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A Comparative Analysis of Traditional and Digital Data Collection Methods in Social Research in LDCs - Case Studies Exploring Implications for Participation, Empowerment, and (mis)Understandings

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Abstract: Digital Data Collection (DDC) is an increasingly common method for data collection in developing country contexts, presenting both challenges and benefits to development practitioners and researchers. This paper explores the advantages gained and the difficulties encountered in transitioning from paper-based surveys to digital data collection using handheld devices, and some of the consequences for participants in the research, both researchers and the target population. Surveys undertaken as part of a research collaboration between University College of Cork and organisations in Malawi and Ethiopia form the basis of this assessment, with of a survey-based impact assessment study of Valid Nutrition's Groundnut Purchasing Scheme with Smallholder Producers in Malawi and Ethiopia forming the centrepiece. The researchers have evaluated data-gathering on these different technologies, reflected on the methods used and approaches taken in transferring and implementing the process, and evaluated each process in terms of its relative effectiveness, efficiency and their implications for researchers and researched.

Keywords: Digital data collection, household questionnaire, panel survey, Malawi, Ethiopia, Personal Digital Assistants (PDA's)

1. INTRODUCTION

In the last three decades, private sector companies use ICTs as a tool for supply chain management, market research, and for monitoring and evaluation purposes. In more recent years the use of ICTs has been adopted by the development and humanitarian sector where in the past, paper based surveys were the most common method for monitoring and evaluation. Paper-based methods are relatively costly, time-consuming, and largely susceptible to human error. While still in use by the majority of practitioners and projects, paper-based methods can take months or years to complete, from research design, through data-collection, inputting cleaning and analysis, to dissemination of findings. The output from such research can be delayed to such an extent that when the findings are released, they are of limited use, due to being out-of-date, or at least losing their original currency.

Research forms an integral part of the toolkit of development workers, and is applicable in many (though not all) intervention situations (Laws et al, 2003). Government development budgets have reduced (OECD, 2012), and this has brought pressure on applicants seeking funding to demonstrate evidence-based results from past projects and programmes. Organisations need to demonstrate lesson-learning and systematically informed and improved project design, progressing toward the much sought-after realisation of sustainable development. But innovation is required if they are to deliver positive sustainable development outcomes in developing country settings, under limited budgets and restrictive time-frames.

Increasing numbers of international development organisations, such as USAID and Concern Worldwide (a large Irish international development NGO), are taking the lead by designing and employing innovative research methods utilising ICT-based approaches. These approaches are proving useful, for instance, in the areas of monitoring, evaluation and communication within agricultural extension and public health projects. FUSAID's Feed the Future programme in 2012 conducted their population-based surveys using Google Nexus tablets and Open Data Kit software in eight of their nineteen focus countries as part of their overall programme research strategy (Agrilinks, 2013). In 2011, Concern Worldwide piloted their digital data collection (DDC) process in Malawi within their conservation agriculture project. Concern's agricultural extension advisors used handheld devices to survey farmers regularly on farming methods, such as land preparation, seeding, harvesting. Concern's pilot project in Malawi has greatly improved the effectiveness of their work, so much so that since the pilot Concern has moved to expand the digital date gathering process to all of their project countries and scaled up to carrying out 150 surveys per annum (Murphy, 2013). ICTs are used in other facets of agriculture and rural development, as well as in other sectors: market-price and weather information can be rapidly disseminated to a large number of

farmers by mobile phone; in the health sector, health workers in the field can be supported in deciding course of treatment (World Bank 2012).

Innovative projects like the above can help narrow the knowledge-management gap that is prevalent in the development sector (Dennehy et al, 2013). The rapidity of the transfer of information from rural based field staff to the experts who are typically based in organisation headquarters in another country creates the opportunities to address findings and if necessary alter the course of action. Data can also be more reliable and of higher quality as the risk of data being misinterpreted or lost in field is reduced if not removed completely.

The use of ICTs in the case studies presented in this paper proved beneficial in the timeliness and reliability of the data collected. These were anticipated and hoped-for consequences that influenced the decision to move from the initial paper-based approach in 2010 to the handheld devices in the subsequent three years. The digital process reduced the time taken and the risk of miskeying, misinterpretation, incompletion and loss of data in field; it also significantly reduced the time between data-gathering and analysis. Many lessons were learned during the transition, and the more significant ones are explored within this paper.

1.1 Methodology

This research used revelatory case-study approach, examining the implementation of digital data-gathering for an extensive panel survey in two different locations, one in Malawi, the other in Ethiopia. A central aspect of this paper is concerned with comparing and contrasting paper-based and digital experiences for the same survey. As panel data were being gathered over four annual iterations from the same samples of the same population, the paper also examines how the data-gathering tools were improved over each of the iterations of the survey.

On conducting a literature scan of the DDC area, revealed much in the areas of digital data-gathering, but little in the sub-area of extensive (long) surveys.

In a previous paper[1], the authors detailed the successes found and advantages gained from utilising digital data-gathering approaches, while also describing the faults and failings that we uncovered in our methods, and itemise the lessons learned from the undertaking. In this paper, we attempt to take this a step further in examining issues of empowerment and ethics, that we might gain insights that might inform guidelines for future implementations in developing country contexts, and through this, begin to establish good practice in this arena.

2. CASE STUDY BACKGROUNDS

2.1 Country backgrounds

Malawi and Ethiopia are two of the most underdeveloped countries in the world ranking 170th and 173rd respectively out of a total 186 countries listed in the UNDPs Human Development Index (UNDP, 2013). Malawi is a land locked country in south-eastern Africa, bordered by Tanzania, Mozambique and Zambia. Malawi is a small country in comparison to its neighbours; however it has a population of 15.9 million people making it one of the most densely populated countries in Sub-Saharan Africa. In 2010, 82.3 percent of Malawi's population were below the $2 a day poverty headcount ratio and 23.2 percent of the population were classed as undernourished (World Bank, 2013).

Ethiopia is also a highly populous land-locked country, located on the eastern horn of Africa, bordered by Kenya, South Sudan, Sudan, Somalia, Dijbouti, and Eritrea, with a population of over 91 million people in 2012 (UNDP, 2013). In 2011, 66 percent of Ethiopia's population were below the $2-a-day poverty headcount ratio and 40.2 percent of the population were classed as undernourished (World Bank, 2013).

Both economies are agrarian-based yet struggle to achieve national food security from year to year. Despite evidence of growth in agricultural productivity over the past decade in both countries, overall this growth has been slow; it has been vulnerable to external factors, including low input use, over reliance on rain-fed agriculture (which is being exacerbated by climate change), little development of irrigation systems or other alternatives to rain-fed agriculture, inadequate access to agricultural credit, inadequate access to markets, and lack of dissemination of technology developments (GoM, 2006). Both countries have mobile phone networks: in Malawi, competition exists between several service providers, while in Ethiopia a single network is operated by a private, is partnership with the Ethiopian Government.

2.2 Research Description

The main research objective of the data surveys in Malawi and Ethiopia is to establish a comprehensive analysis of the impact of an intervention implemented by Valid Nutrition[2] and its partners who are working directly with smallholder farmers in the respective countries. It is envisaged that the smallholders participating in agricultural associations facilitated and supported by Valid Nutrition's partners will receive extension support, training, and agricultural inputs on credit (i.e. improved seed, pesticides, land) and therefore will produce groundnuts of a higher quality for which they should then receive a premium price.

The impact assessment of the guaranteed groundnut purchase scheme was commissioned by Valid Nutrition and undertaken by University College Cork in collaboration with Valid Nutrition, ExAgris Africa Ltd.[3] in Malawi and Self Help Africa[4] in Ethiopia.

[1] 'The Evolution of Digital Data Collection (DDC) in the Monitoring and Evaluation of Projects in Developing Country Contexts", presented at EUTIC, Waterford October 2013

[2] Valid Nutrition is a manufacturer of highly fortified Ready-to-Use Therapeutic Foods (RUTF) working in both Malawi and Ethiopia and other countries.

[3] ExAgris Africa Ltd. is a private agricultural company with a strong emphasis on social responsibility.

[4] Self Help Africa is an international NGO working in the area of rural development in Ethiopia.

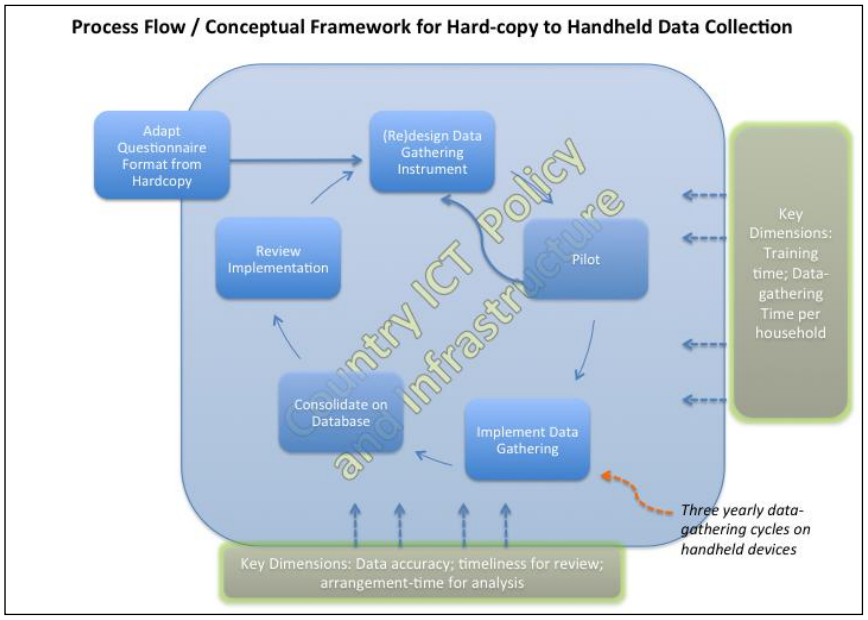

Figure 1: Process Flow and Conceptual Framework for the DDC analysis

The impact assessment used a household survey that was designed using the Sustainable Livelihoods Framework (SLF) and the Household Economy Approach (HEA) to provide a conceptual and methodological framework, both of which have been utilised in various developing-country situations. Using the SLF in the design of the household survey ensured greater understanding of the livelihoods of the smallholder farmers. The HEA was used to structure information on livelihoods and identify key research findings in the household survey. These approaches were adapted to the specific needs of the project, and validated with key stakeholders in the project.

From the survey an array of information can be analysed: household demographics; household assets (i.e. human, physical, social, financial, and natural); crop and livestock production; shocks experienced by the household (e.g. failed crops, death or illness in household) and what coping strategies were employed to circumvent these shocks. Trends in on-farm and off-farm activities of the households can be identified; trends in the utilisation of groundnuts as a food and cash crop amongst the study sample determined; connections between income to expenditure, and what players are involved. The analysis seeks to determine also what is constraining or driving these trends.

The impact assessment sought to measure change in the targeted households over time: this methodology was employed for four years in Malawi (2010 - 2013) and two years in Ethiopia (2011 & 2012) as a cross-sectional panel survey. The sample size was relatively large for both study sites averaging at 215 households in each country, over 6 different data collection geographies. The original baseline survey of 2010 consisted of approximately 50 A4-pages targeting 238 households; the survey instrument when digitised contained approximately 1750 variables.

From the diagram (Figure 1), it can be seen that a 'project-cycle' – type approach is in operation; with each iteration of the cycle, an analysis of the research process was undertaken, in which any discrepancies or issues were addressed. Three areas that were reviewed were data structures (examining issues regarding the data output), question sequencing (where there were problems here regarding possible repetition of questions) or changes to data (where it was determined that, in light of emerging issues, additional data would improve the analysis).

From this it can be seen that the following dimensions were thought worthy of examination: 1) data-gathering time per unit; 2) training time; 3) review timeliness; 4) data arrangement time for analysis; and 5) data accuracy. Permeating the process were concerns of empowerment or disempowerment, and ethics.

2.2.1 Description of the Paper-Based Data Collection (Malawi 2010)

In 2010, after validating the survey with key stakeholders and a local translator, the researcher and the translator conducted a two-day pre-testing with random households, and any anomalies or issues that arose were then corrected. Training of four enumerators followed this, taking approximately three days. The researcher rotated among the enumerators during the first week's data-gathering; performing a review of the work with them each evening, to address any difficulties, uncertainties, inconsistencies or misinterpretations. The enumerators then gathered data as a team in three locations over the next five weeks. After this, the data-entry was begun taking roughly four weeks to clean, enter and perform preliminary validation on the data; a further period of two weeks was required at a later time to assemble the date into a format for analysis and to perform final cleaning.

2.2.2 The DDC system development

Over the past week (7 days), did you or others in your household consume any [. . .]? INCLUDE FOOD BOTH EATEN COMMUNALLY IN THE HOUSEHOLD AND THAT EATEN SEPARATELY BY INDIVIDUAL HOUSEHOLD MEMBERS.	E.1 YES. . 1 N0. .2	E.2	E.3 How much did your household consume in total? (Quantity x unit code)	E.4 How much came from purchases? (Quantity x unit code)	E.5 How much did you spend? (Malawian Kwacha)	E.6 How much came from your own production? (Quantity x unit code)	E.7 How much came from gifts and other sources? (Quantity x unit code)
Cereals, grains, cereal products							
Maize *ufa mgaiwa* (normal flour)		101					
Maize *ufa* refined (fine flour)		102					
Maize *ufa madeya* (bran flour)		103					
Maize grain (not as *ufa*) 104		104					
Green maize		105					
Rice		106					
Finger millet (*mawere*)		107					

Figure 3: A section of one of the data input tables: there were over 100 individual items on the Food lists (i.e., the number of rows in this table was greater than 100).

After the 2010 baseline survey, the conversion of the survey to a handheld digital collection method was it was proposed. With the assistance of Concern Worldwide and their contracted software house PSI, the household survey was transferred to a cloud-based platform. This replicated the paper survey, ensuring consistency with the previously collected data. Its design allowed for features and conditions to cut down on human error to be built in (e.g. numeric only, text only, single-choice, multiple-choice options). A data-path was defined through the survey, ensuring the completion of certain sections prior to moving to the next. The survey was uploaded on completion of each interview to the database, provided a 3G connection was available, otherwise, it uploaded when a connection became available. The data in the database could be amended at any time, once a reliable Internet connection was present.

Hand held devices were assigned to each of the data collection sites in Malawi and Ethiopia (see Figure 2). The devices had touch screens and keyboards, and a battery life that would allow for a full day's data-entry. The data collection was taking place in remote rural areas in Malawi and Ethiopia, so ruggedness and long battery life were prerequisites. Additionally the devices selected could capture an image of survey participants, and recorded the GPS coordinates for each location of the survey instance (usually the respondent's home). This was useful for panel studies, which included a number of rounds of data collection at the same sample households. It does, however, raise ethical issues, as discussed below.

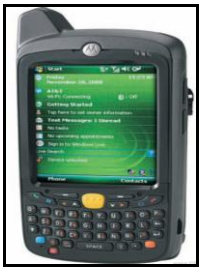

Figure 2: Handheld device use in data collection

Each day, the most up-to-date version of the survey automatically downloaded onto the device. The devices connected to a central database through either a broadband connection or through data-enabled SIM cards. By accessing the database via broadband, the day's data could then be downloaded in spreadsheet format for inspection and analysis.

3. DISCUSSION

The process of transferring to digital data-collection brought many improvements to the data collection process, but with these improvements came many challenges. Through finding solutions for the various challenges encountered during the digitalisation of the data collection process many lessons were learned. The main improvements, challenges and lessons learned will be discussed under the key dimensions of the already-mentioned process flow (Figure 1).

3.1. Data-Gathering Time Per-Unit

In our experience, digital data collection considerably cut down the data-gathering time per-unit and errors involved in data collection. We estimate that the overall data collection time was reduced by approximately 200 data collection hours based on the original sample size of 238 respondents. Many small-holder farmers within the sample population operate on close to subsistence, therefore the less time that they are taken away from their farm work the better; moreover, the shorter the interview time the less likely it is to lose the respondents attention – thus time to execute the questionnaire per household was a critical factor. The digital process not only reduced the time and money spent in field, but also allowed for close to real time access to results for review once the researcher had access to a reliable and sufficient internet connection, in comparison with the months taken on the previous cycle to reach this review stage.

3.2. Training Time

We found that enumerator training time reduced substantially using the digital approach. Training no longer had to cover

the coding of responses, as this is automatic within in the digital process. The data-entry interface on the devices was designed to keep entry errors to a minimum , through the use of drop-menus and lists where possible; and through ongoing data-validation. These steps also improved overall data accuracy. Pre-testing results were reviewed and analysed at the end of the same day, and the online survey amended as required. Hardcopy equivalent processes required took longer, and then required reprinting of the survey instruments; data-inputting was not an option in pretesting due to time and resource constraints. The new processes effectively halved the training time.

3.3. Review Timeliness

Using paper-based approach, validation of data, and trapping of errors was very limited, due to the questionnaire's size (50 pages); data correction did not happen, and when errors were later found, they could not be corrected, but rather became 'missing data'. Using the new processes, a compiled end-of-day review and basic analysis of results was possible subject to Internet connectivity – this was a limitation in the 2012 data-collection, when researchers remained in the field, but was overcome through basing the researchers in town. Additional support from home, where downloadable files were created daily from the data, also improved the efficiency of the processes.

3.4. Data Arrangement Time for Analysis

Limitations in screen size constrained the data-entry method; it was not possible to enter tabular data (as it had been designed on the paper-based process – see Fig 3) – in fact it was constrained to one question per screen. This also impacted on the database structure, requiring the manual rearrangement of the data structures prior to analysis, which proved time-consuming, taking up to two weeks. A reconceptualising of the structure and the survey for the later surveys overcame this in large part.

3.5. Data Accuracy

Estimating data accuracy is difficult; for example, Lane et al., 2006, (reported in Patnaik et al., 2009) found varying results from comparisons between data collection on paper versus handheld devices, with improvement in some trials, and no discernible change in others. In our case, the elimination of the need for coding, and in-built error-trapping eliminated the possibilities of incorrect or missing or excess entries. Filters, controls, skips and jumps also contributed to more effective and accurate data gathering. These skip patterns allowed for the enumerator to be led through the survey reducing the risk for human error and the temptation for taking short cuts. While these initially mimicked the paper-based operation, with operations working effectively similar to that reported in other conversions (e.g. Hattas et al., 2009); the researchers refined these patterns for subsequent data collection cycles, improving their effectiveness. This necessitated the redesign in the approach and logic of the instrument, unlike experiences reported, e.g. by Hattas et al. (ibid), a consequence of both the complexity of the research instrument itself (Fig 3) and the limitations of the devices used. Improvements in technologies, and the experiences of other organizations such as Feed the Future (Agrilinks, 2013) have removed these limitations and available open-source tools[5] offer quick routes to relevant question-interface-design. Using GPS data collection points reaped benefits similar to those reported by Hattas and Eloff (2011), ensuring a record of the physical point of enumeration which could be used and compared with future data. It also provides possibilities for utilizing the data in conjunction with other data sets, in GIS applications for other development projects, as suggested by Crooks(2013). GPS information exists in surveys with wider geographic spread for the mapping of poverty, food security, crop productivity and many other indicators.

Data issues that were encountered during the implementation included incorrect skip patterns, which caused some data not to be gathered during the initial phases. This was only discovered during analysis, and would probably not have happened using the paper-based approach.

4. CHALLENGES AND LESSONS

4.1 In country ICT policy and infrastructure

One of the most significant challenges faced was a stringent telecommunications policy (specific to Ethiopia), and inadequate infrastructure for both connectivity and electricity (in both locations). Ethiopia has a telecommunications policy that limited access to mobile phones to citizens and residents for many years. Non-nationals and non-residents were required to apply for a license to be granted a SIM card; this delayed the start of the research. In comparison Malawi's more lenient requirements, similar to western Europe, was more accommodating to the DDC process.

Reliable 3G connectivity or a broadband connection was a problem in both countries. Enumerators needed to log on to their devices prior each day, before leaving base, to ensure that the devices were operational and up-to-date which had the consequence of running down valuable battery time before surveys had even commenced. This was overcome later through familiarisation with those areas where there was sufficient connectivity. As discussed previously, the 2012 data collection field trips took place entirely out in the study sites, whereas in 2013 the team returned to town centres at the end of the day, as towns had better quality internet and power connections[6]. This meant the results could be exported and validated by the enumerators and the researcher on a daily basis.

4.2 Working with third parties

Having access to experienced third-party support proved invaluable to the digitalising of the research process. It also presented unforeseen challenges in two areas: the limited

[5] For example, Open Data Kit (http://opendatakit.org/)

[6] Solar power and a diesel generator provided power for charging the devices for two of the three study sites in Malawi, where power sources were not reliable.

contextual understanding of developing countries, and lack of expertise in large-scale social science survey methodologies[7]. Given given that our literature scan could not find any evidence of a survey of the magnitude of our own, this was to be expected.

4.3 User Friendly Devices and Interface

The appropriateness of the handheld devices to social research in developing countries raises several concerns. One such concern was the potential risk that the device might create a barrier between the respondent and enumerators. A second concern was the time to upskill enumerators on device usage. In practice, neither respondents nor enumerators were distracted or intimidated by the devices. The enumerators were instructed to explain to the respondents about the purpose of the devices and to reassure them that their anonymity was guaranteed. For the enumerators it only took a few hours during training for them to become confident with using the device - each of the enumerators already had a smart phone for personal use; these were mainly BlackBerrys, which had built-in keyboards.

It was noted in the 2012 survey cycle that enumerators, having gained confidence in the devices, increased their reliance on the device to feed them the next question. This acted as a barrier to participation on the part of the enumerator, impacting on the natural flow of the interview, and turning it to an almost robotic question-and-answer session. This increased the risk of important information being missed or misinterpreted, and also led to the respondents becoming bored and restless.

Another concern raised in relation to the devices was the possible difficulty in reading the screen under strong sunlight. In practice, the enumerator and the respondent found a comfortable place to sit in the shade to conduct the interview.

Unforeseen in relation to the physical specification of the devices was the screen size, and how this in tandem with the software design limited the amount of data that could be presented at any point in time. The screen size and software design limited the amount of data presented at any one time, restricting it to one of a one-question-per-screen shot. If the enumerator need to correct data before completion of the survey, the sequential movement back through the survey could sometimes add up to 30 minutes to the survey time. This led to the frustration of the enumerators, which acted as a barrier to the 'buy in' from enumerators in terms of fully accepting and believing in the technology. In other work (Hattas et al., 2009, Hattas and Eloff, 2011), this is seen as detrimental for the technology to work to its full potential.

4.4 Issues of empowerment and ethics

Empowerment may be defined as "the expansion of freedom of choice and action" (Narayan, 2005). Those whose empowerment may be increased or decreased in the case of DDC are the primary researcher, the enumerators and the targeted population. As was noted, the issue of the 'robotic' enumerator acted as a barrier to communication between the two parties, and this disengagement on the part of the enumerator could be viewed as disempowering for the person being interviewed. It also indicates that the process was less fulfilling for the enumerators, which is also disempowering.

The most basic issues regarding the ethics of data gathering using DDCs in developing countries are that of the nature or respondent data gatherd, and its storage on a remote database. In reviewing our work from this perspective, several problems were revealed. Data that we were gathering was stored on a central database, while we did not seek individual's permission specifically to do so. Where in the past, such data was gathered on paper, and rekeyed into a database, the anonymity of the respondent was maintained. In the DDC version, we purposefully use GPS locations, which are then stored for later use, but could be used to locate and identify the respondent – indeed, we use the GPS locations for just that purpose in the panel survey. We also took the respondents photograph with the rational of being able to meet the same household respondent in an attempt for consistancey.The photographs also were intended to assit in locating households the following years with the aim of reducing sample attrition, something that is seen as one of the main challenges in conducting panel sureveys (Laws et al, 2003).

This needs to be considered in tandem with other issues of power that are at play in the process. In geographies where there is much respect for education, being manifestly well-educated places the researcher in an automatic position of power, both in terms of power to do the research in the chosen location, but also to some extent in terms of power over those that are being researched. The use of unfamiliar sophisticated technologies offers the likelihood of further increasing the power gap. This may influence a persons willingness to agree to be a participant, and may also retard their capability to step away from the research during its execution if they feel that it is not appropriate for them to continue.

It is a reasonable assumption that understandings of the nature of computers or computer storage are close to zero within rural areas of developing countries. The challenge is to provide the respondents with sufficient understandings of the nature and consequences of the process to allow for them to make a reasoned judgement on whether they should or should not participate.

5. CONCLUSIONS AND RECOMMENDATIONS

The conversion from hardcopy to digital data collection in developing country contexts presented the researchers with both benefits and challenges, and highlighted some of the significant issues that are as of yet unresolved in implementations of DDC. The advantages gained highlight the potential for the use of DDC in the collection of large data sets, with a large sample size. There is also the potential for their use with smaller data sets but carried out on a frequent basis, which timeliness of information is critical to using it to its full potential. There is potential for research in

[7] While large-scale surveys are regularly being undertaken using digital devices, the scale refers usually to the numbers in the sample, not the number of questions within the survey; the total number of questions in our survey was greater than 1700.

developed countries to benefit from the lesson-learning in less-developed countries and vice versa.

Improvements in telecommunications infrastructure will offer even more potential; providers are responding to the increasing demand from populations for wider mobile coverage and Internet connectivity[8]. The Ethiopian government is relaxing its telecommunications policy, which may provide a more enabling environment for the use of ICTs in research. A concern however that cannot be ignored is around the challenge of ensuring data protection. This is an issue that needs to be carefully regulated by clear data protection policies relevant to the changing nature of how data are collected, handled and stored, something which may be a challenge for resource poor governments in developing countries. Together with this, ways need to be found to address issues surrounding the ethics of providing truly informed consent for participants.

In the cases of large-scale surveys like the one used in these cases, ways need to be found to reduce the 'robotic-ness' of the experience for enumerators. This may be through designing the interface to offer cues to the user on, for example, running data totals, or through offering greater variety in the mode for data entry.

In conclusion, the future of data collection is most likely to be based around the use of ICTs as the potential not only lies with the increased efficiency and accuracy, but also for reducing research costs with the use of affordable smart phones and tablets. Free open source websites offering tools for building, collecting and aggregating data are readily available and relatively easy to use. With the increasing use of DDC and cloud-based platforms will come ever-more effective error-trapping systems that can be built in to surveys, giving an even greater level of data accuracy and timeliness. Ultimately this can achieve the aim of providing tools for better programme/project monitoring, review and analysis; for highlighting the causes of effective or ineffective activity and intervention, in both developing and developed country settings, and doing so in a manner that is equitable and ethical.

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[8] Mobile subscriptions in Malawi grew from 3.9 million to 4.4 million between 2011 and 2012, likewise in Ethiopia subscription rates grew from 14.1 million to 20.5 million in the same time period (World Bank, 2013).

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