile application than convincing MSRSA because MSRNA had already adopted our web-based system and were happy with it. MSRNA had developed confidence in our ability to build systems that worked. We found a direct impact between the correct functionality of the back-end system and the adoption of the remote systems.

Overall, if something went wrong with the back-end system supporting remote applications, the latter would be blamed. In other words, the significance of the back-end systems to

support any teleactivity, for example telecommuting, is important and has to be taken into consideration when designing such systems.

7.1.2. Time

There are two ways in which time can be a factor in teleactivity:

- **The frequency of commuting:** Telecommuting does not eliminate travel. Hence, there are days or times when a telecommuter has to travel to the activity location. When to travel and when not to travel is described by time as a telecommuting element.
- **The anywhere any time factor:** Describes being able to work outside the confines of space and time (Bui et al., 1996).

In the DLM community, business hours were found to be predictable with field officers carrying out their duties during official hours (8am to 5pm). The job-seekers' hours of waiting were from early in the morning (around 7am) to about 1pm in Cape Town, Johannesburg and Windhoek. In Nairobi, workers stayed longer; usually up to about 3pm or even later than 6pm. Employers in all the regions usually visited the collection points early in the morning for the day's job offer or any time within the waiting time of the workers for a future job offer. Looking at it another way, workers' waiting time was dependent on the likelihood of employers' visit time.

In Nairobi, where the majority of the workers had mobile phones, the workers reported having changed their reporting time to the collection point as a way of avoiding peak hours, but also because they expected that potential employers or their colleagues will call them if need be. This shows that technology, in this case mobile phones, can alter business hours even for the lower income population. The change of commute time, especially to non-peak hours is referred to as part-day telecommuting.

Applications Effect on Time

When we introduced the various software systems, time flexibility of the MSRSA and MSRNA stakeholders changed. Just like the location of executing duties became less significant, especially for field officers, time followed suit. Field officers reported being called by employers to confirm the details of certain workers during unofficial hours. Before the introduction of the mobile phone applications, MSRSA field officers would, for example, have to postpone the confirmation or look for a cybercafé in order to be able to confirm workers' details whenever a request came after official hours. In our interview, for example, one field officer reported to have been able to link workers to employers even after official hours and out of the office. This, he said, was only possible with the MSRSA field registrar.

The time factor as an element of telecommuting would also benefit the workers (who had mobile phones) and employers. With the field registrar, workers would have been dependent on field officers to call them after searching through the system and finding their names as ideal candidates. Employers, on the other hand, would make phone calls to the field officers and get immediate arrangement for a worker. This would reduce the frequency of travelling to the collection point by both workers and employers.

7.1.3 Society/Community

The community of our study context was as small as the individuals and the organisation forming a DLM because of the scope of our study which excluded, for example, the case study cities and other organisations. The individuals were members of either intermediary-organised or self-organised community. The demographic characteristics of the individuals were more or less similar across the case studies (Section 6.1.1, 6.2.1 and 6.3.1 from page 79). For example, the age, gender, education level and ICT knowledge of the job-seekers were comparable. In DLM, the individuals' characteristics are overridden by the organizational characteristics meaning that, once an individual becomes a member, their commuting patterns, among other things, adopt those of the organisation. As a result, the influence and impacts of any intervention, e.g. telecommuting to society in a DLM can only be seen from two perspectives: intermediary-organised or self-organised setups, which have similar groups of individuals, i.e. the employers, workers and field officers (brokers/contractors for self-organised).

Here, we discuss:

- Whether and how the DLM characteristics and the technology e.g. mobile phones had influenced the activities among our participants before our intervention and
- How the interventions that we introduced impacted on our participants

The Society Before

Prior to our research, we did not see any major use of ICTs to reduce travel, e.g. telecommuting practice, among the three DLM communities. The DLM workers across all the four cities were practicing limited or no remote activity execution. Employers would occasionally call to avoid making trips to collection points. Field officers (for intermediary-organised), and brokers (for self-organised), made occasional calls to workers and employers to make prior arrangements. Field officers also, while in the field, made frequent phone calls to the office to confirm worker/employer details.

Although we recommend further studies on the telecommuting practice in the DLM using the mobile phone, we believe that telecommuting in such environment such as DLM does not happen without any deliberate effort to implement it. This resonates with [Cowell and Dunn \(2006\)](#) findings which indicate that successful implementation will depend on increased knowledge levels among stakeholders, changes in attitudes towards work culture and people management, as well as enhanced working tools for the telework environment. The argument may even be more applicable in cases where the community involved is informal, with the members not being able to maintain long-term relationship (for example worker-employer relationship). The argument can be advanced to show that deliberate effort to practice telecommuting follows that of a formal organisation with a formal employee-employer setup. It is the same as having employees, who report to their seniors, while the seniors report to top management who then talk to their clients. In the DLM, therefore, if telecommuting has to be practiced by both workers and employers, the field officers/brokers would have to convince the clients, who are the employers or contractors to avoid the collection points. In other words, for ICTs to be successfully introduced, they need to support existing community structures. This finding is supported by proponents of community informatics (CI), ([Gurstein,](#)

2007) which works on the premise that ICTs embedded in existing community structures is likely to succeed compared to externally ICT based structures (Vaughan, 2006). Likewise, as Toyama (2010) puts it, ICT *is only a magnifier of human intent and capacity*.

Changing the Thinking and not the Organisation

As shown in Section 7.1.1 and 7.1.2, intermediary-organised groups benefited from the software systems more than the self-organised. The only reason we could think of was the responsibility of managing the applications that support DLMs. One key finding was that any intervention could only be capable of slightly changing the way communities (for example self- and intermediary DLMs) operate. This was specifically true where a formal organisation, for example MSRSA and MSRNA, existed. Our intervention process led us to designing applications to suit the existing operational structures of our study context. Its meaning to us was that intermediaries do not just exist, but exist for a purpose. And, should any ICT or otherwise intervention be required, it should consider the existing structure of the community being studied (Vaughan, 2006). We believe that telecommuting is not an exception and, indeed, we saw it in our research process. We thought that we could easily reduce the dependency on intermediary organisations by linking workers and employers directly. That was, however, not the case. As for NDLM, although we blame the failures on lack of champions, we still think that there is a possibility that we did not understand their operation model fully for us to build workable systems. We believe that the MSRSA and MSRNA succeeded because we adopted their structures and model of operation when designing systems. In summary, the understanding of the operation model and the use of champions or user access points (Marsden, 2008; Gitau and Marsden, 2009) is very crucial in designing systems for the DLM.

To further explain the point of the need to design to fit into the community rather than trying to drastically change the community, we use what we called the NDLM paradox. Despite all the indications of workers being able to get most of their jobs through mobile phone calls, they still went to the collection point. Even when workers or field officers go to worker collection points, they still need the mobile phone because *wandering* around may make one lose opportunities. Employers are likely to call if they do not see the person whom they are looking for in a spot where they previously saw them. So the question to us was: why can't the workers wander far away from the collection points, perhaps doing something else as they wait for telephone calls offering them jobs. The answer was that there was a routine. Some of the workers did not know much about the routine, but just found themselves in it. The interviewed workers told of many other benefits why they needed to come to the collection points. We concluded that for any meaningful intervention with an objective of introducing telecommuting, or any teleactivity, it must also consider other factors that make workers or any other participant being studied to do the things they do and, especially, why they choose to travel to a certain place. In fact, one of the reasons why our Nairobi intervention did not succeed is because the DLM stakeholders already had technology (the mobile phone) and were using it to telecommute, hence reducing or even increasing travel.

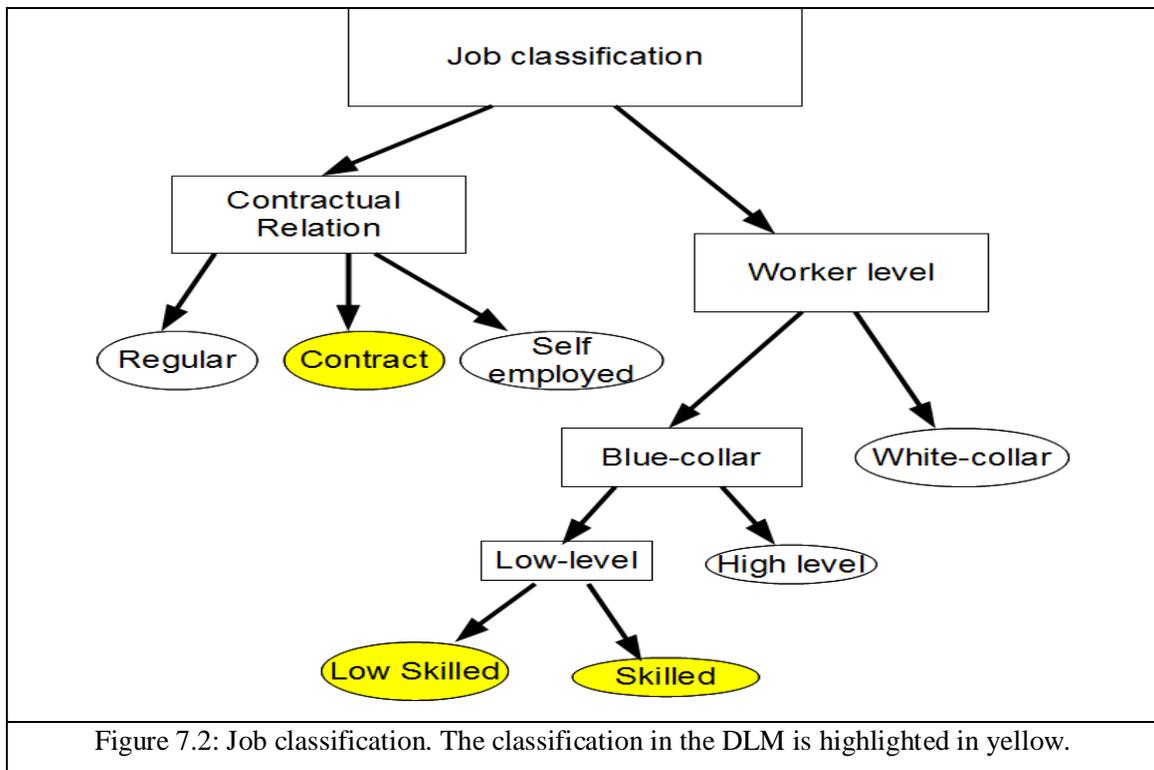
We related this to what other researchers had earlier found. For example, Blomberg et al. (1996) described work relating to incorporating work-oriented designs practices into product

development within an organisation. In their three point premises for their work, [Blomberg et al.](#) showed the importance of detailed analysis of how people use existing technologies and the importance of applications development within the actual use environment. In another example, [Suchman \(1987\)](#) pointed out the need to study how people use their circumstances to achieve intelligent action rather than attempting to abstract action away from its circumstances and representing it as a rational plan.

7.1.4. Job Classification

Literature showed that many telecommuting studies adopt the job classification presented by [Vu and Vandebona \(2007\)](#) model (Section 2.4.2 page 26). We emphasised the workers' job classification because there are differences in terms of skills and competency levels in the DLM. The literature, however, mainly classifies both the skilled and unskilled DLM workers as belonging to the lower level blue-collar workers. We ignored job classification based on contractual relation because it was being taken care of by the natural characteristics of DLM operations. The employee-employer relations are purely contractual in the DLM.

Figure 7.2 shows the possible job classifications available. The classes found in DLM are highlighted in yellow.



What Does the Job Classification in the DLM Mean for Telecommuting?

We found that what makes one be in a certain job classification level (and not the level of classification) determines the possibility of adopting telecommuting. Workers with a higher education level were more likely to be skilled. Skilled workers were more likely to have mobile phones. One would argue that ownership and use of mobile phones, and any other technology, is likely to enhance telecommuting adoption. This can be argued from what we

saw with NDLM workers where they go to collection points, not for job searching only, but also to accomplish other things. The argument is that, had the NDLM workers been going to their collection points for job hunting only, they would probably have reduced the frequency of travel and used the mobile phone instead.

Generally, we can say that telecommuting success depends on, among other things, education level, which dictates the class of workers/jobs; the higher the workers' level, the more the likelihood of telecommuting success. Because of not being able to study workers with different contractual relations, for example self-employed or ordinary employment, we cannot comment on the relationship between telecommuting and type of contractual relation. However, literature shows that freelance employees are better placed for teleworking (Mitter, 2000). Further, because we did not do much research on the impact of either education, skills level and consequently on job classification on telecommuting, we limit our discussions to the DLM organisation characteristics which dictate the job classifications.

Organisation Type and the Role of Intermediary Organisations

We discuss the importance of intermediation in the developing world with regard to:

- Designing ICT applications for informal sector e.g. DLM and
- How it affects telecommuting practice. Do intermediaries provide support or hindrance for telecommuting?

Designing ICT applications for informal sector: The outcome of the prototype applications evaluation showed that self-organised DLM organisations, acting on their own and not being championed by a formal organisation, for example NDLM, were less likely to adopt new ICTs compared to those being influenced by an intermediary organisation, for example MSRSA or MSRNA. However, this can only happen if the workers believe in the organisation. This brought about the need for intermediation. Our findings together with work by Pal (2008) and Gitau and Marsden (2009) showed that designing with a group of underprivileged participants is likely to succeed when intermediaries or NGOs are employed.

Intermediary organisations can also serve in avoiding further exclusion when introducing technology. For example, if you design directly for workers without intermediaries, wealthier (in terms of technology, skills etc) workers may be able to perform more tasks and, thus, earn a higher wage Mookherjee (2001). Employers may pick workers above a certain wealth threshold, excluding poorer individuals, hence leading to disparities among workers. Indeed, from our field findings, we discovered that there were a few workers who would have adopted our systems without any difficulty. These workers had higher skills, education levels and work experience. The same workers had good personal relations with field officers and even employers. For design purposes, we regarded such workers as outliers in the DLM because their number was insignificant. The intermediary organisations serve to control such workers from being a source of disparity and, hence, not misleading the designers into designing systems that do not represent the interest of the majority in the DLM.

However, even among the workers' population, there were still workers with more competitive advantage than others. For example, in our case, the market competitiveness and the existing disparities with regard to mobile phone ownership among workers would only

mean favouring better workers – workers with better education level and skills. Most of these disparities were out of our control and we could not influence them directly.

In an attempt to solve the problem of unequal asset ownership (applied to DLM and assets redefined to include education and skills), we recommended skills training modules to be included in the proposed design. As a result, a training module was included in the MSRNA integrated system. Once again, the only users of the system were the MSRNA office employees. There was no direct usage by workers.

Telecommuting practice: Intermediary organisations (for intermediary-organised) and job-brokers (for self-organised) in the DLM bring a unique employer-employee relation. In an intermediary organisation where workers are employed by the organisation and not a DLM employer (for example the latest model for MSRSA), the level at which telecommuting can be looked at changes. Two levels arise, the level of the intermediary organisation (its employees) and the level of individuals (the employer and job-seekers). In the low-level job classification, intermediary organisations are likely to provide favourable conditions for telecommuting compared to if individuals were acting self-organised. This was seen in situations where we were deciding who to build remote mobile applications for (individuals or organisations). We saw this as emphasising the significance of intermediation both at individual and organisational levels when designing for the poor – low literate levels, low incomes and low technology ownership use or access (Parikh and Ghosh, 2006; Medhi et al., 2007; Sambasivan et al., 2010).

7.1.5 ICTs

In order for us to be able to explain the impact of our systems to the DLM, we needed to first understand the stakeholders’ telecommuting/commuting state before our intervention. We used Senbil and Kitamura’s (2003) typology, also advocated by Andreev et al. (2009), explaining direct impact of ICT on personal activities and travel. In this classification, ICTs can affect one’s activities and travel by:

- a) **Substitution:** The number of trips or activity durations decreases as telecommunications increases – Figure 7.3 (a). Here the travel or activity gets substituted by telecommunication.
- b) **Complementation:** As telecommunications use increases, the number of trips and activity durations also increase – Figure 7.3 (b).

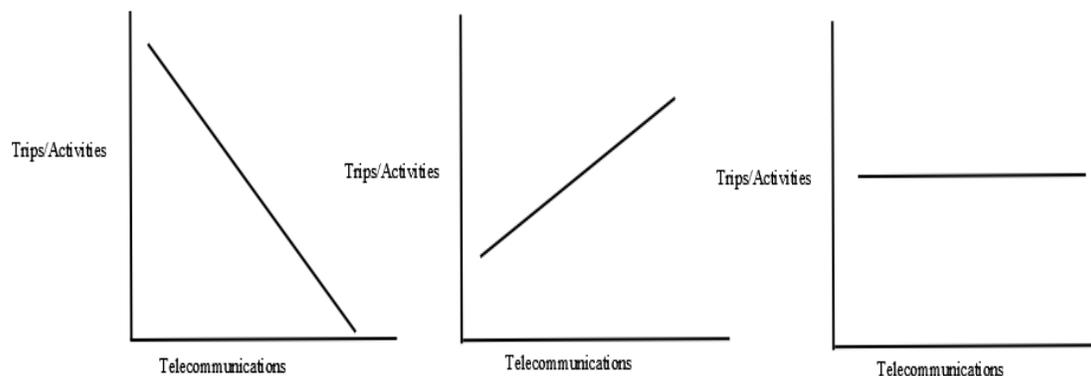


Figure 7.3 (a): Substitution. Figure 7.3 (b): Complementation. Figure 7.3 (c): Modification or neutrality. Source: Senbil and Kitamura (2003) and Andreev et al. (2009).

Figure 7.3: Typology of direct impacts of ICT on personal activities and travel

- c) **Modification:** telecommunications usage leads to modification of aspects of trips and/or activities, such as the route and timing of trips, and the timing, location and sequence of activities.
 - d) **Neutrality:** the telecommunications usage has no effect on either activities or trips
- Figure 7.3 (c).

Using the typology presented in Figure 7.3, we describe how each of our successful systems performed. We also describe what we think led to the failure of the NDLM systems. Table 7.1 shows all the prototype applications that we used in the design process and whether they succeeded or not. F indicates failure, S successful and V.S very successful.

Table 7.1: A summary of the applications prototyped in our study

	Prototype/application	Mobile/ web-based	Succeeded/F ailed	Comments
1	MSRSA Employer	M	F	Viable, feasible but dismissed by stakeholders
2	MSRSA Worker	M	F	Was not visible
3	MSRSA Field Registrar	M	V.S	Was viable. Supported by intermediation
4	MSRSA data upload/download	W	S	Was necessary for our remote software systems to work
5	MSRSA Voice	W and M	S/F	Tested successfully but not deployed for long term use
6	MSRNA integrated system	W	V.S	Designed from scratch based on user requirements
7	MSRNA mobile application	M	V.S	MSRNA integrated system inspired this. The goodwill from it made it a success
8	NDLM web-based integrated systems	W	F	Failed due to lack of champion
9	NDLM mobile application	M	F	No back-end infrastructure and data

Failure in this case means the application was not usable, was not used during trial and the user feedback was negative. Success implies that the application was used during trial; the user feedback was positive and it was adopted. Very successful, on the other hand, means that the application was used during trial; the user feedback was positive; it was adopted and was still in use during the writing of this thesis.

The State Before our intervention

First, we look at possible ICTs that were available prior to our study and how they had helped the DLM stakeholders work efficiently and effectively, e.g. by telecommuting. Mobile phones were the most widely used technology among all the DLM stakeholders. There was

no special software application to support the use of mobile phone technology to carry out DLM activities. Apart from mobile phones, MSRNA and MSRSA organisations had web-based database applications to support the management of worker-employer relationships. Although the applications were not meant to support telecommuting, they ended up helping field officers get quick response from the office employees through phone calls as compared to when using paper based system of keeping records. The NGOs employees would also log into the system anywhere they could access a computer connected to the Internet.

There were a few employers who used the E-mail services provided by the NGOs to communicate requests for workers. Even though the web-based application had an option for employers to request, reference or rate workers, they were not making use of it. The majority of the employers preferred commuting to the collection point to pick up workers and physically referee workers when needed. The office employees, however, would, in most cases, call the employers to ask them for specific worker ratings. The phone calls from the office were through the land-line telephone to either a mobile phone or to another land-line telephone. The few workers who had mobile phones would be offered jobs occasionally through phone calls from employers, field officers or their colleagues.

Overall, mobile technology, using mobile phones, was the most widely used technology that allowed some sort of effective remote work execution among the DLM stakeholders. This was followed by land-line telephone, e-mail and the web-based database applications in that order. Table 7.5 shows how the technology had impacted on the stakeholders before our study. All three stakeholders had done some form of substitution, though not significant, which was measured by asking the stakeholders the number of times in a week that they would connect with a worker, an employer or a field officer without having to travel to the collection points. The presentation in the table only takes into consideration workers who had mobile phones.

Even though the stakeholders practised some form of teleactivity, there were some challenges that came with the operation model of the DLMs. For example, MSRSA and MSRNA field officers practiced some sort of telecommuting long before our study. However, the benefits were being watered down because they still needed to go back to the office to deliver worker or employer registration forms manually.

The state before our intervention showed that day-labour workers had started substituting some of their travels with mobile phones (row one Table 7.2). This was mainly seen in Nairobi where the majority of the workers owned and used mobile phones. These workers, however, performed part-day and not full-day telecommuting. The part-day telecommuting involved travelling to and from the collection points during non-peak hours. This meant that the trips were being made anyway, but the time and the cost of making the trips was reduced. Other workers had also done complementation (row two in Table 7.2). Their routes had started increasing due to the hope that, even when not in the collection point, an employer could still call and offer them a job. As a result, workers would visit construction sites or other locations before passing by the collection point. See Table 7.2 for the impact of the mobile phone to workers, field officers and employers. The majority of the workers from Windhoek, Cape Town and Johannesburg, however, had not been affected by

telecommunication provided by the mobile phone technology. This situation is described as a neutralisation.

Table 7.2: The effect of mobile phone on travel for the DLM individuals

		Employer	Worker	Field officer
1	Substitution	ç	ç	ç
2	Complementation		ç	
3	Modification			
4	Neutrality			

Field officers in Cape Town, Johannesburg and Windhoek and employers from all the four cities had also substituted some of their trips. Employers would make phone calls to request, rate or reference a worker, hence cancelling the trip to the worker collection point. Field officers would mainly call the office to confirm worker details whenever they needed to allocate a job. This would reduce the time taken to confirm a worker when compared to the case where the field officer would have to wait until they went back to the office. In all the cases, all the individual stakeholders substituted, while the field officers both substituted and complemented (Table 7.2).

Why Visits to the Collection Points?

Even though workers, especially in NDLM, had substituted some of their travels because of the mobile phone, there were still more questions to be answered as to why the majority of the workers still went to the collection points. In our efforts to understand the scenario, we did numerous interviews and chats with workers. We found that, as much as the cost of calling (being proactive as a job seeker) was still high, the main reason for going to the collection point was for socialisation and not because they could not afford to call. We must, however, admit that we were not able to find the exact reasons and we were not clear with this issue. We expected that the mobile phone, as a socialisation tool, would eliminate socialisation as the main reason for going to collection point. In a bid to answer the question of why people physically travel even with development of new ICTs, [Urry \(2002\)](#) concluded that *“the analysis of why people travel, and whether they should travel in the way they currently do, is to interrogate a complex set of social practices, social practices that involve old and emerging technologies that reconstruct notions of proximity and distance, closeness and farness, stasis and movement, the body and the other. These intersecting mobilities and diverse proximities are topics fit for a 21st century sociology”*. Following from [Urry’s](#) conclusion, the question as to why DLM stakeholders still preferred to travel to collection points despite the possibility of using mobile phones, is complex.

Workers in Johannesburg reported going to collection points due to high competition and the cost of calling. There were more workers than employers at any given time and, hence, not being at the collection point meant reducing one’s opportunity to be selected for a job. As for Cape Town job-seekers, it was because of lack of mobile phone ownership and the cost of calling.

It was slightly different in Windhoek, Namibia. Some workers reported having stopped going to collection point as soon as they became members of the intermediary organisation

(MSRNA). Instead, they started using the same time to visit the MSRNA offices to read newspapers and apply for jobs. This might have been influenced by MSRNA running projects that allowed job-seekers to use office facilities in their offices.

The State After our Intervention

When we introduced software applications as ICTs, it affected the travel plans and activities of the field officers. As [Siha and Monroe \(2006\)](#) put it, we discovered that technology is the backbone of any telecommuting program. We had found that the DLMs had limited technological support (especially the back-end and remote systems) necessary to support telecommuting. To remedy that, we modified and even build some applications from scratch. Such applications included those that could be used to execute remote activities such as registration of workers by the field officers.

As we mentioned earlier, we resorted to designing through intermediary organisations for MSRSA and MSRNA. The main reasons for this were low mobile phone ownership among DLM workers, feature (low-end) mobile phones owned by job-seekers and the high cost of communication using the mobile phone networks. The potential in the intermediary organisations to support telecommuting, through field officers, was also another key reason why we concentrated on them. Besides, intermediary organisations and NGOs have been shown ([Gitau and Marsden, 2009](#); [Tucker, 2009](#); [Sambasivan et al., 2010](#)) to be valuable when dealing with the poor or illiterate groups.

Table 7.3: The effect of mobile phone and our applications on travel for the DLM major stakeholders

		Employer	Worker	Field officer
1	Substitution			ç
2	Complementation			ç
3	Modification			ç
4	Neutrality	ç	ç	

Table 7.3 shows the changes brought about by our interventions. The change was from substitution (row one of Table 7.2) to include complementation and modification for the field officers (Table 7.3 rows two and three respectively). After implementing the mobile application for registration and searching of workers and employers, field officers would avoid making other trips such as from the collection point to the office. Due to the need to visit more collection points, MSRSA field officers increased their commuting and, at the same time, modified their routes and travel time. This brought about the complementation and the modification factor. As for the MSRNA field officers, they would sometimes be required to go back to the office for other duties and, hence, they did not experience much modification. They, however, benefited by reducing the data entry time into the database back in the office.

As shown in row four of Table 7.3, the workers and employers were not affected (neutralised) after the introduction of our applications. Within the time we observed the

system usage, we did not see any changes in terms of commuting patterns and time for MSRSA and MSRNA workers and employers. We thought that such system usage would alter travel patterns for workers with mobile phones. This is because workers are likely to learn to adapt to the field officers' travel patterns. Employers proved to be unpredictable, as was reported by the MSRSA employees and the employers interviewed. For example, one employer told us that employers may not easily change their travel plans as they always want to see the worker before making any commitments. Contractor employers may, however, change their travel plans because of long-term relationships with workers and hence trust, which always comes with time.

After failing to design for workers in South Africa, we decided to try it in the NDLM case study. The main reason why we thought it was possible to design directly for workers in Nairobi was because the preliminary study had shown that the majority had mobile phones. However, to our surprise, implementation was a total failure. As a result of the failure, the impact on travel for both employers and workers also neutralised for NDLM. This is also shown in row four (neutrality) of Table 7.3.

Impact on the Organisations

Here, we describe how the intermediary organisations were impacted. In both MSRSA and MSRNA, we saw two major changes: One on the management or operational changes and another on performance.

With regard to management, MSRSA recalled three field officers to the office and later terminated their contracts. The remaining three were now required to be in charge of the six collection points run by MSRSA in Cape Town. Although we did not witness it happen, the regional manager was planning to increase the collection points. As for MSRNA, it was planning to expand their services beyond Windhoek. This was, however, not because of the remote applications, but because of their strategic plan. The MSRNA head indicated that the web-based integrated system and the remote mobile application would help them manage more collection points.

On overall performance, MSRSA showed improved performance within two weeks of full usage of the remote mobile applications. The first improvement was on the cost saving by the field officers whose transport costs were being paid for by the organisation. The second thing was the quality of service to the clients (both employers and workers). The service became efficient and effective. The NGOs reported serving more employers within a shorter time than before and with accurate and relevant information. This brought about the realisation that ICT intervention can still benefit the target group through intermediation. This was key to our study as we had found that job-seekers are the hardest hit (in terms of the cost of looking for jobs) in the job search practice, and yet it was not possible for them to benefit from ICTs directly without some kind of intermediation.

Telecommuting/teleworking Impact on Job Security

Literature from the developed world (for example the USA) which deals with employment and teleworking show that teleworking could reduce inner city unemployment. It may also increase the number of jobs that can be accessed by people far away from the work station

(Cox, 2009). In our study, however, we saw field officers being reduced from six to three. The objective of the organisation was cost saving which is a key impact point for organisations seeking to have telecommuting rather than increasing job openings for field officers. This brings about the discussion on the perspective in which telecommuting is looked at. From the ICTD point of view (pro-poor), the objective is to reduce costs to the poor in our case the DLM organisation which translates to efficient and effective service to our target group (the day-labourers). In conclusion, we see travel substitution using technology serving in two ways depending on the objective: it is possible to save the travel time and use it to perform more activities in a day, hence doing work that would have been done by other people or it can allow many people, far away from the physical work station to be able to do work that would have otherwise been done by a few people in the work station. The latter carries the concept of outsourcing or crowdsourcing (Liu et al., 2011) and the former is a classical case of an individual substituting travel for ICTs an example is telecommuting/teleworking (Ahmadi et al., 2000; Di Martino, 2001).

MSRVoice and Telecommuting

MSRVoice was not a planned software system. As we were brainstorming and reflecting on our findings with the MSRSA management, the MSRSA general director came up with the idea of *MSRVoice* to help workers who normally travel long distance to report complaints. He had the day-labour farm workers in mind. The introduction of the *MSRVoice* was seen as evidence of the organisation having understood how telecommuting could be used to help the poor. After a long study period and our efforts to understand the DLM, just out of nowhere, the MSRSA director indicating that we could try such applications as *MSRVoice*. *MSRvoice* contributed to our study in that it showed the prospect of an application that can allow remote reporting by labourers. As stated earlier, remoteness is a key aspect of telecommuting aimed at reducing commute time, distance and, consequently, cost. The workers who were being targeted by the *MSRVoice* concept did not necessarily commute every day and, hence, telecommuting would not have been a good term to use for *MSRVoice*. However, the idea was to find the possibility of reducing or eliminating distance using technology.

Systems Implementation Failures in the NDLM

There are three reasons we could think of as having contributed to the unsuccessful implementation of DLM applications in Kenya. First was that the adoption rate of mobile based applications such as SMS, MIXIT, WHATSUP, and even the Kenyan-based *semenio* product was found to be low. One of the reasons we thought would be hindering the adoption of SMS and other related systems among the DLM workers was their age brackets which was found to be at an average of 44 years. The cost of calling also featured. We thought that the low adoption rate of such applications would be because the voice call charges, though still expensive by the standards of the poor, is affordable when compared to other countries such as SA and Namibia.

The second reason was the type of applications that we were developing. They required, at minimum, a Java enabled mobile phone with Internet connectivity. Most of the DLM workers did not have such phones. We also could not think of building SMS applications as the SMS

adoption rate among the workers was low. Nevertheless, this might not have been a key reason as even those whom we tried the system with did not adopt it.

The third and the key reason was that we did not have a championing intermediary organisation or individual to run the setup needed for implementing our applications. This is what we saw as the main reason for the failure. As has been in other studies, such as [Donner et al., \(2008\)](#), lack of online content (and may be in the native language), may have contributed to failure of our systems. In the case of MSRSA and MSRNA, we had the NGOs as the champions. We regarded the failure in NDLM as a support to our earlier decisions in Cape Town to design through intermediary. This, however, should not be taken as a final conclusion. We recommend further investigations on the same as we might not have understood the context well, as a result of not spending enough time with the participants. ([Donner et al. 2008](#)).

7.2. General Discussion

In this section, we discuss issues that came up but did not get classified within our discussion model. These are findings which we could not directly link to telecommuting elements and impacts, but may have somehow played a role in its success or failure in our study.

7.2.1 Significant Results

These are findings that either guided our study direction or significantly contributed to the decisions with regard to user requirements for designing and implementing the prototypes. They include:

Ownership and use of mobile phones: The discovery of the low mobile phone ownership among job-seekers in Cape Town changed our design decisions for the mobile phone applications. Only 30% of the workers interviewed owned mobile phones (Section 6.1.1 page 87). We redesigned the prototypes for field officers rather than for job-seekers. We also collected data from Johannesburg and Pretoria in South Africa to confirm the Cape Town findings. Further, having not dropped the idea of designing for job-seekers and employers, we designed for the Nairobi DLM, where preliminary field findings had showed over 90% ownership of mobile phones among day-labourers.

The social aspect of going to collection points: As much as the primary objective of going to the collection point was to look for a job, we learnt that job-seekers also went to the collection points to socialise and discuss current affairs. In general, the need to have technological interventions that serve DLM must consider, not only their primary objective, but also their other perceived benefits.

The importance of education level and literacy in any virtualisation: Related to technology ownership and use is the education level. In our findings, we saw a link between literacy, skills and mobile phone ownership. Day-labourers who owned mobile phones had education levels of grade 10 and above. The 30% of the workers in Cape Town who had mobile phones had education level of grade 12. Likewise, a majority of skilled workers owned mobile phones.

7.2.2 Day-labourers, travel and the mobile phone

The main question was why workers, including those with mobile phones (for example in Nairobi and Johannesburg), still went to the collection points despite employers calling whenever they did not find them. The reasons we give here are speculative and based on either what we observed; what we were told by the workers or what we knew about the workers as a people and as members of the society.

- a) As the researcher knows about a majority of African cultures, it is a taboo for men to stay at home during the day. They are required to be bread winners for their families.
- b) Majority of the workers did not have any comfortable home to warrant spending the whole day indoors.
- c) The day-labourers did not have any other activity to engage in apart from job hunting.
- d) The day-labourers wanted to socialise and share their problems with others.
- e) It is possible that some workers lacked awareness. Workers reported having gotten used to the collection point as the only option for getting jobs. It is possible that, if an awareness campaign was run, workers would diversify and start looking for jobs elsewhere apart from the collection points.

7.2.3 The Data Collected

Language Barrier

The main objective for finding out the language literacy for workers was to check if language barrier was among their challenges. There was no communication barrier between workers and employers because the workers worked in groups. Other group members would translate conversations from one language to another for those who could not communicate with potential employers. For instance, a 21-year-old Zimbabwean worker who could not understand English was still able to find jobs with the help of his colleagues in Cape Town.

Workers, however, agreed that language can be a problem when using technology. For example, workers who do not speak English may miss job requests via the mobile phone from English speakers. This means that language barrier could negate the benefits of a mobile phone as a job search tool and may even isolate some workers. This brings out the importance of intermediation.

Language barrier can be a source of misunderstanding between the employer and the worker. For example, a worker may fail to take correct instructions from employers during working hours. For example, one employer told us of a case where a worker painted his flower pot even after being told not to paint it.

Earnings and Expenditure

The main purpose of interrogating the job-seekers balance sheet was to find out if their earnings matched their expenditure and if they made ends meet. More specifically, if waiting on the road side each day was worth it. We were also finding out the significance of trying to reduce their travel to collection points. If their expenditure would reduce by a reasonable margin after adopting our software systems, then we would say it is beneficial. Workers lived a subsistence life. They barely made ends meet. With the figures that we obtained

(Section 6.4.1 page 120), it was clear that workers should be able to significantly save on transport cost if they adopted ICTs to reduce travel.

The Meaning of Worker Earnings and Travel Costs

Using different data collection methods, we found different figures for the average day-labourer earnings. For example, the average amount given by MSRSA employees was ZAR 90 per day. However, interview data from job-seekers indicated an average of ZAR 150. With all the variance, however, we deduced that, if a worker was to get full time employment for a whole month, he or she would comfortably manage to meet his or her basic expenditure. This means that the cost of transport to work, which was found to be standard regardless of the data collection approach we used, would not be a problem for them. With the ZAR 90 to ZAR 150 earnings, workers reported not being able to make any savings but were able to meet their basic needs.

Getting a job everyday in a given month was rare. There were workers who reported having been working for six months and then they were out of work for up to three months. This means that, whenever a worker is out of work, he or she is not likely to afford to pay for transport costs to the worker collection points. A common case is where a day-labourer affords transport to a work station but not to the collection point. As a result, the majority of the job-seekers walk to collection points when out of work and use available paid transport means to the collection point (to be picked up by the employer) or to work station.

Transportation was such a significant aspect of the DLM to a point where MSRNA decided to relocate their office to a location close to where majority of the day-labour workers resided. Their objective was to take services closer to the workers to reduce their walking distance (about 20kms). The workers still needed to walk to the worker collection points mostly located in major road junctions in different parts of the city. One major characteristic of a non-connected worker collection point is that it is always located near rich suburbs in the cities. These rich suburbs are always a long distance from poor suburbs where most of the day-labourers reside. In some cases the two suburbs are separated by the city centre and, hence commuters (job-seekers in this case) tend to cross the city centre. Crossing the city, in the case of cities such as Nairobi, requires that one uses at least one means of transportation, an exercise which can be expensive for job-seekers.

In summary, even when day-labourers are capable of paying for their transport cost, they still go through the frustration of travelling using public means in developing world cities with inefficient transport systems. Further, when job-seekers are out seeking for jobs, they usually walk a long distance (about 20 km). The frustration of walking to collection points, waiting and walking back home without a job can be demoralising to job-seekers. This is why we think using ICT innovations to reduce distance for all classes of people is an idea whose time is here in the developing world.

The Education Level

With our findings, we cannot say with certainty that education level dictated the characteristics of the day-labour workers. However, we could associate some characteristics of different DLM workers with their education levels. For instance, in Kenya, the day-labour

workers who owned registered companies and used for quotations had an education level of over Grade 12. We assumed that this may be associated with their formal training. In MSRSA and MSRNA, we did not encounter such workers. We were informed that they do not come to the collection points. Workers whom we talked to from MSRSA and MSRNA depended solely on intermediary organisations and contracting companies. Workers in Cape Town and Windhoek were reported to be having lower education levels compared to those in NDLM. The day-labourers in Nairobi got to do -bigø jobs, for example Government jobs. We associated this with higher education levels and skills. Such jobs, in other countries, may need quotations through their companies; other peoples companies; or individual contractors.

7.2.4 Telecommuting in a Non-universal Employer-Employee Environment

In our study, the classic employer-employee relationship seen in the developed world telecommuting studies, was not clear. For example, in studying telecommuting, many scholars in developed regions assumed a situation where the employer is the organisation and the employee is an individual whose responsibility is to perform activities as dictated by the employer. In such situations, the employee's decision to telecommute largely depends on, among other things, the employer. With reference to technology, employees in a classic telecommuting arrangement would be provided with ICTs by the employer. In our case, and prior to our intervention, the individuals, whether employees of the intermediary organisation or job-seekers, were responsible for their own technological support.

In many cases, workers reported using shared mobile phones. This affected the telecommuting practice as it required those sharing to travel to the collection point.

CHAPTER EIGHT

CONCLUSIONS AND RECOMMENDATIONS

8.1 Overview

In this study, we had two main research aims: the first was to investigate the ICT design applications that can help alleviate some of the problems faced by the DLM and the second was to find out whether such innovations could be studied under telecommuting for the developing world. The second aim was motivated by initial attempts to solve the first. As we embarked on understanding the DLM problems, we discovered that their main challenge, among others, was the excessive travel in search of the right workers and jobs. This motivated the need for the second question because the problems resembled those in other studies that had been studied in the form of telecommuting/teleworking or virtual work in the developing countries.

We used the term telecommuting interchangeably with teleworking to mean a possibility of substituting mandatory travel for ICTs. The telecommuting definition advanced by [Andreev et al. \(2010\)](#), which emphasised on telecommuting as a type of teleactivity was adopted because it was more relevant to define work and worker search in the DLM as mandatory activities rather than defining them as work (Section 2.4.2 page 26).

To study whether and how the ICTs innovations that we introduced impacted on the target participants, we identified the various stakeholders of the DLM (Section 5.1). We also identified their challenges, current ICTs usage and how the situation changed after the introduction of our ICT designs. In finding out the possibility of implementing telecommuting in the developing world, we found out that our DLM components (people and ICTs) also appeared as part of the broad components of telecommuting. This, therefore, added to the components describing telecommuting. Table 8.1 shows these components of telecommuting.

Table 8.1: Telecommuting components

	Component	Description
1	People	The individual members of an organisation or a community. In our study, they were workers, employers and NGO employees
2	Location	The possible places where an individual can carry out an activity
3	Job classification	A classification of the kind of jobs, for example, contracts or permanent, and employed or self-employed
4	Worker classification	Depicts the type of worker, for example, white-collar or blue-collar. It is related to job classification
5	Time	Dictates the flexibility of commuting and working hours.
6	ICTs	The key component of telecommuting. It can be any technology as simple as a land-line telephone.

In our conclusion, we look at the methodological approaches; show how the research questions were answered; and discuss the study contribution and the meaning of telecommuting in the developing world. We also summarise how well the study performed

and present the weaknesses and strengths of our study. Finally, we discuss the ethical issue of closing the study and recommend future work.

8.2 Methodology and Methods

We applied AR as our overall methodology. Our key aim was to contextualise the study and draw lessons from the study process as opposed to a process that would attempt to have generalisable results. To protect the credibility and integrity of our results, we employed triangulation on both the data collection methods and different data collection regions as case studies (Section 4.2.1 page 60). Apart from using user observation and interviews as our key data collection methods, we also used questionnaires in places where we could not spend enough time. As for places to collect data, we used three case studies from three countries and covering four cities (Section 4.1 page 55). Another measure for credibility was the duration of study. The study took approximately 30 months with continuous contact with the DLMs; continuous literature review; discussions; workshops and seminars.

Our dissemination method included five research workshops; three research seminars; four conference papers and, finally, this thesis.

8.3 Answering the Research Questions

Here, we briefly revisit and summarise our research questions outcome. The summary follows from our results and the discussion.

1) What are the ICT design applications that can help alleviate some of the problems faced by the DLM?

This question was answered through the design process (Section 4.5 and Appendix D). The requirements gathering, design, evaluation and deployment outcome of the prototype applications indicated the ICT applications that could be beneficial to the DLM and which are discussed next.

Recommended DLM ICT Interventions/Applications

From our findings, and using our prototypes as examples, we present the kind of ICT applications which we found that, if implemented with success, would improve the operations of DLM and its stakeholders. Out of the many prototypes, only three became relevant in improving the DLMs operations. Table 8.5 summarises these applications (The designs are presented in Section 4.5 page 68 while the detailed design process is in Appendix D).

Table 8.5: Three types of applications that can help alleviate the DLM problems.

#	Application	Examples	How it would help
1	Remote mobile applications	MSRSA and MSRNA field registrars	Help the DLM field officers carry out their duties efficiently by reducing their travel and time, hence serving more clients and saving on costs.
2	Integrated web-based database application	MSRNA web application.	For worker and employer record keeping. It should also link to other support systems such as payment (for example m-payment or m-banking) systems. The main beneficiary is the DLM self- or intermediary-organisations.
3	The Worker Voice	MSRSA <i>MSRVoice</i> .	For day-labourers to report any abuses by their employers. This may be used by workers themselves (depending on their characteristics e.g. literacy level) or by field officers. The DLM organisations can also use such applications to track abuses and report them to authorities.

a) Is it possible to have ICT design innovations to help DLM workers alleviate some of their challenges?

The DLM workers were not impacted directly by our software systems. We could not design for workers because of a myriad of challenges (Sections 4.5.1, 6.1.1, 6.2.1 and 6.3.1) that characterised the DLM workers:

- Few of the DLM workers had access to technology to access the applications.
- Their education level was low, hence text illiteracy.
- The cost of technology, especially in SA where the rates are exorbitant and unaffordable for the day-labourer.

Even in Nairobi where mobile phone ownership and text literacy was high, we did not succeed because we lacked a champion (individual or organisation) to run the applications.

However, all is not lost with helping the day-labourers. Using applications such as *MSRVoice* and field registrar, there was an indication that it is possible to serve them efficiently and effectively through intermediation. It showed that it might be possible to reduce travel among the poor by using ICTs.

b) What are the ICT design innovations, if any, that can help in solving the DLM employers challenges related to worker search?

We did not have a direct impact on the DLM employers. The early findings (Section 5.5) indicate that it is difficult to involve employers. The DLM organisation (MSRSA) halted our efforts to directly design systems for employers. MSRSA employers had not adopted existing ICTs technologies and systems to make their worker-search efficient. Even when we tried to study them in Nairobi and Cape Town, we found that it was difficult to trace frequent DLM employers. They are diverse and change frequently. The MSRSA employers in Cape Town, however, still benefited from the mobile application by having field officers respond to their requests quickly and effectively.

c) What ICT design innovations can be used by the DLM organisations to run the DLM efficiently and effectively?

Overall, although our designs did not impact the DLM individuals directly, they were impacted through intermediary organisations. Workers and employers alike benefited as the DLM organisations (MSRSA and MSRNA) used the software systems to run the DLM operations effectively and efficiently (Section 6.1.2 and 6.3.2). Besides the applications, we also made recommendations, some of which were adopted by the intermediary organisations. For example, MSRNA started registering and keeping the DLM employer details after our recommendations.

2) *Can the DLM ICT innovations be studied under telecommuting/teleworking for the developing world?*

To answer this research question, we used the challenges faced by the DLM stakeholders. The key problem facing the day-labourers was travelling distance and time during a job exercise. The travel problem, coupled with the teleactivity concepts (Section 2.4.1 page 17), showed that the closest travel-ICT theoretical framework is telecommuting. This, however, came with suggestions to redefine telecommuting and the things to look for when implementing it in the developing world. These issues are discussed in Section 8.5 where Section 8.5.1 details what influences telecommuting; 8.5.3 gives the comparisons between the developed and developing world telecommuting contexts while Section 8.5.4 discusses the things that may go wrong when telecommuting is implemented in the developing world context.

I. What are the possible benefits of telecommuting to Africa and, by extension, the developing world? How do these benefits compare to those which have been reported in the developed world?

Answering the first section of the question entailed understanding our target group and identifying areas in which ICTs could be used to reduce travel. Literature and our software systems design outcomes were used to pick out the benefits to the informal organisations in the developing world, a case of the DLM. To answer the second part of the question, the outcome of implementing, testing and deploying such applications was then compared to what has been reported from developed countries literature.

Most of the developing world's infrastructure is poor causing the commute time and cost to be relatively higher compared to the western world (Section 1.2). This is where telecommuting benefits for Africa should be exploited. Section 8.4.3 on ICTD argues that commuters are likely to benefit if telecommuting was to be implemented for the developing world. However, these benefits may, differ from the benefits in the developed world. For instance, while telecommuters in the developed world would see working from home as an opportunity to spend more time with their children, a telecommuter in the developing world would see it as a way to cut on costs. Section 8.5.3 gives a comparison between the developed and developing countries.

II. Is it possible to implement and adopt telecommuting in an environment where there is limited access to internet and telephone land-lines but with the mobile phone as the dominant connectivity technology?

The mobile telephony has served the poor in many ways including providing them with a means to access the Internet, e-mail and even social websites. In fact, social web applications such as *Facebook* and *Twitter* have provided specialised mobile phone applications. In our study, the conclusion is that, although it may seem possible to implement telecommuting in a mobile technology dominated environment that has no land-line and with limited broadband connectivity, caution must be taken when dealing with those at the lowest level of the economic pyramid. These are the illiterate and/or unskilled, who neither own nor have access to mobile phones as might have been publicised, for example [Abraham \(2007\)](#) and [Versteeg and James \(2007\)](#). Although telecommuting can be possible even with a simple telephone, for activities that require coordination and cooperation, implementations may need more sophisticated applications. This revisits the characteristics, technology and devices that the target users have at their disposal. In the case of the poor, the importance of intermediaries cannot be overemphasised. It may not be possible to implement telecommuting without intermediaries because it requires minimum formal arrangements. Section 8.5 emphasises this finding. In general, the complexity of implementing telecommuting depends on the complexity of the context and may be a challenge to implement it on a purely informal context.

III. Is there a likelihood that the telecommuting adoption process will be the same for both the developed and developing world or could it be that telecommuting requires the African context to see acceptable adoption rates?

This research question was speculative and was answered using literature and our study findings. It was inspired by telecommuting/telework research in developed countries which has been going on since the 1970s but the adoption rate has not been as was predicted ([Vilhelmson and Thulin, 2001](#)). Hence the question: is it going to be the same for developing countries. Although it seemed promising for our study because of the serious travel problems commuters go through, other factors indicated that the trend is likely to be the same for the developing world. For instance, even with the use of mobile phones to get jobs, workers and employers in the DLM still visited the worker collection point. Factors such as a job-seekers not staying home without a job even if they could do virtual search intimated that the developing world trend is likely to be as in the developed world. Other examples include the fact that adoption of ICT applications to support telecommuting may still be hindered by poverty levels.

In general, there was an indication that even with the availability of perfect telecommuting environments i.e. technology, policy and the will by the commuters, people in the developing world were likely to have other more important reasons to meet face-to-face because of the environment in which they live. However, the reasons for slow adoption of telecommuting/teleworking are likely to be different for developing countries compared to those of developed countries. For instance, in developed countries, organisations are worried about management losing track of the employees. On the other hand, employees fear losing

privileges provided in the office. In developing countries, while workers may be scared of losing the office privileges, they are also likely to be conscious about trust when executing activities through ICTs. For instance, in our study, DLM employers would trust a job seeker if they met them face-to-face compared to if they did the same virtually.

IV. Can telecommuting models of the west with its current definition be applied to Africa or does it need redefinition?

Telecommuting/teleworking as it was conceived in the 1970s still holds the same meaning. What has changed, however, are the dynamics of travel and, hence, the meaning of commuting. Although many teleworking studies have contextualised definition, in most cases, they maintain the original components and concepts. This means that there is no likelihood of a major difference in defining telecommuting for the developed and developing world. However, there may be need to redefine the components differently depending on the context. Any designs aimed at telecommuting might require contextualised definitions for the developing world or any informal context. For example, employees, as described in the official telecommuting definition, may not be the same for the informal sector.

V. What other factors can be used to compare and draw lessons from telecommuting attempts in the developing and developed world?

This research question was meant to accommodate unexpected findings. Many factors, in Section 8.5.3, were not captured in questions (I) to (IV) but were important for drawing telecommuting lessons for the developing world. For instance, many telecommuting studies in the developed world assumed availability of back end systems and advanced communication channels for telecommuters. The same studies also assume that any communication link and/or application will serve as telecommuting ICT. As a result, any attempts to follow the developed world guidelines in implementing telecommuting for the developing world may pose a challenge. In our study, we found that there is a need for a specialized, contextualised telecommuting implementation plan which must take into consideration the cost, the availability and the social requirements of the target group. For example, if the cost of using technology is not free, it would not be ideal for a job-seeker who survives on than less than a dollar per day.

8.4 Study Contribution: Knowledge, System Designs and Artefacts

The contributions of our study are in four sections:

- Knowledge contribution which has lessons drawn throughout the study process. It comes with lessons for either practitioners implementing systems in a similar context as ours or researchers who wish to carry out similar studies.
- The designs and software systems we build for the NGOs.
- The ICTD contextô changing the lives of the poor and
- The meaning of telecommuting in the developing worldô related to the knowledge contribution.

8.4.1 Knowledge

The Design Lessons

Many ICT4D research which aim to design artefacts for the poor end up benefiting the less poor among all those homogenised as the poor or fail to benefit anyone. Most policy makers, researchers and practitioners agree that reaching the poorest of the poor is a very difficult challenge (Wagner et al., 2005, p. 94). This may mainly be because of lack of attempts to differentiate groups with different needs and different vulnerabilities. In our study, we draw lessons for trying to design for the poorest (the job-seekers) in the DLM (Section 1.2 and 6.4 page 119).

As a design contribution, we identified the following lessons for other researchers. They apply to designing general ICT applications and those to support teleactivities including telecommuting within an informal set up such as the DLM.

- a) The importance of intermediary organisations cannot be overemphasised (Sambasivan et al., 2010). Intermediary organisations, mainly NGOs, are likely to remain significant until other factors such as extreme poverty and illiteracy are alleviated. Intermediary organisations e.g. NGOs are not without challenges either. For example, studying a community within the NGOs structure may restrict researchers to the limits of the NGOs, which may have own (negative) human intent (Toyama, 2010) or may be limited by the finance and the politics.
- b) Design within the informal sector is more likely to succeed if there is a minimum level of a formal or semi-formal organisation. IT tools cannot be readily applied in developing country enterprises partly because working manual systems do not exist or those that exist are chaotic (Jayawardene and Goonatilake, 2001), meaning at least a minimal level of a working system is key for any ICT intervention. In our case, MSRSA and MSRNA initiatives were successful partly because the NGOs were supportive and had a level of organisation. On the other hand, the Nairobi initiatives failed due to lack of a champion and a formal organisation. The self-organisation in Nairobi may not have been ðformalð enough to support our initiatives. Tied to this is the presence of basic ICT infrastructure. We believe that if the Nairobi DLM had even a minimal ICT infrastructure, it would have helped in our initiatives.
- c) The design and implementation process requires incentives (Easterly, 2002; Tongia and Subrahmanian, 2006). For example, the main objective of a day-labourer is to earn a living. Any intervention, for the workers, must consider how to compensate for their time. One of the things which we blame for the NDLM system failures is that we may have not convinced the workers and employers enough of the importance of the interventions. It is also possible that we did not provide enough incentives to compensate for workers and employers' time when testing our prototypes.
- d) The 'one size fits all' design is not always possible even where the objects of study seem to share similar characteristics. ICT4D designs are better off being contextual (Prakash and Deq, 2007). In our case, the initial assumption that designs for Cape Town could be used for Windhoek and Nairobi turned out to be false. We modified the designs for each

- new case study, albeit with minor modifications in some cases. This was true even for the case of MSRSA which was an NGO formed and operated with MSRSA operation model.
- e) Remote mobile applications fully rely on a server side application that already supports the organisations operations in order to support any teleactivities. The back-end systems must first support the internal operations of the organisation before seamlessly incorporating remote applications (Hawkins et al., 1999; Churchill and Munro, 2001). The MSRSA and MSRNA web-based applications were key as they were already trusted and were seen as a requirement for the NGOs operations. This, therefore, emphasises the importance of the back-end systems to support any teleactivity. Hence, for any remote applications to effectively support telecommuting in developing world, the back-end applications are equally important.
 - f) A combination of fragmented proprietary; open source and legacy pieces of software applications makes it extremely difficult to design computer and mobile phone applications for companies/organisations. For example, for MSRSA, it took a lot of time and expertise to integrate the main web-based database, the web-based payment module and our applications with the proprietary web-based database system.
 - g) In a formal employment set-up, record-keeping and access is not always a problem. The employer keeps employee records for payment and other requirements. In an informal set up, for example the DLM, poor record keeping may affect design. An example is when we needed to interface the MSRSA systems with the mobile payment system. The challenge was getting to verify the identification and the mobile phone numbers of the workers. Had workers been employed by a formal organisation or individual, we would have assumed that their details are verified and would not need to add the verification module to the system. Therefore, informality creates more work in design.
 - h) To increase the chances of design success, intended users must be aware of the expected benefits. We did not find this to be a problem for MSRSA and MSRNA field officers as they were aware of the need to cut down on the number of trips. However, it took a lot of effort to educate job-seekers on the potential benefits of such studies. For example, convincing a job seeker to have trust on the field officer to call them for a job was a difficult task for us. For employers, the task was on convincing them to trust that a worker recruited remotely by filling an online form, calling or E-mailing is as good as one recruited at the collection point.
 - i) The adoption of ICT applications still gets hindered by the poverty level in the developing world (Bruno et al., 2003). For example, even if we assume perfect applications where workers and employers can interact online, workers would still prefer to walk to collection points instead of paying for transport to the work station. This would be the case because employers often pick up workers from the collection points, hence reducing the cost of travelling for the worker. This point came out because many job-seekers preferred to visit a collection point just to go and wait for transport to the job station. In an ideal situation, workers who are returning to work would go directly to work without passing by the collection point.
 - j) Using democratic study methods, such as AR, may force the study process to follow the operational characteristics of the participants. For example, just like the DLM changing characteristics necessitated change of operational model by the MSRSA, the way

participants operate dictates, in many aspects, the design and implementation of ICT applications. Teleactivity or any remote applications may not be different.

Telecommuting and the Mobile Phone in the Developing World

As one of the contributions of our study, we highlight the issues that we identified with regard to investigating the extent to which mobile phones and Internet technologies can support telecommuting in the developing world.

Our first lesson was that telecommuting definition needs to be extended to include non-work activities which require routine commuting. It can still include carrying out activities outside the common time frame—commonly known as working hours in the world of work—and outside the home office. With the redefinition, telecommuting will allow telecommuters to carry out their activities away from their routine activity station which will not necessarily be home as it has been in the original definition (Hill, 1998). For remote activity execution to occur, there is need for some level of time flexibility. For example, in the DLM, if an employer needs the services of a worker, he or she should be able to access and use the skills verification system anywhere and at any time. The availability of the verification systems should not be limited to office hours.

Apart from extending the definition of telecommuting to include other activities which are not formal work, we found that there is also need to re-define it to include lower-level workers and even non-workers—job-seekers. It follows that, once it includes non-work activities, it must include non-workers and workers who do not have predictable work contracts. Such workers may include day-labourers and the general blue-collar workers.

Other Lessons

There were other findings which were not specific to ICT, design or telecommuting. These included findings that may be used to help day-labourers (and the poor in general), but not necessarily in the form of telecommuting. They include:

- The characteristics of the day-labourers (Section 6.1.1, 6.2.1 and 6.3.1), as a representative of the poor, may be used in formulating policies for helping the poor. For example, insurance policies for the unemployed; the training requirements of the youth and the unemployed; policies for handling the disadvantaged and many other policies that benefit the unemployed.
- The use of mobile phones to avoid discrimination—regarded as ICTs for social development (Midgley, 2003). Mobile phones can provide address anonymity (Dunn, 2009b) which may be used to help in closing the gender gap in many of the work types in the DLM. For example, jobs that are dominated by men, for instance field officers in a male dominated worker collection points, would be taken up by women as well, should a virtual DLM become a reality. Also, if remote systems get used by field officers for job allocation, the dispatcher discretion problem may be avoided. The dispatcher discretion problem involves dispatchers using their perceptions of workers' loyalty and reliability to shape the allocation of jobs (Bartley and Roberts, 2006). This undermines one of the DLM sites' benefits—equitable and efficient distribution of jobs.

- Technology designers need to know that technology can only be a complement, not a substitute for face-to-face interaction (Sridhar and Sridhar,2003). Our software systems could do much but not replace many of the DLM operations. Likewise, telecommuting, as it depends mainly on technology, cannot completely replace commuting.

8.4.2 Design and Artefacts

Another research contribution was the designs and artefacts implemented for the intermediary organisations. Although the software systems that we designed mainly served in understanding our problem area, we successfully deployed some of them for NGOs use in a long term basis. As a result, we had made a contribution to the NGOs by providing applications to alleviate some of their hardships. This contribution served the ICT part of the ICT4D under which the study was formulated. The following applications were adopted and, up to the writing of this thesis, were still in use: The field registrar, data upload and download module for MSRSA; and the web-based systems and the mobile application for MSRNA. Because we understand the importance of sustainability in any ICT4D research (Toyama, 2009), we put in place measures to ensure that we did not leave our users with more problems than before by implementing the applications. We implemented measures (Section 8.10) to support these applications and make them a contribution. More significant was the involvement of the NGOs (MSRSA and MSRNA) as part of the project right from the start as we were aware that they will remain part of the DLM long after our study was over (Gitau and Marsden, 2009) and would be able to own and sustain the applications.

The explicit benefits for MSRSA and MSRNA include saving on printing paper; reduced travel costs for field officers; and reduced error rates in data entry. Similar benefits have been reported for telecommuting studies elsewhere. For example, Wataid and DiSanzo (2000) indicated how telecommuting could transform paper based procedures; over reliance on voice and in-person communication into automated procedures and full-scale connectivity and reduced processing errors and improved customer service.

The implicit benefits were mostly as a result of field officers spending more time in the worker collection points, leading to benefits to workers and employers, and being able to visit more than one worker collection point in a day.

8.4.3 ICT4D Context and Changing Lives

ICTD studies have the concept of helping the poor develop economically or socially. In our case, the key target was the day-labourers. The main objective was to investigate ICT designs to help them reduce their daily expenditure and increase income. The informal sector may be here to stay and even expand (Melendez et al., 2009). This assertion challenged us to believe that DLM as an informal sector is a real problem and, hence, the need to study it.

Cost saving is a key component of telecommuting (Wataid and DiSanzo 2000). The cost-saving aspect is, however, looked at more on an organisational context and less on the telecommuter context. Since the majority of studies in the developed world deal mainly with big organisations which usually pay high salaries employees are perceived to be benefiting, not in terms of saving costs, but in terms of saving time and being flexible. The cost of transport for an employee in a big organisation can be said to be negligible compared

to that of a day-labourer in a developing country. For our case, by looking at our study from bottom up, i.e. finding out what can be done for the poor (job-seekers) rather than what telecommuting can do, our aim was to impact the job-seekers. We found that directly impacting the poor is a big challenge and, therefore, we recommend the use of NGOs as an access point to those below the poverty line (Marsden, 2008; Gitau and Marsden, 2009). As it is now, work that aims at direct intervention may isolate the poorest. NGOs level the playing ground for those living in extreme poverty.

8.5 The Meaning of Telecommuting in the Developing World Context

Here, we reflect on what it means to have telecommuting in a limited resource environment. We describe what our study says about this and propose a set of guidelines that can be followed when implementing telecommuting in the developing world. These guidelines can be taken forward for further future studies. We also propose an extended definition of telecommuting that removes the word 'office' and includes 'work station' or 'station of interest'. Further, comparing it with the definition of telecommuting as seen in literature, we discuss the common themes between telecommuting for developing and developed countries.

8.5.1 What Influences Telecommuting

The things that influence telecommuting in Africa are different from those in developed countries. We found that the main drive for the two NGOs adopting remote task execution by field officers was to save travel costs. In the developed world, however, saving time to do other things may be more important than saving the cost of travel. For example, Peters et al. (2001), in a study using employee sample of 849 in Netherlands, reported that when one-way commuting time exceeds one hour, employees adopt telecommuting. Clearly, this indicates the value attached to time as opposed to cost.

Another factor in implementing telecommuting is gender. Gender should not affect telecommuting implementation (Peters et al. 2001). In our study, most of our participant day-labourers were male and, therefore, we were unable to find out the difference between female and male participants. Similarly, there was no difference between female and male field officers during testing of our applications.

Our effort to find out how education level and skills influence telecommuting was also not successful. The idea was to compare the more skilled and educated day-labourers from Nairobi with the less skilled and less educated job-seekers from Cape Town. This, however, did not succeed because we were unable to design for Cape Town workers, while the Nairobi experiments did not get to implementation. As an alternative to understanding the issue, we compared the three field officers while using our systems. We also asked them their education levels and the experiences in the field. The more experienced (more time as a field officer) field officers were faster compared to the less experienced. This exercise did not answer the education question because the three field officers' education level was grade twelve.

From the knowledge that telecommuting adoption follows the pattern of adopting other technologies (Leung, 2004), it is likely that education levels affects telecommuting adoption, with the more educated being likely to adopt telecommuting compared to the less educated.

Even though telecommuting implementation may differ from context to context, there are things that are unlikely to change. Whether implemented in the developing countries or the developed world or whether it uses mobile phone technology or any other technology, it still needs to focus on a number of common issues— some of which were also identified by [Baruch and Nicholson \(1997\)](#), are summarised in Table 8.2.

Table 8.2: a summary of the most common telecommuting issues

	Issues	Description
1	The remote-work interface	How will remote working affect family relations or other personal activities? How is the teleworking going to impact the physical space and facilities available for the teleworker, and especially, if they are working at home?
2	The job	What kind of jobs can be done via teleworking? Is the technology required available? How will the output of the work be affected? How can the performance of a teleworker be measured?
3	The individual	Is the individual fit for remote-working? Does he/she have the personal qualities and needs required for a teleworker?
4	The organisation	How supportive is the business culture to remote-working arrangements, including the willingness and ability of workplace based management to invest the necessary trust in the teleworker.

These issues correlate with our adopted telecommuting/teleworking definition model. The location and ICTs element of our definition covers for the remote-work interface. Jobs, individuals and organisations correlate directly.

Telecommuting as a Term

Throughout our study, the idea was to have mandatory travel reduction using ICTs. In this regard, all the applications designed were expected to, among other things, solve DLM problems, help to reduce travel. For example, we saw the *MSRvoice* application as a way of adopting “telecommuting” by reducing travel distance by workers whenever they wanted to report any abuse. Because reporting is not necessarily working, one may argue that it may not be telecommuting. In this study, however, we argued for telecommuting as being able to perform a mandatory activity remotely.

8.5.2 Study Surprises

There were unexpected findings which we tried to interpret using interviews and observations to clarify with our participants. These findings may be of help to future researchers.

- Providing telecommuting infrastructure has more than technology and the freedom to work remotely. It has more complex dynamics. For example, we saw that the Nairobi workers could still go back to the same worker collection points even after the relocation of the famous paint shop— which was the key reason why a collection point was established there— to a place where it was inaccessible to them. Likewise, even though many of them got jobs through mobile phone calls, they still preferred to wait at the collection point instead of waiting anywhere. This meant that a community culture formed by the DLM job-seekers needed a social and technological approach that would

help in cutting the physical links and creating virtual ones among the job-seekers. This was beyond the scope of this study.

- Contextualising to the smallest unit: The fact that we were not able to implement MSRNA designs in Nairobi, yet Nairobi had better user characteristics in education and mobile phone ownership, may mean that contextualisation to the lowest level is a necessity in designing for the informal set ups such as the DLM.
- Career progression of unskilled illiterate job-seekers: We thought that career progression is always associated with high level jobs (white-collar and higher level blue-collar workers). The MSRNA intermediary organisation proved that career progression can apply even to the poor with minimal education level or skills. The organization enabled day-labourers to start their career paths, with some of them progressing to acquire skills in welding, electrical etc.

8.5.3 Developed versus Developing World Telecommuting

This section gives a summary of similarities and differences between telecommuting contexts in the developed and the developing world. The aim is to show that, although the two regions are different, there still exist benefits for each region. Tables 8.3 and 8.4 list the characteristics showing similarities and differences in telecommuting research in developed and developing world.

Similarities

Table 8.3: Telecommuting research: some similarities in developed and developing world

#	Issue	Comments
1	It can benefit organisations in solving the problem of recruiting and retaining first-rate workers (Leung; 2004).	Both in lower level (for example DLM NGOs) and white-collar organisations. For example, MSRSA needed to retain field officers with lower pay. Allowing them to telecommute may allow the field officers to engage in other income earning activities.
2	Reducing mandatory distance travelled by using ICTs remains the main aim	This is the key objective across the divide.
3	Telecommuting is not about eliminating commuting totally. There are jobs that cannot be done remotely (Pruitt and Barrett, 1993).	The aim is to reduce travel distance where possible and not to eliminate it completely.
4	There are key issues that cut across telecommuting in general (Table 8.2).	Although these issues may vary in description and approach, their concepts remain.

Differences

Table 8.4: Telecommuting research and practice: Some differences in the developed and developing world

#	Telecommuting research and practice in the developed world	Telecommuting research and practice in the developing world
1	Assumes that commuters can only be employees and rarely consider job-seekers or the unemployed.	Considers activities that require mandatory commuting such as job search or worker search.
2	Has a worker and organisation/employer relationship as permanent, well defined relationship with a well defined negotiation platform	Includes loose relationships between employer and employee
3	Assumes an employer-employee relationship where the employee is dependent on the employer and has little or no influence on telecommuting decisions.	Must consider independent workers/individuals who may choose to telecommute without consulting any organisation or individual.
4	There is always a direct employer-employee relationship. There are no third parties involved	Employer-employee relationship may be through intermediation. Direct employer-employee relationships are likely to be similar to the developed model.
5	Assumes readily available ICTs and transport infrastructure	Must evaluate each case independently and consider limited access to ICTs and poor transport infrastructure
6	Telecommuting drivers include social factors such as single-parents being likely to commute compared to non-single parents	The telecommuting drivers include the need to save costs, time and frustrations associated with poor infrastructure for the telecommuter.
7	For most of the definitions, telecommuting and telework have been used interchangeably	To differentiate between commuters who commute to do other activities and those that commute to work, telecommuting and teleworking may be used in that order respectively. The alternative is to have a new class of teleactivity to describe both cases.
8	Studies assume white-collar educated employees that can use a range of technologies (Pyoria, 2003). Even studies that talk of lower level blue-collar workers, anticipate them having access to technologies.	Considers low-literate job-seekers using mobile phone as their only technology or even those who do not have access to any technologies. This could be done through intermediation.
9	Factors that hinder telecommuting, e.g. the data protection and security, and employers not willing to adopt new management skills (Di Martino and Wirth, 1990) issues are more likely to be a reserve of the employer.	Factors that hinder telecommuting are mainly on the side of the employee. For example, workers who cannot afford to make a phone call to confirm a job may not adopt telecommuting.
10	The most frequent form of telecommuting practised is home based (Stanek and Mokhtarian, 1998). This is because workers are likely to have a good home office.	Telecommuters are most likely to telecommute at centres or any other remote sites but not necessarily home because most developing countries' workers, especially the poor, do not have good homes or working office at home.

8.5.4. Introduction of Telecommuting in a Developing Country: What May Go Wrong

Just like any other technological intervention, introducing technology and operational models to push for telecommuting may negatively affect the lives of those involved. In this section, we highlight some of the possible negative impacts of telecommuting adoption in the developing world.

Job Security and Work Station Benefits

Introduction of telecommuting in the developing world may lead to loss of jobs among low-skilled workers. This can happen, for example, in scenarios where telecommuting mothers may take up the day care jobs for the children or the elderly. Day care jobs are usually done by day-labourers, mainly women, mostly known as domestic workers. A positive counter-argument may be that staying home allows the home owner to supervise but not do the work, hence leaving the jobs for the day-labourers.

Such concerns have been raised before. For example, [Cowell and Dunn \(2006\)](#) argued that telework may worsen the employment conditions and job insecurity. It may also transfer to telecommuters the cost of infrastructure such as home improvement and utility costs. This may not be true for the low-level organisations involving blue-collar employees because employees may not afford the equipment or they may not be having a good home with a working space. We anticipate most telecommuters in the developed world working from other alternative places as their key aim is to reduce their travels, but not necessarily to work from home.

Telecommuting may also lead to workers forfeiting some benefits such as the free office telephone services. In the MSRSA office, one of the reasons why field officers went to the office was to make both official and non official phone calls using the office landline telephone. Telecommuting can bring benefits that include reduction in telephone call bills in the office, but may impact negatively on the employees if they feel deprived of one of their benefits. In the developing world context, the loss may not be tangible, but may be equally significant. For instance, one of the job-seekers' benefits was being able to socialise with others. In NDLM, they reported not staying at home because they feared missing on socialisation and political discussions that go on at the collection point. In general, whether developed or not, introduction of telecommuting to any society will certainly have some negative impacts to the telecommuter.

Software Systems and Data Security

Introducing new software systems can introduce new drawbacks. For example, in their work, [Luff and Heath \(1998\)](#) reported a situation where the introduction of a mobile system in a construction site made the user (foreman) less mobile, less able to monitor the ongoing work and less available to engage in activities with others on site. Although we did not see a similar drawback in our case with the field officers, we understand that excessive mobility of the field officers (because of being able to execute duties remotely), may jeopardise the organisation of the worker collection points. This, in effect, means that any introduction of software systems, DLM applications in our case, needs to be examined for any negative

impacts. Further research on the effects of mobility among DLM field officers may also need to be carried out to find out if it affects their work.

Information security has been identified as one of the major issues facing organisations with regard to teleworking (Di Martino and Wirth, 1990; Nortjé et al., 2004). In our study, however, apart from workers' privacy and confidentiality, which are protected by the law, we did not identify any serious security threat associated with using the software systems to support the DLM.

8.6 Study Success

In checking our study success, we were guided by our two research questions (Section 1.3 page 5). Our key objective was to help our participants, the DLM market stakeholders, using ICTs, to reduce their expenditure and, hence, increase their net income. We discovered that the most viable option was reducing the travels; increasing communication and providing information management to make job search and worker search efficient and effective i.e. increase productivity – one of the telecommuting success factors (Belanger et al., 2001). Our evaluation, therefore, was whether the interventions positively changed any of the DLM stakeholders (research question one) and how the change happened (research question two).

The benefits (Section 8.5 page 150) for our study corroborate findings or recommendations from related studies. This served as a validation for success of our study, particularly in meeting our key objective – to reduce travelling. These related studies include cases where for example, other scholars, even though some of them did not explicitly mention telecommuting, have hinted on situations where remoteness and cost and time saving is involved among the poor. (Di Martino and Wirth, 1990; Pyoria, 2003; Abraham, 2007; Aker and Mbiti, 2010). In our study, we used these examples of successes associated with mobility and use of technology for remote work to gauge whether the objectives of our study were met, especially in providing help to our target participants. With regard to knowledge contribution and research, we discussed it based on how well we answered our research questions (Section 8.3).

The Data Collection Truth Meter

In our data collection, we noticed the difference in findings depending on how the data collection was done. For instance, while the average airtime on the phone was ZAR 1 in Cape Town, the average was at ZAR 9.8 in Johannesburg. The difference might have been caused by the fact that we used questionnaires in Johannesburg, while we physically checked the airtime for Cape Town workers. Another example is the number of workers who had mobile phones in Cape Town. Whenever we asked them to tell us whether they had a mobile phone, we got more 'yes' responses as compared to when we asked them to show us the mobile phone. As a result of this, we concluded that interviews and engaging the participant is more realistic than questionnaires. Following this conclusion, we suspect that the average airtime in Johannesburg might have been lower than what was reported.

8.7 The Strength of our Study

In this section, we discuss what we saw as the strength of our study with regard to avoiding some telecommuting research pitfalls identified in the literature.

Selection of individual participants: In many telecommuting/teleworking studies, once a case study has been selected—say a certain organisation or a city—the individuals to be studied are further purposefully selected beforehand using a pre-specified selection criterion. For example, those individuals who telecommute at least three days a week or anyone whose work falls under information processing or any individual with travel diaries, are selected to be part of the study participants. The selection is meant to ensure the success of the telework program. This has been identified as a source of potential bias, which can severely limit large-scale diffusion of telework and realisation of its full potential as a strategic choice for organisations (Shin et al., 2000). Our first strength came from the fact that our study avoided this important pitfall for telework research of purposefully selecting participants, especially the individuals. In our study, although we carried out a selection, for example we could not study all the DLMs in all the cities, the individuals who participated in the design and experiment, field officers, were not in the picture the first time we conceptualised our study. At first, we had an idea of telecommuting every member of the DLM. As a result, we did not have a prior selection of individuals. Even when we had to select day-labourers, we did it randomly.

Problem Definition: Many telecommuting problem definitions have been based on congested cities, the need to retain top employers and other factors that do not touch on poverty and/or poor infrastructure. Our study framed the telecommuting application around saving costs and time. The conception was that the cities in developing countries are expanding and, therefore, there was need to look for ways of reducing commuting costs and time. One such way is telecommuting. Our argument had also been supported by Vu and Vandebona (2007), who indicated that, as cities have become larger and more congested, commuting trips become longer and more stressful, hence the need to look for alternative ways of reducing travel time and cost.

We showed that it may be possible for activities that require corporation to be done remotely under telecommuting: Contrary to the belief that telecommuting remains the preserve of selected activities where one works alone (Vora and Mahmassani, 2002), our prototype implementations showed that there is a possibility of providing ways of working remotely in a cooperation or with others.

One among the few studies: Our work is among the first studies in Africa to critically look at ICT interventions, and more so telecommuting interventions, for the DLM.

Classification of “the poor” in ICTD studies: “the poor” has always been homogenised in ICT4D studies (Heeks, 2009b). Our study, instead, made an attempt to differentiate groups with different needs and different vulnerabilities within the DLM. In so doing, we looked at ICT solutions to the problems of the poorest (day-labourers) in the DLM. The classification was mainly based on income and challenges in the DLM.

8.8 Challenges

Just like many other ICT4D researches, our research process had challenges (Tongia and Subrahmanian, 2006). We categorised them into three: general, study process and system implementation challenges.

8.8.1 General Challenges

a) Measuring the Cost Effectiveness of Using ICTs in Reducing Travel Costs and Time

Many cost-bearing variables are not quantifiable and overall cost-effectiveness is the composite result of both quantitative and qualitative costsóbenefits (Shin et al. 2000). For instance, undetected benefits from improved productivity, quality of work by field officers as well as reduced turnover among field officers, could easily outweigh observable costs such as the cost of transport and phone calls. For non-quantifiable benefits to be measured, the study needs to last for a little longer than it did for this study. Because of the general challenges of studying telecommuting/teleworking (Bailey and Kurland, 2002), we adopted the Senbil and Kitamura (2003), typology explaining direct impacts of ICT on personal activities and travel. This, therefore, had a limitation in that most of our concentration was on travel reduction. In effect, it means that we might have missed other positive or negative factors of implementing the interventions. Another challenge in measuring the cost effectiveness was the lack of means to measure the wider impact. It is difficult to measure the wider impact within a short time (Ho et al. 2009). For our case, it was difficult to measure the wider impacts of our contributions within the short timeframes of our three year research. Because this was a study with the aim of proving a concept, we only adopted methods which measure impact using observable factors and user perceptions.

b) The Informal Sector

DLM is an example of an informal sector. Research within an informal context is arguably complex because of how informal systems and processes are. This was also the case for us. More specifically, understanding the DLM for the purposes of requirements gathering and identifying the stakeholders for telecommuting systems was a challenge (Tongia and Subrahmanian, 2006). The key solution to this problem was to use an exploratory approach.

c) Balancing the Researcher's Objectives and Those of the Participants

Throughout our study, two goals were competing; while we were refining the research questions to meet academic research requirements, the NGOs were thinking of getting what they thought would be valuable applications and operation models. The challenge was, therefore, managing the expectations of each other. For example, it was not easy to provide policy and innovative operational models expected from us by the NGO. The expectations still persisted even when users had known that our objective was to provide ICT solutions and less on policy and operation models.

d) Minimal Resources

There was the frustration of discovering that substituting any travel for ICT intervention had a lowest denominator in terms of access to resources such as literacy, ICT and even income. Our initial assumption was that job-seekers had mobile phones and were literate enough to use ICT systems that support telecommuting. This was, however, not the case. We had not anticipated the challenge of access (UNDP, 2001). Findings revealed that applications that would require direct usage by job-seekers, for example in Cape Town, would lock out those at the lowest level, i.e. illiterate and unskilled. These illiterate and unskilled job-seekers happened to be the poorest among the day-labourers and, therefore, ignoring them would

have left our study within the same state as other many previous studies. Engaging intermediary organisations helped us in dealing with this challenge (Parikh and Ghosh 2006; Medhi et al. 2007).

8.8.2 The Study Process: Challenges and Lessons

Getting into the study community (the DLM) and identifying the stakeholders was our key challenge. At first, the participants in Nairobi ignored us as any other one-or-two day researchers who usually came to talk to them and eventually left the day-labourers feeling used. Because we were aware of the possible challenges, as presented by Tongia and Subrahmanian (2006), we became persistent and showed that we were there to stay. As for NDLM, we identified three day-labourers, made friends with them and, eventually, used them as human access points (Marsden et al. 2008). In SA and Namibia, we involved the DLM NGOs in identifying other stakeholders. We created long term relationships with the stakeholders and explained to them in detail what was in the research for us as well as for them.

As the study progressed, our participants got used to us and opened up. As they got to know about the study, the more curious they became and many of them started demanding to know the exact motive of the study. For instance, when the research assistant was collecting data in Nairobi, an interviewee telephoned the researcher to confirm if she was working for him. The workers had complained of being taken advantage of by many groups (including painting companies selling their products).

8.8.3 Design and Implementation Challenges

- a) Building applications to interface with systems that were designed without remote access was one of our implementation challenges. Legacy systems may be a hindrance to implementing new computer applications because they need substantive effort which may be expensive. For instance, to support remote applications, we had to build the verification module as an interface to the MSRSA old system. Related to this challenge was the presence of many fragmented applications, some of which were proprietary systems with no programming interface. Closed systems for the informal context are not appropriate. They tend not to support innovations and increase the complexity of designing systems needed to implement initiatives such as remote applications.
- b) Although system security was beyond the scope of our study, the challenge to us was how to secure individual records and the system administration issues when it came to self-organised DLM where they had no formal organisation. As for intermediary-organised DLM, the NGO would take responsibility for the records (Cowell and Dunn, 2006).
- c) There was lack of readily available appropriate content (Anokwa et al., 2009). This was specifically for the Nairobi DLM. To resolve this, we designed the mobile and web applications to allow stakeholders to contribute content to the central database. As for MSRSA and MSRNA, there were no electronic records to verify citizens' details. For example, in cases where an employer wanted a qualified driver, the systems developed would rely on the records supplied by the job-seekers and, occasionally, by employers.
- d) In the course of our study, the MSRSA director terminated the contract of three field officers. The reasons he gave was that the field registrar had made it possible for fewer

field officers to complete the tasks. We saw this as interfering with the organization, cases reported by earlier ICT4D literature (Anokwa et al., 2009).

8.9 Limitations of Our Study

The following is a summary of the issues we identified as the limitations of our study:

- I. **Use of DLM as a case in the developing world:** DLM may not have been a good representation for the informal sector. The use of 'developing world' when referring to telecommuting may not be ideal especially when dealing with the informal sector only. The developing world has the formal sector and, therefore, the developing world in our context may be misleading. We, however, still think it is suitable because, if one was to do telecommuting studies in the developing world's formal sector, it would probably have similar characteristics as in the developed world studies. We identify this as a weakness and recommend similar studies for the formal sector in the developing world to confirm or disapprove some of our findings.
- II. **The term 'telecommuting':** In most cases, telecommuting, in its narrow, definition means 'working from home'. As a result, using the term 'telecommuting' in the DLM needed justification. As much as we were convinced that telecommuting/teleworking was the most suitable classification for our study, we still think that the telecommuting concept of the developed world should be studied using different terms in the developing world.
- III. **Using the mobile phone as a terminal device:** Although the mobile phone is the computing device for the poor and it may be the only option available, the small screen can be a constraint to viewing and processing large volumes of text or graphic data (Dunn, 2009b). Therefore, it is possible that our findings might have been biased by challenges of the mobile phone as a terminal device.
- IV. **Time and study scope:** Due to time constraints and the need to scope our study, we could not establish how the following issues affected ICTs adoption before and after our interventions:
 - What the role of workers and employers is to telecommuting implementation and adoption.
 - How privately owned technology versus technology issued and controlled by the organisation can affect telecommuting implementation and adoption.
 - How does shared technology use compare to non-shared technology usage?
- V. **Lack of design for workers:** Despite the knowledge we gained about DLM, we were unsuccessful designing and implementing systems that would be used directly by workers and employers without intermediation. The following is a description of why we failed in the design.

The Failed Applications Contributions

We had three levels of success with the applications designed.

- Succeeded: went to full implementation, deployment and adoption.
- Failed: did not get to the testing stage.
- Partially failed: went to implementation and testing stage but not to adoption.

MSRVoice had a partial failure (Section 6.1.2 page 97). However, during the test period, workers, using field officers as secondary users would report cases from any location. This showed that, if adopted, such applications would make remote task execution possible for day-labourers.

The Nairobi DLM designs were a failure. We blamed the failure on the lack of a champion (either intermediary organisation; worker centre or individual). Designing from scratch for a group that did not have any prior formal organisation was challenging. The whole situation became a chicken and egg scenario where the back-end needed remote applications to work efficiently, while, on the other hand, the remote applications needed the back-end server systems to access data. Hence the conclusion that remote software systems require existing minimum level of organisation and ICT infrastructure to work.

8.10 Leaving the NGOs and Handing Over: The Ethical Issue

Good practice in AR requires an ethical handover during the end of the project (Hayes 2011). Our sustainability plan was reliant on the self- and intermediary-organised DLM organisations managing the various DLMs. The adopted software systems were taken over by the NGOs. Here, we describe our handover situations. The objective was to ensure that the NGOs did not feel used only to achieve our objectives (Dearden, 2012). Our handover ensured that we left someone in charge of the adopted systems.

For each case study, we had a unique handover situation. For MSRSA, through their gradual operational changes, it became a self-sustaining NGO allowing it to finance its operations including the ICT systems. This was convincing as an ethical exit as they had done the same for other systems such as the *Wiwallet* payment system and the *placementpartner*, creating both technological and financial sustainability (Sambasivan et al., 2010).

MSRNA, still operating as a non-profit NGO with its operations funded by well wishers, could not afford to maintain any extra software applications. With this scenario, there were two options: the researcher to continue supporting their systems or to look for a collaborator researcher from a research institution in Windhoek, Namibia. We opted for the latter (as the best option for us) on a short term basis. On a long term basis, the MSRNA NGO committed to find a well wisher, preferably the one supporting their website.

Finally, in the Nairobi DLM we reported unsuccessful system implementation and, hence, had not introduced any system for the NDLM. We report as a failure and planned to continue the research after the publication of this thesis. The researcher and the research assistant already applied for seed funding (already awarded) for further studies.

8.11 Recommendations for Future Work

There has been limited research work on ICTs for the DLM and telecommuting done in Africa and the rest of the developing world. In this study, we have barely scratched the surface towards research in these areas. Whether telecommuting is the right term or not, the concept of reducing distance travelled using ICTs for the informal sector is an area that needs more research. The following are what we think researchers interested in these areas need to consider.

- **The telecommuting/teleworking adoption:** To find out whether telecommuting adoption in the developing world follows the trend on the adoption of new media technology such as computers and internet (Leung, 2004). This is one of the areas that we recommend a study in the developing world on long term basis to ascertain Leung's claim.
- **General studies on ICTs and travel among the poor in developing regions:** These should include general studies in different sectors, informal or formal, to find out how ICTs, especially mobile phones, can affect travel. Although there are studies in Africa which have shown that using ICTs can reduce distance (Abraham, 2007; Aker and Mbiti, 2010; and Chepken and Muhallia, 2011), there has been limited research on daily travel and the dynamics of not travelling at all. More studies such as finding out whether ICTs reduce or increase personal travel are recommended.
- **Contextualised study of a self-organised DLM:** We recommend that researchers working in similar contexts as ours in future need to consider a long term contextualised study of a self-organised DLM because of the failure of our designs.
- **ICTs and Telecommuting/teleworking study in other types of work:** Our study was contextualised and, therefore, results reported were also contextualised to the DLM. This means that claims made based on these results are likely to be true for DLM and not necessarily for other informal sectors. In this recommendation, the need to study ICTs innovations, e.g. telecommuting among various types of informal jobs and workers which are non-DLM related, is presented. This will provide for the capacity to generalise findings for the developing world, ICTs innovations, telecommuting and the informal sector.

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APPENDIX

Appendix A: Telecommuting Definitions

Telecommuting, also referred to as telework, was foreseen as early as 1950s (Smith and Baruch 2001). However, it remained passive until 1970s when personal computers and portable modems in the early 1970s were developed (Hasmi et al. 2001; Campel and McDonald 2007; Hill et al. 2008). Telecommuting was later popularised by Jack Nilles et al. during the 1970s oil crisis (Pyoria 2003). Before the words telecommuting and teleworking were coined, (Bui et al. 1996) reports that Alan Kiron coined the term "Domineering" for the first time in 1969 to suggest the possibility of an employee working at home.

Although teleworking is now an integral part of the fundamental changes characterising the labour markets of developed post industrial societies (Eurofound 1997), a standard definition is still missing. Ever since the terms (telecommuting and teleworking) were coined, no universal definition has been accepted and the search for it is still on-going. As a result, there is still debate surrounding the definition of telework.

There have, however, been attempts to define telework in general terms as remote work involving ICTs as facilitators (Sullivan 2003). This definition was supported by Hill (1998). Hill describes telework as a broad term for doing one's job away from the office via telecommunications equipment (Hill 1998). In another definition, Di Martino (2001) citing (TUC 1998), defines telework as distance working facilitated by information and communication technologies. In yet another definition using ICT, Ahmadi et al. (2000), defined telecommuting as "replacing or supplementing physical travel to the office by using modern telecommunications equipment to bring office resources to the employee".

(Di Martino 2001; Di Martino 2004; Dunn 2009a) also citing (ILO 1990) described telecommuting as a form of work in which (a) work is performed in a location remote from central office or production facilities, thus separating the worker from the personal contact with co-workers there; and (b) new technology enables this separation by facilitating communication.

Although telecommuting and teleworking have been used interchangeably, Nilles (1988a), who coined the term telecommuting in 1973, described telecommuting as a type of "teleworking". He described telecommuting as "partial or total substitution of telecommunications, with or without computers, for the commute to and from work". On the other hand, teleworking was defined to include all work-related substitutions of telecommunications and related information technologies for travel. In either case, Nilles put the emphasis on substitution "the worker newly engaged in tele-X-ing is altering his or her previous travel behaviour" (Nille 1988a).

As the search for consensus in defining teleworking or telecommuting continues, different researchers introduce new terms and phrases to describe teleworking. The term telework has been described as "telecommuting", "remote work", "distance work" or "working-at-a-distance", "outworker" and recently as "virtual work" (Smith and Baruch 2001). Siha and Monroe (2006) also presented the concept of virtual office in describing telecommuting.

Other phrases used to describe different forms of telework include e-work, flexible-location work and home-based business. Sometimes, the words used to describe telecommuting/teleworking vary from region to region. For example American researchers are more likely to adopt the term telecommuting, whereas European and Asian researchers tend to use the terms telework and e-work (Andreev 2010). Telecommuting has been described using many other terms and phrases. These terms and phrases include telework; mobile workforce; flexiplace; homework; hotelling; remote working; homeworking or home-at-working; Mobile Working; Off-site Working; Flexible Work Arrangements; Virtual Workplace and Distributed Work Arrangements (Knoll and Jarvenpaa 1998; Smith and Baruch 2001; Cowell and Dunn 2006).

While many researchers define telecommuting/teleworking using the remoteness concept only, others include workers or employees that practice it. For example, (Blanpain 1997 and Martino 2001) defined telework as work performed by a person (employee, self-employed, homeworker) at location(s) other than the traditional workplace for an employer or a client, involving the use of telecommunications and advanced information technologies as an essential and central feature of the work. Eurofound (1999) describes telework as work performed by a person (employee, self-employed, homeworker) to a large extent at a location other than the traditional workplace, for an employer or a client, involving the use of advanced technologies. Using employees (teleworkers) and remoteness, (Garrett and Danziger 2007), were able to empirically distinguish among teleworkers engaged in three different types of telework: (1) those whose remote work is from the home or in a satellite office; (2) those whose telework is primarily in the field; and (3) those whose work is "networked" in such a way that they regularly work in a combination of home, work, and field contexts. Another classification by Dunn (2009a) listed four types of teleworkers. In his list, Dunn did not include those who work from a satellite office but added in a new category called "freelance teleworkers". The types included: (1) those that work entirely from home, (2) Multi-location teleworkers (3) Freelance teleworkers "work from home but for different employers and (4) Mobile teleworkers.

Researchers who have defined teleworking using workers have done so mainly by looking at their characteristics. For instance, Asaari and Karia (2001), using the term telecommuter for a worker argued that the label "telecommuter" can fit anyone who works in a home or mobile office for an employer somewhere else. In their part, Bailey and Kurland (2002), said that teleworkers often work as contractors rather than full-fledged employees. Ahmed (1994) corroborated this by claiming that telework is ideally suited for part-time work.

Telecommuting and teleworking: Different or the same?

Although telecommuting and teleworking have been used interchangeably (Peters et al. 2002), there are still cases where scholars believe that the two terms have different meanings. For example many US experts now use telecommuting to refer to home working which involves the replacement of travel to work, and use telework to represent a broader range of work options (Nilles 1998a and Martino 2001). Still there are those who define the two terms using the other (Shin, Sheng and Higa 2000). Other scholars have indicated that the term telecommuting is an American equivalent of teleworking (Pyoria 2003).

Even in definitions where telecommuting is defined as being different from teleworking or vice-versa, the objective is still to reduce or eliminate distance travelled and do work from a different place other than the traditional work location. The following definition of teleworking and telecommuting by Nille (1998b), demonstrates this.

“Teleworking: any form of substitution of information technologies (such as telecommunications and computers) for work-related travel. Telecommuting: moving the work to the workers instead of moving the workers to work; periodic work out of the principal office, one or more days per week either at home or in a telework centre. The emphasis here is on reduction or elimination of the daily commute to and from the workplace.”

With many variations of telecommuting definitions, it is difficult to give a single specific and targeted definition. To avoid lengthy comparisons that might arise due to the difficulty of getting a standard telecommuting definition, some researchers have preferred giving the elements or components that make up telecommuting rather than putting forward an express definition for telecommuting. For example (Vu and Vandebona 2007) indicated that the variety of definitions and classifications of telecommuting are brought about by differences that depend on telecommuting time, location, type of communication and employment status (salaried or self-employed employees).

Forms of telecommuting

Telecommuting/teleworking comes in different forms and types. The different types are categorised based on where work is done when moved out of the traditional office. Common forms include: satellite centres; neighbourhood work centres and mobile working (Di Martino and Wirth 1990; Kurland and Bailey 1999; Nortje, Van Brakel and Rensleigh 2009). Other forms which receive less attention are the day extenders. With day extending, those who work full time from a traditional office may work from home after hours (Campbell and Graig 2007). Another form infrequently referred to is across country teleworking. In this case workers working in another country or continent are said to be teleworking (Di Martino 2004).

Appendix B: Action Research definitions and the applied methods

B.1 Action Research Definition

Action Research (AR) has no one universal meaning. As Altrichter et al. (2002) put it; "Action Research does not have one neat, widely accepted definition". In Table B.1, we summarise the most common definitions of AR. We used these definitions to come up with the AR model adopted for our study.

Table B.1: Most common definitions of Action Research

	Authors	Definition
1	McCutcheon and Jung (1990)	Is a systematic form of inquiry that is <i>collective, collaborative, self-reflective, critical</i> , and undertaken by the <i>participants</i> of the inquiry.
2	Reason and Bradbury (2001); Reason (2006).	Is a <i>participatory</i> , democratic process concerned with developing practical knowing in the pursuit of <i>worthwhile human purposes</i> , grounded in a participatory worldview which we believe is emerging at this historical moment. It seeks to bring together <i>action</i> and <i>reflection, theory</i> and <i>practice</i> , in participation with others, in the pursuit of practical solutions to issues of pressing concern to people, and more generally the flourishing of individual persons and their communities.
3	Braa and Hedberg (2002).	Has been typed as a way to build <i>theory, knowledge, and practical action</i> by engagement with the world in the context of <i>practice</i> itself
4	Susman and Evered; 1978; Kock 2011).	Describes the integration of <i>action</i> (implementing a plan) with <i>research</i> (developing an understanding of the effectiveness of this implementation).
5	(Kjeldskov and Graham 2003).	A method through which researchers not only apply scientific knowledge to an object of study, but also add to the body of scientific <i>knowledge</i> through that study, thus differentiating action research from applied science or research
6	Hearn et al. (2008)	A research methodology that focuses on simultaneous <i>action</i> and <i>research</i> in a <i>participative</i> manner. AR is mainly <i>qualitative</i> but may as well incorporate any primary research method. AR, as a family of methodologies, can encompass a number of other methodologies
7	(Hayes 2011)	Action Research (AR) is a class of methods and approaches for conducting democratic and collaborative research with community partners

Summary of action research definitions

In summarising the definitions of AR, we picked key terms used by the researchers to describe AR. We then describe action research as a family of methodologies (Dick 1999) with the following characteristics:

- a. **Action/Practice/practical action:** Action research study requires that some form of action is undertaken. In computer Science or Human Computer Interaction (HCI) the action is mainly designing and building of technological artefacts. In our study, we designed and implemented several web-based and mobile applications during the course of the study.

- b. **Research:** This key word describes the need to have an AR study to develop an understanding of the effectiveness of any change implemented. Most often, software developers, or traditional HCI researchers would stop at a working artifact (Hayes 2011) without critically analysing why things happen (or did not happen) the way they did. Our study, apart from seeking to design and implement software applications, was also in pursuit of an understanding of how DLM operated and how the changes introduced affected them.
- c. **Participants/participatory/participative:** The research process involves the study group as participants and not as subjects. We understood participants in this definition as both the researchers and the *researched* (what conventional science refer to as subjects). The term collaborative is used to describe the close relationship between the researcher and the researched in a way that they are all researchers (Hayes 2011). For example, in our case the DLM intermediary organisations (MSRSA and MSRNA) were part of the design process. It was represented by the head of the organisation at policy level and the field officers and office employees as design partners.
- d. **Knowledge and theory building:** Our understanding of these is that AR does not only apply existing theory or scientific knowledge in a study but also contribute by adding knowledge gained during the study to an existing scientific knowledge (Kjeldskov and Graham 2003). In some cases, action researchers contribute new knowledge or theories from the study outcome. In our research, teleactivity research, and especially using mobile phones, in developing countries was found to be limited. Apart from using knowledge and theory from the developed world, we were seeking to add to the body of knowledge by highlighting key findings about implementation of telecommuting in developing world.
- e. **Critical/ critical reflection/ self-reflective:** These are characterised by one of the stages of doing action research. It involves making sense of problem issues and processes; interpreting a variety of information and perspectives and negotiating meanings (Hearn et al. 2008). According to Riding et al. (1995), the insights gained from the initial cycle feed into planning of the second cycle, for which the action plan is modified and the research process repeated. The insights referred to by Riding et al. are always an output of reflection. In our study we carried out a reflective process where each outcome at the end of each AR cycle was interpreted. The reflection would mainly lead to making decisions on the next action. The next course of action brought about by reflection leads to the most common cyclic or spiral process of AR which alternates between action and critical reflection. In our case, the last reflection was in the form of conclusion and recommendations for further work.
- f. **Qualitative:** Although action research process can utilise other research methods, it mainly employs qualitative data collection and analysis methods (Hearn et al. 2008). We applied mainly qualitative research methods with the exception of a few cases where quantitative data was collected and analysed. For example, we needed to find out how much a job seeker paid as transport costs to and fro the worker collection points.
- g. **Collaborative/ Collective/Cooperative:** Participants, both researchers and the researched collaborate and make decisions collectively. No one party is at liberty to dictate to the other what to do. Other words used in place of collaborative include cooperative. This

characteristic is closely related to participative. In our case, for example, as researchers, we were only airing our opinions on the interventions we thought were viable after field data but were not solely deciding how these applications would look like or how they would be used.

Generally, we found that most of the definitions have many common elements, some of which we have described above, and were clearly captured by Dick (1999) as follows: "*Action research can be described as a family of research methodologies which pursue **action** (or change) and **research** (or understanding) at the same time. In most of its forms it does this by: using a **cyclic or spiral** process which alternates between **action** and **critical reflection**, and in the later cycles, continuously refining methods, data and interpretation in the light of the understanding developed in the earlier cycles. It is thus an emergent process which takes shape as understanding increases; it is an iterative process which converges towards a better understanding of what happens. In most of its forms it is also **participative** (among other reasons, change is usually easier to achieve when those affected by the change are involved) and **qualitative**.*"

Looking at the characteristics of action research derived from the definitions, we noticed that we employed a form of Action Research referred to as Participatory Action Research (PAR). The PAR approach is characterised by six major criteria: (i) it is participatory, (ii) it is cooperative, (iii) it is a co-learning process, (iv) it involves systems development and local capacity building, (v) it is an empowering process for participants, and (vi) it achieves a balance between research and action (Israel et al. 1998; Morisky et al. 2004). Our research process was mainly qualitative utilising other primary research methods such as case studies (Kock 2011), Interviews (Kajornboon 2008), and observations (Taylor and Bogdan 1989).

Existing action research Models

There are many Action Research models based on the general AR model. We highlight some of the models that have been proposed as part of AR definition. We then describe the model applied for our study.

a) Dickens and Warkins model

Dickens and Watkins (1999) describe a cyclic nature of Action Research based on Lewin's action research model (Figure B.1). They show that it proceeds in a spiral of steps composed of **planning, action, observation** and an **evaluation** or **reflection** of the result of the action.

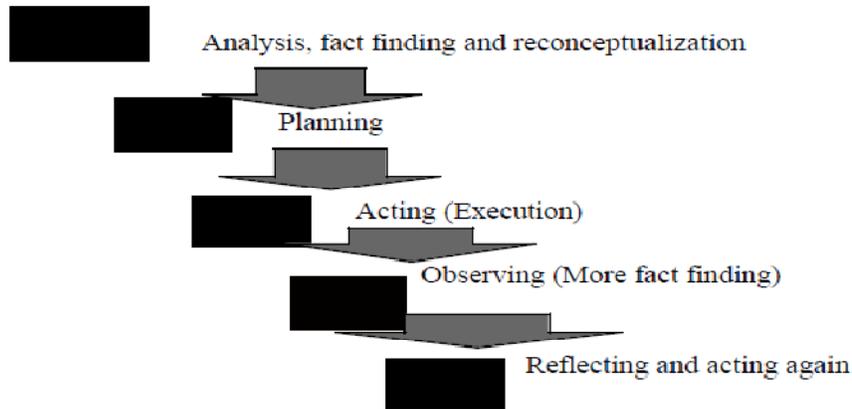


Figure B.1: Lewin's action research model. Source: Dickens and Watkins (1999)

b) Susman and Evered Action Research model

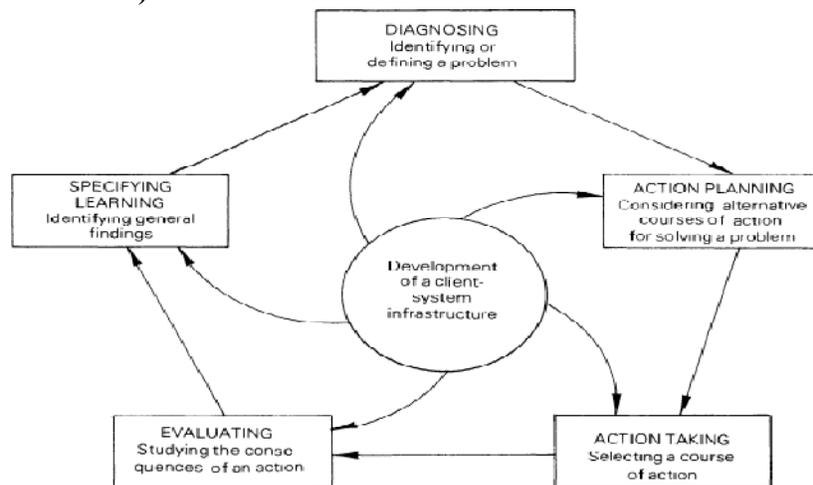


Figure. The cyclical process of action research.

Figure B.2: Susman and Evered Action Research model. Source:(Susman and Evered 1978)

In their definition **Susman and Evered (1978)** defined AR as having five steps namely: diagnosing, action planning, action taking, evaluating, and specifying learning. As shown in Figure B.2, the AR steps are held together by an infrastructure they say is made of client system. They indicate that the infra-structure within the client system and the action researcher maintain and regulate some or all of these five phases jointly (**Susman and Evered 1978**). Resembling the Susman and Evered Action Research model is what was presented by **Baskerville (1999)** (Figure B.3).

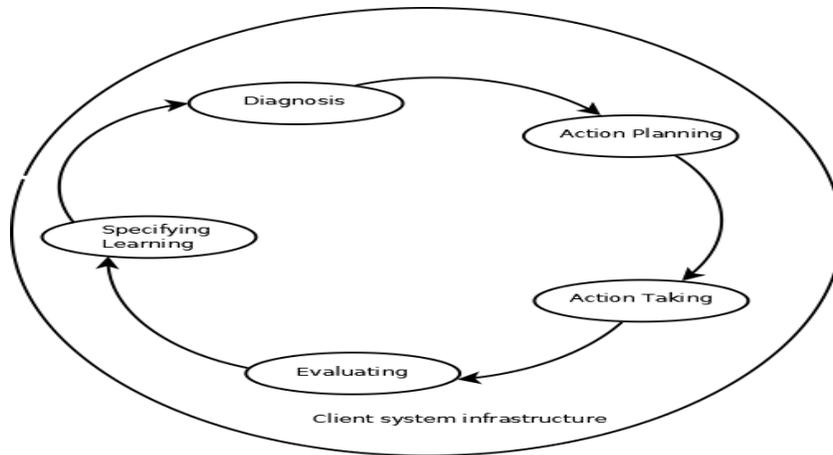


Figure B.3: Action Research structural cycle. Source (Baskerville1999)

c) Hearn et al. Action Research model

The Hearn et al. (2008) AR model is made of planning, acting, observation and reflection steps. Figure B.4 shows the different steps of this model.

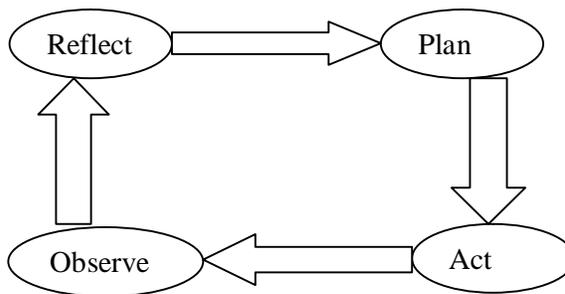


Figure B.4: Hearn et al. Basic AR cycle. Source: Hearn et al. (2008)

B.2 Methods, techniques and tools applied

In this section, using literature, we describe the methods that were applied within our AR model. The methods and what they were used for are listed in Table B.2 and are described thereafter:

Table B.2: Methods applied within our action research process

1	Case studies	This was the umbrella method. Used for making a choice on what we were to study.
2	Interviews	For data collection, participation and feedback
3	Observations	For data collection, participation and feedback
5	Discussions(informal chats)	For collecting general information about the stakeholders
6	Coding	For extracting quantitative data from qualitatively collected information data
7	Prototyping	Our action method. Mostly for system design and development
8	Focus groups/Brainstorming	As a collaborative and participative method
9	Questionnaires	For collecting both quantitative and qualitative data. Used for places where we could not visit frequently. The purpose was also to triangulate in terms of data gathering methods

Case studies

There is no generally acceptable definition of Case studies (Benbasat et al. 1987). In our study, just as in many others, for example, Benbasat et al. (1987), we borrow from the definitions by (Stone 1978; Benbasat 1984; Bonoma1985; Yin 1984; Kaplan 1985). Case study is not a methodological choice but a choice of what is to be studied. A case study examines a phenomenon in its natural setting, employing multiple methods of data collection to gather information from one or a few entities (people, groups, or organisations). It is an in-depth study of a specific instance (Lazar et al. 2010 p. 144). A case study attempts to capture and communicate the reality of a particular environment at a point in time (Jenkins 1985).

According to Baxter and Jack (2008), a case study design should be considered when: (a) the focus of the study is to answer -howø and -whyø questions; (b) you cannot manipulate the behaviour of those involved in the study; (c) you want to cover contextual conditions because you believe they are relevant to the phenomenon under study; or (d) the boundaries are not clear between the phenomenon and context. In this study, we considered multiple case studies because of the context under studyô the DLMô met all the Baxter and Jack four conditions.

The purpose of using case study

In our study, we applied a longitudinal case study where data was collected over an extended period (Yin 2003). We carried out our field work study for about two years. The case study areas were selected progressively (Section 4.1).We used case study as our umbrella method and to identify our study population.

Interviews

Interviews are a systematic way of talking and listening to people. They are a way to collect data from individuals through conversations (Kajornboon 2008). Interviews are a widely used data collection method in qualitative research. They are conducted with a variety of objectives that may include: collecting historical data; opinions or impressions or identify the terminology used in a particular setting (Seaman 1999).

There are three forms of interviews: structured, semi-structured; and in-depth or unstructured interviews (Patton et al. 1990; Lincoln and Guba 1985). In our study, we used structured and

non structured interviews to collect opinions of the job seeker, field officers and other employees of intermediary organisation in the DLM. We also used interviews where we needed to understand, from the participants' perspective, how the DLM operated.

Purpose of using interviews

Apart from user observation, interviews were the most widely used data and information gathering method in our research. The purpose of the structured interviews was to collect specific data which we had planned for collection in advance. Examples of the questions we planned to ask included, finding out the percentage of job-seekers who had mobile phones. In the structured interview, we formulated a series of questions depending on who we were to interview – either job-seekers, field officers, or NGO office based employees. The in-depth interviews were used to get detailed information.

Observations

Observation entails the systematic noting and recording of events, behaviours, and artefacts (objects) in the social setting chosen for study³⁸. Participant observation, as defined in (Taylor and Bogdan 1989), refers to research that involves social interaction between the researcher and informants in an informant's environment. During observation, data are systematically collected in a manner that does not disturb the environment. The idea is to capture first-hand behaviours and interactions that might not be noticed otherwise. During observation, an observer is visibly present and is collecting data with the knowledge of those being observed. Using direct observation, the investigator observes and records the behaviours of the participants. Observations do not include direct questioning of the people being observed (Sapsford and Jupp 1996).

Purpose of using observations

First, because of AR as our methodology, we needed methods that would support the AR characteristics. For example, the need for the researcher to be part of the situation would only be possible with observation. The second reason is accuracy. Observations produce more accurate data than other methods such as questionnaires (Sapsford and Jupp 1996). In an informal setup, accurate data is always challenging to get if other methods such as interviews are solely used. These non-observation methods rely on self-reporting which may be unreliable because participants tend to tell the researcher what they think he needs to hear or sometimes think that it is rude to say they do not know (Anokwa et al. 2009). Observation also can provide an opportunity to those whom researchers may not be able to interview or those who cannot complete questionnaires. In our case, some of the day-labourers were illiterate and could not fill questionnaires or answer interview questions. The other reason is that a researcher involved in observation may get to see the obvious in another angle, giving an opportunity to the researcher to see the obvious as strange (Sapsford and Jupp 1996). Seeing the obvious as strange allows the researcher to interrogate issues that look or sound obvious to him/her but may have hidden information. A good example of this was the case of the day-labourers in Nairobi. The majority of them held painting brushes while waiting for jobs. In our initial encounters, we thought that all those holding brushes were painters.

³⁸http://www.sagepub.com/upm-data/10985_Chapter_4.pdf

However, on further enquiry, we found that even other job-seekers with different skills, such as carpentry were also holding brushes. This was because painting brushes had become a sign of job search activity.

To reduce the problem of reactivity on observation (where somebody behaves in a way different from their natural way because they are being observed) we encouraged all the stakeholders to be free with us. We did that by explaining upfront what we were doing, what would be their benefits and what would be ours.

Questionnaires

A questionnaire is an instrument for collecting data from a wider base than a researcher would be able to if they used interviews or observations. A questionnaire consists of a set of questions presented to a respondent for answers.

The purpose of using questionnaires

We used questionnaires for places that we could not reach frequently. The main aim was to still collect data using the cheapest means. They also served in triangulating the research in terms of data collection methods. The data collected using questionnaires were used to validate some of the findings collected using other methods.

Shadowing

Shadowing is a research technique which involves a researcher closely following a member of an organisation over an extended period of time (McDonald 2005). In our study, the researcher shadowed the intermediary organisation field officers by following them around at the worker collection point and to the NGOs office.

Secondary methods of data collection

These methods included extracting data from MSRSA and MSRNA databases; document and literature review. During the study period, we had access to the databases which contained up to 19000 records with data such as date of birth, age, gender, skills and so on. With regard to document review, MSRSA had a handbook describing their operations and detailing every activity that took place within the organisation. We also referred to the MSRSA and MSNA websites more often. Finally, we conducted systematic literature review on the various areas that touched on our study.

Focus groups and brainstorming

Focus groups involve a group of people with similar interests or agendas discussing particular issues with a view of sharing information (Berg and Lune 2004). A focus group is used to collect a large amount of data from a substantial group of people in a relatively short amount of time (Wilson 2012). During our design process with MSRSA, we organised several brainstorming and focus group sessions to discuss the prototypes. We also used such meetings to discuss what else could be done.

Prototyping

Prototyping has a goal of early observation of behavior of the application being developed. The prototype approach to interactive software system design involves the production of at

least an early version of the system that illustrates essential features of the latter operational system (Hartson and Smith 1991). Prototyping increases communication among system designers, implementers, evaluators, and end-users. As a result, the design process is accelerated so that many alternatives can be evaluated and the effects of each modification can be promptly observed (Hartson and Hix 1989).

Motivation for prototypes

There were two main reasons why we adopted prototyping during our study. The first was because we needed to have constant communication with the users and user representatives. We needed to hear what users would have to say about our proposed designs before moving on to other stages. The second reason was because we were not sure of the type of systems to design. We thought that building full systems when one is unsure would be expensive and time consuming. As Hartson and Hix (1989) advocate, the best alternative for us was to build prototypes rather than complete systems. Our prototypes were non-throw away. The details are presented in the research process (Section 4.5 and Appendix D) and the results.

Data analysis methods

The main analysis method for our study was qualitative. The process involves identifying data patterns and themes (Preece et al. 2007). Most of the data we collected was qualitative and therefore the suitable analysis method was qualitative. We developed the data analysis themes as we understood the context. As the study progressed, we identified *teleactivity* as our key theme. We later narrowed down to telecommuting by using Senbil and Kitamura (2003) model for analysing the impact of ICTs on personal activity and travel. We present the detailed analysis at the results and discussion chapters of this thesis.

Other methods used include, quantitative analysis; coding and database analysis.

Quantitative analysis

Although AR is qualitative methodology in nature, it can still utilise a mix of methods that may include quantitative data analysis. The interest in qualitative studies is about the experience and not about distribution in population (Polkinghorne 2005). However, there are instances where distribution in population might be necessary. For example in our study, we needed to know the distance in kilometers job-seekers' home was from the collection point. Some of these kinds of data were collected in quantitative form and hence needed to be analysed quantitatively.

Database analysis and quantitative analysis

Database analysis involved looking at MSRSA/MSRNA database which had about 20000 records combined. We were looking for information such as gender, age, telephone number, skills, and education level and so on. The purpose was to validate the data we collected from the field and also understand further the DLM community.

Coding

Coding is described as the process of extracting values for quantitative variables from qualitative data (often collected from observations or interviews) in order to perform some type of quantitative or statistical analysis (Seaman 1999). In our study, we applied open

coding (Strauss and Corbin 1990), where the idea was to generate initial concepts. For instance, when we wanted to know if majority of the workers owned mobile phones and what type of phones they had.

Other methods

During our data collection process, we attended a total of two official meetings in the intermediary organisation (MSRSA) in Cape Town. The researcher also attended a community meeting hosted by MSRNA in Windhoek. Although these meetings served mainly as observational, the researcher got to understand issues as they were being discussed by people who were not part of the regular participants in the study.

Design methods

Contextual enquiry

Contextual enquiry is a technique that fosters participatory design by providing a way for users to participate in the design. It contributes to initial design concepts by providing an understanding of the nature of users' work through enquiry to users (Holtzblatt and Jones 1993). The reason for using contextual enquiry is because it does not provide steps for collecting and interpreting data but provides the concepts that guide the design, which will allow the designers to appropriate the concepts. The two concepts of contextual enquiry that we applied are:

Context: Allows talking to people in their actual work environment (Holtzblatt and Jones 1993), an action that we were interested in our design process. This has been said to be the best way of collecting information (Steen et al. 2007)

Partnership: it allows for the users to be partners in the research. This is also an AR principle and has been shown to increase chances of success in research initiatives.

Participatory design

In participatory design (PD), the objective is to include users as participants in the design process (Holtzblatt and Jones 1993). An important aspect of this approach is that users act as fully empowered participants in the design process (Muller 1991). It is collaborative and allows for iterative processes. Using AR as our methodology framework required an iterative process and one that the researchers collaborate with the users. There is an appreciation for the fact that design should be an iterative process where emerging design ideas are tried out in real work situations (Blomberg and Henderson 1990).

Appendix C: Telecommuting/telework study models

In our literature review on telecommuting and/or teleworking, we discovered that most research work, though concentrating on specific themes, tend to reserve substantial space for definitions, benefits and drawbacks and forms/types of telecommuting/teleworking. Most telecommuting non-empirical studies depended on anecdotal discussion of telework motivations, factors, advantages, disadvantages, and barriers (Shin et al. 2000). See for example (Daniels et al. 2001; Dunn 2009a) on how the teleworking themes are build with extensive definitions. For instance the Daniels et al. (2001) study contained subtopics for telecommuting advantages even though that was not its key aim.

In our review, we identified patterns of previous telecommuting work by looking at the patterns that emerged in reviewed papers, in addition to borrowing from literature review studies done by other researchers. Examples of studies which have identified patterns in telecommuting research include the study by Daniel et al. (2001), which proposed a framework for organisational research. The framework contained five variables that teleworking must be examined from. The variables included location; ICT usage; knowledge intensity, intra-organisational contact and inter-organisational contact. The literature review by Siha and Monroe (2006) classified telecommuting studies based on what they called orientations. The four orientations they identified were description, conceptual, empirical, and case study. They also classified articles by the main issues emphasised in them. Bailey and Kurland (2002) did telecommuting literature review under the framework of who participates in telework, why they do, and what happens when they do? Another similar study is by (Campbell and McDonald 2007).

We classified the patterns we identified in the literature review on telecommuting within eleven different topic areas. In Table C.1, we list eleven topic areas and give examples of studies that fall under each topic. Thereafter, a brief description of each topic area is given. We noted that many of the papers fall in more than one category. With the identified topic areas, we show that there has been limited or no research on how telecommuting can be adapted to specific contexts such as job searching in day-labour industry. Another important finding is that there are limited studies focusing on technology requirements for telecommuting. The closest study was that of Venkatesh and Johnson (2002), who examines the impact of technology design on the acceptance and long-term use of telecommuting systems. Many studies assume that technology required for telecommuting is readily available and suitable. This may be true in the developed world but not in the LDCs. Consequently, the review corroborates our need to do research on the possibility of telecommuting within an environment where tools (technology) need to be tailor-made to suit teleworking.

Table C.1: Telecommuting topic areas.

#	Category	Paper
1	Definitions of telecommuting and teleworking	Nilles 1988a; Bui et al.1996; Daniels et al. 2001; Cowell and Dunn 2006; Di Martino and Wirth 2009; Dunn 2009a.
2	Benefits and challenges (Advantages	Nilles1988a; Knoll and Jarvenpaa 1998;Stephens and Szajna1998; Ahmadi, et al. 2000; Daniels et al. 2001;

	and disadvantages)	Cowell and Dunn 2006; Di Martino and Wirth 2009;Dunn 2009a; Polycom 2010.
3	Elements and dimensions of teleworking	Vu and Vandebona 2007; Di Martino and Wirth 2009
4	Constraints on the choice to telecommuting and telecommuters	Mokhtarian and Salomon 1996;Stanek and Mokhtarian 1998.
5	Types of telecommuting and types of teleworkers	Nilles 1988a; Bui et al.1996; Di Martino and Wirth 2009; Dunn 2009a.
6	Frameworks and models	Belanger and Collins 1988; Mokhtarian and Salomon 1994; Bui et al.1996; Feldman and Gainey 1997; Stanek and Mokhtarian 1998; Navarrete and Pick2003; De Graaff 2004; Campbell and McDonald 2007;Andreev et al. 2010.
7	Drivers of telecommuting facilitators and constraints	Nilles 1988a; Mokhtarian and Salomon 1996; Stephens and Szajna1998; Illegems et al.2001; Bailey and Kurland 2002; Wallsand Safirova 2004; Cowell and Dunn 2006.
9	Telecommuting trends and issues	Churchill and Munro 2001; Smith and Baruch 2001; Dunn 2009a.
10	Telecommuting positive and negative impacts	Di Martino and Wirth 1990; Klayton1995; Khalifa and Davison 2001;Baruch 2001;Pinsonneault and Boisvert 2001;Turetken et al. 2001; Virick et al. 2010.
11	Literature review on telecommuting, telework and distributed work arrangements	Walls and Safirova 2004; Bailey and Kurland 2002

Descriptions of the various categories of topic areas

- Definitions of telecommuting and teleworking. These are research papers that had at least a chapter to explain the definition of either telecommuting, teleworking or both. Although some papers did, most papers in this category were not necessarily dwelling on definitions as their only agenda.
- Advantages and disadvantages. The articles in this section had a section to describe the merits and demerits of adopting telecommuting. In some papers, the advantages and disadvantages were referred to as benefits and challenges. Some referred to them as drivers and drawbacks. In some cases, it was shown that benefits and challenges are different from drivers and drawbacks respectively.
- Elements and dimensions of teleworking. These are seen as components that make up telecommuting. The elements were used in some cases to define telecommuting or teleworking. The four major elements identified are:
 - a. Organisations Employers of the telecommuters
 - b. Workers Telecommuters or employees of the organisation involved in telecommuting.
 - c. Society the community in which the organisations or workers belong to. It could be as small as the community of workers in the organisation or as big as the urban area where telecommuting parties are found.

- d. Technology the technology which supports/facilitates telecommuting. It is mainly in the form of all type of ICTs
- Constraints on the choice to telecommuting and telecommuters. In certain cases, organisations and/or workers are faced with the choice of whether to telecommute or not. Even when organisations have agreed to telecommute, they are often faced with a challenge on the criteria for choosing which employees to telecommute. Constraints are factors that may hold back the decision to telecommute by organisations and may also inhibit the proper choice of telecommuters.
- Forms of telecommuting and types of teleworkers. Scholars have categorised telecommuting into five major categories. The categorisation is mainly based on where the telecommuting takes place. They include:
 - a. Home-based also called telecommuting. It is working from a home office for at least once a day or extending working hours at home after a day in the office. It is the most common form of teleworking
 - b. Center based/satellite óthis is involves telecommuters working from an office near their residence. The office is usually owned or leased by the telecommuting organisation.
 - c. Telecottages ó also called a telecentre is a technology centre for the training and resourcing of all members of a community. Teleworkers categorised as telecottage workers normally work at the community technology centre which is not normally owned by the telecommuting organisation.
 - d. Mobile work ó In this category, telecommuters can do their work on the move. For example workers can work in the train or aero planes. Mobile workers mostly posses mobile computing devices such as mobile phones or *Ipads*.
 - e. Anywhere based, also referred to as multilocationalô Telecommuters in this category do not have a specific work station. Even though they can still have a traditional office, they work mostly in many different locations that include home office, telecottages, main office, hotel rooms and so on.

It is often difficult to differentiate between types of telecommuting and telecommuters. In most cases, once an employee chooses to telecommute, for example from home, they become home based telecommuters and hence adopting home based telecommuting.

- Different frameworks and modelsô these are study frameworks or models for understanding telecommuting concepts, adoption, implementation and use. Some frameworks or models identified include those presented below. References are given for detailed description of the frameworks/models
 - a. Systems based Framework for understanding telecommuting adoption and use (Campbell and McDonald 2007).
 - b. Framework for understanding how different constellations of telecommuting arrangements and job characteristics (Feldman and Gainey 1997).
 - c. A model for organisational suitability of telework (Bui et al. 1996)
 - d. Model on main elements of existing definitions of telecommuting (Vu and Vandebona 2007).

- e. Framework of studying distributed work arrangement (Belanger and Collins 1988; Navarrete and Pick 2003).
 - f. A schematic model of the telecommuting decision context (Stanek and Mokhtarian, 1998).
 - g. A framework for the relationship between telecommuting and travel (Andreev et al. 2010).
 - h. Conceptual framework of telecommuting causes and effects (De Graaff2004)
 - i. Models for the choice of telecommuting (Mokhtarian and Salomon 1994).
 - j. Teleworking adoption models (Bernardino and Ben-Akiva 1977; Yen and Mahmassani 1977; Pérez Pérez et al. 2004).
- Drivers of telecommuting- facilitators and constraints. These are factors that can fuel or inhibit telecommuting. Scholars have described these factors in different flavours. For example a literature review by Walls and Safirova (2004) discusses factors that can increase the likelihood and the frequency of telecommuting. Bailey and Kurland (2002) posed and answered a number of research questions which included why (what drives them) people participate in telecommuting.
 - Telecommuting trends and issues- Studies on trends investigate telecommuting research direction. In most cases, these studies report on current study areas and do a projection of what is likely to be studied in future. Such studies also discuss various issues that affect telecommuting studies and practice. For example one pertinent issue is the common disagreements on the number of telecommuters in a certain state or area.
 - Telecommuting positive and negative impacts- for example Klayton (1995) where the study was to study the impact of telecommuting on employee performance appraisal.
 - Literature review on telecommuting, telework and distributed work arrangements. These are studies that carry out systematic literature review on telecommuting studies. They can either be explicit or use the term telecommuting or use other terms or phrases such as distributed work arrangements; teleworking, tele-searching and so on.

Appendix D: Full process of our Action Research cycles

D.1 First cycle of AR: Background study and the Field registrar

The first cycle of our participatory action research had six steps. There were two diagnosis steps, one from Nairobi and another one from Cape Town. The cycle then proceeded with planning, action taking, evaluation and reflection. Figure D.1 shows how the first cycle of our AR proceeded. It specifically shows where the research took place and which AR stages.

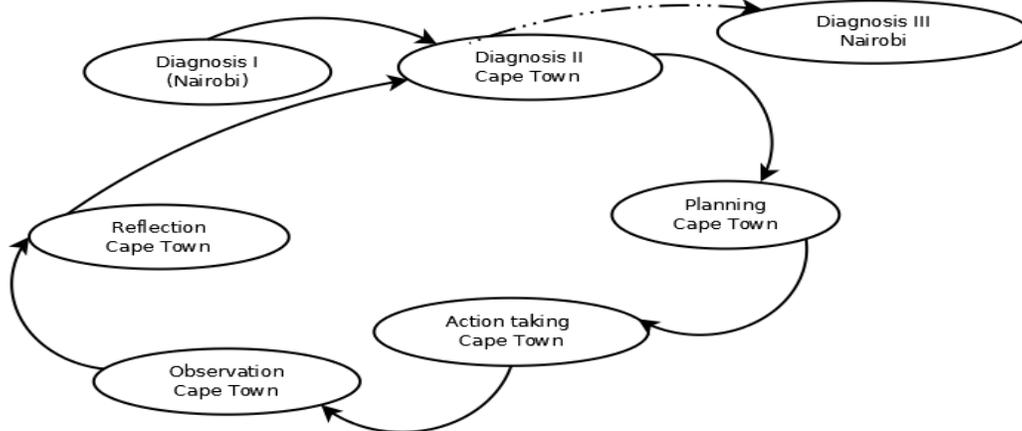


Figure D.1: How cycle one of AR proceeded.

Cycle one of our AR started from Nairobi and Cape Town. The rest of the steps were carried out in Cape Town. The second AR cycle, with more data collection, started in Nairobi

Step one: Diagnosis I: Preliminary data collection in Nairobi

This was an exploratory stage where we gathered preliminary data with the aim of understanding the day-labour market (DLM). It began in September 2009 with preliminary study missions being carried out in Nairobi, Kenya with a group of day-labourers who consisted of mainly men gathering every day in a well known street within Nairobi Central Business District (CBD). In Nairobi, we interviewed five day-labour workers in this first round. We also observed more than 20 workers four days per week for two weeks. The outcome from this step was more questions on how ICTs, especially mobile phones, can be used to make their activities more efficient. Figure D.2 shows a group of day-labour workers in their normal business activities.



Figure D.2 (a): The Nairobi DLM members



Figure D.2 (b): A DLM worker waiting with his tools



Figure D.2 (c): Members of MSRSA



Figure D.2 (d): Members of MSRNA

The data collected from stages one and two were complemented by information from literature review and the MSRSA operational documents/manuals.

Nairobi data collection methods

In Nairobi, we interviewed a total of 33 day-labour workers. The preliminary field work was done in October 2009. In the second field work, which took place between 18 June 2010 and 20 July 2010, we interviewed a total of 14 job-seekers (list in Appendix E as an example). The third field work was undertaken between December 2010 and 15 February 2011. The subsequent one was by the research assistant who did it between March 2011 and May 2011, and was continued by the researcher in June/July of 2011. The research assistant did face-to-face interview with 10 job-seekers and two employers. We did a further field work between 15 December 2011 and 4 February 2012. We interviewed more than half of our interviewees more than once.

Information collected in Nairobi about day-labourers and employers

Here, we describe the information we collected from our field work study in Nairobi. We also indicate the purpose of each information element.

- a) Demographic information (Age and gender): we used this for the general understanding of the DLM in Nairobi. Although this information was not used for design purposes, we used it as an example to describe what makes a typical self organised DLM in Kenya
- b) The number of years of experience of the day-labourers in the collection points: the purpose was to find out if it was true that day-labourers had a long term stay at the collection point or that the collection point was there to help them obtain long term employment.
- c) The DLM organisation: The idea was to understand how the Nairobi DLM was organised in terms of how the stakeholders related.
- d) How individual job-seekers went about seeking for jobs: This was to help us understand the day-day activities of a typical day-labourer.
- e) Technology related information that included mobile phone ownership; telephone usage; airtime on phone at that time: The purpose was to find out whether job-seekers were already using ICTs in running their day-to-day activities. Because our theory was

to design systems that would bring out teleactivity to job-seekers, we needed to first understand how they were using the ICTs at their disposal.

- f) Education level: This was meant to measure the literacy levels of our participants. Research has shown that designing for non-literate and semi-literate is different from designing for the literate (Medhi et al. 2007). Our design decisions would be guided by these literacy levels.
- g) Any other information: During our interviews and discussions, we often requested our interviewees to say anything they thought we might need to know or ask us any questions. The purpose was to capture any information that we may not have factored in when designing our study.

Step two: Diagnosis II: Data collection in Cape Town

In February 2010, the field work study was continued in Cape Town, South Africa. The purpose was to continue the understanding of the DLM.

Data collection methods in Cape Town

We shadowed (McDonald 2005) and observed the many day-labourers at the collection points, six MSRSA office employees and three MSRSA field officers for four consecutive months. We also carried out structured interviews with four MSRSA DLM employers. In the field, we took photographs of the situation, did voice recording, and used field notes to capture data. At the end of the diagnosis in the first cycle of AR, we had gained a better understanding of the DLM to allow us formulate the research questions. The data analysis was done using coding for quantitative data and qualitative analysis for non-quantitative. The results are presented in Section 6.1.1 page 79. At this stage, we also compared the preliminary findings from Nairobi with those from Cape Town. This was also the time we got access to the MSRSA and MSRNA database, which had information about workers, employers and job allocations for the last five years from 2010.

Also at this stage, we applied a unique way of thinking through the problem. We used our problem statement as a take away exam for Computer Science students at the University of Cape Town. The students were postgraduates trained on how to do research in ICT4D concepts and Human Computer Interaction (HCI). The exam was formulated in a way that students were required to give their intervention strategy given the DLM context description. We acknowledge the fact that at that particular time, we had not acquired enough knowledge about MSRSA and hence the formulation of the question might have been hindered by our lack of enough knowledge in the area. To collect as many views as possible from the students, we made the questions as open as it was possible. The questions were also moderated by two professors to ensure that it met the ICTD course standards. The exam answers were used to shape our initial thoughts on the conceptual architecture representing the ICT applications for DLM.

Information collected about Cape Town DLM and MSRSA

- a) The percentage of job-seekers with mobile phones (Section 6.1.1 page 87): Used to find out if it was viable to design mobile phone applications for the job-seekers.

- b) How MSRSA intermediary organisation was being run: Because a majority of the job-seekers and employers were members of MSRSA and related within the operation model of it, we needed to understand the mode of operation to be in a position of proposing any ICT applications for the DLMô this was a kind of user requirements gathering. We were looking at the job allocation criterion; worker and employer verification and registration how or whether ICTs helped in all these (results presented in Section 5.2 page 72 and Section 6.1.1 page 79)
- c) The travel patterns of the individual stakeholders: Here, we were concerned with how the individuals moved from one point to another in search of either a job or a worker. The objective was to understand the movements and evaluate whether there was room to use ICTs especially mobile phones to reduce such travels. (results presented in Section 5.2.2 page 72)

Step three—Action Planning I: Mobile Remote applications

Since our field findings showed that the major challenge was the cost of travel (time and money), using ICT to reduce travel became our first consideration. The concept of working remotely was considered at this planning which was done with MSRSA.

Planning Methods

To engage the job-seekers and the MSRSA employees in design, we carried out two briefing meetings. In these meetings, we shared our design ideas. In our first, we presented our design ideas to the day-labourers. This involved asking them what they thought about having mobile applications that would allow them search for jobs without having to travel. The design ideas inspired by the travel challenges faced by the job-seekers were presented in the form of diagrams printed on paper. This design concept was meant to shape the design ideas of both the researcher and the participants.

Secondly the design architecture concept, based on the travel challenges in the DLM, presented was printed on paper and drawn on a white board to the MSRSA employees (three field officers and the manager) who also contributed. At this stage, while our goal was refining our research questions, MSRSA was for valuable applications and operation models. The outcome was a design architecture with a set of mobile based applications that would remotely allow for worker search, job search and worker-employer relationship management. The design consisted of different mobile application for job-seekers, field officers and employers. To implement these mobile applications, there was need to have a new module of a web-based application for data verification before storing it into the MSRSA main database. We referred to the web-based system as MSRSA verification module.

Step four: Action taking I: Field Registrar Version I

We had two actions undertaken at step four. The first was the design of field registrar and verification module and how it would integrate with the existing MSRSA application.

Field Registrar Version I Design Methods

The first design session was a two hour workshop, led by the researcher, with consultations thereafter. The design ideas for remote applications were presented as paper prototypes to the MSRSA three field officers, two office based employees, the MSRSA regional manager and

the director. The participants only asked questions but contributed less on the proposed design architecture. It is only the general director who was keen on seeing an extra functionality for rating workers in the mobile applications. At the end of the workshop, the stakeholders agreed that we develop the prototypes applications for them to see and critic our design concepts. On top of regular consultations with field officers every one day of the week, we had consultations every time we needed to clarify any design issues. In most cases, consultations took place twice a week during this design stage. The outcome was an overall design architecture having factored in the comments from the MSRSA representatives and considering both findings from Nairobi and Cape Town, but biased towards the latter as we had more understanding about it by the time of prototype designs. This first initial design architecture was not a co-design because at first the participants were still hesitant to contribute towards design. This is why we used prototyping as a design approach. The first design took about two months starting March 2010 to end of May 2010. Figure D.3 shows our first initial design architecture.

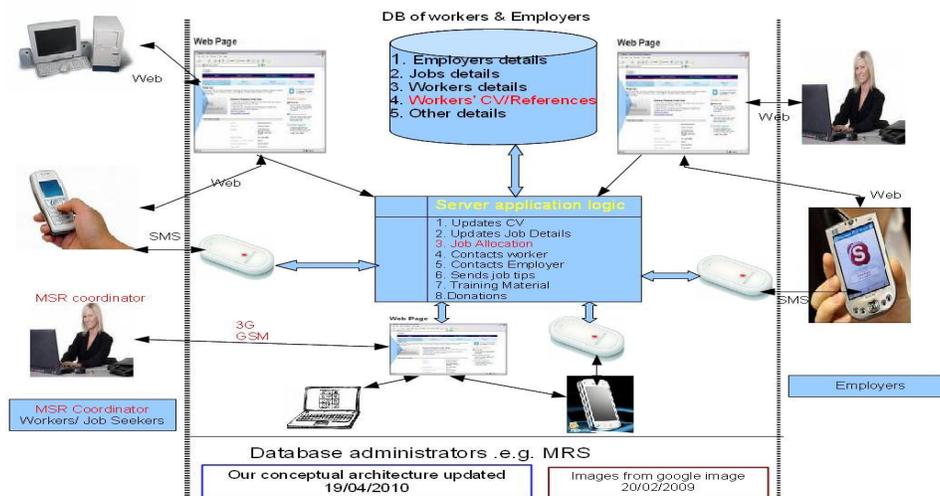


Figure D.3: Initial conceptual system design architecture for the DLM.

Figure D.3 is our conceptual architecture encompassing different modules. It consists of coordinators, employers, administrators and job-seekers as users. We anticipated the use of SMS and Internet based connections from the server application logic to the users. This architecture was used to mock up our design participants who were mainly MSRSA.

The second action was to continue the design process through prototyping to elicit design ideas from the MSRSA stakeholders. The prototypes designs were not final designs but technology probes (Hutchinson et al. 2003). They were divided into three:

- The field officers (field registrar) prototype: had two main functionalities: worker and employer registrations and allocation. The field registrar could allow MSRSA field officers to register workers and employers and allocate jobs remotely anytime and anywhere.
- The workers' mobile application prototype: Workers would be able to search for jobs, request for references or update their information online using.
- The employers' mobile application prototype: Potential employers would post jobs, reference or rate workers and request for workers away from the collection points.

Figure D.4 shows examples of screen shots of the mobile applications prototypes that were to be used as design tools.



Figure D.4 (a): Field registrar main screen.



Figure D.4 (b): Worker mobile application main interface



Figure D.4 (c): Employer mobile application main interface

Figure D.4 (a) shows options of functionalities, for example placing a worker for to a job, which were being presented by the remote mobile prototype meant for MSRSA field officers. D.4 (b) and D.4 (c) are the main entry point for the prototypes and was meant for use by the DLM job-seekers and employers respectively. They would use the prototype for new registrations or search for jobs and workers.

Figure D.4 (a) shows the MSR officer mobile main menu. The options included placing a worker to a job, registering a worker, among others. Figure D.4 (b) is a worker/job seeker mobile interface. It gives the option of registering or logging into the system if already registered. Once logged in, the worker can access a number of services that include job search and registration. Like workers, employers also had an interface that gave them an option either to register or login. Registered employers would access services such as posting a job or rating a worker. Figure D.4 (c) shows the first entry point of employers when they access the mobile application. (Figure D.4 d, e and f show some actions workers and employers could take using these initial prototypes). The prototypes were used as technology probes.

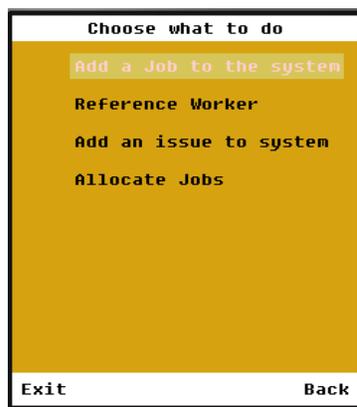


Figure D.4 (d): Field officers options to perform tasks



Figure D.4 (e): Workers searching for a job



Figure D.4 (f): Employers requesting for a worker

In this first action taking, we did not implement the verification module for MSRSA. It was however part of our initial mock up design which consisted of the other application prototypes.

Step five: Observation and evaluation I: Field Registrar Version I

This step involved looking at the effects of the field registrar version one as presented in step four. The objective was to apply user experience to find out the viability of the prototypes. We held a workshop and a focus group discussion with job-seekers, MSRSA field officers, MSRSA management and office employees.

The workshop and focus group discussion method

We showed the three MSRSA field officers and the two office employees the mobile application prototypes and how they would access their database of workers and employers. At first we showed them as a group then discussed its features as individuals. Five randomly pre-selected job-seekers were also shown the worker prototype. Figure D.5 shows MSRSA field officers being shown the prototypes. In this stage also, MSRSA regional manager and general director also gave their comments on the prototypes. According to the general director's comments, the employers and job seeker prototypes were unlikely to be adopted. The field officers had usability comments. For instance one field officer pointed out the difficulty in entering date fields. All these comments were used to come up with the designs for the next phase.

The outcome showed that the immediate requirement was worker and employer registration applications for field officers and web-based verification module for MSRSA office employees. The employers and worker modules were found to be unviable because of various reasons that included the low mobile phone ownership rate and literacy levels among job-seekers in Cape Town. For the employers, we were advised by the NGO of the low probability of adoption among employers. Their argument was based on previous experiences of introducing online systems for use by employers. The discussion chapter presents a detailed discussion of the reasons why we dropped the mobile application for job-seekers and employers.



Figure D.5 (a): The researcher having a focus training with users



Figure D.5 (b): MSRSA Employees trying the field registrar system

The questions asked during the evaluation of the field registrar

Apart from observing the participants trying the prototype applications, we asked them the following questions:

- a) Are all the prototypes necessary? Was asked to the MSRSA management who were in charge of running the organisation and expected to know which applications would work.
- b) Does the mobile application meet your field activities requirements? This question was asked to the field officers—the main users of the field registrar. The objective was to find out if there was any functionality to include in the prototypes.
- c) Would you use such a system to look for work? This was asked to the five day-labourers. The aim to solicit general comments from the job-seekers who we thought had not understood the whole concept at this stage.

Step six: Reflection I—Understanding the context outcome

We looked back at the process of data collection, design and engagement with the NGO (MSRSA) and the discussion outcome with our potential users—the NGO field officers. The purpose of this stage was to critically interpret the data collected and compare it with the literature and operational documents/manuals. The scope of reflection at this stage was data collected in Nairobi and Cape Town; the prototype design and development for MSRSA and workshop outcome. From the research point of view, we also aligned the research questions with our preliminary findings. Also in the same agreement was the decision to drop any further design on the worker/job seeker and employer mobile applications.

At this stage, it was clear that there were many challenges hindering design for MSRSA job-seekers directly. There was a clear indication that designing for them through the intermediary organisation (MSRSA) was the only feasible option. This scenario caused the transition from the Cape Town experience, where we found that only 30% of the day-labourers had mobile phones while employers were not keen using existing systems provided by MSRSA, to thinking of the Nairobi DLM. This was because our preliminary studies in Nairobi showed that the majority of the job-seekers (over 90%) had mobile phones. Also found the literacy rates in Nairobi were higher than in Cape Town. Since we still hoped to design directly for workers and employers, we thought of Nairobi as the most viable option.

Initial findings from AR cycle one

In this first reflection, the outcome was findings which informed the next cycle of AR. We briefly highlight these findings, and present them in more details at the Sections indicated against them.

- a) The different forms of DLM, the self-organised and the intermediary organised group (Section 5.1).
- b) The design outcome for the field registrar was agreed on by the researcher and the MSRSA field officers and management (full description in Section 4.5 and 6.1.2).
- c) Designing for MSRSA DLM job-seekers directly would be a challenge (discussed above and further in Section 7.1).

- d) Not much information from the job-seekers on the kind of ICT interventions for their job search was forthcoming. We assumed that it was because they were yet to conceptualise the idea or that they were not yet free with us.
- e) According to MSRSA stakeholders, employers were not likely to adopt the mobile phone applications we were proposing in our initial designs. The reasons for this are given in Section 6.1.1.

D.2 Second cycle of AR: Self-organised versus Intermediary organised DLM

The second cycle of AR started where the first one did in Nairobi, where we went back for further data collection. It however included Cape Town.

Step seven: Diagnosis III- Self versus Intermediary organised differences

The purpose of this step was to collect and analyse more data to allow us critically examine the similarities and differences between the identified self-organised and intermediary-organised DLMs.

The study process

In Nairobi, we conducted both a non-structured and structured face-to-face interview with 14 job-seekers. We also observed them for many hours go about their daily business. Photography, voice recording, and field notes were used to capture data. For the interviews, the job-seekers were asked whether they belonged to any organisation helping them to find jobs. They were also asked how they related to each other and to their potential employers. The purpose was to find out how the self-organised DLM operated.

To help us cover more ground in a reasonable time, we trained and used the services of a research assistant to collect data and do an alternative analysis. There were two reasons for using the research assistant; to validate the understanding we had about the self-organised DLM and because the researcher was going back to South Africa. After she had been introduced to the NDLM point man and the chairman, the research assistant was given the freedom to design an independent study. The introductions were done through preparatory meetings where we briefed the research assistant on the broad objective of the field work. The results from the research assistant were not quite different from what we had found earlier and are presented in Section 6.2.2 page 102 together with our other results.

While the research assistant was busy in Nairobi, in this same AR step, we continued with data collection in Cape Town. Within the same period, the MSRSA general director organised a brainstorming meeting with three regional managers (Pretoria, Cape Town and Gauteng). Because the officers had their strategic meeting for that year, we didn't have any issues in terms of the cost of flying them from and to their work stations. To kick off the meeting, the director introduced the researcher and explained the purpose of the meeting as one that would allow us brainstorm on the best ICT systems that would allow them operate with lower costs than they were doing. The main objective of the meeting was to brainstorm how to improve MSRSA operations specifically using ICTs. The meeting turned out to be a discussion forum with the researcher carrying out voice recording and taking notes. In the next day of the visit by the MSRSA regional managers, we went for field trips to various worker collection points. The regional managers were on a field trip to check on various

projects Cape Town branch of MSRSA had been involved in. We accompanied them to various places where MSRSA member workers were working. We could not take photographs of the men at work because they were working at private homes on that day.

During this data collection period, apart from using traditional data collection methods, we employed the prototype applications as technology probes in eliciting comments from the MSRSA field officers and other MSRSA employees. Data was collected in the form of criticism of the applications during the workshop and informal discussions between the researcher and the MSRSA employees. It is worth noting that by this time, the researcher was being seen as an insider in the MSRSA NGO. We could walk in and out of its operation areas without any suspicion, which helped in understanding the organisation better. Qualitative data analysis was also done at this step. We began to describe the operation models of the NGO and the activities carried out by job-seekers and field officers. Every time we described the NGO, we would go and reconfirm the same with an MSRSA employee to check if we were correct or not. We also scrutinised the database for quantitative data about workers and employers. The scrutinisation of the database involved checking on the job seeker's end employer's details that had been stored by MSRSA.

Self- versus intermediary-organised DLMs: Information collected

The following information about the DLM stakeholders was collected during this stage of the study. The results are presented in Section 5.1 and 6.1.1, 6.2.1 and 6.3.1.

- a) Job-seekers affiliation to any DLM and how they operated: The aim was to find out whether job-seekers belonged to any organised DLM or looked for work as individuals; find out the kind of DLM organisations that existed and understand whether there was any other form of organisation apart from self- and intermediary-organised DLM.
- b) Existence of any information systems supporting any of the DLM types: This was at self-organised Nairobi DLM. The purpose was for deciding whether to design from scratch or build on top of what existed or even not design at all.
- c) Observation on how job-seekers approached employers and vice-versa: For us to model job search and worker search using ICTs, we needed to understand the process in real life. We also needed to understand the role of the mobile phone use in job or worker search.
- d) User experience comments from field officers and other MSRSA stakeholders: We analysed the comments, mainly from the field officers, on the first prototypes. The aim was to elicit design ideas from the users for further understanding of the operation model of the NGO for the next design phase.
- e) Comments of how MSRSA was being run: This was from the two other regional managers we had not met before. We analysed their comments on how they operated their branch offices. The aim was still to understand the organisation of an intermediary organisation and whether there were any other forms of DLM organisations outside Cape Town.
- f) Job-seekers education levels and mobile phone ownership and use: During this study stage, we continued finding out the job-seekers education level and mobile phone ownership from Nairobi and Cape Town. The reasons for this was to confirm the differences which showed that sampled job-seekers in Cape Town were less educated and

were less likely to own a mobile phone compared to sampled job-seekers in Nairobi. The confirmation was still meant for design decisions as designing for the literate has been shown to be different from designing for the illiterate or semi-literate.

Step eight: Planning II—Field registrar version II

We considered three different sets of data to consider. Data collected in Nairobi diagnosis II (presented in Section 6.2.1 page 100); the data generated from the field registrar and verification prototypes (MSRSA prototypes) (presented in Section 6.1.2 page 90) and data accumulated from the continuous Cape Town field work was the third set (presented in Section 6.1.1 page 85).

Field registrar version II redesign process

At this step, we identified weaknesses in the MSRSA field registrar by analysing the comments and usage logs from the field officers. Using data from the prototype testing, we proposed improvements on the prototype. The improvements did not have any architectural changes but included the ability for field officers to search for worker ratings and referees using the mobile application. Ratings were described by MSRSA as a value between one and five where five was excellent and it indicated how a job seeker was good at performing their work. On the other hand, referees were said to be people who had engaged the job seeker and were satisfied with their work.

We also identified the similarities and differences between the design requirements for self-organised and intermediary-organised DLM by analysing data collected in Nairobi through face-to-face interviews described in step seven. The two MSRSA systems earmarked for the next action taking stage were a web-based verification module proposed as a design idea in the action stage (step four action I) and the enhancement of field registrar (mobile applications).

Step nine: Action taking II—Field registrar version II prototype modification and the verification module

Actions taken

As presented in our planning II stage eight, the action taking in this cycle was a continuation of the first cycle that involved using prototypes as technology probes. There were three major actions in this stage: The first was using the information collected to modify our design architecture idea which we presented it to stakeholders (MSRSA stakeholders) for a design discussion session. The second action was modifying the mobile phone prototypes (field registrars) according to the comments from the MSRSA field officers and management. The third action was the prototype deployment and testing as a design process.

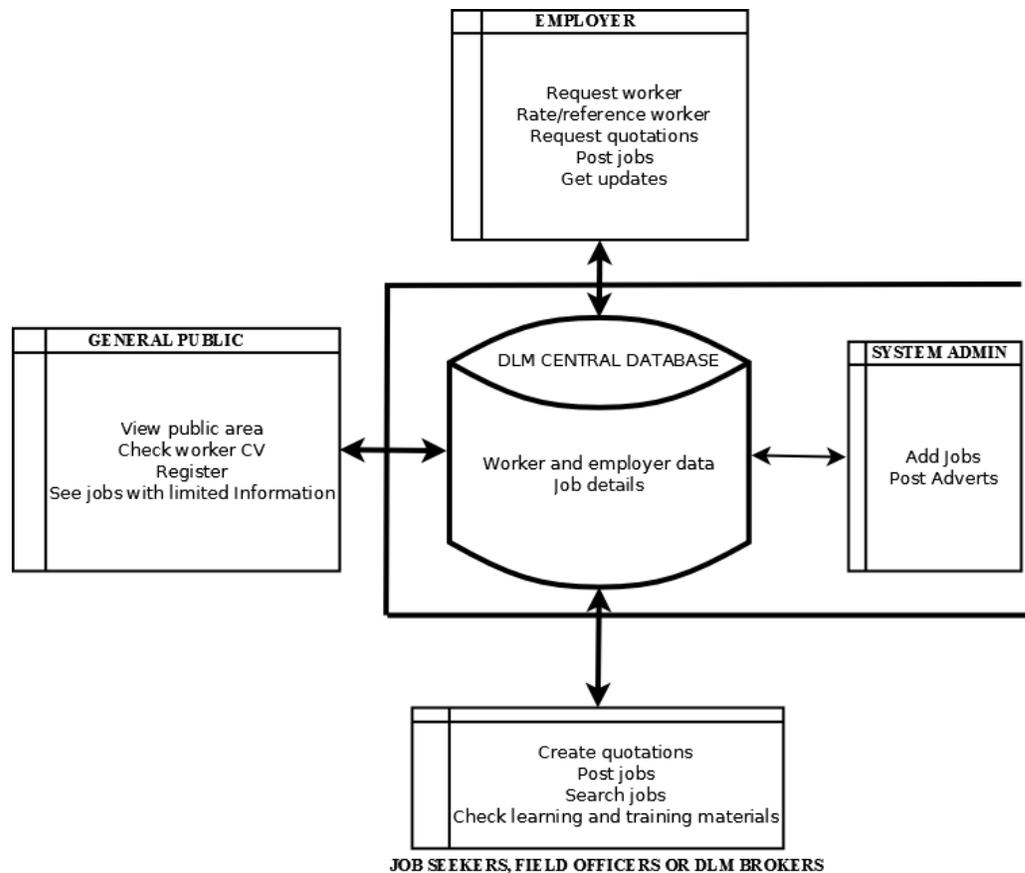


Figure D.6 (a): Generalised design architecture for the self-organised DLM

The DLM central database—our conceptual design after user requirements gathering—stores all the job-seekers and employer details such as skills, job allocations etc. It can be accessible through mobile phone applications or through Internet via a web browser. The users of the DLM central database are employers, job-seekers, field officers, the general public and the administrator

Design architecture concept modification method

At this stage, we modified our overall design architecture concept (presented in Figure D.3) and separated it into self-organised and the intermediary-organised designs. The modification process was informed by the understanding of the difference between self and intermediary organised DLM. While the self-organised DLM in Nairobi needed to have modules to populate the database with jobs and worker and employer details, the MSRSA intermediary organised needed modules to link three databases that were being run by the NGO. The difference between the two designs is depicted in Figure D.6 (a) and D.6 (b). The generalised architecture in Figure D.3, (which was used as a mock up design architecture at the beginning), assumed a scenario where all the DLM stakeholders had adopted technology, be it mobile phone or computers, and where able to use it. After analysing data from Nairobi and Cape Town, we found out that working with an intermediary organisation required contextualized (with unique functionalities) design and hence Figure D.6 (b) which shows a design architecture concept which we presented to MSRSA. The main reason why it needed to be contextualised was because the NGO already had a model of working and there were systems in place. The designs, following the contextual design process therefore had to

conform to the NGO's working model. For self-organised, data from Nairobi revealed that there was a possibility of implementing a design that would include other stakeholders such as members of the public and system administrator. The self-organised design needed to be flexible to allow for system management.

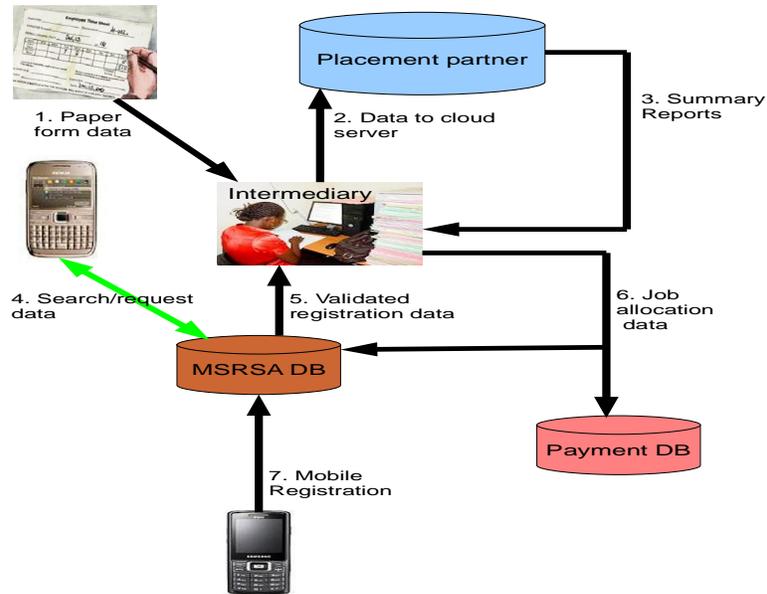


Figure D.6 (b): MSRSA design (mainly for intermediary-organised)

Figure D.6 (b) shows an initial design architecture for MSRSA. It costs of paper based registration form (1) and the mobile application for worker and employer registration and search (4 and 7). It also has the functionality of uploading data from the local MSRSA database to the placementpartner cloud database (2). Summarised data can also be downloaded from the placement partner

Verification module design process

According to the MSRSA stakeholders, within the intermediary-organised design architecture, the verification/validation module was an important part on the server side (accessible to MSRSA employees through a web-based interface). It was to be used for verifying information before saving it to the MSRSA main database. Because of its importance, the design architecture and the actual design concept was done majorly by the MSRSA general director and the researcher. We held a discussion where the general director explained by drawing it on paper how he expected information flow from the field to their database. From the design session, we came up with the design architecture shown in Figure D.3, which we later incorporated a verification module in the intermediary-organised DLM overall design concept. The verification module design was approved by the general director.

Figure D.7 shows a design architecture of the verification module which would be used by the MSRSA office based employees.

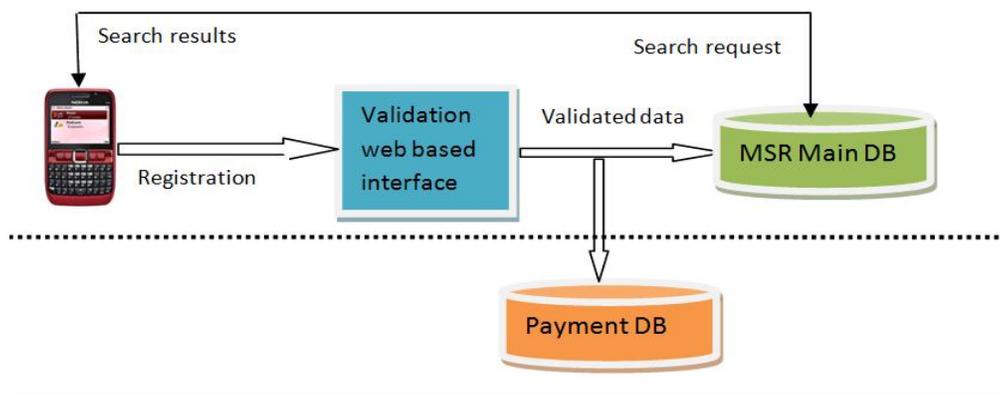


Figure D.7: MSRSA design architecture with the web-based verification module

Figure D.7 shows the verification design architecture that includes the verification module and the payment module. The web-based validation interface provides a means to upload the data to either the payment database or MSRSA main database.

The verification module had the process of saving verified data into a payment database. The payment database was an external database (out of control of MSRSA) and was being introduced by MSRSA for their newly acquired model of operation. In the new operation model, MSRSA would link workers to jobs and handle the payment process using mobile payment. For that to happen, they needed a service provider for the payment process. The service provider provided them with an interface to enter worker payment details through a web interface. On introduction of our systems however, MSRSA director proposed a design where the data captured either from the field or in the office would also be transmitted to the payment database. That is why our verification module design included the payment database interface.

Field registrar prototypes implementation

During this stage's action taking, we also implemented the mobile application prototypes (field registrars) without the allocation module. The final prototype developed, tested and implemented and approved by the MSRSA field officers had the screen shots presented in Figure D.8. In addition the verification module was built and deployed as a web-based application. Figure D.9 shows the home page screen of the verification application (Chepken et al. 2011b).

Field registrar deployment as a design process

The third action in this stage was the deployment of the applications and training of the users of the MSRSA field officers and the MSRSA office employees. The deployment involved the installation of mobile applications and interfacing it, together with the verification module and the MSRSA web-based database system which was already in place.



Figure D.8 (a): Main UI main menu



Figure D.8 (b): Employer registration user interface

Service order No.	Service name	Status	Rating	Time
07337324...	Lindt	Pain...	4.8	26
07344924...	Julies	Pain...	4.6	26
07332176...	Mujinga N...	Pain...	4.8	23
07202211...	Bihl	Pain...	4.8	22
07427362...	Mansokela	Pain...	4.6	22
08264415...	Lindt	Pain...	4.6	21
3609703	Hodson	Pain...	4.6	21

Figure D.8 (c): Worker confirmation user interface

The retraining of the field officers was one other action undertaken for this stage. A total of four field officers were trained on the mobile field registrar and search applications. We also trained MSRSA office based employees on how to use the verification application.

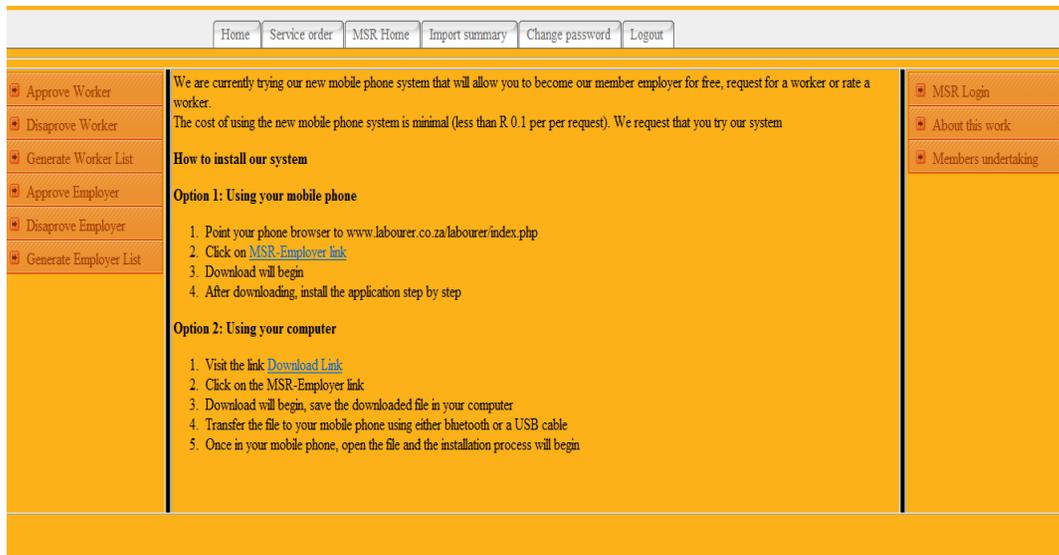


Figure D.9: The MSRSA verification module home page

Field registrar deployment and training process

- Showing the field officers how to download and install the mobile applications prototypes
- Having the three field officers try the prototypes with data that had already been captured using the paper based form.
- Having a one to one training with field officers on how to use the field registrar

Step ten: Observation and evaluation II: Field registrar and verification module usage

In ordinary AR process, observation at any particular cycle observes and evaluates the stage within the current AR cycle. In our case, it was therefore meant to be about the observation of our second cycle only. However, it included looking at activities carried out from the start of our research. Here we revisited steps one to nine at the same time following closely the real-live usage of the systems (field registrar and verification module), which were already in use by MSRSA. At this stage, we were looking at the outcome of the deployment and use actions.

We applied system usage observation on field experiments (Nunamaker et al. 1990), face-to-face interviews with three field officers and two office based employees. We also analysed the system data logs from the web server. We had implemented a log for all the activities carried out in the system. During our evaluation, we chose to use only usability evaluation experience because the key objective for us was the concerns of the NGO and the DLM in general. The interventions we were implementing were contextualised and therefore the user opinions were important feedback for us. No formal lab experiments were performed on our systems except at the NGOs office. Results of this stage are comprehensively reported in Section 6.1.2 page 90.

Information collected for field registrar and verification module

- a) The time it took to register or search for a job seeker or an employer: This was measured manually by the researcher and the average time calculated. The detailed results are presented in Section 6.1.2 (a).
- b) Comments from the field officers on the new version of the field registrar: The aim was to verify that we had obtained the design of the field registrar as per the changes that had been proposed by MSRSA field officers.
- c) Comments from the MSRSA office employees on the use of the verification module: Within a scale of one to five, we asked the users to rate the verification module on its usability, efficiency (how long it took to complete a task) and effectiveness (If it actually served to correctly verify information before storing it in the main database). The outcome is described in Section 6.1.2 (b).
- d) The number of logins and activities performed by users: This was meant for finding out the adoption rate of the prototype applications. The two field officers using the system logged in at least once every day.

Step eleven: Reflection II- Different types of DLM and their organisation structures

The key areas at this stage were (a) the DLM what is a DLM and what makes it; how does it operate and how similar or different they were? And (b) the applications deployed were these systems (field registrar and verification module) changing our understanding of the DLM? Was it having any impact on the intermediary organisations operations or their clients (job-seekers and employers)? If yes how?

This AR cycle ended with a number of lessons. First, we identified the connected and non-connected types of day-labour workers that can either be under an intermediary-organised or self-organised group of job-seekers. Also identified were employer-centred and worker-centred intermediary organisations. The identification of the employer-centred and worker-centred intermediary-organisations was as a result of the operation change process that was being undertaken by MSRSA. During the change process, we discovered that MSRSA had worked as employer-centred as opposed to worker-centred intermediary-organisation for sometime during our study (MSRSA worked as a pure worker-centred since 2001 until June 2010 when we discovered that it was gradually changing to employer-centred, which they maintained until the end of our study). Due to this realisation, we had believed that we might have had reasonable understanding and knowledge on how employer-centred organisations operate. However, we had less knowledge about worker-centred organisations. This

necessitated the need for another cycle of AR with the aim of understanding how the worker-centred organisations operated. The third cycle of AR, apart from being expected to give a reasonable understanding of worker-centred DLM, was also expected to improve our understanding of day-labour markets outside Cape Town, but within South Africa.

The key achievement at this step was the strengthening of our research theory/framework. Telecommuting the mobile, a case of the DLM benefited from the outcome of the field registrar field test. The confirmation that field officers and job-seekers actually commute to collection point everyday made the viability of telecommuting in DLM more feasible. It appeared to be more viable than we had previously thought. The reflection on the results of the first two applications – the field registrar and the verification module also contributed in building up the telecommuting/teleworking theory. The field test outcome of the field registrar showed how possible it was to provide applications to support remote applications in an informal set up such as DLM.

Summary of AR cycle two findings

- a) We identified the existence of the connected and non-connected types of day-labour workers.
- b) We also confirmed that there exists worker-centred (which are charitable organisations) and employer-centred (which are self-sustaining) intermediary organisations.

The details for the two findings were presented in Section 5.1.

Key findings for the next planning

The outcome included the understanding that the DLM in Nairobi needed a different approach in system designs as it did not have even the basic infrastructure for workers and employers. From the lessons learnt from MSRSA, we deduced that the Nairobi DLM would only start using software applications after the information needed was made available. For example, for workers to start searching for jobs, employers should have started populating the database with the job information. To kick-start the process, we anticipated a situation where the administrator (who would be us in the meantime) would be able to solicit jobs and worker details manually and be able to post them to the database. See Figure D.6 (a) on some of the then anticipated roles of the system administrator.

Our proposed job allocation mobile based application module for MSRSA was not viable because the process of allocating jobs to job-seekers proved to be complex and required a lot of face-to-face negotiations. We also confirmed with the percentage of mobile phone owners among job-seekers in Cape Town that building mobile applications for them was going to be challenging. The enhancement of the field registrar included the search module (emphasised by the field officers) and the registration module specifically for use by the field officers.

In trying to know how other MSRSA branches operated, it was evident that they operated as typical intermediary organisation in a DLM (Section 5.1). The only difference was that they had to scan and fax all the job-worker related information to the Cape Town head for entry into the system by the MSRSA office based employees. Detailed results and discussions are presented in the Section 6.1.1

D.3 Third cycle of AR: Worker-centred versus employer-centred intermediaries and the South African DLM beyond Cape Town

The purpose of the third cycle of AR was to firm up the design requirements, similarities and differences between self-organised and intermediary-organised DLM on one hand and the employer-centred (self-sustaining intermediary organisations) versus worker-centred organisations (Non profit making or charitable intermediary organisation) on the other. The other major purpose was to look at the suitability of telecommuting/teleworking concept to the DLM. To expand the scope to other DLM areas, we identified two DLM groups for further research. The contacts were obtained through MSRSA. The first group was the MSRSA branches based in Pretoria and Johannesburg, South Africa while the second one was Men on the Side of the Road Namibia (MSRNA), based in Windhoek. The main reason for collecting more data from Pretoria and Johannesburg South Africa was to be able to generalise findings from Cape Town and combine and report them as those from South Africa.

Step twelve: Diagnosis IV: Data collection from MSRNA, Pretoria and Johannesburg



Figure D.10 (a): Interview session with the head of MSRNA



Figure D.10 (b): MSNA members being observed

Figure D.10 (a) shows the researcher doing a structured interview with the head of MSRNA in their offices in Windhoek Namibia. The interview was aimed at understanding how MSRNA was being run. Figure D.10 (b) shows the researcher shadowing some of the job-seekers in one of the collection points in Windhoek.

In this step, the further data collection exercise was to clearly understand DLM from different perspectives.

Data collection methods

Windhoek, Namibia: We used observation and face-to-face interviews; telephone (using Skype) interviews and questionnaires. Before visiting Windhoek Namibia, we collected data by first reviewing their website³⁹ and the web-based database application (which at that time it was sharing with MSRSA). From the database and the website, we reviewed the following information and the results are presented in Section 6.3.1:

³⁹www.msr.org.na

- The demographic details (age and gender) of day-labourers: To compare it with findings from Nairobi and Cape Town where we found that the DLM was mainly male dominated.
- The mobile phone ownership: This was done by looking at those who had given mobile phone numbers as their primary contact details. The objective was to have a rough idea of the number of day-labourers who owned mobile phones for the design purposes.
- Education levels of the job-seekers: This was also for design purposes. As indicated earlier, design decisions, especially those for mobile phones are affected by among other factors literacy levels. We got this information by looking at the education levels in the database.
- The number of day-labourers and employers registered with MSRNA: This was by looking at the MSRNA database. The objective was to compare it with figures from MSRSA and Nairobi to see how big the DLM was in Namibia.
- The operation model of MSRNA: To find out whether we could try the designs from MSRSA with MSRNA, we needed to understand their model of operation. We relied on the different forms of DLMs to understand MSRNA operation model and hence we were checking whether it was self- or intermediary-organised; employer- or worker-focused; or any other form of organisation. We also checked whether MSRNA had connected or non-connected day-labourers or both.
- Any other relevant information: The aim was to find out any information that would help in design but which may have been missed in our earlier data collections.

The next action was getting in touch with the MSRNA managing director. Through numerous E-mails we were able to collect more data. Finally, the researcher made a four day visit to Windhoek where the head of MSRNA, one field officer, one office worker and a total of 20 day-labour workers were interviewed. Figure D.10 (a) shows an interview session with the head of MSRNA while figure D.10 (b) shows members of the MSRNA hanging out with the researcher. During the Windhoek study, we also found out about work done by [Gonzo and Plattner \(2003\)](#) on day-labour workers in Namibia and the researcher had the privilege of talking to Mr. Gonzo and getting his views about the DLM in Namibia.

The same information as those collected using MSRNA website, E-mails and Skype call interviews were collected during face-to-face interviews. The details of the findings are presented in Section 6.3.1 page 112.

Johannesburg and Pretoria, South Africa: For further understanding of the DLM in South Africa, we collected data from Johannesburg and Pretoria MSRSA branches. We conducted face-to-face interviews with two regional managers and four office employees. At worker collection points observed and did face-to-face interviews with randomly selected job-seekers. The researcher also trained the MSRSA employees on how to use the field registrar. The training process elicited comments which were used for the second round of design. Although MSRSA employees outside the head office (Cape Town) were not direct users of the verification module, the Johannesburg and Pretoria MSRSA employees were nevertheless shown how the module works. The purpose of this was to get constructive feedback. The outcomes of the training and the group discussions were later discussed with the head office managers of MSRSA in Cape Town.

Because of the limited resources to continue the field work in Pretoria and Johannesburg, we used a short simple questionnaire, developed and tested in Cape Town with two field officers, which was administered by the field officers. Three field officers were each given ten questionnaires and trained on how to administer them. The objective was to capture basic information about the day-labourers. The questionnaire is in Appendix F and G while the outcome formed part of the results and is presented in Sections 6.1.1 and 6.4.

The data collected by the research assistant in Nairobi was analysed using qualitative methods. Using these findings (which was used to validate our prior findings), on connected versus non-connected day-labourers, we did not notice any design changes which differentiated between non-connected and connected day-labourers. However, the findings, showed the differences between intermediary and self-organised DLM.

Face-to-face interview with the day-labourers: Pretoria and Johannesburg

The purpose of this interview was to find out whether job-seekers in Pretoria and Johannesburg had similar characteristics as those in Cape Town. We therefore collected similar types of information we collected for other DLMs (Cape Town and Nairobi). The outcome is presented in Section 6.1.1 page 79.

Observation at the worker collection point: Pretoria and Johannesburg

We had a check list of the following items to observe:

- How the workers approached the employers: The purpose was to find out if indeed employers came to pick workers at the collection point or request for them through the mobile phone calls. We were also observing whether the job-seekers scrambled for jobs (as seen in Cape Town) or were more organised. The objective was to confirm the challenges associated with worker collection points, which were forming the basis of designing for intermediary organisation in our case.
- The worker collection point organisation: The aim was to understand how the job-seekers were being organised. In this case, we were looking for any other form of organisation (besides self and intermediary), for example hybrid organisation where even with an intermediary organisation, they may be some form of self organisation at the collection point. The objective was to confirm the existence of only two forms of organisation within our case studies.
- The role of the field officers in the collection point and finding jobs: we observed how the job-seekers and the field officers related in terms of job search related activities. The field officers aided in approaching the employers on behalf of the workers. The objective for this observation was to confirm the existence of the intermediation among job-seekers for the DLM in the South African case studies and hence justify the design.

Note: Field observations on worker collection points in Pretoria and Johannesburg had similar findings as those from Cape Town. The findings are presented in Section 6.1.

Training the field officers on how to use the field registrar

Because the MSRSA head office in Cape Town had planned for a countrywide rollover of the field registrar, they had acquired Nokia E-63 mobile phones for all its field officers. In our

training in Pretoria and Johannesburg therefore, we showed the field officers how to download and install the J2ME application of the field registrar. We then took them on a step by step session on the functionalities starting with registration of workers and employers followed by how to search for records remotely. We also discussed the importance of the remote application with regard to it capable of reducing travel distance. Finally, we asked them for their opinion on how the prototype application could be improved.

Step thirteen: Planning III- Worker-centred design for MSRNA

In addition to data collected by the research assistant in Nairobi, the data collected during and after our visit to Windhoek, Johannesburg, and Pretoria informed this action planning stage. Data analysis revealed the need to have a worker-centred design for MSRNA. Operational facts about MSRNA showed that day-labour job-seekers were its main focus. They had implemented programmes that would allow workers get jobs in an efficient way. For example, their office based training centre allowed workers to create their Curriculum Vitae (CV) and produce their business cards. As for the Nairobi DLM, the generalised design concept identified through user requirements gathering in the second cycle of AR stood but with emphasis on designs to facilitate new worker and employer registrations. The decisions on the actions to take next were therefore the implementation of the web-based worker-employer database for MSRNA and for the Nairobi DLM.

Finally for this step, a voice application for workers to report alleged abuse by employers for MSRSA was thought of as a viable application. The idea was conceived by the director general of MSRSA. Because MSRSA director had shared our other ideas with many of the MSRSA employers; the friends and other intermediary organisations outside South Africa, he had come up with a number of ideas. One such idea was the "voice for the DLM workers" latter named *MSRVoice*. Furthermore, sentiments from job-seekers (both from Cape Town; Johannesburg; and Pretoria) and the field officers hinted the need to provide workers with an alternative avenue for remotely reporting abuse. From literature review, we also saw similar applications having been implemented in other DLMs. Examples include *vozmob*⁴⁰ and *migrantvoices.org*⁴¹. We saw the idea of being able to report abuse remotely as one way of applying *teleactivity*, (where the activity is reporting) to support DLM.

Step fourteen: Action taking III: The MSRNA and Nairobi DLM databases

Design methods for The MSRNA and Nairobi DLM databases

The design process for the MSRNA and Nairobi DLM databases was not a co-design but followed an ordinary design process that involved requirements gathering, analysis, design and implementation.

The MSRNA design: After collating information collected through the website; Skype call interviews and the E-mails, we modified the MSRSA design architecture to allow it have functionalities that favoured job-seekers. These functionalities were depicted by the information collected on how MSRNA operated as a worker-centred intermediary organisation. While coming up with the proposed design for the MSRNA web-based

⁴⁰<http://vozmob.net/en/about> and <http://mobileactive.org/mobile-voices-part-i-development-process>

⁴¹<http://www.migrantvoices.org>

database, we factored in the MSRNA main services (records keeping, job search initiatives, worker referencing) to the workers. These services are presented in Section 6.3.2.

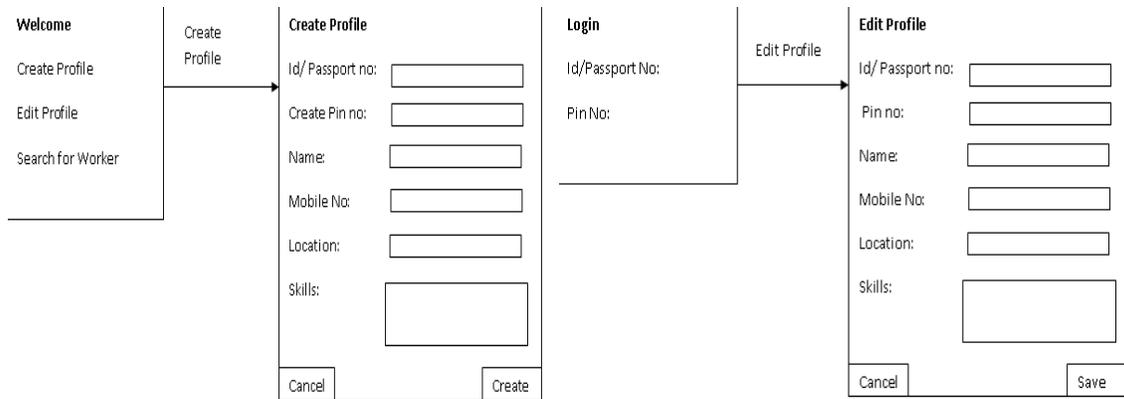
Nairobi DLM databases and mobile applications: The design process for the Nairobi DLM databases and the mobile application (equivalent of the MSRSA field registrar) was similar to the MSRNA. After gathering information that included technology ownership and use; site organisation and literacy levels, we proposed the designs which we developed as prototype applications. The design process was therefore a series of design ideas generated from understanding the Nairobi DLM and prototyping it. The prototypes would then be tested with the users to solicit more design ideas. The prototypes were shown to job-seekers in Nairobi and asked what they thought about. The outcomes of these experiments were not successful and are discussed in Sections 6.2.4 and 7.1.5 respectively.

Actions taken: Nairobi and MSRNA DLM prototype applications

The following applications were built at this action taking step. First, we completed the design architecture idea for a web-based database for the Nairobi and MSRNA DLMs⁴². We then built and implemented these systems. The second prototype application built was a mobile application for the Nairobi DLM. It consisted of three main functionalities: (1). new user registration module (2). user details update module and (3) the employers' job posting module. The new user module was for both job-seekers and employers who were not members but needed to register as members. The user details module was also needed for both workers and employers who wanted to change or update their details for example address for employers or new skills for workers. Figure D.11 shows the design of the mobile application module for the Nairobi DLM. Figure D.12 shows screen shorts of the Nairobi DLM J2ME mobile applications while figure D.13 shows the Nairobi DLM web-based database login page. The Nairobi DLM applications were similar to those for MSRSA and MSNA with a few modifications in the functionalities to meet the needs of a self-organised DLM with no prior back end ICT infrastructure.

The MSRNA and Nairobi DLMs were comprehensive web-based database applications for managing day-labour markets. Although they had design uniqueness based on the fact that MSRNA was intermediary-organised while Nairobi DLM was self-organised, the two designs had similar design architecture. The functions of the DLMs can be accessed through www.msr.org.za/msrna or www.dlm.afrocentury.net. The MSRNA application is actively in use by MSRNA. Figure D.14 shows screen shots of the MSRNA web-based database application. It had options for workers to generate their CVs automatically once registered and provided their personal details, skills and experience.

⁴²www.msr.org.za/msrna or www.dlm.afrocentury.net



Creating user profile

Editing worker profile

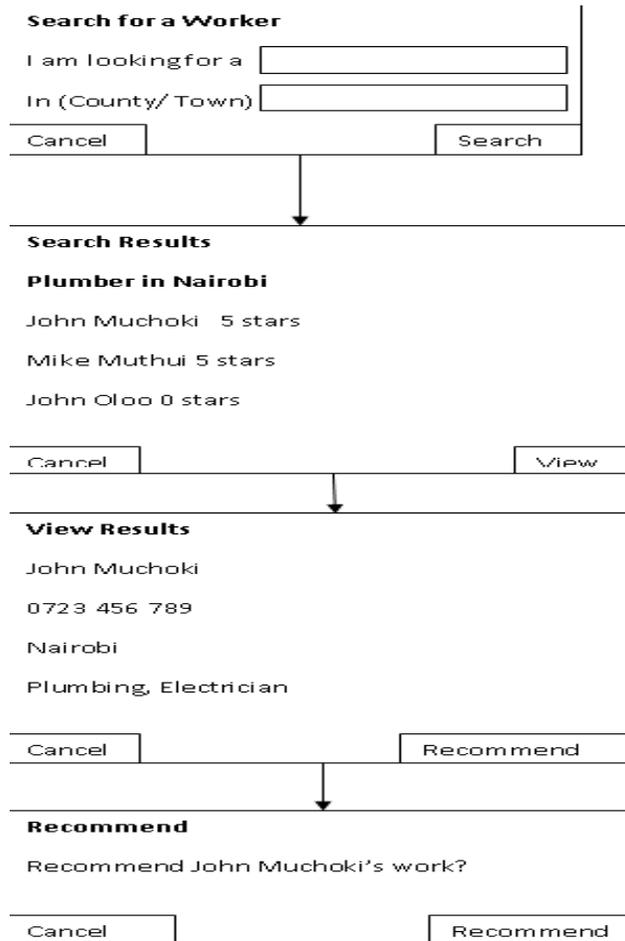


Figure D.11: The designs for the Mobile application module for the Nairobi DLM

The mobile application user interfaces were similar to what we had for MSRSA but had modifications in the functionality.



Figure D.12 (a): A screenshot of an employer registration module for NDLM.



Figure D.12 (b): A screenshot of a worker registration module for NDLM.

Day Labour Market, Kenya

For free buying and selling of Day labour service

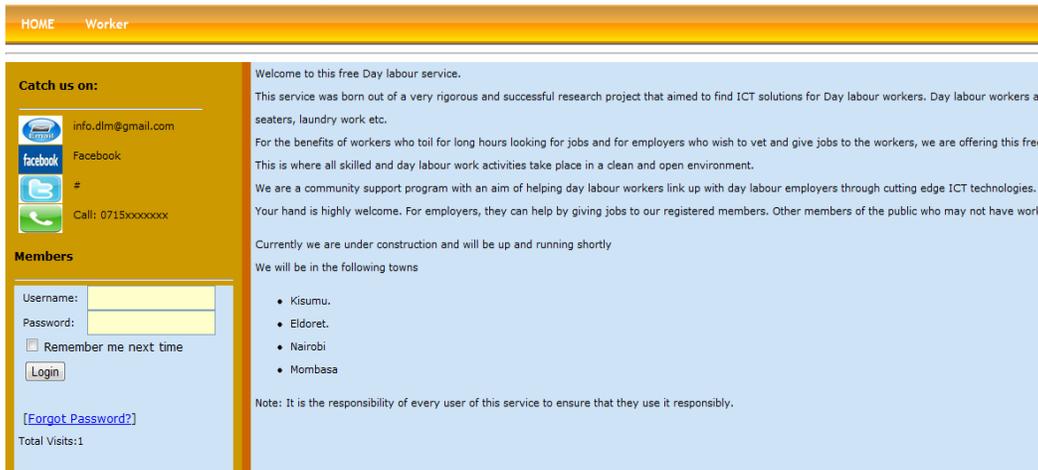


Figure D.13: Nairobi DLM screen shot of the web-based database home page

HOME Employers Workers Vacancies Diary My account Reports Log out

Basics Skills Verification References Jobs Ratings

Worker ID: NAM0441 First name: Kleaphas
Surname: Hangula Other names:
Nationality: Namibia DoB: 21 February 2012 1962-11-11
Gender: M Male Married: married Married
Contacts: 0 Address: 95 Ongava str Okuluyang
Cellphone: 0813358573 Email:
Schooling: primary Primary Computer skills: no No
Drivers license: No Criminal record: no No
First Languages: English English Site: 401 Olvmlola
Upload CV Browse... Qualifications: n/a

Update worker details

Number of users: 10
1 registered members and 0 guests currently using the system.

officer /

Figure D.14 (a): MSRNA web-based system; Example of worker details

http://www.msr.org.za/msrna/index.php?page=index Gmail - [ctd]-resea... Android SDK [Androi... Facebook (12 unread) - chumb... shadowing at a resea... google.co.za Studying actions in c...



Connecting unemployed people with job and training opportunities.

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office@msr.org.za
Facebook
@MSR.org.na
Call: 061 - 305892

Members
Username:
Password:
 Remember me next time
Login
[Forgot Password?]
Total Visits: 1

Number of visitors to the MSR offices: February 2011
92 members came to the office to make use of the resources
24 members were put in touch with work opportunities

MSR has moved MSR has moved to the following address: Workshop #1 Habitat Research & Development Centre, Claudius Kandovazu St Katutura	Our bank details: Bank Windhoek Main Branch Account number: 8001384357 Branch code: 481-972 WO number: W0348 INCORPORATED ASSOCIATION NOT FOR GAIN Reg. No. 21/2007/025
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WINDOW CLEANING SERVICE
Two MSR members have set up a window cleaning service, so if you would like your home or office windows cleaned call Kefas on 081 2865923 (English) or Joseph on 081 2918735 (Afrikaans). MSR connects unemployed people with jobs. If you need any unskilled or semi-skilled workers, please contact us. We facilitate and put you in touch with suitable workers - the rest is up to you. Note that we do not take any portion of, and we do not have any right to, the remuneration earned by the workers for whom we facilitate job opportunities. If you pick up workers from one of the job sites, remember to ask to see their MSR card, and give us feedback by using their membership number.

Figure D.14 (b): MSRNA web-based system; home page

Apart from application building, we also designed the planned *MSRVoice* application (and latter built at step nineteen).

Design process of *MSRVoice*

The following are the steps we followed while designing the *MSRVoice*.

- An idea by MSRSA general director: In his own admission, the MSRSA director was inspired by the field registrar prototype application to think about other ICTs which can be used to aid workers reduce travel. *MSRVoice* was one such idea. He said that through research from other similar DLM organisations, he was able to piece together ideas on how to help workers working in different parts of the country and far from the Government labour offices.
- Validated by MSRSA general director: MSRSA director validated the idea by discussing it with some of the MSRSA employers.
- Sharing of the idea with the researcher: After being convinced that it was a good idea, the director convened a meeting with the researcher and the MSRSA office manager. The agenda of the meeting was to co-design the *MSRVoice*. In the meeting, the director took us through all the steps he had come through with the idea and asked for our opinions, which we both agreed with. After the meeting, the office manager and the researcher were asked to find out a list of items employed by workers while reporting abuses and come up with a model for design respectively.
- Coming up with the design: Using the general director's ideas and the office manager's list of items, we came up with a design idea which we discussed with the director and the office manager. We also looked at other similar systems and compared them with our design while considering the contexts.

The *MSRVoice* design

Design requirements of *MSRVoice* was such that it was to have a web driven database and a mobile application each for registering workers, posting and viewing of complaints. Figure D.15 (a) shows the *MSRVoice* design architecture while Figure D.15 (b) and (c) shows screen shots of the mobile application. Figure D.16 shows a screen shot of the DLM worker voice login page.

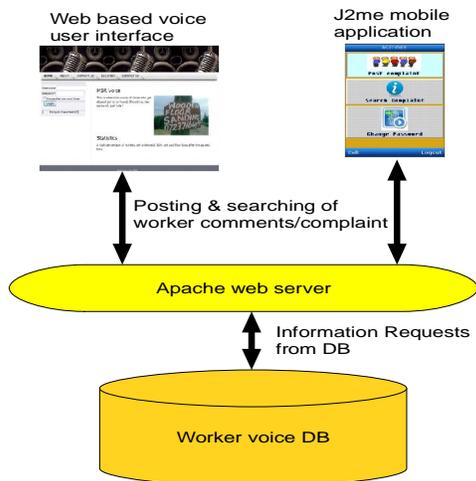


Figure D.15 (a): MSRVoice design architecture



Figure D.15 (b): MSRVoice mobile application

Figure D.15 (c): Posting new complaint using mobile application interface



Figure D.16: DLM worker voice home page

Step fifteen: Observation and evaluation III- Prototypes applications deployment

The following prototype applications were being observed and evaluated at this stage: (a) the mobile based field registration and search application for MSRSA; (b) The web-based verification data upload module for MSRSA; (c) The integrated web-based DLM application for MSRNA and the (d) the *MSRvoice* mobile application for workers to report alleged abuse by employers for MSRSA. We were also deploying and observing the web application and the mobile field registration; job posting and user details update application for the Nairobi DLM.

MSRvoice evaluation only went on for two weeks because the MSRSA changed their operation strategy and model. The new MSRSA operation model became employer-focused and hence suspended most of the job seeker related support including *MSRVoice* included. However, with the assistance of field officers, *MSRvoice* was successfully tested with a few job-seekers. Within the same time, the field registrar was being adopted by the field officers who were by then familiar to their newly acquired Nokia E-63 phones. The most common feature of the field registrar that was being used by field officers was worker registration and worker search. The details of the usage outcome of MSRNA are presented in Section 6.3.3.

Both the Nairobi applications were deployed on an independent host server different from the MSRNA and MSRSA server. The first deployment attempt for Nairobi DLM applications was delayed due to lack of championship on the ground. The research assistant had gotten a job and hence could not continue deployment.

Step sixteen: Reflection III: MSRSA change of operation model

During this step, we were reflecting on two major issues. One was trying to make sense of the changes that occurred in our major DLM partner organisation – MSRSA – and if it was going to affect our research. The second issue was to understand the effects of the changes (in terms of software applications and operations) that we had already introduced. We were critically analysing the benefits of the software applications introduced. To be able to analyse the effects of the changes brought about by the prototype applications, we adopted a discussion framework presented in Section 7.0.

We identified which applications worked and which ones did not. With the aim of coming up with an overall design for DLM applications (both mobile and back-end), we went ahead to find out why each application worked or did not work. Among those which worked, we were looking at how they contributed to reducing travel hence reducing the cost of travel in terms of time and money for the DLM stakeholders.

Among those applications prototyped and did not work include the mobile job allocation application, the registration and search application which was intended for use by workers and employers. In the end, the idea that one could design mobile applications for workers and employers was thwarted. It emerged that the majority of our target group (MSRSA job-seekers) could not benefit from mobile and Internet applications without an intermediary (whether organisational or individual). The MSRSA field registrar for field offices was very successful in deployment and usage. It would allow field officers register and search the database on behalf of the workers and employers. The success metric was the full adoption of the application by the field officers and the MSRSA organisational changes that occurred as a result of its introduction. Its evaluation outcome is presented in Section 6.1.2 (a) while the effects are discussed in Section 7.1.5 page 133.

Namibia

The MSRNA web-based DLM application also succeeded and underwent a number of improvements to a level that was acceptable by its users. We monitored its real life usage through web logs and frequently checked the records for any new updates and searchers. The usage results are presented in Section 6.3.3 page 114.

Kenya

Although the Nairobi DLM systems (both mobile and web-based) succeeded in the testing process, the lack of a champion to drive the adoption and usage saw it collapse after our experiments.

The fact that the Nairobi findings at this stage did not indicate any difference between connected and non-connected DLM job-seekers was a confirmation to us that job-seekers are commuters. Connected job-seekers always commute to a certain location where there is a possibility of job opening. These places can be a construction site or an industrial area. For a non-connected job seeker (who goes to a collection points far from any possible work station) to be reported as having same characteristics as connected meant that their commute frequency were also comparable. Because connected job-seekers cannot predict when jobs will be available, their commute frequency is comparable to ordinary employees.

In this step also was the concept of *MSRVoice*. When it came up, the idea that all participant contributions are taken seriously and treated with equal weight^ô advocated by **Greenwood and Levin (2007)** and quoted by **Hayes (2011)**.^ô came in to play. Although we had not planned to design the *MSRVoice*, we had to listen to the sentiments of the MSRSA general director and his employees.

The AR cycle three summary of the findings

The following is a summary of findings from this AR cycle.

- Connected and unconnected day-labourers: We did not find any difference between connected and unconnected day-labourers in the DLM that would bring any design differences. Whether connected or unconnected, the job search process is the same and mainly involved commuting to the worker collection points or to the work station.
- Using the examples of applications we deployed for MSRSA in Cape Town and MSRNA, we concluded that a majority of our target group (job-seekers) could not benefit from mobile and Internet applications without an intermediary (whether organisational or an individual). Remote applications in a DLM were likely to succeed within an intermediation context.
- Designing for a self-organised DLM requires a champion: One of the reasons why designing for Nairobi DLM did not succeed fully was because there was no champion (whether organisational or an individual) to educate the participants on the importance of using ICTs in the job search market. The main reason why we believe this was so is because the other two case study areas (with champions as MSRSA and MSRNA) showed success in the majority of the applications we experimented with.
- Job-seekers are commuters: whether connected and unconnected, job-seekers commute to a certain location where there is a possibility of job opening or a designated location known to potential employers.

D.4 Fourth cycle of AR: The final designs and consolidating the lessons

The overall objective of this AR cycle was to consolidate all the activities and findings of the first three cycles. This cycle was also to serve in collating all the lessons learnt throughout the study to come up with an overall design for implementing teleactivities in a DLM.

Step Seventeen: Diagnosis V: Making sense of all the information

The main diagnosis method at this stage was analysing the reactions by the DLM stakeholders. We asked the DLM job-seekers, MSRSA and MSRNA employees and day-labour employers what else they would like to do with regard to ICT. We also asked them their thoughts about the implemented systems.

MSRSA was in the process of adopting a new web-based proprietary application to conform to their new operation model. The new application could not allow our remote applications to access data directly for mobile search and the verification module. This forced us to introduce other application interfaces to allow the field registrar continue working.

While completing the study on the MSRNA DLM and analysing usage logs, we also looked at what worked and what did not work for MSRSA and the Nairobi DLM. We also tried to find reasons why the initiatives failed or succeeded. Generally in this diagnosis step, we relied largely on the data generated through the first sixteen steps of our study. Although we were still collecting data from the general DLM context, this diagnosis stage was more of us looking for data from within what we had done.

Information collected and methods applied

- Which applications succeeded and why: The aim for finding out this was to know which design concept worked for DLM. We also wanted to understand why certain applications failed with the aim of drawing design lessons. We used the rate of adoption and continuous of the prototype applications to decide whether they failed or succeeded.
- What other initiatives: For MSRSA and MSRNA, which we had developed close partnership, we asked them to give us any other ideas regarding using ICTs to help the DLM. Our thoughts were that at this point, they had reached a point where they could be able to better understand what we were attempting to do and combined with them fully understanding their DLM operations, they were likely to come up with other design ideas. MSRNA participants (the director and the two employees) who we asked this question reported being satisfied. The MSRSA however had a problem on how to have the field registrar and the verification module interface with their new proprietary database application. There was also the *MSRVoice* co-designed with the MSRSA director and the placement officer. The two brought about the need to consider further designs for MSRSA.
- Usage logs for MSRNA: Because we were away from the MSRNA work station, we only used usage logs and scrutinised their database when checking whether they were using the application or not. The aim here was to use the usage rate as one of the ways of measuring the success of the prototype applications. This would then be used to contribute to the overall design for the DLM.
- General DLM context information: The purpose was to understand the DLM further and to be sure that we were not reporting any erroneous information. In collecting this information we reviewed information we had collected about intermediary versus self-organised DLM (MSRNA, MSRSA against NDLM); self-sustaining intermediary versus charitable (for example MSRSA versus MSRNA) and connected versus and unconnected

day-labourers in a DLM. This information was also presented in many research workshops and conferences to validate the information from audience.

The outcome of the information collected is presented in the results chapter Sections 6.1, 6.2 and 6.3 depending on whether the data was collected from MSRSA, MSRNA or Nairobi DLM

Step eighteen: Planning IV: MSRNA field registrar and MSRVoice

Three actions were planned: Android mobile based field registration and search application for MSRNA; the data update/upload module for MSRSA and the *MSRVoice*. The mobile application was for finding out if the success in implementing it for MSRSA (an example of an employer-centred organisation) could be replicated for MSRNA (an example of a worker-centred organisation).

Planning process

The MSRVoice: The *MSRVoice* design concept was planned as both a web-based and mobile based application that could be used by day-labour workers to report abuses and any other issues relating to work. After getting the *MSRVoice* concept from the MSRSA director and checking out similar initiatives, we embarked on a brief field study which involved asking workers what they thought about the ideas and whether they had witnessed any abuses or other issues they would like to report. The workers interviewed were randomly selected from two different collection points in Cape Town. Due to time and monetary resources constraints, we only interviewed 10 job-seekers. In the previous field findings from Nairobi, we had asked the workers about their challenges. One of the reported challenges indicated different types of abuses.

We decided on the *MSRVoice* application based on the results from both Nairobi and Cape Town, most of which had complaints by job-seekers about being abused by some of their employers. Day-labour workers claimed that the cost of reporting such abuses was unaffordable for them. The requirement was then backed by literature showing that there were other day-labour intermediary organisations which had implemented such applications. We saw the *MSRVoice* as an extension of the field search mobile application for the MSRSA field officers. As much as we wanted to build it for the day-labour workers, the same reasons (low mobile phone ownership rates, low literacy levels and the high cost of communication and low-end mobile phones by workers) that kept us from building the mobile field registrar and search application curtailed it. These reasons are discussed in the results and discussion chapters of this thesis.

The update/upload module for MSRSA: The data update module was a web-based application for uploading comma-separated values (CSV) files generated by the proprietary application implemented by MSRSA. The CSV files needed to be uploaded to the MSRSA search database that was being accessed by our mobile applications. The reason for the upload was because of the proprietary application adopted by MSRSA towards the end of our study. The proprietary application could not allow us to build add-ons for the mobile applications. However we needed to have the information stored in the proprietary cloud

database searchable from the field-based mobile applications. The data update module was therefore planned as part of our last actions.

Step nineteen: Action taking IV: The MSRNA field registrar and the *MSRVoice*;

Actions taken

The actions in this stage were the tailoring of the MSRSA field registrar for MSRNA and further design and building of the data update module for MSRSA and the *MSRVoice*.

The mobile based field registration and search application for MSRNA was implemented to complement the web-based user interface access to the MSRNA database. It was based on the MSRSA field registrar, the only difference having been implemented using the Android platform. Non-throw away prototypes were implemented for MSRNA mobile applications.

The main reasons why we decided to design the MSRNA field registrar based on MSRSA were because most of their operations and characteristics were similar in many ways. This was specifically true to the fact that:

- Field officers visited worker collection points and their activities included worker and employer registration, search and confirmation of worker details as well as job allocation.
- The office workers would receive worker requests from employers and occasionally allocated jobs.
- The job-seeker characteristics were similar with regard to literacy levels, mobile phone ownership and use.
- The commuting characteristics of the field officers and the day-labourers were comparable.

Design process

- Reviewed the MSRSA field registrar design.
- Used information collected (and presented as outcomes in Section 6.3) from the website, field work study in Windhoek to check if there were any changes (compared to MSRSA field registrar). At the end of this review, we decided to have the field registrar design concept with only field registrations and search of workers and employers.
- Prototyping: Involved coming up with a prototype based on the MSRSA field registrar and the modifications presented above.
- Testing the prototype: The prototype application was tested with two MSRNA workers and the results presented in Section 6.3.3 (a). The overall field registrar's original design architecture remained unchanged

The first trial of the MSRNA prototype occurred at the collection point with their only regular field officer. The researcher asked the field officer to test the system with the registrations he had manually done. The first case was challenging as he was still learning how to use a touch screen mobile phone (which we provided them with), it was, however, done successfully. He did the subsequent registrations without any difficulty. After three registrations using the system, we then asked him to search for the same records using the mobile application. He was excited to find the same records he had posted.

The next deployment was in the office with the same field officer and one office based employee and a volunteer to the MSRNA. Usually, the office based employees and the volunteers go to help with worker registrations in the field once in a month. The two new users carried out a few registrations and searches as the researcher observed. Because we had provided only two android phones, the field officer had to lend his to the volunteer during our second deployment. The registrations in the office were first done with the researchers help then thereafter independently by the user. The office-based MSRNA employee was keenly waiting to see the system because she had seen the field officer excited by the fact that he was able to find the registration records he had done from the field on the web-based database.

Figure D.17 shows screen shots of the mobile registration and search application for MSRNA.

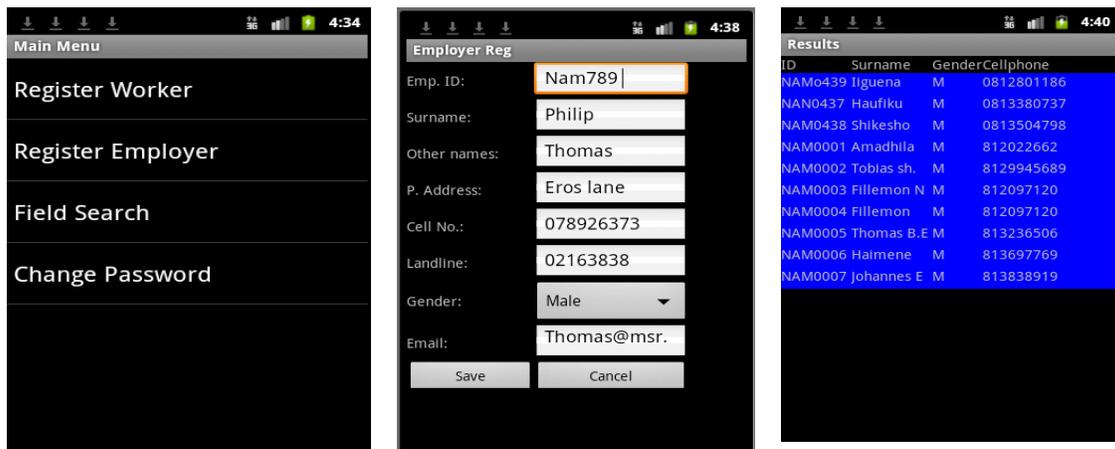


Figure D.17 (a): Home page

Figure D.17 (b): Register employer menu

Figure D.17 (c): Search worker results

In figure D.17: (a) is the home page and is the main interface where the user is taken to after a successful login; (b) is the interface for registering an employer while (c) shows search results of workers from a certain collection point

Finally, we trained the users on how to download new versions of the mobile applications. This was because we were not going to travel to Namibia every time we needed to release a new version.

The data update module for MSRSA

The data update module for MSRSA was implemented as a web-based application. Figure D.18 shows a screen shot of the data upload web page.

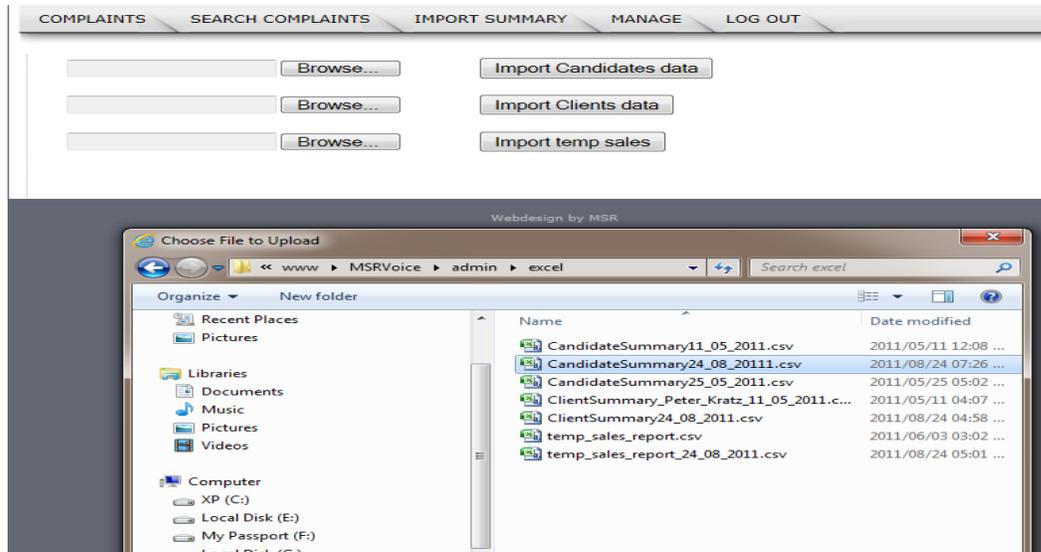


Figure D.18: Data update module for MSRSA.

The data upload module would be used to download and upload data from the MSRSA proprietary web-based database to another database which had an interface with the field registrar and other MSRSA applications

Step twenty: Observation and evaluation IV: The field registrar for MSRNA, and *MSRVoice* for MSRSA

We were majorly looking at the usage performance of two of the three deployed applications, namely: the mobile application for MSRNA, and *MSRVoice* for MSRSA. Additionally, we were looking for more facts with regard to other systems prototyped during the whole study process for purposes of recommendations for future studies.

With regard to *MSRVoice*, MSRNA mobile application and data update module for MSRSA, lessons learnt followed those seen on MSRSA field registrar and MSRNA web-based database. The *MSRVoice* succeeded up to the test stages only. However, it received positive perception from the job-seekers that we evaluated with. One of the job-seekers however was concerned at who would be able to see the complaints and how it would be relayed to the labour office.

Because the data update module for MSRSA was an add-on to the already existing MSRSA systems, it had no implementation or usage challenges. We also thought that the successful adoption was because it was being used by MSRSA employees who were already using many other web-based systems.

After observing three users use the MSRNA mobile application for three days, subsequent monitoring was done online. A usage a usage log that would differentiate between the mobile application and the web-based system accessing the database had been implemented. On whether the usage was actually in the field or in the office, we would ask users via E-mail or Skype calls. There was a limitation on the usability observation after we left Windhoek as we could not observe the usage physically and hence could not capture usability experience.

Step twenty one: Reflection IV: The applicability of teleactivity in a DLM

This was the last step of our AR cycles. It involved reflection on the overall process that included the following three key areas:

- Reflections on the last three actions (the prototyping of MSRNA field registrar, the *MSRVoice* and the data update module for both MSRNA and MSRSA)
- The overall study process and findings
- The DLM context and the applicability of telecommuting

In this section, however, we present the reflections on the prototyping of MSRNA mobile application, the *MSRVoice* and the data update module. Reflections on the overall study process; findings and the DLM context and the applicability of telecommuting are the subjects of the results, discussion and conclusion chapters.

Reflections on MSRVoice

MSRVoice partially failed because it only went through design, implementation and field experiments with field officers intermediating for job-seekers. The deployment session was short but was successful according to the comments from the three field officers. The reasons for failing include the fact that MSRSA, the lead user, changed its operation model from being a non-profit intermediary organisation to a profit making NGO. During their change process, MSRSA lost the ability to have enough field officers to run the *MSRVoice* project. Recommendations are that *MSRVoice* is a viable project because of its numerous advantages perceived by the workers and the intermediary organisation.

As for the MSRNA field registrar and search, initial test results from the field indicated successful deployment. It was well received by users who recognised the importance of it as saving time and travel. The most important usage according to MSRNA field officer was that the system could allow him to register workers once. Before, he would do manual (paper based) registration in the field and go back to the office to enter the same data into the system. The overall conclusion with regard to MSRNA mobile application was that because of the success of the web-based application, the adoption rate was relatively quicker than the MSRSA field registrar and with positive reactions. In other words, the organisation had trusted us and was willing to try our systems and also share feedback without any difficulty.

Further field work studies on the Nairobi day-labour workers

As part of the reflection process, our key challenge was finding out the causes of failures for Nairobi DLM deployments. We carried out further field studies on the Nairobi DLM workers with the objective of finding out why it was not possible to successfully deploy applications. We were specific on technological use and what we might have missed during our initial studies. However, the details of the two months field study did not influence any our design thereafter and hence was not included in this thesis.

Fourth AR cycle Summary of the Findings

- The field registrar worked better for worker-centred intermediary organisation compared to when used for employer-centred. We discovered that MSRSA use of the field registrar declined after they started concentrating on clients (employers). On enquiry, the MSRSA

general director informed us that that was so because employers were not readily available when compared to job-seekers. While job-seekers would be easily profiled and reached whenever and wherever needed, an employer, even when having a profile of them would still require some convincing.

- The change of operation model by MSRSA to employer-centred did not meet our study objective of using ICTs to help the poor (in our case day-labourers). The new operation model by MSRSA would only use the best job-seekers who in most cases were the minority and skilled and hence would earn wages which were likely to remove them out of the poverty bracket. Employers on the other hand were mostly contractors or middle class citizens and working towards ICT interventions to help them would defeat the ICTs for the poor concept that we had in mind.

Appendix E: A sample of NDLM Interviewees and a Summary of data collected

				Owned	On pavement			Weekly		How you acquired	Highest	Daily	
	Name	Tel No	SMS?	phone since	Since	Experie nce	Age	Airtime	Skills	Skills	Education	Expenditu	Rent
1	Francis Oluoch	+254718873	Yes	1996	1986	24	44		Painter	Experience			
2	Samson Olindo	+254722927	Yes	1998	1979	31	53		Electricia	Experience			
3	Charles Okoth	+254720615 398, 020239730 8	Yes	2003	2000	10	30		Capenter	Youth polytechni c			
4	Justus Ashiraka	+254721594	Yes	2001	1994	16	34		Painter	Experience			
5	Joel Otieno	+254724369	Yes	2003	2007	3	37		Painter	Experience			
6	Jotham Mirembo (Contact person)	+254 721 718	Yes	2001	1985	25	50	20 to 560	Painter	Experience		80 to 130	
7	Michael Opondo	+254 724167	Yes	2003	1990	20	50	20 to 350	Painter	Experience		80 to 180	
8	Nebart Mbewa	+254 720 146	Yes	2003	1994	16	46	20 to 350	Painter	Experience		50 to 100	
9	Ouma Epoto (V. Chair)	0733606294	yes	2002	1997	13	37	00 to 150	Plumber	Youth polyt	Form 2	160 to 200	1500
10	Ouma Ogelo	0720561951	Yes				30	20 to 250	Painter	Experience		120 to 180	2,500
11	Sammy Onyango Oyokoh	0733584251	Yes		1995	15	43	50 to 300	Electricia	National Po	Form 4	120 to 180	800
12	Mzee John (Not his name)	Has a phone	No		1973	37	64		Plumber	Experience from Uganda b4 IDD Amin		100 to 120	
13	David	Has a phone	Yes				50		Painter	Experience			
14	Michael	0728969003	Yes	2005	1990	20	49	20 to 200	Painter	Experience		100 to 300	2000

Appendix F: Structured Interview guide

1. Demographic data
 - a) Names
 - b) Phone number
 - c) Gender
 - d) Age
2. Skills
 - a) What are your skills?
 - b) How many years experience?
 - c) Can you do general work, e.g. cleaning?
3. Languages
 - a) Which languages do you speak?
 - b) How long have you been in this site?
4. Literacy
 - a) What is your education level?
 - b) Can you write? In which language?
 - c) Can you read? Which languages?
 - d) Can you use a map to get to a place?
 - e) How do you normally get to a place if you have never been to that place before?
5. Ownership and use of technology (mobile phones, computers, internet, landlines)
 - a) Do you own a mobile phone? Which model?
 - b) Is your phone with you every time? Will I get through if I call it now?
 - c) Do you call?
 - d) Do you receive calls?
 - e) Do you use SMS?
 - f) Are you computer literate?
 - g) Do you know about internet, do you use it?
 - h) Which is your preferred telephone (landline or mobile)?
6. Income and expenditure
 - a) How much on average do you earn per day?
 - b) How much do spend on transport per day?
 - c) How much do you spend on calling/SMS per day?
7. Activity (it is used to test writing and reading literacy as well as technology use)

- a) Can I call your phone?
- b) Can you call me back?
- c) Can I send you an SMS? And can you reply?

8. About your organisation (Leadership)

- a) Do you have any organisation?
- b) Are you a member?
- c) How much do you pay to become a member?
- d) Has the organisation benefited you in any way?
- e) What are your chances of getting a job (in five days, on average how many days do you succeed?)

9. Any other information

- a. Are you affected by the Labour laws?
- b. Have you received any support from either the Local or national Government?
- c. Is there any other information you would like us to know?

Appendix G: Questionnaire administered by the field officers

SECTION A: Technology and Commuting

1	Your age	
2	Gender (Male or Female)	
3	What is your phone type (e.g. Nokia 1200)	
4	How do people communicate to you when you are away?	
5	How much airtime do you have in your phone?	
6	How much do you pay for your transport from home?	
7	Do you walk to collection point? If no, do you take a taxi? Or train? Or?	
8	What is your average daily earning?	
9	What is your highest education level?	
10	How much do you spend on calling or SMS per day?	

SECTION B: Location Activities and time-Weekdays

In the table below, tick the places that you can be found in and the time that you are always there. Include any other place that is not listed in the table.

#	Place	Time	Activity
1	<i>Home</i>	<i>6 pm to 4 am</i>	<i>Talking to people, cooking sleeping (example)</i>
2	Work station		
3	Collection points (job sites)		
4	On the road (commuting)		
5	Any other location		

SECTION C: Location Activities and time- Weekends

#	Place	Time	Activity
1	<i>Home</i>		
2	Work station		
3	Collection points (job sites)		
4	On the road (commuting)		
5	Any other location		

Appendix H: Software prototypes and their designs

This Section is divided into three main sections. The design decisions of all the prototype applications are presented in the first section. Section two presents the individual application designs and functions while Section three shows the screen shots of the main user interfaces for the users. We came up with the user interfaces and the functions based on the legacy web-based systems; using the requirements gathered and in consultations with the main users. The web-based system is online at www.msrna.org.za/msrna.

H.1 Design decisions

a) The high level architecture

The main drive for our interventions was the challenges faced by our target DLM stakeholders (Section 1.2 page 3). Key among them was the amount of travel done by the field officers, workers and employers (Section 5.2 page 72). Our design decisions were shaped by literature on the DLM, our assumptions and later actual findings on mobile phone ownership among day-labourers and the empirical field findings (as user requirements) which were used for contextual design. The literature and field study findings helped in understanding how the DLM operated (Chapter five).

With the assumption that the majority of the day-labourers owned and used mobile phones, and the fact that the DLM intermediary organisations were already using web-based applications, we started by the proposed architecture involving the web-based and mobile phone client applications. The conceptual design architecture was used as a mock up design (Nardi 1992) with the MSRSA management (The design process is described in Appendix D). The initial conceptual architecture had both the web-based and mobile based applications for employers, workers and the DLM organisations users including the field officers.

Table H.1 shows the components that make up the design and gives the motivation for each component.

Table H.1: Motivation for the design architecture components

	Component/service	Motivation
1	Computer web-based client	The DLM (MSRSA and MSRANA) were already using web based applications and they insisted on the new designs being web-based.
2	The mobile-based clients	The target group was the DLM stakeholders e.g. field officers who were field based and mobile. The mobile phone fitted their mobile characteristics (Section 5.2 page 72).
3	Internet	The cost of Internet data bundles was the cheapest compared to SMS or calling, especially in South Africa where the call rate is more than 5 times higher than Kenya.

In summary, the overall design was based on the operation model of the DLMs and the applications they had already adopted and the requirement to have remote applications supporting remote activities.

b) The web-based integrated application

The web-based integrated application for MSRNA was designed based on the operational requirements of the MSRNA and NDLM through prototyping (Section D.3 page 224). Our field studies indicated that the DLMs had many initiatives (Section 6.2.1 and 6.3.1 starting from page 100) which needed ICT support for more effective and efficient operations. The users and the management gave a list of the things the application needed to do and how they should do them. We have also been improving the application based on user feedback since April 2011.

In Nairobi, the web-based application was designed by modifying the MSRNA design with the additions of the specific requirements for a self-organising DLM (Section 5.1 page 70 and 6.2 page 100). Table H.2 shows the characteristics which differentiated between self- and intermediary organisations and which informed the difference in design.

Table H.2: Difference between self- and intermediary organised DLM organisations

	Self-organised	Intermediary-organised DLM
1	Workers did not use field officers	Use field officers to find jobs on behalf of workers
2	They mostly do not have computerized system although they used minimal manual systems	MSRSA and MSRNA, had a functional web based database application for running the daily activities of the organization
3	The workers interacted directly with employers	Employers interacted through the NGO hence a good means of verifying skills
4	They had no job allocation problems	The field officers faced the job allocation problem
5	They did not have existing records of employers	The NGOs kept a list of employers and workers
6	There was no champion responsible for collecting data such as work allocations and skills	The NGOs were responsible for collecting information about the relationship between employers and workers

c) The remote mobile applications

Since the key challenge for the DLM stakeholders was travelling, the remote mobile applications were aimed at having the users reduce their travel by being able to carry out some tasks away from their usual workstation. Initial designs assumed that a majority of the day-labourers had mobile phones and therefore we had them being the primary users of the mobile applications. Field findings, however, showed that the mobile phone ownership among day-labourers varied from case to case with Nairobi having over 90% mobile phone ownership and Cape Town and Windhoek having less than 30 % ownership. Other day-labour characteristics such as education level also varied (Section 6.4 from page 119).

Direct and indirect use Design decisions

One of the key decisions we made about design was whether to directly design for workers or through intermediaries. We chose the intermediation approach where the mobile phone applications for MSRSA and MSRNA were designed for the field officers because of the following reasons:

- a) The operation model of the DLMs was using intermediation where day-labourers were the primary beneficiaries of the system through secondary agents—the field officers (Section 5.1 page 70). The importance of intermediation has also been emphasised before (Pal 2008; Gitau and Marsden 2009).
- b) The low mobile phone ownership could not allow for direct design for users (Section 6.1.1 and 6.3.1).
- c) The text illiteracy among the day-labourers was a hindrance to using mobile phone applications effectively (Section 6.1.1 and 6.3.1). 70% of the day-labourers interviewed had an education level of grade eight and below, and a majority had not used SMS, E-mail or any other mobile phone related applications.
- d) The strong evidence by the MSRNA and MSRSA management that employers had not adopted any of their ICT application because of their characteristics (Section D.1).
- e) The type of mobile phones owned or used by the job-seekers would not support application development (Section 7.1.1 page 125).
- f) Since a majority of day-labourers were struggling to make ends meet, they could not afford to pay for the service (Section 6.4 page 119).

We could not design the mobile phone applications for employers because, according to MSRSA, they preferred to be manually registered on the roadside as they select workers. They had not adopted any of their ICT initiatives such MSRSA website and E-mail for registration or requesting of workers.

The mobile phone application for Nairobi was targeted at the day-labourers direct use (primary users) because they had high mobile phone ownership and were more text literate (Section 6.2.1 page 100). They also did not have intermediaries working for them and hence there was a direct interaction between workers and employers.

MSRNA and Nairobi DLM were designed based on the field registrar's functions, and user requirements gathered from Nairobi and Windhoek field studies using the traditional software development process of investigation; system analysis; Design; Testing and maintenance.

After deciding whom to design for, the next question for the mobile application was the functionalities and the user interfaces.

User Interface design

For MSRSA, the design process was contextual enquiry to foster participatory design (Holtzblatt and Jones 1993) with target users (field officers; the office employees and management) participating in the design process (Section D.1 page 210). The functionalities and the UI designs of the mobile applications, through contextual enquiry and then participatory design as presented next, were derived from user suggestions. MSRSA and the

researcher agreed on the functions of the field registrar (Section D.1 and D.2). The reason we selected participatory design and contextual enquiry are presented in Appendix B.

This section describes the UI design decisions taken for the mobile phone applications during the design process (Section D.1). We present the design process steps, giving the design rationale for each decision taken.

1. **Contextual inquiry:** The initial user interfaces were based on functionality decided using the data collected by using contextual enquiry carried out in Nairobi and Cape Town (Section D.1).
2. **Paper prototyping:** Paper prototypes for the workers (Figure H.1 a), employers (Figure H.1 c) and field officers (Figure H.1 b) application's main user interface were first drawn on paper by the researcher. They were then presented as paper prototypes to the MSRSA three field officers, two office based employees, one regional manager and the director (Section D.1). The first paper prototype for the employers was discussed with the MSRSA officers who represented the employers because they also hired the day-labourers at their homes. The challenge was involving the employers whom we had not contacted at that time.

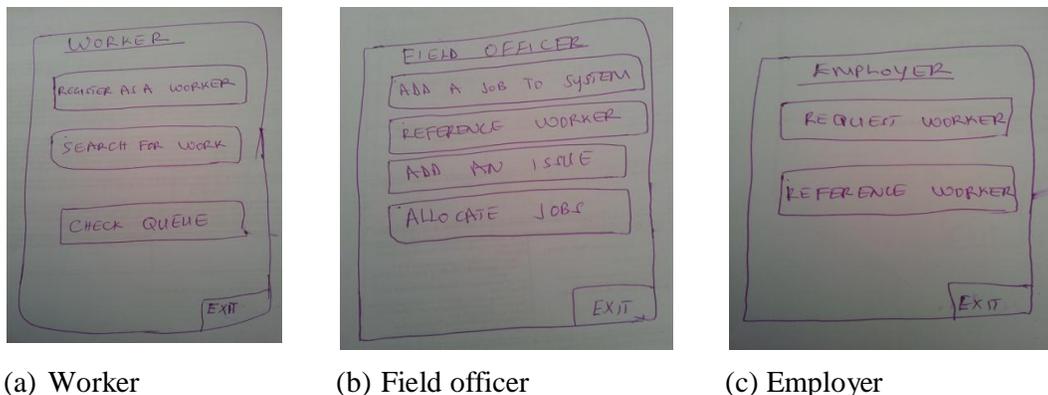


Figure H.1: The paper prototypes for the mobile applications

The discussions on the paper prototypes involved asking the MSRSA stakeholders (management, field officers and office employees) what they thought about having mobile applications that would allow them carry out such functions and their opinions on the arrangement of the interfaces. The functionalities, based on the contextual enquiry presented in the AR (Appendix D), had been discussed and agreed in a workshop (Section D.1). The arrangements of the menus on the prototypes were done by the researcher (on the MSRSA director's request) based on the operational functions of MSRSA how MSRSA were using the existing web-based applications.

3. **Actual prototyping:** We prototyped the three remote mobile applications as they were presented on paper on a J2ME platform because none of the participants made any substantial change to the user interface, hence the MSRSA director proposed we build the application and show them as working prototype.

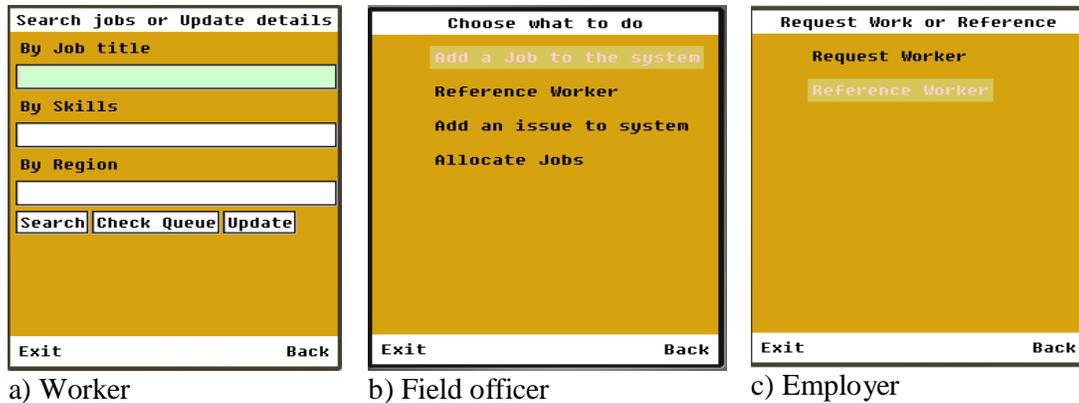


Figure H.2: The first working prototypes for the mobile applications

The first working prototypes had the UIs as depicted on the paper prototypes. We introduced buttons for the workers' UI to see which of the following the MSRSA management and users would prefer; buttons (e.g. H.2 a) or J2ME command menus (e.g. in H.2 b and c). The menus for the worker prototypes were also different because we used the same information (job title, skills and region) for the three different functions (Search job, check queue and update worker details)

4. Selection of Icons: When the first working prototypes were presented to MSRSA three field officers, and the director, they proposed two major icons that came from their logo and a picture from their website (Figure H.3 a). They then recommended that we pick the missing icons, which they would approve or reject once they are on the applications.



Figure H.3: The second working prototypes for the mobile applications with icons

During the selection of icons, the menu naming and the prototype functions changed. The MSRSA representatives proposed the following: the workers main UI changed to a login for the registered and registration for non-members. The field officers proposed the *“want to become a member”* for registration because it was a term they were used to. The field officers' application added more functions as we understood the MSRSA DLM functionality. The employer *“add worker”*, *“request worker”* interface changed to *“add service order”* and *“rate worker”* (terms used in the MSRSA inner circles).

While designing the various mobile phone applications, we were also doing field work in Cape Town. At this point, field findings indicated that an attempt to directly design for workers and employers as the primary users was going to be challenging. The design using intermediation was agreed among the MSRA management, the field officers and the

researcher and hence we followed up with field officers. After presenting the first set of icons, the MSRSA representatives (field officers and the MSRSA management) brought up the following suggestions in a discussion:

- Any menu with an event to save data to the database must have the save icon similar to the one used in computers (Figure H.4 a)
- Anything to do with the login, uses the padlock symbol and cross symbol for cancel (Figure H.4 b)
- Any menu with an event leading to a function not saving data used a tick symbol (Figure H.4 c).



(a) The save UI icons (b) The login UI icons (c) The next menu UI icon

Figure H.4: The second working prototypes for the mobile applications with icons

The login interface was necessary, according to the MSRSA representatives, because they needed to track usage and allow field officers to share their mobile phones. The UI for registering employers had two main options: (1) if the employer was a company or if they were individuals and (2) if the employer was paying through the bank. This design decision was included by MSRSA director when MSRSA introduced the mobile payment system through *wiwallet* (Section D.2 page 215). The presentation on the UI was approved by both the director and the field officers.

5. More functionality for the field officer’s mobile application (the field registrar): The MSRSA director and the field officers introduced two more functionalities (worker rating and refereeing) for the field registrar that would change the design view. These functions were among the MSRSA activities (Section 6.1.1 79). The MSRSA explained how the rating happened by describing on paper as a 1 to 5 scale where 5 is the highest (best). Initially, we had captured it in the requirements as ‘confirming a worker’ because we thought that rating and refereeing were the same. As we dropped the designs for workers and employers, MSRSA representatives also suggested consolidating the field registrars’s main functions to only four: (a) the worker registration, (b) the employer registration and searching (checking) of workers (c) the password changing function (Figure H.5 b).



(a) First adopted field registrar main interface (b) Second adopted field registrar main interface (c) Third adopted field registrar main interface

Figure H.5: Split interfaces for the field registrar

6. **Separate modules for the field registrar:** During the use of their application, field officers reported a less frequent use of the employer and worker registration functions compared to the functions for searching for workers and employers details (check details). This prompted the MSRSA director to propose a split for the field registrar main functions; one for only checking details (Figure H.5 c) and one for registration and checking only worker details (Figure H.5 b). The arrangement of the buttons for the two prototypes was approved by the MSRSA director.

7. **UIs for *MSRVoice* and the icons revisited:** The icons used for the field registrar were selected based on the criteria put by the MSRSA representatives. The process was that the researcher proposes the icons and the users approve or disapprove it. We selected icons based on what we thought was representing the action. For example, we used the padlock as a log-in icon because we expected users to understand a padlock and a key inside it meant opening. Based on the interface of the field registrar, the MSRSA director and the employees decided on the *MSRVoice* icons and how the entry and search interfaces would look like. They provided the following guidelines.

- To register symbol should be represented by a suggestion box.
- The change password icon was a login symbol used in the MSRSA mobile phone interface to the *wiwallet* system and the office employees recommended it (Figure H.6 b).
- The post complaint symbol was initially used in the workers prototype for checking their queue in the job allocation system. The MSRSA director remembered the symbol and asked if we could use it.
- The save new complaint and the login buttons icons were based on the field registrar icon guide presented in point 4 above.
- The search complaint icon (Figure H.6 b) was selected by the researcher (to represent information) and was approved by the MSRSA representative.



(a) Login and register (b) Main functions (c) Posting new complaints

Figure H.6: MSRVoice UIs

MSRNA and Nairobi user interfaces

The user interfaces for MSRNA were based on the functionality of the field registrar and not the icons. We did not include any icons because we wanted to see if they needed any. During the testing, the field officers liked the UIs as they were. We thought that it may have been because Android list presented a good UI or a limitation on our design because we did not provide alternatives. The Nairobi design was based on Cape Town UI design. The UIs for the web-based applications were borrowed from the legacy systems mainly because the users were used to it and had reported no problem with the interfaces. Their main issue was the functionality of the systems (Sections D.2 and D.3 page 224).

d) MSRVoice

The motivation for *MSRVoice* came from the MSRSA director and was confirmed by our field findings from both Nairobi and Cape Town, most of which had complaints by job-seekers about being abused by some of their employers. For example, the 10 workers interviewed on the same issue reported having been abused. The director reported being inspired by the need to reduce travel distance (having seen how the field registrar worked for the field officers) for the day-labourers and similar initiatives by labour organisations outside Africa. The design outcome was as a result of a participatory design involving two MSRSA employees and 10 day-labourers (Section D.3). *MSRVoice* functions were to register workers, collect worker complaints and store it at a central database where they could be searchable and labour officers could access. Compared to similar systems, for example the digital storytelling used by farm employees to report abuses (Bidwell et al. 2010) and the *ushahidi*⁴³ used to report the 2007/2008 post election violence in Kenya, *MSRVoice* was specific and with controlled usage for accountability purposes. Workers would have to register with the intermediary organization and sign a usage responsibility form.

e) The verification and the upload/update module

Throughout our study, MSRSA had working web-based database applications. However, when we introduced the field registrar, the web-based database applications needed interfaces

⁴³<http://ushahidi.com/>

to validate data before uploading, hence the verification module, and the application to upload or download the data from external databases to the database accessible to the field registrar. The verification and upload module were co-designed with MSRSA director (Section D.1 and D.4 page 235). Much of its design was dictated by the already existing programming interfaces from the external applications.

Initial design of the payment interface was to have the verification module have a direct connection to the external payment system (*Wiwallet*) using server side Hypertext Pre-processor (*PHP*) scripts. However *Wiwallet* providers did not provide a programming interface hence we implemented it within the *MSRVoice* with *php* scripts to generate *CSV* files for upload to the *Wiwallet* system.

H.2 The Individual application designs and functions

The web-based integrated database and the remote mobile applications were designed for the Nairobi and MSRNA DLMs, with differences in functionality. The *MSRVoice*; the verification and upload/update and a remote mobile application were designed exclusively for MSRSA. For the applications common to the DLMs, we shall present the overall design but highlight the functional differences as modified for each DLM. All these applications fit into the overall architecture shown in Figure 4.5.

a) The Web-based integrated application

The web-based integrated application design architecture is shown in Figure H.7. The data collected from the field using paper forms can be entered through the web interface. Data can also be captured directly into the database using the remote mobile application. Data dissemination can be through the mobile application in the form of search results or generated through the web interface. MSRNA often printed the reports on paper. The server side has processing logic for the mobile application that saves and retrieves data from the DLM database. The integrated applications for MSRNA and NDLM do not update an external database to update.

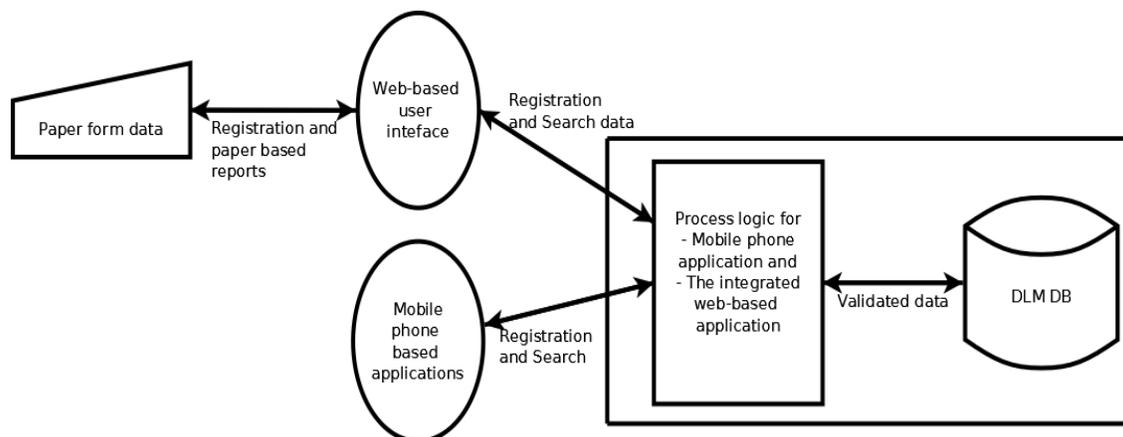


Figure H.7: Web-based integrated application design architecture for the MSRNA and NDLM

The web-based integrated application has two main types of users: registered and unregistered. Unregistered users can only view the general information on the 'about us', view sample worker profiles, donate to the NGO or register to become a member. The

registered users are workers, employers or DLM organisation users or the administrator. Figure H.8 shows the type of users and the functions of the system.

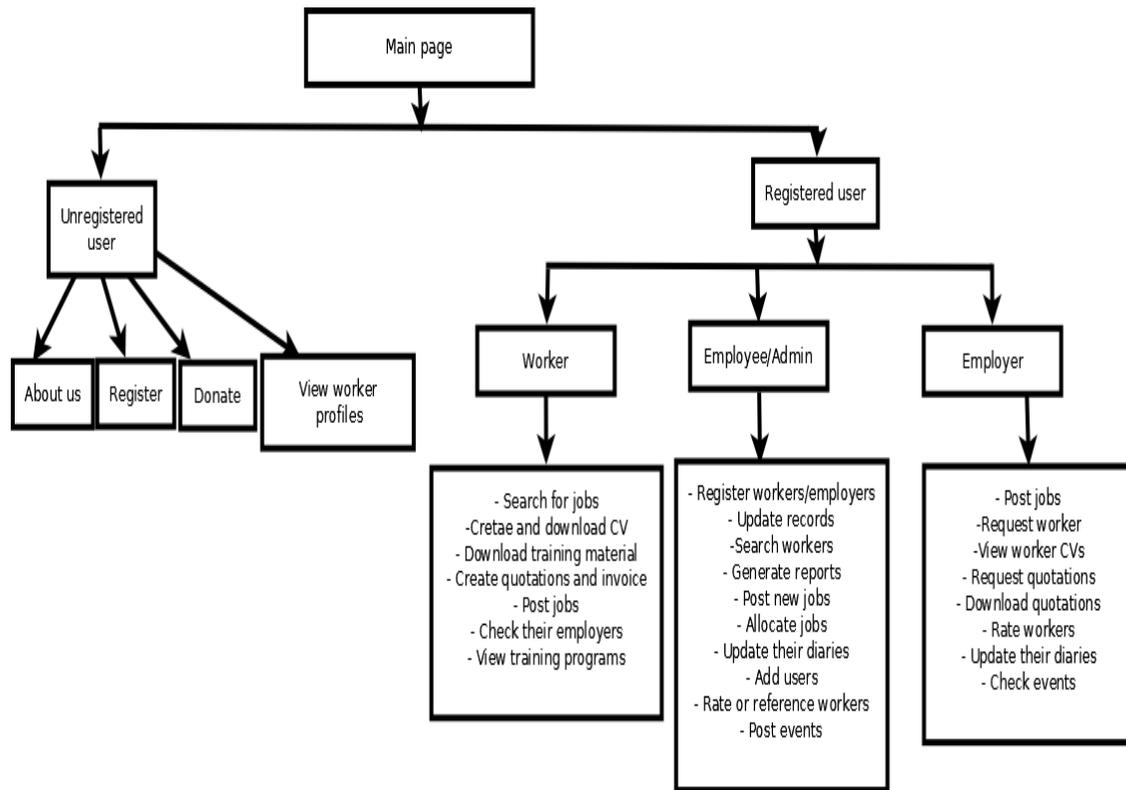


Figure: H.8: Functions of the integrated web-based database application

The main reason for having the registration and job postings was for the Nairobi DLM where we deployed the system with no data in the database. The job posting and registration was therefore meant to populate the database. With MSRNA, there were existing users and the administrator would create users as need arose. In Nairobi, we did not have a champion (a full time system and overall DLM administrator) and therefore there was need for potential users to be able to register online without any physical intervention.

Figure H.9 shows a screen shot of the web-based integrated database applications (the full design process using the user requirements we gathered is described in the AR process in Appendix D). At the top, it shows the menu for a non-administrator DLM organisation user. The current activity in the form is updating workers details with the options for updating skills, referees, jobs and ratings.

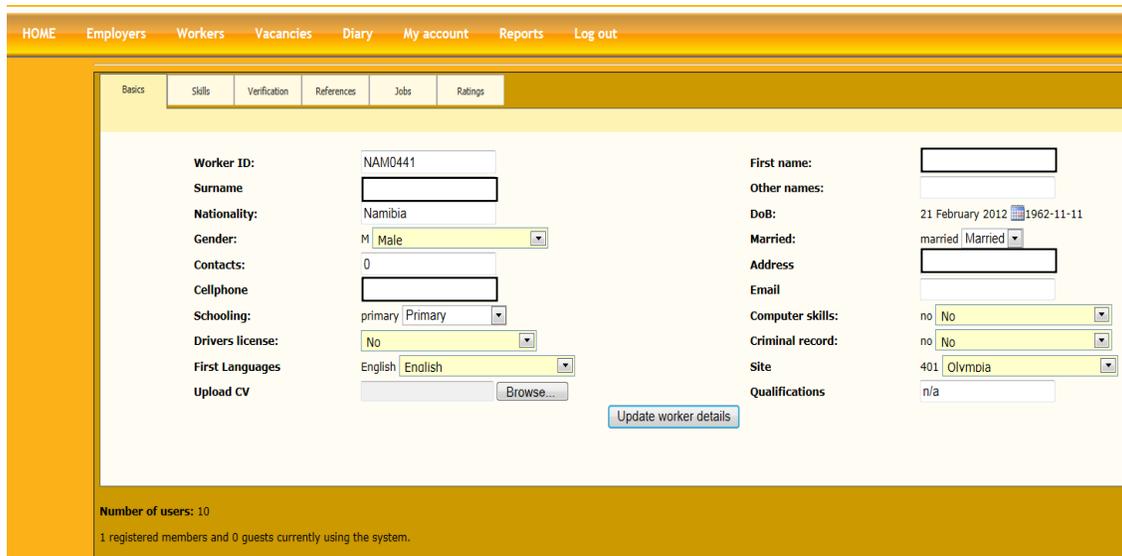


Figure H.9: An example of screen shot of the web-based integrated database application

b) Remote mobile applications

The remote mobile application is a mobile software system mainly designed with the following functionalities for the three DLMs:

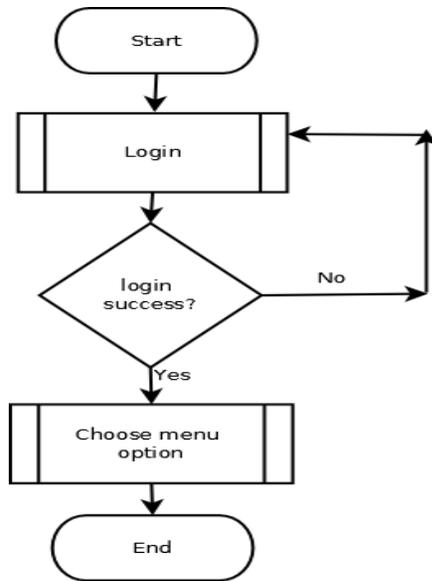
1. Registering workers remotely and saving data in central database.
2. Searching for workers and employers details.
3. Rating workers.
4. Posting and searching jobs.
5. Posting and searching complaints.

Table H.3 shows the different mobile applications designed; their names; functionalities and their target users.

Table H.3: The remote mobile applications

DLM	Name of prototype	Functionalities	Intended users
MSRSA	Field registrar	1, 2 and 3	Field officers
MSRNA	MSRNA Remote mobile application	1 and 2	Field officers
NDLM	NDLM Remote mobile application	1, 3 and 4	Workers, employers and job brokers
MSRSA	MSRVoice	5	Workers

The field registrar functions were specific user requirements from MSRSA. A participatory design process was applied. *MSRVoice* was also designed and tested with MSRSA. The remote mobile applications for the Nairobi and MSRNA DLMs implemented a subset of the functions implemented by the web-based integrated database application.



The remote mobile applications was simplified for users. The login processing logic was at the server side. Once logged in, users would choose from the various menus depending on the functions shown in Table H.3. For example the menu options for the field registrar is shown in Figure H.12(b). The same process apply for the MSRANA and NDLM remote mobile applications except that the menus change to reflect the functionalities. The flow chart process is shown in Figure H.10.

Figure H.10: Flow chart for the remote mobile applications

Figure H.11 shows the design architecture for MSRSA depicting how the support applications were combined with the web-based application; the *MSRVoice* and the field registrar. It shows how data moved from the external databases, *placementpartner* and the payment. The fundamental difference between the MSRSA and the MSRANA & NDLM designs were that the latter had no external database to update or get data from and hence did not need the support applications. The difference was because we used existing legacy systems to achieve our remote application designs for MSRSA while we designed everything from scratch for MSRANA and NDLM.

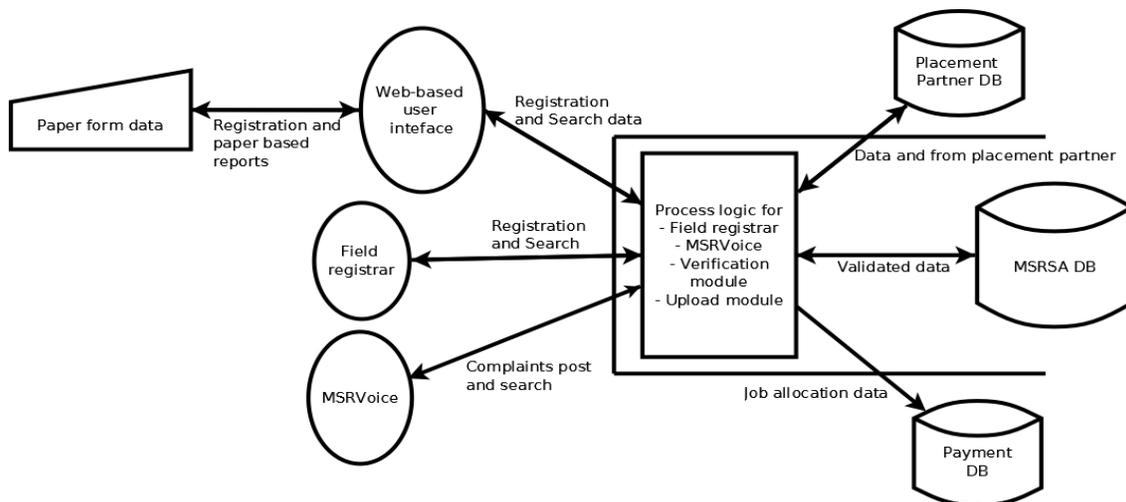


Figure H.11 MSRSA design (mainly for intermediary-organised)

Figure H.11 shows the design architecture for MSRSA. It consists of paper based registration form, which its data can be captured through the web-based user interface and the mobile application for worker and employer registration and search. It also has the functionality of uploading data from the local MSRSA database to the placementpartner and payment external databases. Summarised data can also be downloaded from the placement partner

Figure H.12 show examples of user interfaces provided by the mobile applications.



Figure H.12 (a) Figure H.12 (b) Figure H.12 (c) Figure H.12 (d)

Figure H.12: Examples of user interfaces provided by the mobile applications

(a) is a login screen interface for the field registrar. (b) is the main interface with options for the user to choose between registering workers or employers, or checking workers (search and rate workers) (c) is the interface for MSNA mobile application. It has the choices of registering worker and employers and another for searching their details. (d) is the MSRVoice mobile application. It allows the user to remotely post and search for complaints.

c) MSRVoice web application

The design of *MSRVoice* had a web-based database and a mobile application. The web-based specific functionalities for specific users are shown in Figure H.12.

Figure H.13 (a) shows the *MSRVoice* design architecture of how the mobile and the web-based applications interact. Figure H.13 (b) shows a screen shot of the *MSRVoice* user interface for new complaints by a worker.

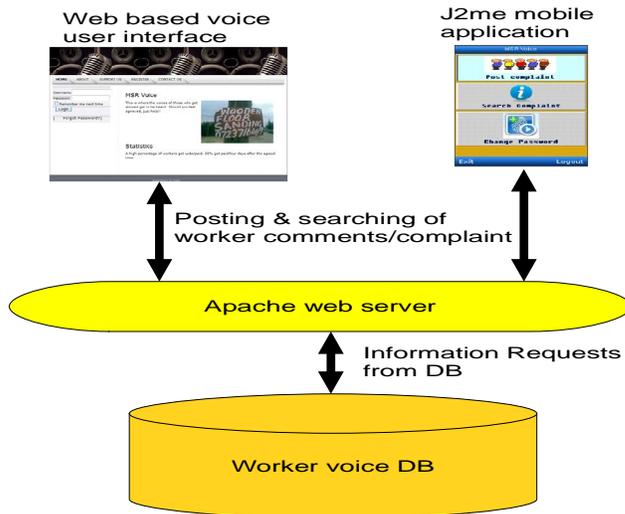


Figure H.13 (a): MSRVoice design architecture

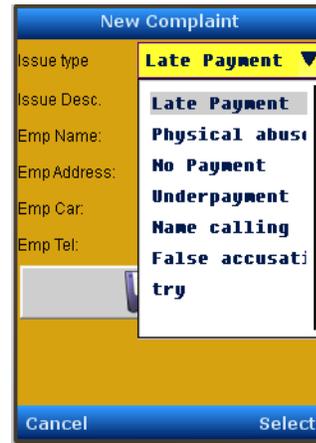


Figure H.13 (b): Posting new complaint using mobile application interface

d) The upload/update module

The data upload/update module for MSRSA was designed as a module in the *MSRVoice* server side because they had the same administrators. The upload/update module is a simple

web-based application for uploading and downloaded data from the external proprietary database (*placementpartner*) used by MSRSA to the MSRSA local database. We needed the information stored in the proprietary cloud database searchable from the field registrar, however *placementpartner* did not have programming interfaces for the mobile applications. The data is in the form of comma-separated values (CSV) file and consisted of workers details (candidates), employers (clients) and the job allocations (temp sales). Figure H.14 shows a screen shot of the data upload web page.

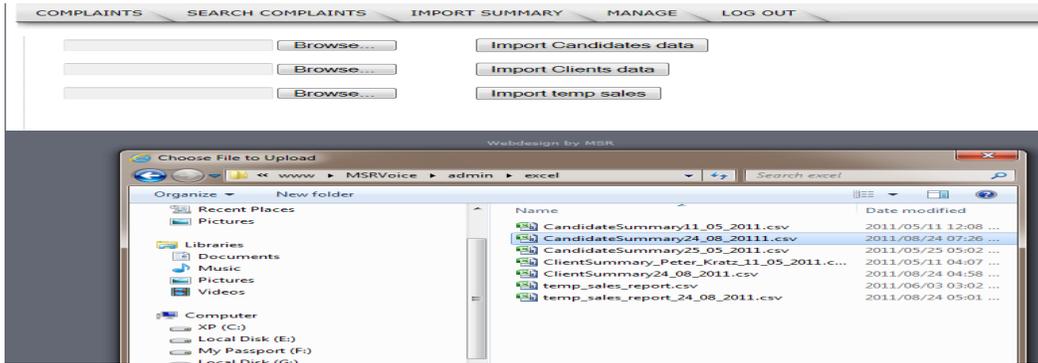


Figure H.14: Data update module for MSRSA.

The data upload module would be used to download and upload data from the MSRSA proprietary web-based database to another database which had an interface with the field registrar and other MSRSA applications

e) The verification module

The verification (validation) module is a web-based application for verifying data captured by the field registrar before saving it in the MSRSA local database and into the external payment database (*Wiwallet*). Its functions include employer and worker data verification and generating CSV files for upload to the *wiwallet* system. The users were MSRSA office employees. Its process logic was all implemented at the server side using PHP scripting. Figure H.15 shows the structure and functions of the verification module.

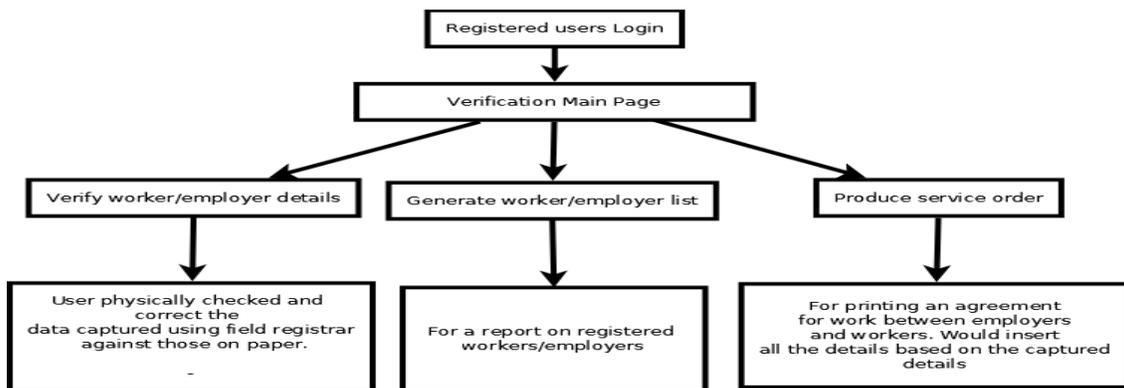


Figure H.15: The structure and functions of the verification module

H.3 The user interfaces for the web-based integrated application

a) The unregistered users main interface

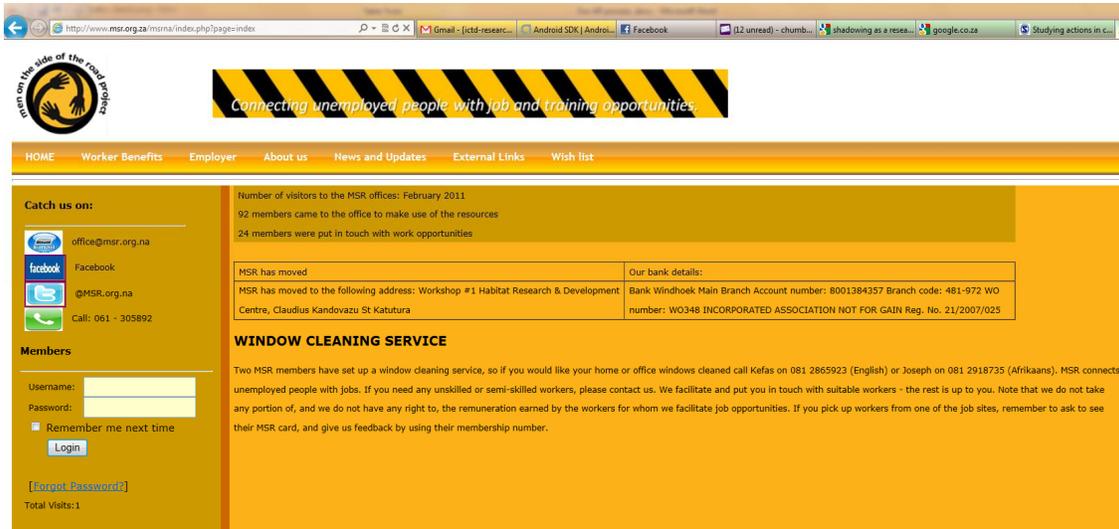


Figure H.16: The unregistered user UI.

Unregistered users can view general information. They can also register or contact the NGO anonymously.

b) The worker/day-labourer main user interface

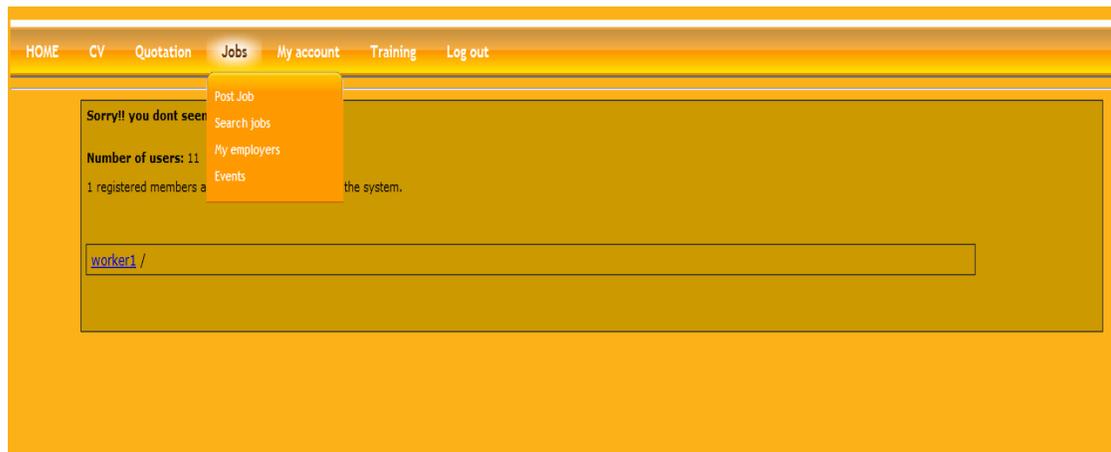


Figure H.17: The workers' main UI. In the menu option selected, workers/day-labourers can post jobs, search for jobs, view and contact previous employers or check their events, among other things.

c) The field officer or office employees user interface

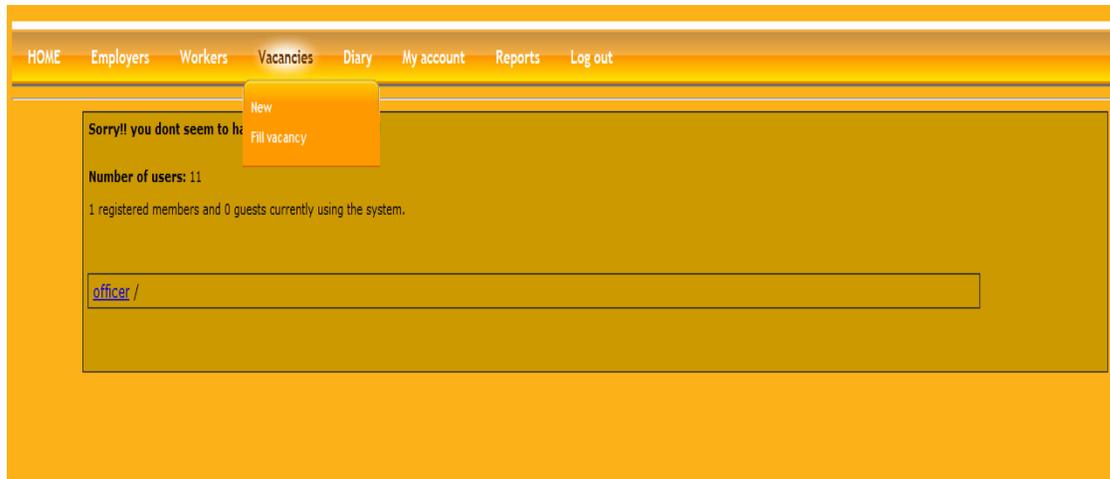


Figure H.18: Field officers or office employee main UI. The selected menu allows for the user to add a vacancy (post job) and allocate a job to worker(s)

d) The events/reminders for user the users; an example of the field officer or office employee



Figure H.19: Daily reminders for the users. Users can save reminders or events and they will be able to see them when they log in to the system.

e) The DLM employers main user interface

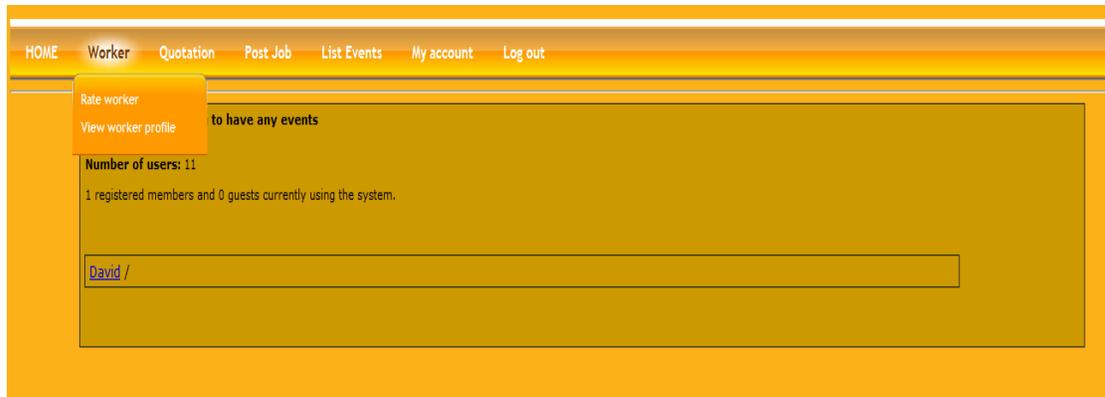


Figure H.20: DLM employers main UI. The selected menu allows employers to rate workers and view worker profiles.

f) The administrator's UI

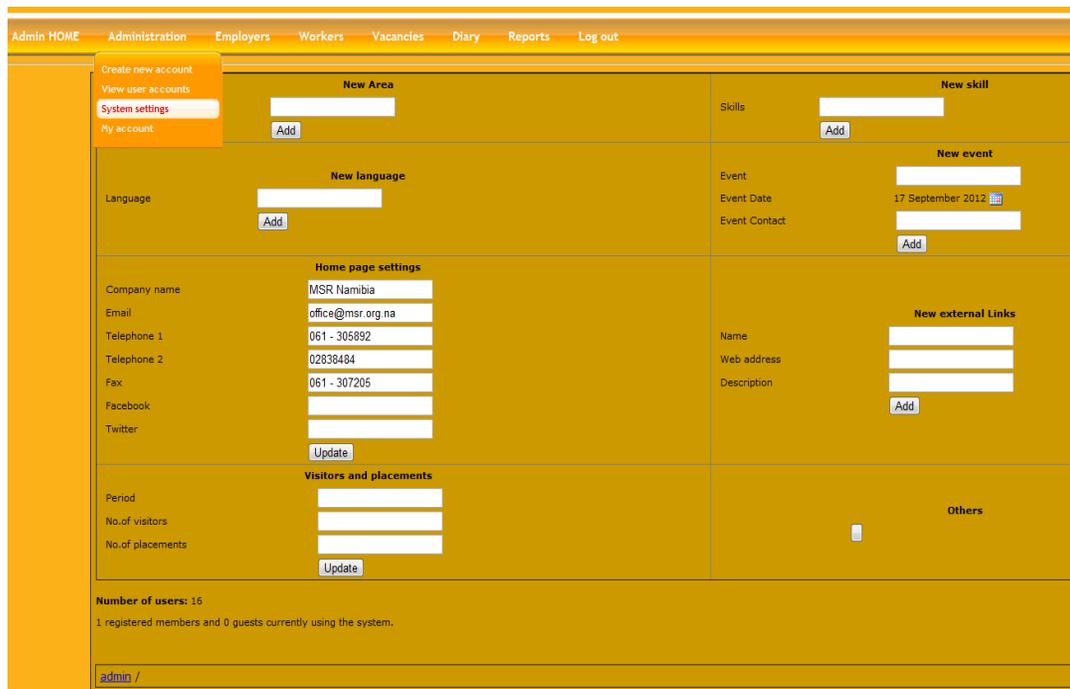


Figure H.21: The system administrator's UI.