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## Technology for street traders in Tanzania: A design science research approach

Nasibu Mramba<sup>1</sup>, Mikko Apiola<sup>2\*</sup>, Emmanuel Awuni Kolog<sup>2</sup>, and Erkki Sutinen<sup>3</sup>

<sup>1</sup>College of Business Education (CBE), Dar es Salaam, Tanzania

<sup>2</sup>School of Computing, University of Eastern Finland (UEF), Finland

<sup>3</sup>Department of Information Technology, University of Turku (UTU), Finland

\*Corresponding author email: [mikko.apiola@ieee.org](mailto:mikko.apiola@ieee.org)

The informal sector employs the major part of workers in developing countries. Street trading is a common form of informal work. Despite its huge economic value in developing countries, little research is being done to improve street traders' empowerment and entrepreneurship. Also, development informatics is over-focused on social development and under-focused on economic development. This study takes a design science research (DSR) approach in order to identify barriers for street traders in Dar es Salaam, Tanzania, that can be addressed with technology. As a follow-up to our previous qualitative study, a questionnaire was administered to a sample of ( $N = 285$ ) street traders. The data was analysed using mixed methods. The results show that street traders operate in a challenging environment, and make most of their decisions based on tacit knowledge. Traders are restrained by unreliable business information, weak business strategies, and access to capital. A variety of technology innovations, such as customer-client matchmaking, and record keeping are proposed to directly address the daily challenges of street traders. Future technology projects form exciting possibilities for technology experts, students, and scholars globally. The expected future implications of this project are increased STI capacities, economic growth, and human development.

**Keywords:** Design science research (DSR), developing countries, entrepreneurship, innovation, informal workers, ICT4D, street traders, street vendors, Tanzania

**JEL classification:** C93, N67, L26, O35, Q55, E26

### Introduction and background

In many developing countries, two economic systems (the formal and the informal) operate in parallel. In sub-Saharan Africa, formal employment is the exception rather than the rule: an approximated 72% of employment in north and sub-Saharan Africa is informal (Webb et al. 2013). The estimated impact of informal work to gross national products (GNP) in developing countries is significant (Webb et al. 2013; Sparks and Barnett 2010). The informal economy typically consists of small and micro enterprises, self-employment, street trading, smallholder farming, or selling of agricultural products (Wongtada 2014; Böhme and Thiele 2011). The informal economy lacks labour legislation and social protection schemes, and is characterised by survival rather than opportunity. Studies show that informal and formal economies are interlinked in many ways with regard to distribution channel, product demand and flow, and product supply chains (Böhme and Thiele 2011; Xaba 2012). The most common form of informal work in Dar es Salaam, which is the economic hub of Tanzania, is street trading.

A review of street trading research (Wongtada 2014) shows that more research is needed on several viewpoints to street trading: personal factors, human capital (skills, education, experience, social networks), environment factors (coercion, competition), customer relationships, social capital, financial capital and constraints, strategy (site selection, management, planning, and dealing with coercion), and success factors (Wongtada 2014). In addition, research about practical interventions that empower informal economic workers is rare. It has been argued that, in general, despite its huge economic

impact, there is little research of the informal economy from an entrepreneurship perspective (Webb et al. 2013). Moreover, educational interventions to improve informal workers' business skills are rare (Wongtada 2014).

On the other hand, it is widely acknowledged that developing countries need to improve their capacities in science, technology, and innovation (STI) (e.g. Trojer et al. 2014). However, there is a gap between adoption of e-commerce systems in developing countries and understanding about the informal economy. Several researchers have studied e-commerce in developing countries (for a review, see Boateng et al. 2008) from various viewpoints, but often with disregard of the distinction between informal and formal economic systems. Moreover, current development informatics research is over-focused on social development and under-focused on economic development (Heeks 2014, 17).

ICT4D (information and communication technologies for development) as an academic discipline is often conducted by social scientists and over-focuses on evaluating the feasibility of existing technologies rather than designing new ones (Sutinen and Tedre 2010). We argue that it is important for ICT4D to integrate more with design science research (DSR) (Hevner 2007) in order to construct technological solutions that are adapted to the demands and requirements of people in developing regions. This is well aligned with arguments from the information systems (IS) perspective, which call for expansion of IS to new areas such as development research, with increased DSR and action research approaches that construct new artifacts and study how well they work (Walsham 2012).

This study presents the initial stages of a DSR study which aims to improve Tanzanian street traders' business prospects with technological solutions. More specifically, this study takes a mixed-methods approach to explore the business activities and challenges of street traders in Dar es Salaam,<sup>1</sup> Tanzania. This study explores the street traders' daily business, and identifies a number of potential future technological ideas for increasing the empowerment and entrepreneurship of street traders.

### **Related research**

There is a lack of research on the application of e-commerce in street trading in Tanzania. However, Kabanda and Brown (2015), Makame et al., (2014), Mlozi et al., (2010), and Oreku et al. (2013) have studied e-commerce in the context of Tanzanian SMEs. The findings of these studies show the potentials of employing ICT in small business, yet they point to the low level of e-commerce adoption in small and medium enterprises. Low level of e-commerce adoption, usage, and acceptance in Tanzania is attributed to lack of awareness, resources, readiness, support, infrastructure, and social factors (Kabanda and Brown 2015; Makame, Kang and Park 2014). Among e-commerce tools, mobile phones are the predominant device used by the majority of small business owners in Africa (Kabanda and Brown 2015). Mobile phones are mostly preferred, because they require only basic literacy, they are cheap, portable and easily accessible (Mlozi et al. 2010; Kabanda and Brown 2015). With regard to Tanzanian informal workers, and specifically street traders, there is a lack of research on technological solutions, including e-commerce. Given the estimated high economic impact of informal work, this is a serious lack.

### **Design science research (DSR)**

While empirical research describes, explains and predicts the world, design science research (DSR) aims to improve the world by developing and studying the development and impact of technological artifacts from a variety of perspectives (Johannesson and Perjons 2015, 1–19). A common driving force behind typical DSR projects is the desire to improve an environment by technological artifacts (Hevner 2007). Complementary to the *local* improvement, a DSR project contributes to the *global* knowledge base.

DSR projects typically start by providing requirements for research (e.g. what is the problem to be addressed with technology), and proceeds to design, construct, and evaluate suitable technological solutions (Hevner 2007). Johannesson and Perjons (2014, 75–89) present a guiding framework for DSR projects, which defines the typical stages of DSR projects as: *problem explication*, *requirement definition*, *design and development*, *demonstration*, and *evaluation*. Each of the stages makes use of a combination of research, design, and engineering strategies and methods including qualitative and quantitative research methods (Johannesson and Perjons, 75–89).

This study covers the beginning stages of a DSR project (Hevner 2007), and focuses on the *problem explication* (Johannesson and Perjons, 91–102) and *requirement definition* (Johannesson and Perjons, 103–116) stages. The

common objective for the initial stages of a DSR project is to identify and represent opportunities, problems, and potential technology solutions in a given environment (Hevner 2007). The *problem explication* stage of DSR aims to identify problems experienced by stakeholders of a given practice. The *requirement definition* stage aims to identify or outline potential artifacts that can address the explicated problems (Johannesson and Perjons, 103–116).

Both the *problem explication*, and *requirement definition* stages typically make use of surveys, interviews, case studies, and action research (Johannesson and Perjons 2014, 75–89). In this study, we have used mixed-methods research, and specifically the sequential research design, where qualitative exploration is followed by quantitative data collection (Cresswell 2014).

### **Common entrepreneurial domains**

The fundamental domains for entrepreneurship and business are marketing, bookkeeping, management and strategic planning (Pride and Ferrell 2015; Kotler and Keller 2015; Thumarak 2007; Taylor 2004; Kourdi 2009). Weak skills in any of these have a negative impact on business success, also in small businesses (e.g. Mramba et al. 2015). In this study, the street traders' daily activities are looked at through the lens of these business domains, introduced briefly in the forthcoming subsections. There are several reasons for why this was done.

First, these entrepreneurial domains have been proven to have a significant impact for the success of businesses of all sizes, which makes them an important lens also in the context of street trading. Second, although street trading has been studied from different perspectives in different parts of the world, no previous studies have used this lens to study street trading in Dar es Salaam, Tanzania. Third, although studies have targeted e-commerce in Tanzanian companies, those studies have not targeted street traders. Fourth, this is an essential lens from a DSR perspective, where it is vital to understand business actions first before it is possible to design technological artifacts that produce positive change.

### **Marketing**

Marketing is an activity of informing people about the value of a product or service in the purpose of inviting potential customers to buy (e.g. Pride and Ferrell 2015; Kotler and Keller 2015). A well-known form of marketing is *word-of-mouth (WOM)*, in which information about a product is spread in day-to-day communication with people. Other forms of marketing include social marketing, mass marketing through the Internet, and electronic WOM. Traditional marketing management decisions also involve identifying customer needs, making decisions on products, setting the price, placement of products, and customer profiling. Successful marketing is considered to be one of the key factors of success in businesses of all sizes (e.g. Pride and Ferrell 2015; Kotler and Keller 2015).

### **Bookkeeping**

Bookkeeping is the art of systematically recording financial transactions including purchases, sales, receipts, and payments (Thumarak 2007). Typical examples of

bookkeeping are single-entry bookkeeping and double-entry bookkeeping. However, any process of recording transactions is considered bookkeeping. There is a strong positive relationship between record keeping and performance of enterprises of all scales. Keeping accurate records is a powerful source for decision making, which invariably affects performance of businesses. The common bookkeeping records kept by small businesses are daybooks including receipts of payments, inventory, purchases, and sales. (Thumarak 2007) Many micro businesses in Africa do not keep good records of their business, and sometimes business records are memorised only (Tushabomwe-Kazooba 2006).

### **Management**

Management is the art of organising and coordinating business functions in an efficient way (Taylor 2004). Management involves harnessing human, physical, and financial resources to accomplish business success. Business management requires analysis, time, interpersonal, communication and conceptual skills. Lack of management skills has been highlighted as a cause of business failure. Small business managers require management skills like planning, controlling, evaluation, time, communication, and interpersonal skills for smooth business management. (Taylor 2004). As management is essential for business success, it is important to understand street traders' management activities more thoroughly.

### **Strategic planning**

Strategic planning is the activity of planning the direction for the future of a business. This involves decision making on resource allocation, control mechanisms, diagnosing the business environment and competitive situation, a guiding policy on what the business intends to accomplish, and an action plan for achieving the guiding policy. Strategic planning may involve the consideration of strengths and weaknesses of one's business, personal values of key workers, opportunities of the environment, and broader societal expectations (Porter 1980). For informal workers, strategic planning may involve anti-coercion strategies, survival strategies, business operational strategies, strategies to combat losses, and strategies to deal with theft and corruption. (Lyons 2013; Bhowmik 2005; Wongtada 2014)

### **Research questions**

DSR projects typically start by providing requirements for research (e.g. what the problem is to be addressed with technology). This study covers the initial stages of a design science research (DSR) project that targets street traders of Dar es Salaam with technological solutions, and uses mixed methods as its research strategy (Cresswell 2014).

The specific aim of this research is to explore street trading in Dar es Salaam from an entrepreneurship perspective in order to identify potential future technological innovations. This aim is approached through the following objectives: (1) to identify the entrepreneurial needs, strengths, limitations, and types of work undertaken by street traders, and (2) to identify the technological innovation possibilities that arise from the entrepreneurial

needs, strengths, limitations, and types of work undertaken by street traders. The following research questions were set:

- RQ<sub>1</sub>: What are the entrepreneurial needs, strengths, limitations, and types of work undertaken by street traders in Dar es Salaam?
- RQ<sub>2</sub>: What technology innovation possibilities arise from the entrepreneurial needs, strengths, limitations, and types of work undertaken by street traders in Dar es Salaam?

Setting the research aims, objectives, and questions were directed by the common entrepreneurial domains introduced above. This means that although the street traders have many *needs, strengths, limitations*, and may conduct various *types of work*, this study focused mainly on aspects that relate directly to entrepreneurship. In this study, this was achieved by looking at the research through the lens of the common entrepreneurial domains introduced above, which are *marketing, bookkeeping, management, and strategic planning*.

### **Methods and data**

This research reports the first stages of a DSR project, where the objective is to provide requirements for technology innovation. The research was performed by following the sequential research design of the mixed-methods research, where qualitative exploration is followed by quantitative data collection (Cresswell 2014). The study is a direct continuation of a qualitative study that was reported in Mramba et al. (2015), which consisted of preliminary interviews with 19 street traders, notebook data, photos, researcher diaries, and four focus group discussions (FGD) with a total of 20 street traders. The themes for the FGDs were built around the common entrepreneurial domains introduced above (marketing, bookkeeping, management, strategic planning). The data analysis was performed by using qualitative content analysis (Denscombe 2010, 281). The results were reported in Mramba et al. (2015).

For the purposes of the study, the central themes arising from the qualitative study (Mramba et al. 2015) were combined into a structured questionnaire. Thus, the qualitative data was extended by collecting quantitative data in order to give statistical power to the findings, as suggested by Creswell (2014). The questionnaire consisted of 100 items on a 7-point Likert scale (1 = not at all true, 2 = very little true, 3 = slightly true, 4 = moderately true, 5 = quite true, 6 = very true, 7 = completely true), and was administered to a sample of  $N = 285$  street traders in Dar es Salaam, Tanzania. A total of 265 questionnaires were returned, and 245 of those qualified for data analysis. Thus, the questionnaire received an 85% ( $n = 245$ ) response rate. The sample was a convenience sample (Creswell 2014), and it was drawn from 23 districts that belong to three municipalities of Dar es Salaam city: Temeke, Ilala, and Kinondoni. Street traders within the age range 18–35 and who had business experience for more than one year were selected for the sample. The collected quantitative data were analysed by using descriptive statistics (mean and median), as well as basic measures of statistical association in relevant parts.

Regarding the assumptions of statistical tests, the following was found. First, for each of the calculated Spearman's rank correlation coefficients ( $\rho$ ), all three assumptions of Spearman's  $\rho$  (ordinal scale, paired observations, and monotonic relationship) were met. The monotonic relationship was confirmed from scatterplot images of each of two calculated variables. Second, for each calculated Kruskal-Wallis H-test (sometimes denoted as ANOVA for ranks), all assumptions were met (ordinal scale dependent variable, category scale independent variable, and independence of observations between groups). With regard to all the calculated Kruskal-Wallis H-tests, the distributions per groups of independent variable were found to be differently shaped for each calculated H-test. This was found by visual inspection of boxplots.

In addition to collecting and analysing the quantitative data, in order to gain DSR ideas for future technology projects, workshops were arranged at the University of Eastern Finland's School of Computing, in which Master's and doctoral students gathered together, studied the qualitative study (Mramba et al. 2015), and brainstormed on future ideas for technological DSR.

#### Data collection

Ten students from CBE with a diploma in marketing were selected and trained to collect the data from street traders by using printed questionnaire forms. The training of the data collectors was organised on two consecutive days, in a bid to provide them with the necessary knowhow for getting the respondents to answer the questionnaires. The selection of data collectors was made based on their willingness and geographical settlement given the context in which street traders seek for customers. In addition to stating the purpose of the study on the questionnaire, the data collectors were strictly told to verbally inform the respondents about the purpose of the study.

#### Context

The data were collected from three municipal areas of Dar es Salaam: Ilala, Kinondoni, and Temeke. *Kinondoni* is the most populated district of Dar es Salaam, with most of the city's population, and it is home to many high-income suburbs including Masaki and Oysterbay. *Ilala* is the administrative district of Dar es Salaam, and it houses almost all government offices and ministries. The Central Business District (CBD) of Dar es Salaam is located in Ilala, as well as the international airport and the central railway station of Dar es Salaam. *Temeke* is the industrial district of Dar es Salaam, and it contains the main manufacturing activities, and the seaport of Dar es Salaam. Temeke populates many low-income residents due to

industry, as well as many port officials, military personnel, and police officers.

#### Findings

The analysis of the qualitative data (Mramba et al. 2015) resulted in the following eight themes: *gender issues, business profile, obtaining products, product pricing, selection of place to sell, product promotion, customer care, bookkeeping, management, and risk prevention*. For each of these themes, a number of issues were revealed. For each of the eight themes presented above, a number of questionnaire items were designed for the purposes of this study. The results are presented in the following subsections. The sections begin with a short summary of the qualitative findings (Mramba et al. 2015), and proceed to present the quantitative findings.

#### Demographics and business profile

This section presents the demographics of the sample. Most of the respondents (63.7%,  $n = 156$ ) were male, while 36.3% ( $n = 89$ ) were female. 119 respondents (48.6%) belonged to the age group 24-29 years, while 41 respondents (16.7%) belonged to the age group 18-23, and 84 respondents (34.3%) belonged to the age group 30-35 years. 55.1% of the respondents were married. 36.6% of the respondents did not have dependents. 18.5% of the respondents had one dependent, 21.8% of respondents had two dependents, 9.5% had three dependents, 10.3% had four dependents, and 3.3% had more than four dependents. Of those respondents who had dependents ( $n = 154$ ), the average number of dependents was 2.3. The average household size in Dar es Salaam in 2012 was 3.9 (URT 2012).

Most of the respondents (50.6%) had completed primary school, 35.9% had completed secondary school, 5.7% had completed vocational school, while 5.3% had no previous formal education.<sup>2</sup> 41.2% of the respondents were trading in Ilala municipal area, 31.4% at Kinondoni municipal area, and 27.3% in Temeke municipal area. 45.7% of the respondents reported selling clothes, 13.5% foodstuffs, 28.2% sold various house items and small goods, 5.3% sold electronics, and 6.1% sold miscellaneous goods. Table 1 shows the number of study participants per area of sales (municipality), products sold, and gender.

Experience in business years, initial invested capital, average profit per day, and working hours per day were all measured by ordinal scale variables due to data collection reasons. 16.7% of all respondents had one year of business experience in street trading, 22.4% had two years business experience, 19.2% had three years, 20.0% had four years, and 18.4% had more than four years of business experience. 20.8% of respondents had initially invested

**Table 1:** Study participants per area of sales (municipal), products sold, and gender ( $n = 242$ )

Municipality	Clothes			Foodstuffs			House items and small stuff			Electronics			Miscellaneous			All products total		
	M	F	All	M	F	All	M	F	All	M	F	All	M	F	All	M	F	All
Temeke	16	12	28	4	5	9	14	11	25	1	1	2	2	0	2	37	29	66
Kinondoni	28	16	44	2	2	4	10	10	20	7	1	8	1	0	1	48	29	77
Ilala	28	12	40	12	8	20	17	7	24	3	0	3	11	1	12	71	28	99
Total	72	40	112	18	15	33	41	28	69	11	2	13	14	1	15	156	86	242

M = male, F = female

TZS 0–50 000 capital in their business, 27.3% had invested TZS 51 000–100 000, 13.1% had invested TZS 101 000–200 000, 19.2% had invested TZS 201 000–400 000, while 12.7% had invested more than TZS 400 000 as initial investment to start their business.<sup>3</sup> The average profit per day distributed in the following way: TZS 0–10 000 (38.4%), TZS 11 000–19 000 (33.1%) TZS 20 000–29 000 (17.1%), TZS 30 000–39 000 (4.1%), and above TZS 40 000 (2.4%). 21.2% worked for 1–6 hours per day, 61.2% worked for 7–12 hours per day, while 15.1% of respondents reported working 13–18 hours per day.

Clothes traders were found to be the highest earners. Most of clothes traders earned between TZS 11 000–19 000 per day, while the biggest number of traders per each other product group was located in the lowest earning group TZS 0–10 000 per day. The differences in distributions between groups were statistically significant as measured by Kruskal-Wallis H-test ( $\chi^2(4) = 14.563, p = 0.006$ ).<sup>4</sup> With regard to municipalities, Ilala was found to be the highest earning region with the only earners that earned above TZS 40 000 per day ( $n = 6$ ), and most earners in groups TZS 10 000–19 000 and TZS 20 000–29 000. The differences in distributions between earnings groups (municipalities) were statistically significant (Kruskal-Wallis H-test  $\chi^2(2) = 6.174, p = 0.046$ ).

There was no statistically significant association between working hours and daily profit as measured by Spearman's rank correlation coefficient ( $\rho$ ). There was a significant positive association between initial invested capital and daily profit ( $\rho = 0.486, df = 240, p < 0.01$ ). Also, experience in business years correlated mildly but positively with daily profit ( $\rho = 0.202, df = 240, p < 0.01$ ). This is to be expected, as development of business experience should develop one's knowhow about conducting business. However, the mildness of this association can be seen as an indicator that interventions are needed to assist street traders in more efficient development of their business skills and strategies. This also calls for further research about explaining factors that contribute to profit, business skill, and strategy development. A number of research studies have aimed to categorise informal economy workers based on their business performance (e.g. Grimm et al. 2012); however, no such studies have been targeted at the street traders of Dar es Salaam, Tanzania.

### **Working as a street trader**

The qualitative findings (Mramba et al. 2015) showed that street trading is a necessity-based activity for most traders and that street traders work for long hours with minimal profit that barely allows them to survive. This was confirmed by the quantitative data. Street traders work long hours, with over 75% of the respondents reported that they work between 7 and 18 hours a day (see above). Most study participants considered that street trading is rarely conducted as a part-time job together with other employment: “*street vending business is a part-time activity, after having other employment*” resulted in a mean of 2.16 with a mode of 1 (not at all true). The results also confirmed that street trading is entered into mainly because other employment opportunities are not available. The

statement “*most street traders have no other employment opportunities available to them*” resulted in a mean of 5.66 with a mode of 7 (completely true).

As seen above, the biggest earning group (33.1%) of the study participants reported earn between TZS 11 000 and 19 000 per day. This averages to approximately TZS 300 000 per month (calculated on an average 20 working days per month with TZS 15 000 per day profit), equalling roughly to a salary of US\$140 per month. The participants of this study earn above the daily GDP per capita of Tanzania, which is approximately TZS 5 700 per day,<sup>5</sup> and also above the extreme income poverty of US\$1.25 per day (in 2005 purchasing power parity terms). It is noteworthy that the study participants consider that they earn enough to finance their own and their dependents' needs. The question “*most of my fellow street traders earn enough profit to support their families*”<sup>6</sup> resulted in a mean 4.08 with mode 6 (very true). This indicates the humble attitude of the study participants, given the income inequalities between informal and formal workers. Also, besides supporting themselves and dependents, a number of studies show that street traders from urban areas send part of their earnings to support relatives and families in poor rural or suburban areas (Lyons et al. 2012; Lyons et al. 2014; Reid et al. 2010). Also, informal workers operate with no job security, healthcare or social security packages or plans that are typical in the formal economy.

The qualitative findings (Mramba et al. 2015) showed that the interviewed street traders hoped to upgrade from informal to formal business. For means to do that, the qualitative data showed that the traders hoped to get business education and access to capital to expand their business. The quantitative data confirmed that most street traders would like to have another type of employment. The question “*most street traders would like to have another type of work*” resulted in mean of 5.13 and mode 7 (completely true). The statement “*most of the street traders have no other employment opportunities available to them*” resulted in a mean of 5.66 with a mode of 7 (completely true).

### **Selecting and obtaining products**

The qualitative data (Mramba et al. 2015) revealed several themes in relation to selection and obtaining of products. First, street traders explained that in general they do not change their product offerings but work mainly on a single product type. This means that street traders stick to similar products from day to day. However, some changes were explained to happen as opportunities arise, but this was explained to be minimal. The data showed that street traders work typically in cycles of one day, which means that the day begins by collecting the products to be sold during the day from a wholesaler. This was explained to be because of low capital and lack of storage space. The study showed that some street traders obtain products through a service called *mali kauli*.<sup>7</sup> In this category, street traders explained that for some traders, success in street trading had opened the possibility to open formal shops.

Based on the qualitative findings, several questions were designed to measure the street traders' behaviours in relation to selection and obtaining of products. *Street traders change products per season* resulted in a mean

of 3.84 (the values were almost equally distributed in all categories). A closer look reveals that in the municipality of Ilala, product change was less frequent than in other municipalities with mean 3.27 (Ilala) as compared to 4.22 (Kinondoni) and 4.24 (Temeke). The differences in distributions between product change per municipality were statistically significant (Kruskal-Wallis H-test  $\chi^2(2) = 20.007, p = 0.000$ ). There were no significant differences found between product groups and product change behaviour. In general, product change behaviour was found to vary a lot, which rejects the observation from Mramba et al. (2015) that product type is mostly fixed.

With regard to the factors that street traders consider when choosing their products at the beginning of the one-day selling cycle, the following preferences were given: *Easiest to sell* (mean 5.63, mode 6: very true); *low buying price is more important than quality* (mean 5.30, mode 7: completely true); *rare products that are not often available or are approaching out of stock from the wholesaler* (mean 4.88, mode 7: completely true); *products that customers typically ask for* (mean 4.09, mode 6: very true); *products that other traders do not sell* (mean 4.07, mode 6: very true); *product quality and authenticity* (mean 3.64, mode 1: not at all true).

The lack of consideration for product quality is seen in other studies (e.g. Asiedu and Agyei-Mensah 2008 in Ghana, and Reid et al. 2010 in China), which shows that some products in street trading are counterfeit or low quality. This is due to the lack of legislation or control in the informal economy, and calls for more research into the origins of different products and the interplay mechanisms between the informal and formal economies.

#### **Determining the product price**

Qualitative data (Mramba et al. 2015) revealed several themes in relation to pricing strategies. These included unsystematic price setting strategies that are based on one's own experience and tacit knowledge, and recommendations from fellow traders. The data showed also indication of some customer profiling behaviours that are based on outlook mostly, where customers that are evaluated to be wealthy are asked for higher prices. Also, the data revealed situations where street traders have to sell for no profit in cases where there is an acute need for daily expenses, such as bus tickets. The data also revealed issues that are related to the interplay between the formal and informal economic systems: the study participants acknowledged the better pricing of the informal economy as compared to the formal economy and attributed this to lack of need to pay rents, taxes or salaries. It was explained that sometimes formal shops recruit street traders to sell the same products that are available in the shops.

Several questions were designed to compare varying factors that affect the street traders' pricing strategies. The data revealed that the strongest factor in pricing was *Negotiating with the customer*, with mean 5.65, mode 7 (completely true). The second strongest factor was found to be *Purchasing price*, with mean 5.30, mode 6 (very true). The third factor was *Price reduction when facing acute expenses*, with mean 5.27 and mode 7 (completely true). Fourth, the *expected demand of product* was found

to affect the strategies, with mean 4.56 and mode 5 (quite true), followed by *consideration of business expenses* (mean 4.15, mode 5 (quite true)). The lowest ranking factor was *Following how fellow traders set prices* at a mean of 4.12 and mode 5 (quite true). Hagglng for product prices was found to influence trade significantly. Nevertheless, traders need to balance between not reducing a price too much in bargaining, and the risk of losing the customer. The statement *Customers who don't like to negotiate for the price often walk away without buying*, resulted in mean 5.04, mode 7 (completely true).

Thus, the price setting strategies were found to be rather *expected*, but they were found to base on nonsystematic tacit knowledge and situations rather than thorough planning. For example, the finding that unexpected acute expenses had such strong negative impact on pricing was unexpected, and reveals the very tight business environment where traders operate. On the other hand, this is a rather simple issue, which might be improved for example with technical aid in increased business planning. Studies from other regions show differences in price setting between contexts (e.g. Reid et al. 2010).

#### **Deciding on the selling location**

The qualitative data (Mramba et al. 2015) showed that street traders typically do not have a permanent place to sell, but they constantly move from one point to another. The interviewed traders had established their own typical selling routes, based on tacit knowledge (estimates of availability of customers, estimates of traffic jams, and estimates of police movements). Good places were explained to be crowded places, such as traffic jams (selling directly to cars), places near big offices, near marketplaces, bus stands, and worship places. The data showed that some traders have a product stash near home, with friends and relatives, or in a room rented jointly with other traders.

For the purposes of this study, several questions were designed to measure the decision making with regard to selling location. The question "*The majority of street traders have a permanent street that they visit*" resulted in a mean of 4.14 with mode 5 (quite true). The answers were quite equally distributed so the behaviour seems to vary a lot although the tendency was that most had some places that they typically visit. The question "*Sometimes a street trader changes from one route to another to look for customers*" resulted in mean 4.17, mode 6 (very true). This variable was also very equally distributed, which means that the amount of route changing behaviour differs a lot between traders. The question "*When choosing a vending route the existence of traffic and congestion is a major factor*" resulted in mean 4.77, mode 6 (very true). The question "*Availability of potential customers is the main consideration when selecting a trading route*" resulted in mean 4.46, and mode 5 (quite true).

#### **Promoting products**

The qualitative data (Mramba et al. 2015) showed several product promotion strategies of street traders. The typical methods are that products are placed for display on the

ground, and then products are marketed for potential passing customers by verbal introduction and marketing slogans. In some cases, a loudspeaker is used. The data showed that methods typical in formal businesses such as advertising, personal selling, or sales promotion are not methods available to street traders. The data showed that street traders collaborate with other businesses including fellow traders and businesses with regard to recommending other fellow traders, or even formal shops.

The quantitative data measured the promotion methods, and found that the main strategies for promotion were *displaying products on street* (mean 5.56, mode 7 (completely true)), *viva voce (word of mouth, WOM)* with mean 5.44, mode 7 (completely true), *discounts and allowances* with mean 5.22, mode 7 (completely true), *persuasive language* with mean 5.37, mode 7 (completely true), and *loudspeaker* with mean 4.57, mode 7 (completely true). With regard to the satisfaction of the current strategies, the claim *“The current strategies are not strong enough to attract customers”* resulted in mean 3.92, mode 3 (slightly true).

#### **After-sales customer care**

The qualitative findings (Mramba et al. 2015) showed that keeping in contact with customers after sales through mobile phones is rare. For example, street traders do not generally use phones to inform or advertise when certain products become available. Some exceptions were found, though. For example, one interviewed study participant noted that sometimes the satisfied customers called traders afterwards and asked them to deliver products to their offices or homes. The street traders explained that for such services, extra charges were asked. This was a type of activity that was not widely conducted, but could in the future have potential for business expansion through mobile services that match customers and traders. The traders were in general not found to keep any systematic customer lists or databases that are used to keep in touch with customers.

This study confirmed many of the issues revealed by Mramba et al. (2015). First, it was found that street traders rarely communicate with their customers. The question *“Street traders communicate with their customers from day to day”* resulted in mean 3.20, mode 1 (not at all true). Second, it was found that street traders have no systematic way of keeping track of their customers. The question *“Many street traders have a list of customers and their contacts”* resulted in mean 2.15, mode 1 (not at all true). Also, the question *“When a street trader gets new stock, he/she informs the customers”* resulted in mean 2.65, mode 1 (not at all true). Moreover, the question *“Many street traders have repeat purchase customers”* resulted in mean 2.93, mode 1 (not at all true). However, communication originating from customers and product delivery services were not common, but sometimes practiced. The question *“I know cases when traders are asked by their previous customers through mobile phone to supply products”* resulted in mean 2.98, mode 2 (very little true). This could be a service of the future, as suggested by the previous section.

In addition, street traders rarely had any product

returning practices in cases of damaged products, or communication with dissatisfied customers. The question *“Street traders allow products to be returned if damaged”*, resulted in mean 2.18, mode 1 (not at all true), and the question *“Street traders communicate with dissatisfied customers to avoid negative reputation”*, resulted in mean 2.29, mode 1 (not at all true).

#### **Bookkeeping**

The qualitative findings (Mramba et al. 2015) showed that the interviewed study participants did not do any systematic recording of sales, purchases, expenses, wholesaler activities or supplies. The participants did not consider bookkeeping activities to be of benefit because they considered their business to be so small in scale. It was found that some study participants sell products on credit to trustworthy customers. The study participants reported not to have access to banking or bank accounts, but instead many of them reported to save their spare money in a “special box”, or sometimes through rotating savings associations (*mchezo*), or MobileMoney. The study participants reported that in addition to the lack of motivation to do bookkeeping, they lack the means to conduct bookkeeping well.

The results confirmed that street traders mostly do not record their business transactions. The statement *“Street traders in Dar es Salaam write down their daily sales”* resulted in mean 3.28 with mode 1 (not at all true). The results also confirmed the two reasons found in Mramba et al. (2015) not to keep records (no perceived gain, lack of skills). The statement *“Because street trading business is so small in scale, there is no point in systematic bookkeeping”* resulted in mean 5.21 with mode 7 (completely true), and the statement *“Street traders do not keep business records because they do not know how to do it”* resulted in mean 4.74, mode 7 (completely true).

However, some of the responses were a bit contradictory and it seems that some street traders were of the opinion that bookkeeping would be beneficial. The statement *“In street trading, lack of bookkeeping sometimes results in unwise business decisions”* resulted in mean 4.89 with two modes (5, quite true and 7, completely true). Moreover, it was considered to be important to compute profits and losses: *“For a street trader, it is important to compute profit and loss”* resulted in mean 4.89 with mode 7 (completely true). This indicates that street traders do compute but not on pen and paper. The question *“Street traders have a paper or book to record credit transactions”* resulted in mean 2.95, mode 1 (not at all true). With regard to *mali kauli* transactions the statement *“When traders buy through mali kauli, both seller and buyer write down records”* resulted in mean 3.44, mode 3 (slightly true).

With regard to how profit is calculated, the following answers were given. *“The profit in street trading is obtained by subtracting purchases from sales”* resulted in mean 5.28, mode 7 (completely true), and *“The profit in street trading is obtained by subtracting business expenditures from net revenue”*, resulted in mean 4.42, mode 6 (very true). With regard to selling on credit, the statement *“Street traders often sell on credit”* resulted in mean 2.10, mode 1 (not at all true).



It was found that street traders did use mobile money services to save money. “Many street traders use mchezo to save money” resulted in mean 4.22, mode 7 (completely true). However, money was reported to be equally saved in houses “Many street traders save their money in their houses”, with mean 4.56, mode 7 (completely true), but not in banks “Many street traders save money in banks”, mean 1.66, mode 1 (not at all true), which is understandable considering the rare access of traders to banking services. The usage of MobileMoney indicates that street traders have taken one mobile service as a daily part of their business, and there is no reason why they would not start to use other services if they become available. Some of the future services might well be in the area of bookkeeping.

#### **Future prospects and management issues**

The qualitative findings (Mramba et al. 2015) showed that participating street traders had hopes of upgrading from informal to formal business, setting up a built-up structure, obtaining better access to capital, getting business education and becoming entrepreneurs. The quantitative data showed that there is ambition in expanding business. The statement “Many street traders are ambitious to become big businessmen in formal business” resulted in mean 5.59, mode 7 (completely true). However, findings from Mramba et al. (2015) were confirmed, as the traders lacked the means to do that. The statement “I know street traders with written business plans, goals and strategies” resulted in mean 2.35, mode 1 (not at all true), and the statement “Street traders know how to achieve their plans and goals” resulted in mean 3.20, mode 1 (not at all true).

#### **Security issues and risks**

The qualitative findings (Mramba et al. 2015) revealed several additional risks for informal traders compared to formal businesses. The most serious risks that need to be prevented were explained to be the risk that their products are confiscated by police,<sup>8</sup> the risk of heavy rain ruining their products, and the risk of theft. In order to minimise the risks, several risk prevention strategies were used. For example, the traders carry the minimum possible amount of stock on them to avoid loss of theft or confiscation by police. The traders also know good escape routes, and prefer to move in groups in order to be less vulnerable to theft. In addition, street traders explained that they use mobile phones to alert their fellow traders.

The findings of this study confirmed issues related to risks and risk management. The statement “In order to avoid confrontation with police, street traders often run away when they see police” resulted in mean 4.52, mode 7 (completely true). Also, the statement “In order to minimise risks, traders only carry part of their stock with them” resulted in mean 4.69, mode 7 (completely true). Street traders reported the necessity of paying bribes to city police. The question “Street traders have to pay bribes to city police” resulted in mean 5.44, mode 7 (completely true). One questionnaire paper contained an additional writing “When we come here in the morning we contribute TZS 700 each, and make a sum of TZS 4900 to pay for city police. In afternoon another group of city police come here, while those that were here shifted to another street,

therefore again we contributed the same amount, and the same situation happened in the evening. On average we use up to TZS 5000 per day to pay bribes.”

#### **Education and future interventions**

The results of this study indicate that street traders possess low levels of formal business skills. The data shows that most of the street traders have only primary school education (see above). Primary education does not equip traders with basic business skills e.g. marketing, bookkeeping, and management. The data also shows street traders’ perceptions about possible future educational interventions.

The quantitative data showed that most of the street traders consider future education in all business areas to be beneficial for them. The statement “Street traders need business education” resulted in mean 5.55, mode 7 (completely true). More specifically, the traders unanimously considered future education to be beneficial in all business areas: *record keeping* (mean 5.69, mode 7: completely true), *marketing and customer care* (mean 5.69, mode 7: completely true), *planning, organising and management* (mean 5.31, mode 7: completely true), *customer relationships* (mean 5.34, mode 7: completely true).

In addition to education, *improved access to capital* (mean 5.80, mode 7: completely true), *a fully legal status* (mean 5.68, mode 6: very true), and *authorised business locations* (mean 5.62, mode 7: completely true) were considered to be of primary importance in the future.

#### **Mobile phone usage patterns**

With regard to street traders’ mobile phone usage patterns, several issues were revealed. It was found that mobile phones are used for communicating with suppliers and customers (mean 5.83, mode 7: completely true), as a calculator for computing price or profit (mean 5.92, mode 7: completely true), and as MobileMoney (mean 5.23, mode 6: very true), but less for marketing products (mean 3.23, mode 2: very little true) and verifying the need of products from customers (mean 3.72, mode 1: not at all true). Thus, the data shows that street traders are using smartphones for various purposes, but the smartphone usage patterns could be extended in the future when more mobile services become innovated and developed. Currently most of the street traders do not have smartphones, but they have basic phones that are capable of USSD.<sup>9</sup>

The motivation of street traders towards future mobile services and participation in mobile development projects was found to be high. Four questions were designed to measure the motivation for future services on a scale of *yes/no*. For the question “I believe that access to information through mobile services would improve livelihood”, 72.2% responded positively. For the question “I am interested in receiving business information through mobile phones”, 73.1% answered positively. Also, for the question “I am interested in business education through mobile phones”, 78.4% responded positively. Finally, to the question “I would be interested in participating in a project of testing information services for mobile phones”, 78.8% responded positively.

### Technology innovation workshops

To generate ideas of technologies for street traders, an idea-generation workshop was arranged at the University of Eastern Finland in April 2015. The technology workshop was targeted at information technology and computer science students at Master's and doctoral level. The preliminary task for the study participants was to read the research article (Mramba et al. 2015). The actual workshop consisted of a one-day seminar and idea generation sessions complemented with a final report. First, the workshop included a seminar that lasted one hour, where the research project of street trading was introduced to the study participants. Second, the workshop participants were divided into two groups. The first group consisted of four students that originated from Russia, Nepal, and Iran. The second group consisted of five students who originated from Ghana, Nigeria, the UK, and Uganda. A total of nine students participated. This section briefly summarises the observations from the workshops as well as from the student reports.

A vast amount of argumentation and discussion about various phenomena related to street trading was found in the workshops and reports. Because of the diverse origin of the study participants, many reflected the situation of street trading in their countries of origin. For example, the informal nature, connections to formal business, legal status, illegal aspects, and connections to organised crime were discussed by many participants, reflecting the varying conditions and situations in different countries. Especially participants from African countries saw similarities in street trading activities reported in Tanzania as compared to their own respective home countries. These observations highlight the importance of understanding each specific country in question when studying street trading.

With regard to technological interventions targeted especially at street traders in Tanzania, a number of ideas were generated by the student groups. These can be divided into the following categories: *educational applications and educational games, product database and catalogues, customer profiling, daily sales recording, advisory applications, matchmaking applications, social networking for sharing ideas and daily stories, customer relationship management, and money handling technologies*. For example, various descriptions for matchmaking applications were given, including customer-driven matchmaking (customer searches for a nearby product or service), and trader-driven matchmaking (trader searches for customers for specific products or services in a certain location). A particularly interesting idea was the use of mobile vouchers as currency. Currently, vouchers are widely sold in kiosks to increase credit on one's mobile phone. A similar mechanism could be used in the future to ease the risks of handling cash that traders face.

### Discussion

#### *Needs, strengths, limitations and types of work (RQ1)*

Research question *RQ<sub>1</sub>*, asked: "What are the entrepreneurial needs, strengths, limitations, and types of work undertaken by street traders in Dar es Salaam?" This study opened up the daily business operations of street traders in Dar es Salaam from a number of angles.

First, this study confirmed that street trading in Dar es Salaam is a survival-based activity that is conducted by a low-educated mass of traders who have little other employment or education opportunities available to them. The working hours of street traders are long and the obtained profit is barely enough for survival. The traders also face a number of threats and risks. Street traders are looking for a path for more successful and less risky business, but many traders lack the opportunity and means to do that. In this study, clothes traders were found to be the group that earns the most compared to traders of other product groups. Initial investment was found to be associated with business success. In general, the average earning was found to be above the minimum wage in Tanzania. However, in addition to financing their daily business, the traders often finance their own families as well as send part of their earnings to relatives in rural areas.

Second, the results show that street traders operate within a one-day operational cycle and they do not have the means to conduct very thorough planning of their business. The day begins when the products to be sold during the day are selected and fetched from the wholesaler. The daily activities then include selecting the place and route to sell during the day, determining the product price, profiling of customers, handling the business transactions, and employing various risk prevention strategies in order to avoid confrontation with police, thieves, or rain. Confrontation with police will pose a risk of having to pay bribes or product confiscation by police. Most of the strategic and managerial decisions related to these activities are made based on tacit knowledge, as information for more accurate decision making is not available.

Third, when looked through the lenses of the common business domains of management, marketing, bookkeeping, and strategic planning (see above), the results show that many decisions are based on tacit knowledge and acquired habits rather than well organised or explicit planning, accurate information, and education. From a *marketing viewpoint*, street traders display products on street, use loudspeakers and word-of-mouth, but they do not use mobile phones or any other organised means for systematic marketing. From a *management perspective*, most decision-making activities, including pricing, selecting of selling place, preventing risks, obtaining products, storage, money handling, and customer relationships, are made based on tacit knowledge and learned habits. From a *bookkeeping perspective*, nothing is recorded in books, which makes it difficult to make any plans and predictions. From a *strategic planning perspective*, street traders wish to plan for the future, but lack the means to do that.

Fourth, the results of this study show that street traders in Dar es Salaam have low levels of business skills and low levels of formal education or proper on-the-job training, and that they work in a challenging business environment with additional threats and risks compared to formal businesses. The traders work long hours with low profit, but do not have the knowhow, skills, or means to improve their business prospects much. This study showed that there is a mild association between business years and profit, which tells that some beneficial on-the-job

experience is gained. Also, initial invested capital was associated with better business success.

Fifth, a high number of daily operational challenges of street traders were reported by this study. However, from the viewpoint of empowerment and entrepreneurship, three challenges rose above the others. First, *access to capital* was shown to be one of the biggest challenges for empowerment and expansion. The street traders rarely have access to banking, and they are financially trapped within a small-scale cash flow. Handling currency is complicated by having to stash money in hideouts, weak planning and savings and risking theft. Second, *lack of education* in all areas of business was found to be a major challenge. Street traders lack the skills to do any systematic planning of strategy, management, or recording transactions in books, which has a serious negative impact on their business.

Sixth, *weak support structures* were found as a major challenge. This category includes undeclared juridical status of street trading, lack of means for formalising one's business, and lack of authorised business locations. This category also includes lack of social protection schemes, lack of labour legislation, and lack of healthcare. A summary of the research results for research question *RQ<sub>1</sub>*,

is found in the column “*Needs, strengths, limitations, and types of work (RQ<sub>1</sub>)*” of Table 2.

#### **Technology innovation possibilities (RQ<sub>2</sub>)**

Research question *RQ<sub>2</sub>* asked “*What technology innovation possibilities arise from the entrepreneurial needs, strengths, limitations, and types of work undertaken by street traders in Dar es Salaam?*”

The results of this study have shown high potential for future DSR projects in a number of areas. Based on the analysis of the quantitative data as well as results from the technology innovation workshops, a number of areas for DSR projects are proposed. A summary of the research results for research question *RQ<sub>2</sub>* is found in the column “*Innovation opportunities arising from the needs, strengths, limitations, and types of work (RQ<sub>2</sub>)*” of Table 2. Most street traders possess phones that are capable of running USSD-based applications. In the near future, more street traders will have access to smartphones. Based on the findings of this study, several tracks for future technology projects are proposed.

First, from a *management perspective*, a number of technology projects are proposed. The data shows that

**Table 2:** Summary of results from mixed methods analysis

	Needs, strengths, limitations and types of work (RQ <sub>1</sub> )	Innovation opportunities arising from the needs, strengths, limitations, and types of work (RQ <sub>2</sub> )
<b>Management</b>		
Pricing	Bargaining, customer profiling based on outlook	Customer profiling Pricing advisor
Selection of place and route, finding customers	Estimating customer movement Estimating police movement Estimating traffic	Location-based matchmaking Traffic advisory application Social networking with traders Customer-trader matchmaking Order and delivery management
Risk prevention	Product confiscation by police Theft Weather ruining products Risk of having to pay bribes Stashing products Alerting fellow traders	Social networking Weather applications Advisory technology for formalising
Obtaining products	Fetching products from wholesaler Using MALI KAULI Fetching products from formal shops	Wholesaler product availability Trader-wholesaler matchmaking
Storage	Storing products in rented locations or home	Storage optimisation
Money handling	Saving money in houses No access to banking Risks of carrying cash around	Mobile currency to replace cash
Customer relationship	No customer relationship after sales	Customer and seller matchmaking
<b>Marketing</b>		
Promotion	Word of mouth Displaying products on street Persuasive language Use of loudspeakers	Product database and catalog Matchmaking application Electronic WOM (eWOM)
<b>Bookkeeping</b>	No records are kept (no skills, no perceived benefit)	Bookkeeping application
<b>Strategic planning</b>	Ambition to upgrade and expand Lack of skills Lack of education Lack of access to capital	Advisory applications Educational applications for all business domains (MOOC) Improved access to capital through apps Management and planning applications
<b>Others</b>	Healthcare, Counseling, Storytelling	Counseling and healthcare applications Storyboards and social media
<b>Mobile phone usage patterns</b>	Communication with suppliers (SMS/calls) Using calculator to compute price of profit High interest in participating in future DSR projects	All of the above.

customer profiling and bargaining behaviour are areas where technology can have a significant impact in the future. For example, a customer database would help to categorise customers with different interests, needs, location information, giving important information for pricing. Also, as traders are not computing their buying and selling prices very systematically, a simple application that would provide simple advice on the buying and selling price per each trade transaction is an interesting idea for future DSR projects. Other areas include matchmaking between customers and traders, which could make use of GPS information. Matchmaking between traders and customers could also be helped by traffic advisory applications and social networking between traders and customers. With regard to order and delivery management, there is also a clear potential for technology.

With regard to risk prevention, social networking, weather information, and advisory applications that would help in the formalising process are suggested. Such advisory applications would give advice on how traders can upgrade their business from an informal status to a formal status. With regard to obtaining products, a clear opportunity for innovation is technology that would give improved online information about wholesaler product availability, and improved matchmaking between wholesalers and traders. With regard to storage, applications that help to optimise the use of storage sites pose innovation possibilities. Various ways of increasing the usage of mobile currency could help to replace the risks that are involved in handling cash. Matchmaking and customer database applications are also a clear area for innovation, as they would make it possible for forming long term relationships with customers instead of conducting only single business transactions with them.

Second, from a *marketing perspective*, several innovation possibilities arose from the research data. These include product databases and catalogues, matchmaking, and electronic word-of-mouth. Together with customer profiling, social networking, and applications that help in pricing, technology has a clear potential for more targeted and systematic ways of doing marketing. Third, from a *bookkeeping* perspective, it is clear that record keeping poses an innovation opportunity. As the traders are currently not recording business transactions, mobile-based bookkeeping could give significant benefit in planning and organising their business, as well as helping in the formalisation process. Fourth, from a *strategic planning* perspective, various advisory applications and educational technology to train business skills, as well as improved access to capital pose clear technology innovation opportunities. Other potential technology innovation opportunities include counselling and healthcare applications, storyboards, and social media.

The results of this study have shown innovation possibilities in business applications that will help street traders to automate important parts of their business. As seen in this section, these possibilities include various matchmaking, record keeping, customer and product databases, social media, promotion, marketing, reputation management, and customer care applications. It is also interesting that in the developed world, there is an

ongoing trend of developing and launching mobile-based business services such as house rental, food and other product delivery, taxi and transportation services, which are enabling citizens with little prior business experience to start various businesses easily. Interestingly, the trend means in-formalisation of formal business; opposite to the street traders' expectations to formalise their informal businesses. However, in the developing world, there is also enormous potential for similar applications for various product and service offerings, as most part of people are already engaging in "self-made" business activities.

With all the proposed technological interventions above, without proper and self-oriented education it will be difficult for street traders to improve their sales, minimise loss and maximise profit. Thus, a clear potential for education and educational technology for street traders has been shown by this study. This can include various kinds of online or mobile mass courses for teaching basic business skills, strategies, and providing training on how to upgrade one's business from informal to a formal status. Along the lines of design science research (Hevner 2007), we are proposing the initiation of co-design teams that consist of software professionals, researchers, and street traders to work on these topics. These teams can be initiated by companies, universities, or technology hubs. Besides the aforementioned opportunities, the technology might change the street business as we know it now and even change the categories that describe how it works at the moment. To go for these, co-design in a mutually trusting environment is needed.

#### **Relation to other studies**

In relation to other studies (see Section 1.1), this study has provided research results from an important, yet currently unstudied area. As noted in Section 1.1, while several studies have targeted at Tanzanian companies and their e-commerce processes, and while street trading has been studied before in various places, no previous studies have targeted at the street traders of Dar es Salaam specifically through the lens of marketing, bookkeeping, strategic planning, and management. Results for research question RQ<sub>1</sub> provided important new understanding about the entrepreneurial needs, strengths, limitations, and types of work of street traders, while the results for RQ<sub>2</sub> provided a number of ideas for technology innovation. This has built the grounds for a variety of tracks of DSR research, where street traders' business prospects can be improved or even completely reshaped with technological solutions.

#### **Future work**

The study has covered the first stages of a DSR project, including problem explication and requirement definition (Johannesson and Perjons 2014, 91–116). Based on the presented results, a variety of threads for future projects can be initiated, where the DSR efforts move to more detailed *requirement definition, design and development, demonstration, and evaluation* (Johannesson and Perjons 2014). However, the DSR stages do not need to be sequential, but can be used iteratively. With regard to *design and development*, software engineering capacities are required. Our project has currently one active DSR

thread where a group of street traders are working with a software engineer and researchers on co-design activities in Dodoma, Tanzania, to prototype on various smartphone-based applications for street traders. Our project is planning to initiate further software teams to work on street trading applications. We hope that this research will also inspire other DSR researchers to start working on technology projects.

We also hope that DSR penetrates more into information technology (IT) education. IT graduate programmes are being initiated in universities of developing countries at an increasing pace. It is important that DSR projects like the ones proposed in this study are also included in the curricula of technology programs, to teach technology students to work specifically on African problems. One challenge in technology education is that the curricula are too often directly imported from the Western world. Locally developed and implemented ICT projects will help Africa to avoid remaining as a passive recipient of technologies that are developed by overseas corporations, and helps to increase contextually relevant science, technology, and innovation (STI) capacities.

With regard to future empirical research, this study has touched on a variety of issues that affect the daily business activities of street traders in Dar es Salaam, Tanzania. However, any one of the issues identified in this study would benefit from a study of a greater depth. For example, the future research tracks might include the study of product flows, supply chains, trader and wholesaler hierarchies, and more thorough categorisation of street traders based on different product groups and success profiles, and real life stories of street traders. As one idea for further research, it would be interesting to analyse the intensity of business over a period of work. For example, how much of an 18-hour workday is idle time, and which are the peaks for profit making? The identification and further analysis of the business strategies of the most successful street traders is one important future research direction. The results from these further studies would extend and complement previous studies, and increase the understanding in the benefit of DSR projects.

This research project is conducted as a part of a researcher training hub that has been established between the College of Business Education (CBE), Dar es Salaam, Tanzania, and the University of Eastern Finland (UEF) School of Computing (Apiola et al. 2015). This research group is working on a series of cases where informal workers are targeted with DSR research in order to directly address their daily challenges with technological solutions. Our group is working on a series of research projects on informal business activities in the areas of street trading, smallholder farming, as well as micro business (Apiola et al. 2015; Misaki et al. 2015; Gomera and Apiola 2015).

### Conclusions

It is a widely acknowledged fact that developing countries need to improve their capacities in STI that push more efficient research and development (R&D) activities that directly contribute to human development (e.g. Trojer 2014). Small businesses in developing countries need ways to generate more income. Technology can play

a significant contribution to this, if implemented well. This requires an increased amount of DSR research, and the expansion of ICT4D from evaluative research to design science research. Also, it must be kept in mind that technology initiatives are not sufficient alone, but must be brought to work in collaboration with other legal, environmental, political, and economical efforts to improve the business prospects of informal workers.

Our study has shown that access to capital, lack of education, and weak support structures are the major challenge factors for street traders in Dar es Salaam. This study has also provided a number of potential practical ideas for future DSR projects. Previous studies have identified the lack of studies about informal workers from an entrepreneur, education, and empowerment perspective. To our knowledge, this is the first study in Dar es Salaam that takes a design research approach in order to directly address street traders' daily challenges with technology. The wider impacts of this project are economic and inclusive growth, human development, increased STI capacities, and an increased number of exciting technological opportunities for joint technology projects between researchers from developed and developing countries.

### Notes

- 1 Dar es Salaam is the economic hub of Tanzania. In 2007 there were an estimated 2.8 million inhabitants in Dar es Salaam area, and an estimated 700,000 street traders (Lyons et al, 2014).
- 2 The majority of Tanzanians (81.7%) have completed primary school, 14.4% have completed secondary school and 2.3% have completed university (URT, 2014)
- 3 The average start-up capital required from micro, small, and medium enterprises found by Tanzania National baseline survey averaged TZS 220,500 (URT, 2012). TZS 10000 equals approximately US\$4.6 (calculated by the exchange rate of 11 September 2015).
- 4 Pairwise comparison (Dunn's procedure with Bonferroni correction) revealed statistically significant differences between "House items and small stuff" and "Clothes" (32.845) ( $p = 0.008$ ), but not between any other group combination.
- 5 <http://data.worldbank.org/indicator/NY.GDP.PCAP.CD>
- 6 Some of the questions were targeted to ask about street traders' peers rather than themselves in order to minimise the bias due to a tendency to give socially acceptable answers.
- 7 *Mali kauli* is a credit transaction in which a trader obtains goods with credit without collateral, and is allowed to return unsold stock at the end of the day. Usually a *mali kauli* transaction is initiated by a request for assistance by a retailer, who has limited capital. For further information, see for example (Ogawa, 2006).
- 8 In Dar es Salaam, street trading is not against the law. However, it is against the law to trade in some areas, and especially to lay out ones products on the street. In some cases the areas where trading is legal are not preferred by traders.
- 9 USSD (Unstructured Supplementary Service Data), [https://en.wikipedia.org/wiki/Unstructured\\_Supplementary\\_Service\\_Data](https://en.wikipedia.org/wiki/Unstructured_Supplementary_Service_Data)

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