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List of abbreviations

|  |  |
| --- | --- |
| ACM | Association for Computing Machinery |
| AIS | Association for Information Systems |
| CDMA | Code Division Multiple Access |
| CI | Confidence intervals |
| CSCs | Common Service Centres |
| GDP | Gross Domestic Product |
| ICTs | Information and Communication Technologies |
| IDRC | International Development Research Centre |
| IEEE | Institute of Electrical and Electronics Engineers |
| MMS | Multimedia Messaging Service |
| MSMEs | Micro, Small and Medium Enterprises |
| PCs | Personal Computers |
| PMS | Propensity Match Scoring |
| RCTs | Randomized Control Trials |
| SMD | Standardized mean differences |
| SMEs | Small and Medium Enterprises |
| SMS | Short Messaging Services |
| SSRN | Social Science Research Network |
| UNCTAD | United Conference on Trade and Development. |
| WLAN | Wireless Local Area Network |

# Abstract

The review question

Does access to business relevant information through networked devices enhance the internal efficiency and business growth of the urban micro, small and medium enterprises in low and middle income countries?

Who wants to know and why?

In the developmental policy domain, micro, small and medium enterprises (MSMEs) are treated as significant sources of employment and livelihood for the poor in low and middle income countries. It is argued the rapid advancements in Information and Communication Technology (ICTs), have made it possible for the MSMEs to reach erstwhile inaccessible goods and services including labor. It is also argued that networked ICT devices like mobile phones have resulted in positive outcomes for the MSMEs in these countries. The present systematic review attempts to validate the above assumptions and hopes to benefit the policy makers, academia and development practitioners and researchers.

Methods of the review

Using a set of keywords, electronic databases and grey literature were searched for the period 2000 onwards. From the initial results of more than 24000, ten research studies were included for the final analysis. Following inclusion criteria were used: whether the study is conducted in urban localities?; whether the study is conducted in the listed low and middle income countries?; whether study contributes to understanding of MSMEs (maximum of 250 employees and annual turnover of less than 50 million for an enterprise)?; whether the study has numeric data?; whether MSMEs use at least one networked device?; whether MSMEs process business relevant information?; and whether study is published in English.

All the studies that used experimental and non-experimental designs were included. Access to business relevant information by the MSMEs for business related activities through networked devices was used as the intervention for the inclusion. The review also considered causal linkage between the ICTs and the internal efficiency or the business growth of MSMEs as the outcomes. Studies also met inclusion criteria if they were conducted in the low and middle income countries.

For synthesis, meta-analysis was conducted using the Stata software where sub-group analyses was performed based on the outcome, internal efficiency or business growth of MSMEs.

Results

Of the final papers, the period of work is 2007 – 2014, the location of studies is split between India and African continent and survey method is adapted. Five studies have followed probability sampling method with sample size ranging from 100 to 560 (excepting one study with 3691). Except one, all the studies have used the self-reported data about the use of ICTs.

The review showed that the numbers of business calls have increased with the longer use of the mobile phones. ICT usage and possession predict the labour productivity in the MSMEs. Operational support, strategic development and process improvement, operational performance, and operational performance are improved by the use of networked devices. After purchase of mobile phones, there is increase in the number of customers. The higher ICT expenditure resulted in increase in turnover of the enterprises. The profits of the enterprises have increased with use of mobile money.

The meta-analysis showed that networked devices have a very small positive effect on the growth of the MSMEs, with overall effect size as 0.047 with a confidence interval (-0.513, 0.606). The meta-analysis results did not support that the business relevant information through networked devices as an intervention lead to improved internal efficiency. The pooled effect was 0.321 (p=0.837).

Implications

The review showed that the impact of ICTs on the growth of MSMEs is small. The ICTD domain and the information systems domain still lack adequate causal studies that link the ICTs and access to business relevant information, and growth of MSMEs. Any large scale policy interventions of ICTs for MSMEs are in need of further evidences. The review highlights the gaps for future researchers to explore and underlines the policy relevance of the empirical research. The suggestions include: undertaking causal studies with rigorous methodology and reporting, including randomized control trials; adapting probability sampling techniques thus avoiding biases; moving beyond India and Africa based studies to improve the understanding; considering other networked devices apart from mobile phones; testing for recursive relationships between ICTs and business growth; and performing disaggregated analysis of sub-groups and different business relevant information.

CHAPTER ONE

# Background

Outline of chapter

The chapter introduces the research question examined by the systematic review. It describes the definitional and conceptual issues confronted by the review. It presents the review of earlier work done in the selected domain and highlight the need for the review. The background of the authors of the review are shared and the potential users of the review.

## Aims and rationale for current review

The objective of this systematic review is to examine the evidence as to whether access of business relevant information through networked devices enhances the internal efficiency and business growth of urban micro, small and medium enterprises (MSMEs) in low and middle income countries.

MSMEs play a crucial role in the economic growth and job creation of both developing and advanced economies (Stein, Goland, and Schiff, 2010). MSMEs offer a broad range of employment opportunities and play an important role in reducing urban poverty.

The studies of information and communication technologies (ICTs) in this space are moving from capturing adoption to understanding impact (for instance, Chew, Levy, and Ilavarasan, 2011). The adoption studies are conclusive about the level of adoption of information and communication technologies (ICTs)[[1]](#footnote-1) by MSMEs, mobile phones lead the pack of ICTs and voice based activities in the personal domain dominate the usage patterns. The studies on the impact of ICTs, especially in the growth of MSMEs seem to be unclear (Chew, Levy, and Ilavarasan, 2011).

For instance, Chowdhury and Wolf (2003) found that the ICT investments by small and medium enterprises (SMEs) in East Africa determines the market expansion through better access of information, but have no effect on enterprise return and export performance and negative impact on labour productivity. To quote Murphy (2013) “while new ICTs have enhanced communication practices, they have generally not enabled SMEs to develop better connections to outside ideas, markets, and investors, nor have they helped SMEs to upgrade significantly their manufacturing systems such that they might more proactively, productively, and flexibly respond to market trends” (p. 1770).

With rise of networking capabilities, through Internet, of low cost technologies like mobile phones, questions are being asked whether these networked technologies are resulting in overall economic growth, at least for the MSMEs. With confusion persisting over the impact of information and knowledge mediated through networked devices on MSMEs, this review is first of its kind to attempt a conclusion.

The review aims to identify the contexts under which information and knowledge through networked devices may or may not contribute to the growth or even to increasing internal efficiency of the MSMEs. Some of the most commonly used types of indicators in the assessment of MSMEs growth and internal efficiency include those related to: time saving; increase in sales, turnover, number of employees, branches, customers, suppliers, work locations, partnerships, products, services, business networks, and incoming referrals, diversification into new areas of business, products & services, and inventory management among others.

The review focuses on the urban MSMEs, since half of the world’s six-and-a-half billion people now live in cities and over the next 30 years almost all global population increase is projected to occur in the urban areas of the developing world (United Nations Department of Economic and Social Affairs Population Division, 2006). As the world moving towards urbanization, understanding of ICTs in urban MSMEs will provide evidence based support for policy making. Also, direct and positive correlation have been demonstrated between the urban percentage of population in low-income nations and higher scores on the U.N.’s human development index (United Nations Department of Economic and Social Affairs Population Division, 2006). As the MSMEs are populated by the microenterprises which are again owned by either poor or low income population groups (Stein, Goland, and Schiff, 2010), the findings from this review is directly applicable to the poor.

We hope that the outcome of this review shall benefit the policy agents in the low and middle income countries to support or rethink their approaches in supporting or encouraging MSMEs and penetration of ICTs in their respective countries.

The present systematic review is important on many counts. Micro, small and medium enterprises (MSMEs) are significant sources of employment and channels of livelihood for the poor in low and middle income countries across the world (Ghanem, 2013). It is assumed or propagated in the development domains (for instance, Consoli, 2012; Duncombe and Heeks, 2005) that the rapid advancements in technology, particularly Information and Communication Technology (ICTs), have made it possible for the MSMEs to gain access to some of the goods and services including labour that may have been previously beyond their reach. Further, increased access to information and knowledge as well as the opportunity to participate in knowledge networks through the use of ICTs and globalization have led to increased opportunities for the MSMEs to integrate with the global markets. The review shall examine these assumptions.

The review also attempts to validate the existing broad notion that networked devices like mobile phones, computers with Internet and Internet cafes etc result in positive outcomes for the MSMEs in the low and middle income countries. This notion is widely seen in the policy documents of the national governments, international agencies[[2]](#footnote-2) or even in the academic literature (Heeks, 2008). Though we are not belittling the serious attempts made by these players in creating the evidences, a closer look at the field is not showing repeated evidences. The most cited studies by Jensen (2007) and Aker (2008) on impact of mobile phones are either not being replicated or other studies not widely visible to the researchers. The impact of ICTs on enterprises is debated between no impact (for instance, Carr, 2004) and both negative and positive impact (for instance, Chowdhury and Wolf, 2003), due to nature of MSMEs (Esselaar et al., 2007) or minimal impact (Chew, Levy and Ilavarasan and Levy, 2011). With respect to MSMEs, Duncombe and Heeks (2005) offer a valuable framework to examine the use of ICTs by MSMEs to alleviate poverty, but empirical evidence is sparse.

Deducing inferences from macro studies (national level data) (Katz, 2012) that links mobile penetration or broadband subscriptions to GDP for micro level (individual level) impact is a case of ecological fallacy. For instance, increase in broadband penetration may result in increase in GDP, but not necessarily increases revenue for microentrepreneurs. The review includes both macro and micro empirical studies.

Needless to elaborate, presentation of importance of MSMEs in national development in terms of employment provision and related livelihood opportunities is abundant. MSMEs in low and middle income countries experience higher mortality rates and suffer from many challenges which include lack of access to market information, onslaught of global competition, infrastructure woes, poor manpower availability, lack of connectedness and technological obsolescence (Liedholm and Mead, 2009). Emergence of ICTs appear to circumvent many of these challenges. With gradual decrease in cost of hardware and blurring of computers and handheld devices, along with increasing access of broadband, availability of erstwhile privileged information to reach markets seems to be achieved. Out of these much discussed ICTs, mobile phones are leading the pack (Ilavarasan and Levy, 2011; LIRNEasia, 2014). The penetration of other networked devices like computers and laptops with Internet among the MSMEs is minimal (Ilavarasan and Levy, 2010, 2012; Esselaar et al., 2007; LIRNEasia, 2014). Hence it's important to see whether these devices, especially mobile phones, have enabled the MSMEs to overcome the challenges and achieve better economic growth status.

Among all the networked devices, the literature highlights the ubiquitousness of mobile phones, especially among the lower class population categories or bottom of pyramid and its positive impact on many domains[[3]](#footnote-3) for instance, which include empowerment, economic growth opportunities, and transparent governance (also see Sen, 2010). The review also looks at whether these phones have served the purpose of enabling the access to information that is relevant to the users like MSMEs to achieve the positive results.

The ownership of device alone is inadequate to achieve the desired outcome, as the relevant usage determines the outcome of the device. For instance, studies on use of mobile phones by microenterprises indicate dominance of personal domain rather than the business domain (Donner, 2009; LIRNEasia, 2014). Also, an understanding of causality of the relationship between the device and outcome is important to decide the primacy of the actor.

## Definitional and conceptual issues

We attempted to examine whether access to business relevant information through networked devices enhances the internal efficiency and business growth of urban micro, small and medium enterprises (MSMEs) in low and middle income countries.

The extant literature is abundant and is consensual about adoption and diffusion of information and communication technologies (ICTs) among MSMEs in low and middle income countries and cost barriers to ICTs are lowering, especially Internet, and mobile phones (PewResearchCenter, 2014; Qiu, 2009). However, agreement emerging out of quantification of impact of ICTs on MSMEs, as explained above, seems to be unclear (for instance, Duncombe, 2009). This review attempts to fill this gap.

We selected 'access to business relevant information through use and access of networked devices' as intervention in the review. Any tool through which user can receive and send information to other users is treated as networked device and should be electronic. Examples of networked devices include: mobile phones, computers, laptops, tablets, and phablets[[4]](#footnote-4) etc. Though the value of non-networked ICTs brings value to the enterprises, the networked nature of the devices or the interconnectedness of technologies generates higher value to the MSMEs (Piscitello and Sgobbi, 2004). For instance, , an invoice generating software takes lesser time than the manual preparation, but the value to the enterprises increases when the invoice is sent to the buyers immediately, thus possibly reducing the credit cycle time.

The focus here is the networked nature of the intervention, which refers to the use of such devices as the medium of information exchange or an interactive communication process, in spite of its ownership, electronic nature or one-way communicational impacts. In other words, only when the intervention fosters the “exchange” of information, it can be counted as “networked”. The users, i.e. the MSMEs, need not necessarily own these networked devices. The devices can be of public access as well. For instance, a MSME accessing a computer in an Internet cafe will be treated as networked device. Or, the use of mobile phone to send business related SMS should be included while the use of the same device only as a calculator should be excluded. Similarly, use of laptop or computer will be included only when they are connected to Internet or intranet. A television will not be included in this review, as a MSME receives the information from it and will not be using it to send information.

The networking nature of the devices will be completely open, as it either be restricted to a particular location or sets of devices. The networking can be enabled by MSMEs themselves or an external agency - government, private or a non-governmental organization. The access to the network can also be either paid, shared or non-paid.

The business relevant information is treated as any information that are used by the MSMEs for business related activities. The information types are multiple and are often interrelated. The examples include, communication from employees to owners and among themselves that are related to the enterprise (simple examples include availability or non-availability of workers for work and location of owners etc.), communication with customers, suppliers and partners (example being conveying status of orders to the customers or placing order with the suppliers), informal communication with business friends or networks to gauge the market, on-going market prices of inputs ( raw materials, labor, transport, etc.), and products, and special services catering for MSMEs (e.g., government policies regarding business registration, tax incentives or other programs).

We assume that MSMEs that receive business relevant information through networked devices will use them to achieve better internal efficiency and business growth of the enterprises (for instance, Donner and Escobari, 2010). For example, intimation on arrival time of pick-up truck from the transporter will enable the microenterprises to inform the customers about the time of delivery, thus resulting in better customer relationship management or repeat sales.

An earlier research (Ilavarasan, 2004) indicates that universally accepted standard definition of MSMEs is not available. The definition for a MSME is multiple across different countries. Some of the factors used in definitions are: number of employees; nature of work contract of employees; annual turnover; investment; shareholders fund; gross income; and value of fixed assets. If the review considers country specific definition, there is a risk of non-generalization of the findings. As a nominal definition, the review has kept 250 employees as the outer boundary to define a MSME. This outer boundary is taken from the definition of European Union, which defines a medium enterprise as one with less than 250 employees and annual turnover of less than 50 million Euros[[5]](#footnote-5).

We understand that the definition of the European Union may not be appropriate for low and middle income countries. The review has made efforts to differentiate the conclusions on the basis of number of workers. The other factor in the definition, 50 million Euros, is also kept to be inclusive of small high technology start-ups with lesser employees who are able to achieve this.

The review included only MSMEs that are operating out of urban locations. It did not differentiate the nature of industrial or business domain the MSME is operating - manufacturing, services and trade. Even MSMEs operating on a business related to agriculture, like selling fertilizers or seeds, will be included, provided they are stationed in the urban localities. The literature pointed out that the ICTs are used differently by different domains (Ilavarasan and Levy, 2010; UNCTAD, 2008).

The internal efficiency of the MSMEs with respect to the focus of the review, information and networked devices, are inferred by multiple factors: the amount of time take by the enterprises while engaging in business - less travel due to networked devices, ability to manage home and work, especially for women entrepreneurs, availability of market requirements optimizes the production or service delivery process and inventory management, coordination with the employees and between different functional units within the enterprise improves productivity, enhanced channels for customer feedback improves the customer relationship management practices, improvement in managing business networks with respect to customers and suppliers, and increased access to finances due to inflow of information from various sources etc. Heeks & Duncombe (2005) delineated four possible roles for ICTs in the internal processes of MSMEs which can be extrapolated for the review as well. The four major areas are: value chain core (internal core operations of the business), value chain boundaries (to contact current and new customers, suppliers, etc.), value chain support (accessing information about supply and demand, and policy guidelines), and networking support (Connecting with social networks and building social capital with other business people).

Business growth is measured not just by increase in turnover or revenue. As the focus is on MSMEs, multiple facets of business growth are considered - increase in sales, turnover, number of employees, number of customers, number of suppliers, expansion of work premises, moving to a larger premises, shifting from rented location to owned, number of branches, number of service offerings, number of products, business networks, new partnerships, and inflow of referrals for business.

The impact of business relevant information on the internal efficiency and business growth of MSMEs is possible through use of networked devices. However, there are other intervening factors that influence this relationship. Some of the possible factors are characteristics of MSMEs (age, size, industry domain, nature of employees, nature of customers and suppliers- walk-in, domestic, export, and ownership pattern etc.), characteristics of owners (age, education, education, ICT literacy, and English language capabilities, etc.), policy environment (protective of MSMEs, financial incentives for internationalization, and skill development facilities etc), gender, and national culture specific factors like paid employment preferences, and poor women labor participation rate etc). These important external factors are context specific and shall not be ignored in the review. However, these factors will not be used for filtering in or out the literature, but in the synthesis of the findings. The review will attempt to sift the findings in the light of these external factors. While conducting analysis, the review will consider the assumption that the business relevant information through networked devices might result in internal efficiency which in turn will result in business growth.

## Research background

To our knowledge, no systematic review in the proposed area has been performed to date[[6]](#footnote-6). There are some reviews of ICTs in MSMEs, but suffers from inadequate rigour in the reviewing process. For instance, Barabara-Sanchez, Martinez-Ruiz, and Jimenez-Zarco (2007) and Ongori and Migiro, (2009) claim that they have done either 'critical review' or 'literature review' but failed to elaborate on how studies were chosen for review, examined and findings were synthesized. The approaches of these studies were more of ad-hoc rather than systematic. One study clearly follows systematic review methodology, Donner and Escobari (2010), but restricts itself to mobile phones and omits other networked ICTs. One more study (Donner, 2008) reviews an impressive 200 studies, but again focuses on mobile phones, and fails to provide a numerical analysis of the literature. Given this inadequacy in the field and vigorous pursuance by the policy makers in pushing ICTs, especially networked ones, there is a dire need for a systematic review to support their claims and policy initiatives.

Rather than restricting to only mobile phones, this review broadens the scope by including networked devices as there are possibilities of other handheld devices made available by the market or the government in the low and middle income world[[7]](#footnote-7).

## Authors, funders, and other users of the review

The review was done by P. Vigneswara Ilavarasan (PVI), Albert Otieno (AO), Ying Huang (YH), Charlie Cabotaje (CC) and Garima Sahay (GS). PVI served as the project lead. All members undertook the study as an independent research along with their regular employment. None of the content in this review represents the views of the respective employing institutions or organizations. All the team members worked on the review as part time basis. The review was carried out in an independent manner. The output of the research is kept for public domain and is for non-commercial reasons.

The review is intended for policy makers, academia and development practitioners who work in the area of ICTs and MSMEs.

## Review questions

The present review aims to assess and synthesize research evidence on impact of access to business relevant information through networked devices on internal efficiency and business growth of the urban MSMEs in low and middle income countries. This is schematically presented in Figure 1‑1.

The review operationalized networked devices as electronic tools through which users can receive and send information to other users. The business relevant information is treated as any information that are used by the MSMEs for business related activities. The review used a nominal definition of MSMEs, adapted from the European Union, with outer boundary of 250 employees and annual turnover of less than 50 million Euros. The review included only MSMEs that are operating out of urban locations. The internal efficiency of the MSMEs are inferred by multiple things. Examples include the amount of time take by the enterprises while engaging in business due to less travel, efficient management of home and work, and coordination with the employees etc. Multiple facets of business growth are considered. Example include increase in sales, turnover, number of employees, customers, suppliers and expansion of work premises etc. The list of low and middle income countries as defined by the World Bank is used by the review.

Figure 1‑1: Role of networked devices in causal relationship between business relevant information and its impact on MSMEs.



CHAPTER TWO

# Methods used in the review

Outline of Chapter

The chapter presents the inclusion and exclusion criteria by which relevant studies were defined and found from all the possible sources. It describes the process by which sources were searched and screened. It briefly explains the method by which quality was assured while identifying and describing the studies. The chapter also explains how the researchers reviewed and synthesizes the evidence out of the studies.

## Identifying and describing studies

### Defining relevant studies: Inclusion and exclusion criteria

The review had followed the following criteria to search for studies to be included in the review:

Criteria for considering studies in this review

Population:

Studies should have been done in the low and middle income countries. The list of countries provided by the World Bank was used.[[8]](#footnote-8) The MSMEs in question should be located in urban areas, as reported by the authors of the study. The studies should have shared the definition for MSMEs. The studies of MSMEs with no more than 250 employees and annual turnover of less than 50 million Euros or equivalent are included.

Interventions:

The business relevant information is treated as any information that are used by the MSMEs for business related activities. The examples include, communication from employees to owners and themselves that are related to the enterprise (simple examples include availability or non-availability of workers for work and location of owners etc.), communication with customers, suppliers and partners (example being conveying status of orders to the customers or placing order with the suppliers), informal communication with business friends or networks to gauge the market, on-going market prices of inputs ( raw materials, labor, transport, etc.), and products, and special services catering for MSMEs (e.g., government policies regarding business registration, tax incentives or other programs). The studies should explicitly mention that the information is being used for or relevant to the business.

Any tool through which user can receive and send information to other users is treated as networked device. These devices are electronic tools. Examples of networked devices include: mobile phones, computers, laptops, tablets, and phablets etc.

Outcomes:

The review looked at the causal linkage between the ICTs and the internal efficiency and business growth of MSMEs. The examples for the internal efficiency of the MSMEs include the following: the reduced amount of time taken by the enterprises while engaging in business, availability of market information, coordination with the employees, and receiving customer feedback, etc. The business growth is measured by increase in turnover or revenue, increase in sales, turnover, number of employees, number of customers, number of suppliers, expansion of work premises, moving to a larger premises, shifting from rented location to owned, number of branches, number of service offerings, number of products, business networks, new partnerships, and inflow of referrals for business etc.

Study types:

All the studies that used experimental and non-experimental designs are included. Among the non-experimental designs, exclusive qualitative studies are omitted. The exclusive qualitative studies are not excluded, if they presented the causal relationships in numerical forms. As the review is focusing on causal relationships, studies that use only descriptive statistics are excluded. The studies that did not include networked devices or business relevant information as part of investigation are excluded. The review included only studies that are published in English.

Time period:

The review included studies, both published and grey literature, that are available from 2000, a year of Millennium Development Goals of United Nations where Goal 8 has Target 8F '... to make available benefits of new technologies, especially information and communications.'[[9]](#footnote-9) The literature was scanned in multiple databases until June 2014.

### Identification of potential studies: Search strategy

A set of keywords for each of the components was prepared on the basis of the requirements of the review. The list was shared with an external information scientist[[10]](#footnote-10) to search for studies. After testing out different combinations, the scientist used a set of keywords that are slightly different from the proposed one. Please see the Appendix 2.1 for the keywords used by the scientist. The terms related to urban location were not used, as they excluded more number of studies. The research team wanted to have wider coverage of studies for the screening. The databases searched were: Acad Search, Business Source, Econlit, Scopus and Web of Science.

In addition to the above databases, following institutional databases and collections, the second set, were searched using the search option in the respective databases or through Google search engine using keywords like [www.idrc.ca+SMEs](http://www.idrc.ca+SMEs): Infodev, World Bank, DIME, JOLIS, IMF, DFID’s Research for Development, IDRC’s Digital Library, IDEAS, J-PAL, ELDIS, British Library of Development studies, Millennium challenge, USAid, FAO, UK Theses Ethos, US/Canada Dissertations and SSRN. Each database or collection was assigned to a single team member who searched using the keywords, both individually and in combination: MSMEs, SMEs, microenterprises, enterprises, ICTs, mobile phones, and computers.

Further, a third set of databases, ACM Press, IEEE Xplore Digital Library and AIS Electronic Library were also searched using the search option. The keywords were same as above.

### Screening studies: Applying inclusion and exclusion criteria

The search results from the information scientist were uploaded in the EPPI Reviewer 4.0 (Thomas, Brunton and Graziosi, 2010) a web based application to manage and process the literature review.[[11]](#footnote-11) All the studies were divided across five members of the review team. Following set of filters were used to select the studies for the next stage of screening:

Whether the study is conducted in urban?

Whether the study is conducted in the listed low and middle income countries?

Whether study offers something on MSMEs (maximum of 250 employees and annual turnover of less than 50 million for an enterprise)?

Whether the study has numeric data?

Whether MSMEs use at least one networked device?

Whether MSMEs process business relevant information?

The reviewers read the title and abstract and excluded the studies that did not meet the criteria. The studies for which decision was not made due to inadequacy of information were moved to the next stage. In the second stage, studies were redistributed to the reviewers (PVI, AO, GS) such a way that a study was been reviewed by at least two reviewers. In this stage, two more additional criteria were included: publication in 2000 and after, and duplication of studies. In the next stage, full text were downloaded from the relevant sources. The methodology section of the studies were read by the reviewers to select the final studies (PVI, GO, GS). At least two reviewers reviewed each of the full papers.

The results from the second and third sets of databases were screened directly by the respective member by reading the titles and abstracts.

### Identifying and describing studies: Quality assurance process

The screening of three datasets resulted in a total of thirty papers. All the papers were either meeting the criteria or unclear on some parameters. The senior member (PVI) wrote to the authors of the papers or studies directly seeking further clarification, mostly on the location of the studies. The studies that are clearly identified as urban based ones were included for the full screening. Few studies had mixed locations and did not present disaggregated data for urban or rural. After failing to get a satisfactory response from the authors, they were discarded. The discarding of papers were done after discussion between the two review members (PVI, AO). After this entire process, a final set of ten studies were included for full text screening and data extraction. The list of papers is given in Appendix 2.2.

## In-depth review

### Moving from broad characterization (mapping) to in-depth review

Two senior members (PVI, AO) of the team extracted data from each of the final papers. The research question was broken down into small components for which information was extracted from each of the studies. An excel sheet for data extraction was used with the following titles in the columns:

* Paper identification number;
* Authors; Year of publication;
* Title of the article / chapter;
* Other publication details (Journal name, Book, Editor details, Issue no, page numbers etc.);
* Summary;
* MSME Location;
* MSME Nature of business;
* MSME number of employees;
* MSME turnover;
* MSME business domain;
* MSME age;
* MSME ownership;
* MSME export intensity;
* MSME Owner gender;
* MSME Owner age;
* MSME Owner literacy;
* MSME Owner mathematical skills;
* MSME Owner first generation entrepreneurship;
* Country;
* Sample Size;
* Sampling technique used;
* Year of study;
* Nature of statistics used in analysis;
* Information on policy environment;
* Information on cultural factors;
* Exclusivity of quantitative method in the study;
* Nature and types of ICTs used 1, 2, 3, 4;
* Nature and types of networked devices used 1, 2, 3, 4;
* Nature and types of business relevant information processed by MSMEs 1, 2, 3,4;
* Impact on Internal Efficiency 1, 2, 3, 4;
* Impact on Business Growth 1, 2, 3, 4;
* Role played by networked devices 1, 2;
* Dependent variable; Predictor variables.

### Detailed description of studies in the in-depth

After data extraction for each of the components listed above, the two members (PVI, AO) compared the notes. Wherever there was a disagreement, they discussed and finalized the findings. One final excel sheet was prepared for further use in the review.

### Assessing quality of studies and weight of evidence for the review question

AO took the lead in conducting the risk of bias in the final studies. The extant research (for instance, Higgins et al., 2003; Kjaergard, Villumsen, & Gluud , 2001) argues that studies that have questionable methodological quality are prone to a number of biases which may include overestimation of the positive effects, systematic errors or underestimation of the negative effects. To assess the risk of bias for the included studies, Cochrane Handbook for Systematic Reviews of Interventions by Higgins and Green (2008) was adapted. The adaptation is done as the final studies are survey based and the actual framework is meant for experimental designs. The following domains were used to assess the bias of risk among the final included studies: selection bias (whether respondents / research subjects were allocated randomly for control and experimental groups), incomplete outcome data (how were the incomplete outcome data handled), and selective reporting (reporting of selected outcomes) (Table 3‑1).

The final studies were retained, if there were some information on the components related to the research question. These studies met the inclusion criteria that were used to screen the studies earlier - studies conducted in urban locations of low and middle income countries, on MSMEs, discussed at least one networked device, used numeric data and MSMEs process some business relevant information.

### Synthesis of evidence

The data were extracted from the final studies and compared with each other to answer the research question under scrutiny. First a narrative analysis of the final papers were presented, followed by meta-analysis of the quantitative data. The Stata version 12 software was used to analyse the data. Since most studies reported continuous outcomes, standardized mean differences (SMDs) with 95% confidence intervals (CIs) were calculated as the differences in means, and α = 0.05 was used as the statistical significant level. I2 was calculated based on fixed effect model to test for the heterogeneity between the studies. Lack of heterogeneity was noted for the values of I2 less than 50%. The funnel plot was used to estimate the risk of publication bias, along with other tests for significance to check the publication bias in the final papers. Details of computation of the effect size is presented in Appendix 2.2.

### In-depth review: Quality assurance process

The final ten papers were reviewed and data were extracted independently by two reviewers (PVI and AO). The two data extraction excel sheets were combined. Whenever there was a disagreement, both of them discussed and finalized the findings. For each study, the risk of bias was assessed to be either high risk, unclear risk (for studies with insufficient information to be used in judging the bias), or at low risk. For final analysis, only on excel sheet of data extraction was used.

CHAPTER THREE

# Identifying and describing studies: results

Outline of Chapter

The chapter details the number of citations resulted from the search process and how the final set of studies were arrived at. It provides a detailed descriptive account of the final studies. It shares the outcomes of quality assurance by calculating the risk of bias. It also gives a brief summary of the final studies.

## Studies included from searching and screening

A total of 23926 citations were found using the keyword search by the information scientist. The reviewers read the title and abstract and excluded the studies that did not meet the criteria. The studies for which decision was not made due to inadequacy of information were moved to the next stage. In the second stage, we had 650 studies. These 650 studies were redistributed to the reviewers such a way that a study has been reviewed by at least two reviewers. In this stage, there were 192 studies remained. In the third stage, for these 192 studies, full text were downloaded from the relevant sources. At least two reviewers reviewed each of the studies. Nineteen studies were shortlisted by this process. Manual search using keywords in institutional databases followed by screening of keywords and abstracts resulted in nine studies. Screening of search results from the databases that formed dataset 3, resulted in two studies. A total of thirty papers were found after the above processes. All the papers were either meeting the criteria or unclear on some parameters. Studies for which there was no clarity on location or on statistical parameters used in the analysis even after receiving the responses from the authors, were discarded. After completion of this entire process, a final set of ten studies were included for full text screening and data extraction. The list of final papers is given in the References chapter of the report. The entire screening process to arrive at the final papers is summarized in Figure 3‑1.

## Characteristics of the included studies (Systematic Map)

Of the final ten papers, the period of work is 2007 - 2014 and the location of studies are split between India and African continent. Though these studies are not representative of all low and middle income countries, the final list indicates the need for undertaking rigorous empirical studies in other countries.

All the studies adapted survey as a method for data collection. Randomized control trial (RCT) studies are not present in the domain undertaken for this systematic review. According to Banerjee and Duflo (2009), RCTs reduce the gap between researchers and policy implementers. The paradigm of systematic reviews and evidence based summaries in the field of medicine is enriched by the RCTs. Not belittling the survey designs which are ex post facto driven, the causal relationships are best captured by the experimental designs (Babbie, 2013). The domain under examination, impact of ICTs on micro enterprises, is likely to

Figure 3‑1: Filtering of papers from searching to map to synthesis.

One-stage screening

Papers identified in ways that allow immediate screening, e.g. handsearching

24204 citations identified

Title and abstract screening

Citations excluded

Not urban - 239

Not LMI Country - 3173

Not MSMEs - 13751

Not numerical data - 683

No networked device - 1883

No business info processing - 3059

Not in English - 766

Remaining - 650

11 citations identified

650 citations

192 citations

203 citations identified in total

198 reports obtained

Acquisition of Studies

Full-document screening

5 studies not obtained

30 studies

Systematic mapping

10 studies

In-depth review

10 studies

Excluded studies

Not urban - 9

No information - 4

No causal linkage in quantitative analysis - 7

Remaining - 10

Two-stage screening

Papers identified where there is not immediate screening, e.g. electronic searching

Citations excluded

Not urban - 5

Not LMI Country - 139

Not MSMEs - 112

Not numerical data - 68

No networked device - 53

No business info processing - 25

Not in English - 19

Study before 2000-6

Duplicate study - 31

Remaining - 192

gain more credibility if the studies follow more appropriate study designs to capture the cause and effect relationships.

A rigorous sampling technique ensures that the generalization from the sample is possible. Though there are adequate numbers of probability sampling techniques, only three studies had followed three stage random sampling. Two studies (Jahanshahi et al., 2011; Wamuyu and Maharaj, 2011) had reported stratified sampling, but did not provide adequate details on the sampling process.

Except one study (Esselaar et al., 2007) whose sample size is large, 3691, the final studies are small scale surveys, with sample size ranging from 100 to 560. The rationale for the sample size and decision making on number of respondents to be interviewed is not reported in any of the studies. In one study (Jahanshahi et al., 2011), details about the nature of respondents is not reported.

We had anticipated some mixed design studies, but the final papers are exclusively quantitative studies. As the requirement of the protocol, all the studies had followed either regression models and regression based structural equation models. A descriptive summary of the final papers is given in Appendix 3.1. Appendix 3.2 provides summary of each of the final studies.

## Identifying and describing studies: quality assurance results

Selection bias: Out of the final studies, six studies reported that selection of participants were random and are rated as low risk of bias. However, of the six studies that reported random selection, only one study (Fredrick, 2014) shared sufficient information about the methods and procedures that were adapted by the study. Four of the studies used non-random selection of participants in the survey like convenience or purposeful sampling technique. Therefore these studies are gives high risk of bias rating.

Incomplete outcome data: None of the studies reported handling drop-outs and missing data hence little or no attempts were made to control for the missing data. As the required information is not available, unclear risk of bias is reported for all the studies.

Selective reporting: The research team was unable to find published protocols for any of the ten studies and it was thus difficult to check for selective reporting bias. All the studies have used questionnaires specifically designed by them to meet their objectives. There are possibilities of bias related to validity and reliability of the factors used by the studies. Six of the studies have reported about the reliability or validity of the factors or instruments used to measure the predictors or outcomes. These are given low risk of bias. Unclear risk of bias was assumed for the studies that did not report any assessments of validity or reliability.

## Summary of results of map

Of the final papers, the period of work is 2007 - 2014 and the location of studies is split between India and African continent. All the studies adapted survey as a method for data collection. Only three studies had followed three stage random sampling and two studies had reported stratified sampling, but without much details. Except one study, with sample size of 3691, rest are small scale surveys, with sample size ranging from 100 to 560. The rationale behind the sample size is not reported in any of the studies.

Table 3‑1: Risk of bias assessment of final studies

|  |  |  |  |
| --- | --- | --- | --- |
| Risk of Bias Assessment | | | |
| Studies | Selection bias | Handling incomplete data | Selective reporting |
| Chadha, S. K., and Saini, R. (2014) | High | Unclear | Unclear |
| Donner, J. (2006) | High | Unclear | Unclear |
| Chew, H. E., Levy, M., and Ilavarasan, P V. (2011) | Low | Unclear | Unclear |
| Jahanshahi, A. A., Gashti, M. A., Khaksar, SMS, and Pitambar, B. K. (2011) | Low | Unclear | Unclear |
| Mwangi, G. W., and Acosta, F. R. (2013) | High | Unclear | Unclear |
| Fredrick, L. I. (2014) | Low | Unclear | Unclear |
| Chew, H. E., Ilavarasan, P. V., and Levy, M. R. (2012) | Low | Unclear | Unclear |
| Chew, H. E., Ilavarasan, P. V., and Levy, M. R. (2013) | Low | Unclear | Unclear |
| Esselaar, S., Stork. C., Ndiwalana, A., and Deen-Swarray, M. (2007) | High | Unclear | Unclear |
| Wamuyu, P., and Maharaj, M. (2007) | Low | Unclear | Unclear |

Except one, all the studies have used the self-reported data about the use of ICTs for processing business relevant information. Use of composite index that covers all possible things one can do using ICTs in an enterprise is observed in four papers. Two studies focus on mobile phones with voice based activities (calling and receiving calls for business) and SMS are observed. Two studies are not specific to mobile phones and indicate processing of business relevant information much more than voice based and business communication beyond customers, employees and suppliers.

Four studies report MSMEs using the mobile phones exclusively to achieve either internal efficiency or business growth. Four other studies show mobile phones being used in tandem with other networked devices. Two papers mention about advanced networked devices like database management systems, e-document management software and e-commerce applications etc, but failed to report the usage adequately. There is no disaggregated analysis, if there are multiple networked devices are used by the businesses.

Out of the final ten studies, half of them discuss about the impact of networked devices on the internal efficiency with only two are explicit. The numbers of business calls have increased with the longer use of the mobile phones. ICT usage and possession indexes which are combinations of multiple networked devices predict the labour productivity in the MSMEs. Rest of the three studies uses composite factors, namely operational support, strategic development and process improvement, operational performance, and operational performance which is improved by the use of networked devices.

CHAPTER FOUR

# IN-DEPTH REVIEW: RESULTS

Outline of Chapter

The chapter provides an in-depth review of the final papers. Each of major components in the research question - business relevant information, networked devices, internal efficiency and business growth of MSMEs, and sub-group analysis is presented in detail. Quantitative meta analysis for two outcomes, business growth and internal efficiency, was done separately and presented.

## Selecting studies for the in-depth review

The review included only those studies that had explicitly discussed the causal linkage between ICTs and internal efficiency or business growth or both of the MSMEs. Each of the studies were reviewed in-depth to arrive at this selection. Three studies did no mention about the location of the fieldwork, whether urban or not. The respective authors were contacted to share more information based on which selection of papers were made.

## Comparing the studies selected for in-depth review with the total studies in Systematic Map

Of the ten studies included for final data extraction, three studies (Chadha and Saini, 2014; Fredrick, 2014; Esselaar et al., 2007) had missing data. Hence seven studies are included for the meta-analysis stage. The publication period of the seven studies ranged between 2007 and 2013, and all the seven studies had used regression analysis. A total of 2457 MSMEs were interviewed in the seven studies. All the seven studies employed cross-sectional design and used survey questionnaire as a tool for data collection. However, for narrative analysis of the studies, all ten are used.

## Further details of studies included in the in-depth review

We will follow the major components present in the research question while describing the studies. The section will start with the business relevant information, then networked devices and the impact on internal efficiency and business growth. A detailed summary of each of the studies is given in Appendix 3.2

### Business relevant information

The data extracted from the final papers about business relevant information is presented in Table 4‑1. Except Donner (2006), all the studies have used the self-reported data about the use of ICTs for processing business relevant information. Four studies (Chadha and Saini, 2014; Jahanshahi et al., 2011; Mwangi and Acosta, 2013; Esselaar et al., 2007) have used a composite index through which processing of business relevant information can be deduced. The index covers all possible things one can do using ICTs in an enterprise, as inferred by the list reported in the papers. Each of these items contribute to an index and inferred to be influencing the impact on business growth or any other parameter under study. Its important to note that the detailed information on each of items is given only in Esselaaar et al. (2007).

The studies by Chew et al. (2011; 2012 & 2013) and Donner (2006) focus on mobile phones, but do not provide adequate details on the nature of the business relevant communication. Only voice based activities (calling and receiving calls for business) and SMS are observed. However these studies indicate that the phones are basic feature phones in which high value added services are either difficult or impossible to undertake. Fredrick (2014) divides the sample into two - one who uses mobile money and other one not.

Two studies that are not specific to mobile phones (Chadha and Saini, 2014; Jahanshahi et al., 2011) indicates processing of business relevant information much more than voice based and business communication beyond customers, employees and suppliers.

Table 4‑1: Business relevant information processed by the MSMEs

|  |  |
| --- | --- |
| Studies | Inferences for processing business relevant information |
| Chadha and Saini (2014) | Information Technology (IT) is used in the knowledge management practices of the organization: facilitating the processes of capturing, categorizing, and retrieving knowledge and ideas; accessing external information and knowledge on competitors and market changes; facilitating communications effectively when face-to-face communications are not convenient; enhancing the visibility of knowledge; quickly finding documents and people in the organization who have specific knowledge; supporting collaborative works regardless of the time and place. |
| Chew, Ilavarasan and Levy (2012) | The entrepreneurs called and received the calls the customers, employees and suppliers using mobile phones. |
| Chew, Ilavarasan and Levy (2013) | The entrepreneurs called the customers, employees and suppliers using mobile phones. |
| Chew, Levy and Ilavarasan (2011) | The entrepreneurs called the customers, employees and suppliers using mobile phones. |
| Donner (2006) | The entrepreneurs communicated with the customer, employee, colleague/partner and supplier through any one of the three - incoming call plus outgoing call, incoming call plus SMS and outgoing call plus SMS. In the second part of the analysis, emphasis was on the new call partners with whom communication happened after purchase of mobile phones |
| Esselaar, Stork, Ndiwalana and Deen-Swarray (2007) | The SMEs used landlines, mobile phones, faxes, computer and Internet to communicate with clients and customers and to order supplies. They sent and received SMS or Text messages for business purposes. They also uses the internet for business purposes. |
| Fredrick (2014) | Usage of mobile money by the microentrepreneurs. |
| Jahanshahi, Gashti, Khaksar and Pitambar (2011) | 21 items related to five areas of ecommerce: e-marketing, e-advertising, e-CRM, e-Order and delivery, e payment systems by the enterprises. These items are taken as a single factor in further analysis. The relevant activities are: handling customers feedback/queries online; online application/registration; personalized email communication; allowing a customer to contact a sales office; share information with competitors, customers and suppliers; using internet to find out customers’ needs and wants; using internet for anticipating customer needs; achieving customer satisfaction through the electronic channel; electronic Fund Transfer; online credit card processing; coordinating procurement with suppliers online; on-line ordering of software products; tracking incoming and outgoing goods delivery; online order entry and delivery and electronic data interchange. |
| Mwangi and Acosta (2013) | Mobile phones were used by the entrepreneurs in three broad areas: income, profitability and customer base in which following activities are relevant: getting better market prices and information for product and services; obtaining increased support from the government; information about new products and their use and application; received payments from customers in the form of mobile money; advertising through SMS to inform customers about products and services; reducing time to make business arrangement; increasing the speed of communication with customers and suppliers; enhancing frequency of contact with the customers; responding quickly to customer queries and complaints; maintaining customer loyalty even if the customer relocates; and allowing customers to contact any time to report problems and enquiring to visit the shops. |
| Wamuyu and Maharaj (2007) | Usage of mobile technologies which include mobile Internet services and mobile money transfer services. They help the entrepreneurs in accessing up-to-date information to meet their needs and getting information quickly and easily. |

### Networked Devices

The networked devices found to be used by the MSMEs in the final list of papers seem to be limited (Table 4‑2). Four studies (Donner, 2006; Chew et al., 2012; Fredrick, 2014; Mwangi and Acosta, 2013) report MSMEs using the mobile phones exclusively to achieve the outcomes. Four other studies (Chew et al., 2011; 2013; Esselaar et al., 2007; Wamuyu and Maharaj, 2007 ) show mobile phones being used in tandem with other networked devices.

In three studies (Chew et al., 2011; 2013; Esselaar et al., 2007), role played by other devices, fax computer and landlines, are combined to form into a single index of networked devices which is then used for analysis. Wamuyu and Maharaj (2007) have also combined mobile phones with others, but did not make efforts in quantifying the amount of use of networked devices and only one term 'mobile technologies' is used in the analysis. Two papers (Chadha and Saini, 2014; Jahanshahi et al., 2011) mention about advanced networked devices like database management systems, e-document management software and e-commerce applications etc, but usage of these networked devices is not reported in the paper. Overall seven papers studies give clarity on the nature of networked devices and how they are used in the cause and effect relationships. However, there is no disaggregated analysis, if there are multiple networked devices are used by the businesses.

Table 4‑2: Networked devices used by the MSMEs

|  |  |
| --- | --- |
| Studies | Networked Devices |
| Chadha and Saini (2014) | The questionnaire contains - Intranets, Internet, Portals, Database management systems / knowledge based systems, Groupware, Data warehousing / mining, e-Document management system, Dedicated knowledge management software. |
| Chew, Ilavarasan and Levy (2012) | Mobile phones |
| Chew, Ilavarasan and Levy (2013) | Mobile phones, personal computer, laptops, Internet in home and business, use of public calling offices, employees phone use for business, computers at workplace, Internet connection at business, computers to employees. |
| Chew, Levy and Ilavarasan (2011) | Mobile phones, personal computer, laptops, Internet in home and business, use of public calling offices, employees phone use for business, computers at workplace, Internet connection at business, computers to employees. |
| Donner (2006) | Mobile phones |
| Esselaar, Stork, Ndiwalana and Deen-Swarray (2007) | Telephone, mobile phones, computers, fax, Internet |
| Fredrick (2014) | Mobile phones |
| Jahanshahi, Gashti, Khaksar and Pitambar (2011) | Different applications of e-commerce - e-marketing, e-advertising, e-CRM, e-Order and delivery, e payment systems. |
| Mwangi and Acosta (2013) | Mobile phones |
| Wamuyu and Maharaj (2007) | Mobile technologies consists of mobile Internet services and mobile money transfer services. Cellular telephones, smart phones, personal digital assistants , public hotspots, desktop systems, laptops connected to wifi systems. |

### Internal Efficiency & Business Growth

The outcomes of processing business relevant information through the networked devices are summarized in Table 4‑3. Out of the final ten studies, half of them discuss about the impact of networked devices on the internal efficiency. In this set of five studies, only two (Donner, 2006; Esselaar et al, 2007) are explicit about the internal efficiency. The numbers of business calls have increased with the longer use of the mobile phones (Donner, 2006) which is an indicator for internal efficiency. Esselaar et al (2007) found that ICT usage and possession indexes which are combinations of multiple networked devices predict the labour productivity in the MSMEs. These two studies used the facts, either the logs of calls or the turnover values of the enterprises. The data are not perceptual and self-reported.

Rest of the three studies uses composite factors, namely operational support, strategic development and process improvement (Chadha and Saini, 2014), operational performance (Jahanshahi et al., 2011), and operational performance (Wamuyu and Maharaj, 2007). The respondents were asked one of the Likert type responses for a list of items. A disaggregated analysis for each of the factors is not undertaken in these three studies. However, the statistical analysis proves that the networked devices are overall improving the above factors in the enterprises.

The impact of the networked devices seems to be better on the business growth of the MSMEs when compared to the internal efficiency. Eight papers proved that the there is change in growth of the enterprises. Donner (2006) showed evidence that after purchase of mobile phones, business related call partners are new entrants with half of them are customers, thus inferring increase in number of customers. Esselaar et al (2007) identified that the higher ICT expenditure resulted in increase in turnover of the enterprises. Fredrick (2014) showed that profits increased with use of mobile money. These three studies did not use self reported perceptual data as in other studies. The business growth of microenterprises are defined as percentage of increase in income when compared to last year in percentage, as perceived by the respondents in all three studies reported by Chew et al (2011, 2012, 2013). Studies by Jahanshahi et al (2011) and Mwangi and Acosta (2013) used a Likert type responses set to measure the business growth in terms of market share, profits, profitability and increase in customer base and found to be positively influencing.

Table 4‑3: Internal efficiency and business growth of MSMEs

|  |  |  |
| --- | --- | --- |
| Studies | Internal Efficiency | Business Growth |
| Chadha and Saini (2014) | Improves operational support (reliability, content visibility, security, documentation, completeness, systematic storage); Strategic development (knowledge management process improvement, employee participation, decision support, cross-unit performance, competence, integration of systems); and process improvement (speed and accuracy, easy, cost-Effectivess, control and operational efficiency). | NIL |
| Chew, Ilavarasan and Levy (2012) | NIL | Length of mobile phone use and business use of mobile phones leads to growth of microenterprises. |
| Chew, Ilavarasan and Levy (2013) | NIL | Business use of mobile phones results in business growth. |
| Chew, Levy and Ilavarasan (2011) | NIL | Business growth |
| Donner (2006) | Mobile phones increases the proportion of business calls made by the entrepreneurs. | After purchase of mobile phone, business related call partners are more likely to be the new entrants, with almost half of them as customers. |
| Esselaar, Stork, Ndiwalana and Deen-Swarray (2007) | ICT usage, and possession leads to increase in labour productivity. | Higher ICT usage expenditure leads to increase in turnover of SMEs. |
| Fredrick (2014) | NIL | Use of mobile money leads to increase in profits (measured by log of profits last month) |
| Jahanshahi, Gashti, Khaksar and Pitambar (2011) | Application of e-commerce application enhances the operational performance of the MSMEs. new product / service introduction, product / service delivery, marketing effectiveness, customer satisfaction. | Application of e-commerce application enhances the market share |
| Mwangi and Acosta (2013) | NIL | Use of mobile phones induces growth in income, profitability and customer base. |
| Wamuyu and Maharaj (2007) | Mobile usage leads to increase in organizational performance. | NIL |

### Sub - groups analysis

Out of the ten papers that met the inclusion criteria set by the protocol, four papers did not report any sub-group analysis as a part of the findings (Table 4‑4). Though Chadha and Sainin (2014) and Wamuyu and Maharaj (2007) have information on the microentrepreneurs that would allow sub-group analysis across different sizes of MSMEs, education of owners and industrial domains.

The sub-group analysis is clearly presented in only one study (Esselaar et al., 2007) which showed that whether an enterprise is registered with the government, in other words, formality of the businesses differently influences the relationship between ICTs and business growth. ICT usage expenditure is highest for the informal enterprises.

In the multiple regression models used by Chew et al (2011, 2012 & 2013) along with ICTs there are other variables that predict business growth. These variables may not be presented as sub-group analysis, but provides insights on intervening factors. Following are the various variables observed: gender, number of hired workers or size of the enterprise, age and education of the entrepreneurs positively predict the business growth.

However the results are not uniform. Business growth is likely to be higher among the women owned enterprises in Chew et al., 2012, but inverse relationship is present in Fredrick, 2014. The education of the respondents is a positive predictor for growth in Chew at al; (2013), but negative in Donner (2006).

Table 4‑4: Sub-group analysis for outcomes reported in the final papers

|  |  |
| --- | --- |
| Studies | Sub-group analysis |
| Chadha and Saini (2014) | No sub-group analysis is performed on the data and reported in the paper.  The sample description contains information on three industrial segments of the sample - textiles, software and pharmaceutical. Size of the enterprises is not discussed. |
| Chew, Ilavarasan and Levy (2012) | Apart from length of mobile phone use and business use of mobile phones, other predictors - gender, number of hired workers, and age are positively predicting the business growth.  All the microenterprises had less than ten employees. |
| Chew, Ilavarasan and Levy (2013) | Apart from business use of mobile phones and its interaction with entrepreneurial expectations, caste, education, and number of children predictors of business growth.  Only women microentrepreneurs are interviewed for the study. All the microenterprises had less than ten employees. |
| Chew, Levy and Ilavarasan (2011) | Apart from total ICT access, formality status of business negatively predicts the business growth.  All the microenterprises had less than ten employees. |
| Donner (2006) | The longer the mobile phone is used, the more the business calls are made.  The higher the education of the microentrepreneurs, lower the number of business calls are made.  The older owners are less likely to have call partners as new entrants while making business calls.  Better educated owners are more likely to have call partners as new entrants while making business calls.  All the microenterprises had less than five employees. |
| Esselaar, Stork, Ndiwalana and Deen-Swarray (2007) | Formality / registration status of the enterprises differently predict the impact of ICTS on turnover. |
| Fredrick (2014) | Log of profits last month is positively predicted by mobile money usage and market location, and negatively by the gender. Being a female entrepreneur, one is most likely to earn less revenues. |
| Jahanshahi, Gashti, Khaksar and Pitambar (2011) | No sub-group analysis is performed on the data and reported in the paper.  The paper does not report about the size, gender of the owners or any other details of the sample. |
| Mwangi and Acosta (2013) | No sub-group analysis is performed on the data and reported in the paper.  The paper reports about nature of the business as a part of sample description. |
| Wamuyu and Maharaj (2007) | No sub-group analysis is performed on the data and reported in the paper.  The paper reports about number of employees, number of computers, availability of local area network and owners' age and education as a part of sample description. |

## Synthesis of evidence

### Business Growth

The first meta-analysis focuses on the business growth of MSMEs as the dependent. Six studies looked at the impact of business relevant information through networked devices on the growth of the MSMEs (Donner, 2006; Chew.et.al, 2011; Mwangi and Acosta, 2013; Chew.et.al, 2012; Chew.et.al, 2013; Wamuyu and Maharaj, 2007) (Table 4‑5)

Table 4‑5: Quantitative meta-analysis for business growth

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Studies | sample  size (n) | Beta | Standard Dev. | Std. Mean Diff. | t |
| Donner (2006) | 277 | 0.948 | 2.97915 | 0.31821157 | 2.58 |
| Chew, Levy and Ilavarasan (2011) | 231 | 0.154 | 0.36 | 0.43 | 1.861 |
| Mwangi and Acosta (2013) | 100 | 0.49 | 1.72 | 0.284883721 | 1.6 |
| Chew, Ilavarasan and Levy (2012) | 560 | 0.073 | 0.833 | 0.087635054 | 2.082 |
| Chew, Ilavarasan and Levy (2013) | 598 | 0.02 | 0.72 | 0.027777778 | 0.3 |
| Wamuyu and Maharaj (2007) | 570 | 0.419 | 0.44416 | 0.943353746 | 10.01 |

Meta-analysis showed that networked devices have a positive effect on the growth of the MSMEs, that is, networked devices as an intervention leads to the growth of the MSMEs (Table 9). The overall effect size for the six studies is 0.047 with a confidence interval (-0.513, 0.606). This effect size is very small. According to Higgins and Green (2008), a small effect is represented by 0.2, 0.5 for moderate effect and 0.8 for large effect. However the authors also argued that interpretations, such as these, are problematic as the importance of finding is context dependent and not amenable to generic statements.

There was no evidence of variation in effect sizes attributable to heterogeneity (I2 = 0.0%) (Figure 4‑1; Table 4‑6). So we are therefore 95% confident that the effects of the intervention (networked devices) being tested are accurate and therefore can be trusted.

Table 4‑6: Results for the combined effect size on the Business Growth

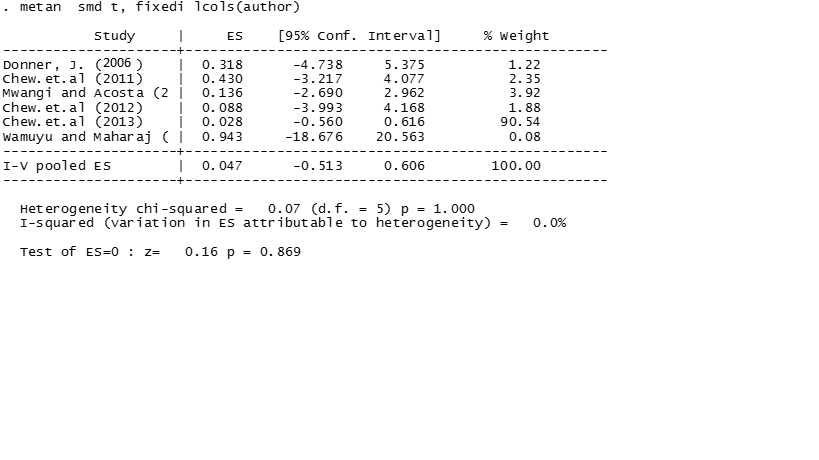
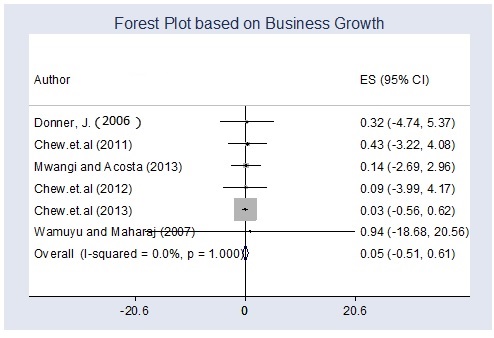


Figure 4‑1: Forest plot of impact on the business growth



As a part of the analysis, we tested for publication bias. According to Dickersin (2005), those studies that exhibit significant results are more likely to be published than those studies that report non-significant results; this may result to publication bias. In this study, we plotted a funnel plot to check for the publication bias in the study (Figure 4‑2). As the studies are not scattered evenly in the funnel, it is deduced that there is presence of publication bias.

Figure 4‑2: Funnel Plot with pseudo 95% confidence limits



Further, Egger’s test was performed to explore whether there is significant publication bias in the study (Table 4‑7). The test confirmed the results of the Funnel Plot that there exists a publication bias (P = 0.008) in the study.

Table 4‑7: Eggers's Test for publication bias in reporting business growth



### Internal efficiency

In the final set of studies, three reported the impact of networked devices on the internal efficiency of MSMEs (Mwangi and Acosta, 2013; Wamuyu and Maharaj, 2007; Jahanshahi.et.al, 2011) (Table 4‑8).

Table 4‑8: Quantitative meta analysis for internal efficiency

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Author | sample size (n) | Beta | SD | SMD | T |
| Mwangi and Acosta (2013) | 100 | 0.49 | 1.72 | 0.284884 | 1.6 |
| Wamuyu and Maharaj (2007) | 570 | 0.58 | 0.71502 | 0.811166 | 14.24 |
| Jahanshahi, Gashti, Khaksar and Pitambar (2011) | 121 | 0.98 | 0.869 | 1.127733 | 8.32 |

The meta-analysis results of the three studies showed that business relevant information through networked devices as an intervention leads to improved internal efficiency, although the overall effect size is not statistically significant at a level of 5 percent (Z=0.21, p=0.837). The overall pooled effect is 0.321 with a 95 percent confidence interval of -2.740 to 3.382 (Table 4‑9). Similarly, just like the case of business growth, there was no evidence of variation in effect sizes attributable to heterogeneity (I2 = 0.0%).

Table 4‑9: Results for the combined effect size on the internal efficiency.



The above analysis indicates that the impact of business relevant information through networked devices does not have any significant impact on the internal efficiency of the MSMEs.

## Summary of results of synthesis

Six studies had reported about the business growth. Meta-analysis showed that networked devices have a positive effect on the growth of the MSMEs, with overall effect size as 0.047 with a confidence interval (-0.513, 0.606). This effect size is very small and much lower for the standard low impact of 0.2.

The value of I2 inferred that the effects of the intervention being tested are accurate and therefore can be trusted. In the funnel plot studies are not scattered evenly in the funnel, inferring the presence of publication bias. Egger's test results have also reinforced the same.

In the final set of studies, three reported the impact of networked devices on the internal efficiency of MSMEs. The meta-analysis results did not support that the business relevant information through networked devices as an intervention lead to improved internal efficiency. The pooled effect was 0.321 (p=0.837).

CHAPTER FIVE

# IMPLICATIONS

Outline of Chapter

The chapter shares the strengths of the review. The implications of the review for different shareholders are given.

## Strengths and limitations of this systematic review

The question undertaken for the review is focused and is filling many important gaps in the extant understanding of causal linkage between ICTs and growth MSMEs. Rather than examining mere ownership of ICTs, the review looked at the important use, processing of business relevant information and its impact on MSMEs. Even in the impact, the review is focused on the internal efficiency and business growth of MSMEs. The location of MSMEs, urban and low and middle income countries is also specific. The boundaries of the review are clearly drawn to avoid any ambiguity which helps in discourses for evidence based policy making in the ICTD domain.

This systematic review have few limitations. First, the meta-analysis showed that this review suffered from the publication bias. The findings from the data extraction should be treated cautiously. The review included only those are published in English. There is a possibility that relevant studies in non-English language would have been left out. We also limited our search to articles from 2000 and onwards by keeping the year of Millennium Development Goals of United Nations as a cut off. This might have left out some appropriate studies done before 2000. The review also focused only on the quantitative studies. The field under review is populated by social science researchers who also use qualitative methods extensively. Inclusion of qualitative studies would have provided insights on the impact of the intervention.

## Implications

The systematic review, as described above, showed that the number of studies that meet the inclusion criteria is only ten, despite the large number of results arrived initially during the literature search. The ICTD domain and the information systems domain still lack adequate causal studies that link the ICTs and access to business relevant information, and growth of MSMEs. The findings of this review is useful to the policy makers of ICTs whose decisions are influenced by many other factors including the evidence-base in the field. They might like to use these findings more cautiously, as the review lacks any RCTs and is based on only ten cross sectional survey based studies. The implications of the present systematic review can be approached from two perspectives: researchers and policy makers.

### Policy

The review showed that the impact of networked devices, through which business information is processed, on the business growth of urban MSMEs seems to be marginal. The business growth of the MSMEs is also determined by other sets of factors in addition to the ICTs. It appears that any ICT driven strategy to strengthen the MSMEs might be ahead of time. The policy makers might like to take these findings cautiously, as the review is of studies with publication bias and is based on ten cross sectional survey based studies. The policy makers should support or encourage RCT based or longitudinal studies to support their decision making.

### Practice

The review highlights the lack of rigorous evidences on the impact of ICTs. It appears to be a right time for the development practitioners to consider the findings from this review in developing future plans and ICT strategies in MSMEs. Practitioners, especially those who are observing the impact of the intervention examined by this review, should encourage researchers to study and document the evidences. The required rigor in reporting as implied for the researchers, as below, shall serve as adequate guidelines while documenting the evidence. They should also be invited to be part of research investigation that informs future debate and dialogue in developing ICT strategies for MSMEs.

### Research

The review is able to highlight the following gaps in the field for future researchers to explore:

We found only ten of studies that meet our inclusion criteria and follow rigorous methodology and reporting. If one were to follow the methodologies that attempt to unravel causal linkages, the future research should move from dominant survey methods. The appropriate methods from experimental designs domain should be adapted. Though difficult but possible to carrying out RCTs in international development, it's surprising not to find a single RCT study for the research question raised by this review.

The sampling techniques followed by the survey based studies have not attempted to use a probability sampling technique. Not belittling the efforts made by the extant researchers, an attempt to scrutinize the methods to increase the generalizability or representativeness of the sample is met with unsatisfactory results. However, there is a possibility that studies that followed rigorous sampling techniques are not included in the review due to weak reporting or non-use of inferential statistics. Despite having the rigor, if one does not establish the causal linkages, the reach of the studies to convince the policy makers shall be minimal.

The location of studies is predominantly Indian and African continent. The list for low and middle income countries contains about hundred names which does not present in the review. There is a need for understanding the impact of ICTs on MSMEs in these countries. For instance, in the ICT development Index 2015 of International Telecommunication Union (ITU, 2015), there are other low and middle income countries ranked better than India (131) and other African countries. Some of them are: Iran (91), Indonesia 9108), Egypt (100) and Sri Lanka (115). These ranks indicate that ICT access is already there and there is a need to study about the impact.

Among the ICTs, mobiles phones are dominant focus of the studies. Some of the ICTs like PCs predate the mobile phones. Not all the business functions can be performed using only mobile phones. The future research can look at the use of other ICTs, in a disaggregated manner, and its impact on the internal efficiency and business growth of the MSMEs. There is likelihood that medium sized enterprises are using ICTs such as Laptop, computer, tablets, and phablets among others. The number of studies on adoption is relatively large, as inferred by the initial results of the literature search. There is a need for understanding the impact of these ICTs after the adoption. These, ‘post adoption studies’, i.e., impact studies are still due, as deduced by this review.

The relationships between ICTs and economic growth or internal efficiency can be recursive in nature. In other words, increase in business growth could result in purchase of ICTs and its use. Except Chew at al. (2011) the final studies did not investigate this. The studies have assumed that ICTs are leading to business growth or internal efficiency, which can be doubted. For instance, increase in income of a microenterprise could result in purchase of mobile phones. Also, purchase of mobile phones can result in increase in income of the same enterprise. Both the directions of the relationships, with respect to time, should be examined by the studies. There is a need for untangling these enlaced relationships.

It's still unclear about the nature of business relevant information that is processed by the networked devices. The review deduced about the information from the nature of ICTs used. Each of the possible business relevant information and their processing, and their linkage with the internal efficiency or business growth of MSMEs should be investigated in future studies.

CHAPTER SIX

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APPENDIX 1.1: Authorship of this report

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Details of Advisory Group membership

Details of Review Group membership

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Conflicts of interest

The team members do not have any conflict of interest in conducting this systematic review.

APPENDIX 2.1: Inclusion and exclusion criteria

|  |  |
| --- | --- |
| Components | Description |
| Participants | Countries: Low and lower middle income countries as defined by World Bank.  Target group: Micro, Small and Medium Enterprises - maximum with 250 employees and annual turnover of less than 50 million Euros. All MSMEs irrespective of size, domain of business (agriculture or not; manufacturing or not) and ownership gender etc) will be included. The studies should have provided segregated analysis for the MSMEs.  Location: Urban. |
| Interventions | Business relevant information enabled by networked (ICT) devices. Business relevant information include communication from employees to owners and themselves that are related to the enterprise, communication with customers, suppliers and partners, informal communication with business friends or networks to gauge the market, on-going market prices of inputs and products, and special MSME policy related information. Networked devices include any electronic tool used by MSMEs that are connected to other similar devices either through Internet or intranet. |
| Comparisons | Among the selected studies, comparison groups will be delineated for analysis. Some of them include, personal vs non-personal networked devices; male vs female owned MSMEs micro vs small and medium enterprises; and Asian vs African countries. |
| Outcomes | Internal efficiency of MSMEs; Business growth of MSMEs. |
| Study types | All the studies that experimental and quasi experimental design are included in the analysis. Exclusive qualitative studies will be omitted.  The analysis of the studies should have undertaken at least inferential statistics.  The studies do not include networked devices or business relevant information as part of investigation shall not be included. |
| Time Frame | Published in 2000 and after. |

APPENDIX 2.1: Search strategy for electronic databases

1. (Afghanistan or Angola or Albania or "American Samoa" or Argentina or Armenia or Armenian or Azerbaijan or Bangladesh or Belarus or Belize or Benin or Bolivia or Bosnia or Herzegovina or Botswana or Brazil or Bulgaria or Burkina Faso or Burkina Fasso or Burundi or Urundi or Cambodia or Cameroon or Cameroons or Cameron or Camerons or Central African Republic or Chad or China or Colombia or Comoros or Comoro Islands or Comores or Congo or Costa Rica or Cuba or Zaire or Cote d'Ivoire or Ivory Coast or Djibouti or Dominica\* or East Timor or East Timur or Timor Leste or Ecuador or Egypt or United Arab Republic or El Salvador or Eritrea or Ethiopia or Fiji or Gabon or Gambia or Gaza or Georgia Republic or Georgian Republic or Ghana or Grenada or Guatemala or Guinea or Guiana or Guyana or Haiti or Honduras or Hungary or India or Indonesia or Iran or Iraq or Kazakhstan or Kenya or Kiribati or Korea or Kosovo or Kyrgyzstan or Kirghizia or Kyrgyz Republic or Kirghiz or Kirgizstan or Lao PDR or Laos or Lebanon or Lesotho or Liberia or Libya or Macedonia or Madagascar or Malagasy Republic or Malawi or Malaysia or Maldives or Marshall Islands or Mali or Mauritania or Mauritius or Agalega Islands or Mexico or Micronesia or Moldova or Moldovia or Moldovian or Mongolia or Montenegro or Morocco or Ifni or Mozambique or Myanmar or Myanma or Burma or Namibia or Nepal or Nicaragua or Niger or Nigeria or Pakistan or Palau or Palestine or Panama or Paraguay or Peru or Philippines or Philipines or Phillipines or Phillippines or Romania or Rwanda or Ruanda or Samoa or Samoan Islands or Sao Tome or Senegal or Serbia or Seychelles or Sierra Leone or Sri Lanka or Solomon Islands or Somalia or South Africa or St Lucia or St Vincent or Grenadines or Sudan or Suriname or Swaziland or Syria or Tajikistan or Tadzhikistan or Tadjikistan or Tadzhik or Tanzania or Thailand or Tonga or Togo or Togolese Republic or Tunisia or Turkey or Turkmenistan or Tuvalu or Uganda or Ukraine or Uzbekistan or Uzbek or Vanuatu or Venezuela or New Hebrides or Vietnam or Viet Nam or West Bank or Yemen or Zambia or Zimbabwe).hw,ti,ab,cp.

2. ((developing or less\* developed or under developed or underdeveloped or middle income or low\* income or underserved or under served or deprived or poor\*) adj (countr\* or nation? or population? or world)).ti,ab.

3. ((developing or less\* developed or under developed or underdeveloped or middle income or low\* income) adj (economy or economies)).ti,ab.

4. (low\* adj (gdp or gnp or gross domestic or gross national)).ti,ab.

5. (low adj3 middle adj3 countr\*).ti,ab.

6. (lmic or lmics or third world or lami countr\*).ti,ab.

7. transitional countr\*.ti,ab.

8. exp Developing Countries/

9. or/1-8

10. (SMEs or MSMEs or enterprise\* or business\* or microenterprise\* or microbusiness\* or entrepreneur\* or microentrepreneur\* or self-employ\* or owner\* or businessman or businessmen or businesswoman or businesswomen or "self-help group\*" or cooperative\* or "social enterprise\*" or Start-up\* or incubators or "born global\*").ti,ab,sh.

11. (Laptop\* or computer\* or PC or Internet or landline\* or telephone\* or mobile\* or phone\* or cell or cellphone\* or smartphone\* or CSCs or telecenter\* or telecentre\* or Wifi or WLAN or GDPRS or messaging or digital or ipad\* or iphone\* or apple or android or windows or broadband or wireless or wireline or CDMA or SMS or text\* or MMS or facebook or linkedin or network\* or Intranet or "discussion list\*" or contacts or "online forum" or "discussion thread\*" or "online feedback" or ICT or ICTs or "communication technolog\*" or "information systems").ti,ab,sh.

12. 9 and 10 and 11

13. limit 12 to yr="2000 -Current" –

APPENDIX 2.2: Computation of effect size

A key step in meta-analysis is the computation of the effect size. It is used to determine the scope of the relationship between networked devices and internal efficiency and business growth of MSMEs.

The effect sizes for each study were computed for the papers where data were available. We followed Petrosino et al. (2012) in the use of standardised mean differences (SMDs) for synthesising the continuous outcomes. The formula used to compute the effect sizes is as below:

Computation for the standardised mean difference, SMD =

smd=(Beta (β))/s\_p

Where β is the standardised coefficient for the independent variable (e.g. use of mobile phones) and s\_p is the standard deviation of the whole sample population.

In cases where s\_p was not given, we computed the value based on standard error (SE);

SE=(Standard deviation (s\_p))/√n

Standard deviation (s\_p )=SE√n

APPENDIX 2.3: Journals hand-searched

Institutional databases

• Infodev

• World Bank

• DIME

• World Bank

• JOLIS

• IMF

• World Bank

• DFID’s Research for Development

• IDRC’s Digital Library

• IDEAS

• J-PAL

• ELDIS

• British Library of Development studies

• Millennium challenge

• USAid

• FAO

• UK Theses Ethos

• US/Canada Dissertations

• SSRN.

ACM Press, IEEE Xplore Digital Library and AIS Electronic Library

APPENDIX 2.4: EPPI-Centre keyword sheet including review-specific keywords

[You do not need to include the EPPI-Centre keyword sheet – this will be added in later. Please include only review-specific keywords.]

Review-specific keywords

ICTs

Impact

Micro, small and medium enterprises

Business relevant information

Internal efficiency

Business growth

Mobile phones

Low and middle income countries

Urban

APPENDIX 3.1: A summary of the final studies

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| SNO | Authors | Summary | Country | Method of data collection | Sample | Sampling technique | Only quantitative method | Statistical Analysis |
| 1 | Chadha, S. K., and Saini, R. (2014) | Information technology tools enabled better knowledge management practices in organizations | India | Survey | 260 C level executives of SMEs | Judgemental-cum-convenience sampling | Yes | Structural equation model |
| 2 | Chew, H. E., Ilavarasan, P. V., and Levy, M. R. (2012) | After three years, use of mobile phone in business results in better business growth | India | Survey | 560 microentrepreneurs | Three stage random cluster sampling | Yes | multiple regression analysis |
| 3 | Chew, H. E., Ilavarasan, P. V., and Levy, M. R. (2013) | Mobile phones when used for business by entrepreneurs who high entrepreneurial expectations results in higher business growth | India | Survey | 335 microentrepreneurs | Three stage random cluster sampling | Yes | Hierarchical multiple regression analysis |
| 4 | Chew, H. E., Levy, M., and Ilavarasan, P V. (2001) | Impact of ICTs on growth of female owned microenterprises is present, but in a small or limited amount. | India | Survey | 231 Microentrepreneurs | Three stage random cluster sampling | Yes | Structural equation model |
| 5 | Donner, J. (2006) | Mobile ownership influences the proportion of business-related calls and enhances the business network for the microentrepreneurs | Rwanda | Survey | 277 Microentrepreneurs | Convenience sampling | Yes | Fractional logit model & Logistic Regression |
| 6 | Esselaar, S., Stork. C., Ndiwalana, A., and Deen-Swarray, M. (2007) | ICT usage expenditure, ICT usage and possession influences turnover and labour productivity of the SMEs. | 13 African Countries | Survey | 3691 SME entrepreneurs | Convenience sampling method | Yes | Kruskal-Wallis test & Regression analysis. |
| 7 | Fredrick, L. I. (2014) | Use of mobile money results in marginal increase in profits among the microenterprises | Zambia | Survey | 430 micro-entrepreneurs | Cluster sampling | Yes | Multiple regression analysis |
| 8 | Jahanshahi, A. A., Gashti, M. A., Khaksar, SMS, and Pitambar, B. K. (2011) | Use of e-commerce applications improves the operational performance of SMEs | India | Survey | 121 (Unclear about the respondents) | Stratified random sampling. | Yes | Path analysis |
| 9 | Mwangi, G. W., and Acosta, F. R. (2013) | Mobile phone usage increases the on the growth of microenterprises measured by income, customer base and profitability | Kenya and Tanzania | Survey | 100 microentrepreneurs | Purposeful sampling method | Yes | Regression analysis & Descriptive statistics |
| 10 | Wamuyu, P., and Maharaj, M. (2007) | Use of mobile internet services and Mobile money transfer services facilitate adoption of e-commerce application which results in better organizational performance. | Kenya | Survey | 530 - entrepreneurs or key managers | Proportionate stratified sampling | Yes | Structural equation model |

APPENDIX 3.2: Details of studies included in the systematic map and review

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| Chadha, S. K., & and Saini, R. (2014). Information Technology Support to Knowledge Management Practices: A Structural Equation Modeling Approach, IUP Journal of Knowledge Management, 12(1), 39-52. | |
| Summary | Information technology tools enabled better knowledge management practices in organizations |
| Country | India |
| Method of data collection | Survey |
| Sample | 260 C level executives of SMEs |
| Sampling technique | Judgemental-cum-convenience sampling |
| Only quantitative method | Yes |
| Statistical Analysis | Structural equation model |
| Inferences for processing business relevant information | Information Technology (IT) is used in the knowledge management practices of the organization: facilitating the processes of capturing, categorizing, and retrieving knowledge and ideas; accessing external information and knowledge on competitors and market changes; facilitating communications effectively when face-to-face communications are not convenient; enhancing the visibility of knowledge; quickly finding documents and people in the organization who have specific knowledge; supporting collaborative works regardless of the time and place. |
| Networked Devices | The questionnaire contains - Intranets, Internet, Portals, Database management systems / knowledge based systems, Groupware, Data warehousing / mining, e-Document management system, Dedicated knowledge management software. |
| Internal Efficiency | Improves operational support (reliability, content visibility, security, documentation, completeness, systematic storage); Strategic development (knowledge management process improvement, employee participation, decision support, cross-unit performance, competence, integration of systems); and process improvement (speed and accuracy, easy, cost-Effectivess, control and operational efficiency). |
| Business Growth | NIL |
| Sub-group analysis | No sub-group analysis is performed on the data and reported in the paper. The sample description contains information on three industrial segments of the sample - textiles, software and pharmaceutical. Size of the enterprises is not discussed. |

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| Chew, H. E., Ilavarasan, P. V., & Levy, M. R. (2012). A latency effect for mobile phone investments by microentrepreneurs, Media Asia, 39(2), 99-10. | |
| Summary | After three years, use of mobile phone in business results in better business growth |
| Country | India |
| Method of data collection | Survey |
| Sample | 560 microentrepreneurs |
| Sampling technique | Three stage random cluster sampling |
| Only quantitative method | Yes |
| Statistical Analysis | multiple regression analysis |
| Inferences for processing business relevant information | The entrepreneurs called and received the calls the customers, employees and suppliers using mobile phones. |
| Networked Devices | Mobile phones |
| Internal Efficiency | NIL |
| Business Growth | Length of mobile phone use and business use of mobile phones leads to growth of microenterprises. |
| Sub-group analysis | Apart from length of mobile phone use and business use of mobile phones, other predictors - gender, number of hired workers, and age are positively predicting the business growth.  All the microenterprises had less than ten employees. |

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| Chew, H. E., Ilavarasan, P. V., & Levy, M. R. (2013). When there’s a will, there might be a way: The Economic Impact of Mobile Phones and Entrepreneurial Motivation on Female-owned Microenterprises, Proceedings of the Sixth International Conference on Information and communication Technologies and Development, Cape Town, South Africa, Vol. 1, 196-204. | |
| Summary | Mobile phones when used for business by entrepreneurs who high entrepreneurial expectations results in higher business growth |
| Country | India |
| Method of data collection | Survey |
| Sample | 335 microentrepreneurs |
| Sampling technique | Three stage random cluster sampling |
| Only quantitative method | Yes |
| Statistical Analysis | Hierarchical multiple regression analysis |
| Inferences for processing business relevant information | The entrepreneurs called the customers, employees and suppliers using mobile phones. |
| Networked Devices | Mobile phones, personal computer, laptops, Internet in home and business, use of public calling offices, employees phone use for business, computers at workplace, Internet connection at business, computers to employees |
| Internal Efficiency | NIL |
| Business Growth | Business use of mobile phones results in business growth. |
| Sub-group analysis | Apart from business use of mobile phones and its interaction with entrepreneurial expectations, caste, education, and number of children predictors of business growth.  Only women microentrepreneurs are interviewed for the study. All the microenterprises had less than ten employees. |

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| Chew, H. E., Levy, M.R & Ilavarasan, P V. (2011). The limited impact of ICTs on microenterprise growth: A study of businesses owned by women in urban India, Information Technologies and International Development, 7(4), 1-16. | |
| Summary | Impact of ICTs on growth of female owned microenterprises is present, but in a small or limited amount. |
| Country | India |
| Method of data collection | Survey |
| Sample | 231 Microentrepreneurs |
| Sampling technique | Three stage random cluster sampling |
| Only quantitative method | Yes |
| Statistical Analysis | Structural equation model |
| Inferences for processing business relevant information | The entrepreneurs called the customers, employees and suppliers using mobile phones. |
| Networked Devices | Mobile phones, personal computer, laptops, Internet in home and business, use of public calling offices, employees phone use for business, computers at workplace, Internet connection at business, computers to employees. |
| Internal Efficiency | NIL |
| Business Growth | Business growth |
| Sub-group analysis | Apart from total ICT access, formality status of business negatively predicts the business growth.  All the microenterprises had less than ten employees. |

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| Donner, J. (2006). The use of mobile phones by microentrepreneurs in Kigali, Rwanda: Changes to social and business networks, Information Technologies and International Development, 3 (2), 3-19. | |
| Summary | Mobile ownership influences the proportion of business-related calls and enhances the business network for the microentrepreneurs |
| Country | Rwanda |
| Method of data collection | Survey |
| Sample | 277 Microentrepreneurs |
| Sampling technique | Convenience sampling |
| Only quantitative method | Yes |
| Statistical Analysis | Fractional logit model & Logistic Regression |
| Inferences for processing business relevant information | The entrepreneurs communicated with the customer, employee, colleague/partner and supplier through any one of the three - incoming call plus outgoing call, incoming call plus SMS and outgoing call plus SMS. In the second part of the analysis, emphasis was on the new call partners with whom communication happened after purchase of mobile phones |
| Networked Devices | Mobile phones |
| Internal Efficiency | Mobile phones increases the proportion of business calls made by the entrepreneurs. |
| Business Growth | After purchase of mobile phone, business related call partners are more likely to be the new entrants, with almost half of them as customers. |
| Sub-group analysis | The longer the mobile phone is used, the more the business calls are made.  The higher the education of the microentrepreneurs, lower the number of business calls are made. The older owners are less likely to have call partners as new entrants while making business calls. Better educated owners are more likely to have call partners as new entrants while making business calls. All the microenterprises had less than five employees. |

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| Esselaar, S., Stork, C., Ndiwalana. A, & Deen-Swarray, M., (2007). ICT usage and its impact on profitability of SMEs in 13 African countries, Information Technologies and International Development, 4 (1), 87-100. | |
| Summary | ICT usage expenditure, ICT usage and possession influences turnover and labour productivity of the SMEs. |
| Country | 13 African Countries |
| Method of data collection | Survey |
| Sample | 3691 SME entrepreneurs |
| Sampling technique | Convenience sampling method |
| Only quantitative method | Yes |
| Statistical Analysis | Kruskal-Wallis test & Regression analysis. |
| Inferences for processing business relevant information | The SMEs used landlines, mobile phones, faxes, computer and Internet to communicate with clients and customers and to order supplies. They sent and received SMS or Text messages for business purposes. They also uses the internet for business purposes. |
| Networked Devices | Telephone, mobile phones, computers, fax, Internet |
| Internal Efficiency | ICT usage, and possession leads to increase in labour productivity. |
| Business Growth | Higher ICT usage expenditure leads to increase in turnover of SMEs. |
| Sub-group analysis | Formality / registration status of the enterprises differently predict the impact of ICTS on turnover. |

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| Frederick, Laura I. (2014). Impact of Mobile Money Usage on Microenterprise Evidence from Zambia Master's Theses, University of San Francisco, Paper 92. Retrieved 10 July 2014 from <http://repository.usfca.edu/cgi/viewcontent.cgi?article=1099&context=thes> | |
| Summary | Use of mobile money results in marginal increase in profits among the microenterprises |
| Country | Zambia |
| Method of data collection | Survey |
| Sample | 430 micro-entrepreneurs |
| Sampling technique | Cluster sampling |
| Only quantitative method | Yes |
| Statistical Analysis | Multiple regression analysis |
| Inferences for processing business relevant information | Usage of mobile money by the microentrepreneurs. |
| Networked Devices | Mobile phones |
| Internal Efficiency | NIL |
| Business Growth | Use of mobile money leads to increase in profits (measured by log of profits last month) |
| Sub-group analysis | Log of profits last month is positively predicted by mobile money usage and market location, and negatively by the gender. Being a female entrepreneur, one is most likely to earn less revenues. |

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| Jahanshahi, A. A., Gashti, M. A., Khaksar, S.M.S, & Pitambar, B. K. (2011). Electronic Commerce Applications among Indian Small and Medium Enterprises, Information Management and Business Review, 2(6), 276-286. | |
| Summary | Use of e-commerce applications improves the operational performance of SMEs |
| Country | India |
| Method of data collection | Survey |
| Sample | 121 (Unclear about the respondents) |
| Sampling technique | Stratified random sampling. |
| Only quantitative method | Yes |
| Statistical Analysis | Path analysis |
| Inferences for processing business relevant information | 21 items related to five areas of ecommerce: e-marketing, e-advertising, e-CRM, e-Order and delivery, e payment systems by the enterprises. These items are taken as a single factor in further analysis. The relevant activities are: handling customers feedback/queries online; online application/registration; personalized email communication; allowing a customer to contact a sales office; share information with competitors, customers and suppliers; using internet to find out customers’ needs and wants; using internet for anticipating customer needs; achieving customer satisfaction through the electronic channel; electronic Fund Transfer; online credit card processing; coordinating procurement with suppliers online; on-line ordering of software products; tracking incoming and outgoing goods delivery; online order entry and delivery and electronic data interchange. |
| Networked Devices | Different applications of e-commerce - e-marketing, e-advertising, e-CRM, e-Order and delivery, e payment systems. |
| Internal Efficiency | Application of e-commerce application enhances the operational performance of the MSMEs. new product / service introduction, product / service delivery, marketing effectiveness, customer satisfaction. |
| Business Growth | Application of e-commerce application enhances the market share |
| Sub-group analysis | No sub-group analysis is performed on the data and reported in the paper. The paper does not report about the size, gender of the owners or any other details of the sample. |

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| Mwangi, G., & Acosta, F. (2013). Mobile phones and Growth of microenterprises: A case of Safaricom' "Zidisha Biashara customers, Business & Economic Review, 23(1), 105-135. | |
| Summary | Mobile phone usage increases the on the growth of microenterprises measured by income, customer base and profitability |
| Country | Kenya and Tanzania |
| Method of data collection | Survey |
| Sample | 100 microentrepreneurs |
| Sampling technique | Purposeful sampling method |
| Only quantitative method | Yes |
| Statistical Analysis | Regression analysis & Descriptive statistics |
| Inferences for processing business relevant information | 21 items related to five areas of ecommerce: e-marketing, e-advertising, e-CRM, e-Order and delivery, e payment systems by the enterprises. These items are taken as a single factor in further analysis. The relevant activities are: handling customers feedback/queries online; online application/registration; personalized email communication; allowing a customer to contact a sales office; share information with competitors, customers and suppliers; using internet to find out customers’ needs and wants; using internet for anticipating customer needs; achieving customer satisfaction through the electronic channel; electronic Fund Transfer; online credit card processing; coordinating procurement with suppliers online; on-line ordering of software products; tracking incoming and outgoing goods delivery; online order entry and delivery and electronic data interchange. |
| Networked Devices | Different applications of e-commerce - e-marketing, e-advertising, e-CRM, e-Order and delivery, e payment systems. |
| Internal Efficiency | Application of e-commerce application enhances the operational performance of the MSMEs. new product / service introduction, product / service delivery, marketing effectiveness, customer satisfaction. |
| Business Growth | Application of e-commerce application enhances the market share |
| Sub-group analysis | No sub-group analysis is performed on the data and reported in the paper. |

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| --- | --- |
| Wamuyu, P., & Maharaj. M. (2011). Factors influencing successful use of mobile technologies to facilitate E-Commerce in small enterprises: The case of Kenya, The African Journal of Information Systems, 3(2), 48-71. | |
| Summary | Use of mobile internet services and Mobile money transfer services facilitate adoption of e-commerce application which results in better organizational performance. |
| Country | Kenya |
| Method of data collection | Survey |
| Sample | 530 - entrepreneurs or key managers |
| Sampling technique | Proportionate stratified sampling |
| Only quantitative method | Yes |
| Statistical Analysis | Structural equation model |
| Inferences for processing business relevant information | Mobile phones were used by the entrepreneurs in three broad areas: income, profitability and customer base in which following activities are relevant: getting better market prices and information for product and services; obtaining increased support from the government; information about new products and their use and application; received payments from customers in the form of mobile money; advertising through SMS to inform customers about products and services; reducing time to make business arrangement; increasing the speed of communication with customers and suppliers; enhancing frequency of contact with the customers; responding quickly to customer queries and complaints; maintaining customer loyalty even if the customer relocates; and allowing customers to contact any time to report problems and enquiring to visit the shops. |
| Networked Devices | Mobile phones |
| Internal Efficiency | NIL |
| Business Growth | Use of mobile phones induces growth in income, profitability and customer base. |
| Sub-group analysis | The paper reports about nature of the business as a part of sample description. |

1. According to the World Bank, “ICTs consists of the hardware, software, networks, and media for the collection, storage, processing, transmission and presentation of information (voice, data, text, images), as well as related services." (ICT Glossary Guide). [↑](#footnote-ref-1)
2. For instance, <http://www.infodev.org/infodev-files/resource/InfodevDocuments_19.pdf> [↑](#footnote-ref-2)
3. see here for detailed multi-country studies <http://lirneasia.net/projects/2008-2010/bop-teleuse-3/>. [↑](#footnote-ref-3)
4. a smartphone having a screen which is intermediate in size between that of a typical smart phone and a tablet computer. (Source: http://www.oxforddictionaries.com/definition/english/phablet) [↑](#footnote-ref-4)
5. <http://ec.europa.eu/enterprise/policies/sme/files/sme_definition/sme_user_guide_en.pdf> [↑](#footnote-ref-5)
6. An attempt is being made at systematic review of impact of mobile phones on rural enterprises and households (see here for further details http://www.3ieimpact.org/en/evidence/systematic-reviews/details/249/). Duncombe (2015) provides a systematic review on role of mobile phones on agriculture and rural development. The proposed review differs in terms of focus on networked devices, internal efficiency and business growth of microenterprises located in urban localities. [↑](#footnote-ref-6)
7. for instance, Govt, of India is giving $ 2 billion worth free mobiles, tablets to student community. <http://www.financialexpress.com/news/rs-10000-cr-plan-in-the-works-to-give-free-mobiles-tablet-s/1165642> [↑](#footnote-ref-7)
8. <http://data.worldbank.org/about/country-classifications/country-and-lending-groups#Low_income> [↑](#footnote-ref-8)
9. <http://www.un.org/millenniumgoals/global.shtml> [↑](#footnote-ref-9)
10. We are thankful to Mr. John Eyers who served as information scientist for this project. [↑](#footnote-ref-10)
11. Further details are here: http://eppi.ioe.ac.uk/cms/Default.aspx?tabid=2967 [↑](#footnote-ref-11)