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SHAPING SOLUTIONS WITH A COMMUNITY: THE RESEARCH DESIGN USING DESIGN SCIENCE RESEARCH (DSR) AND CASE STUDY RESEARCH WITH AN ICT4D PROJECT

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Abstract

This paper describes the research design of a mixed method information and communication technology for development (ICT4D) study using design science research (DSR) and case study research in the pragmatic tradition. The study participants are a group of women working as domestic workers in Johannesburg, South Africa and a selected group of organisations. The organisations are included to gain an understanding of their approach to information inclusivity and to evaluate the resulting artefact. The novelty of this study is the combination of DSR with ICT4D, the use of journals as a self-documentation technique to collect data, followed by a design thinking workshop and interviews. The problem that the study addresses is how should the information needs that are meaningful to women working as domestic workers, be effectively translated through the use of ICT in order to enhance their experience of the good life as defined by Sen's capability approach (1999) and to contribute to the success and social value of ICT4D projects.

Keywords

ICT4D, DSR, participatory design, capability approach, design thinking

1. Introduction

Information and communication technology for development (ICT4D) is an interdisciplinary field as an intersection of information systems (IS), computer science and development studies, with IS as the main custodian (Heeks, 2008; Walsham, 2012). It is still a new area of research boosted by the emergence of new technologies such as the mobile phone and social networking and a renewed interest in the potential markets represented by poorer people (Walsham, 2012).

ICT4D research is criticised on the one hand for being technology driven and on the other hand for becoming a social science concerned with creating theories of explanation without engaging with technology (Avgerou, 2008; 2009; Dutton, 2013; Harris, 2016; Heeks, 2008; Kleine & Unwin, 2009; Krauss, 2009; 2013). Both criticisms have disengagement with the beneficiary community and a lack of understanding of their worldview in common (Avgerou, 2009; Harris, 2016; Heeks, 2010; Krauss, 2013; Unwin, 2009). Active participation of the community as producers and innovators are encouraged, even though community participation is complicated as it creates divides between those who participated and the rest of the community (Gurstein, 2013; Heeks, 2008).

We designed this study to create and evaluate an emerging framework for community participation in shaping solutions where access to information through ICT as a commodity can contribute to expansion of choice as an indicator of development. The study is shaped by Sen's (1999) capability approach and the social shaping of technology theory. A group of women who works as domestic workers and a selection of organisations participated in the study. We included the organisations to evaluate the artefact and to add another perspective

on information inclusivity as primary information providers given their relationship with developing communities as represented by the group of women. The study is directed by the primary research question and the secondary research questions:

- Primary question: How should the information needs that are meaningful to women working as domestic workers be effectively translated through the use of ICT?
- Secondary questions:
 - a. What is meaningful information for the group of women?
 - b. How are the information needs of the group of women currently fulfilled?
 - c. What are the existing organisational views on information inclusivity with reference to developing communities?
 - d. How can access to information through the use of ICT contribute to the experience of the good life as defined by Sen's capability approach?

The purpose of this paper is to describe the research design of the study. The paper is organised as follows: the first section is a brief introduction to the motivation of the study, the second section is the background to the study, the third section describes the research design and the fourth section is the conclusion.

2. Background

According to Statistics South Africa, South Africa has a population of 50.59 million with an increasing rate of urbanisation and urban poverty. It is estimated that almost eight million people live in urban slums in South Africa and that 39.2 per cent of urban residents are poor (UN-Habitat, 2016). Poverty is the deprivation of basic capabilities rather than merely the lowness of incomes (Sen, 1999). It is multidimensional with people experiencing economic poverty, time poverty and information poverty (Britz, 2004; Chopra, 2015). Analysing data from the South African labour market for the period 2001 to 2012, show that income inequality has risen, unemployment remains high, and employment for low and unskilled workers has declined (Bhorat, Goga, & Stanwix, 2014).

There are 53 million people employed globally as domestic workers of which 83 per cent is female (Chopra, 2015). In South Africa about a million people, mainly black women, are employed as domestic workers and earning minimum wages (Budlender, 2010). The domestic sector is characterised by longer work hours, lower wages, few if any benefits, less legal or social benefits or protection, no maternity leave, health care or pension provision than the other formal sectors. Female domestic workers are subjected to gender discrimination, prejudice and stereotyping in relation to their work, that is regarded as low status and accorded little value (Budlender, 2010; Chopra, 2015; D'Souza, 2010). The knowledge of most workers and employers about details of the legal provisions is poor and often incorrect (Budlender, 2010). Awareness-raising and information-sharing are very limited within the domestic sector adding to the hidden nature of the workplace (Budlender, 2010; D'Souza, 2010).

Women have a double burden of unpaid care work in their own households and economic empowerment referred to as time poverty (Chopra, 2015). Due to the fact that work opportunities are typically away from their residences and their reliance on public transport, women face the prospect of increasing levels of time poverty (Chopra, 2015; Joseph & Andrew, 2009). Time poverty is a critical determinant of women's poverty and a critical determinant of their economic empowerment (Chopra, 2015).

If domestic work is performed under fair working conditions, it has tremendous potential for reducing poverty and empowering women (D'Souza, 2010). Women working as domestic

workers allow other female workers with family responsibilities to achieve equilibrium between work and family life and remittances of migrant domestic workers create pockets of relative prosperity in otherwise resource-starved communities (D'Souza, 2010; Wardoyo & Mahmud, 2013).

Information is one of the most important resources conducive to development and helps people in communities to expand horizons, increase perceptions, enhance competencies, enlarge a sense of perspective and enhance self-esteem (Meyer, 2002; Rogers, 1992; Sturges & Neill, 1998). Access to information alone does not guarantee development; what matters are people's actions once access is provided (Alampay, 2006).

ICTs can be used as an opportunity producer, capacity enhancer, knowledge producer and social enabler by women in the domestic sector (Wardoyo & Mahmud, 2013). ICTs can provide access to information and public services such as health and education that can further women's empowerment and offer a creative solution to provide safe locations and environments for women to work in without contributing to time poverty (Chopra, 2015). However, low income and low education levels are barriers to accessing and using ICT (Mansour, 2015). Mansour (2015) describes the information-seeking behaviour profile of women in the domestic sector who participated in a study as showing a preference for verbal over written information sources such as speaking to other people, watching television and listening to radio with a small number of the participants using the Internet.

There are limited published research studies on ICT4D and women in the domestic sector with none of the studies using DSR, self-documentation and design thinking. Examples are Wardoyo and Mahud (2013), Chopra (2015) and Mansour (2015) who all recommend further research into the use of ICTs and its contribution to women's empowerment.

The objective of this study is to describe a more effective way to surface information needs of people in developing communities through understanding what is meaningful information; determining if change is needed from the current practice of fulfilling information needs; understanding if information inclusivity is important to organisations that are primary information providers; and confirm the relevance of this study to the development agenda through the lens of Sen's (1999) capability approach. The objective of this paper is to describe the research design of the study. Women working as domestic workers in an urban environment represent the developing community.

Given this background, the problem addressed in this research is how should the information needs that are meaningful to women working as domestic workers, be effectively translated through the use of ICT in order to enhance their experience of the good life as defined by Sen's capability approach (1999) and contribute to the success and social value of ICT4D projects.

3. Research design

The research design elements are summarised in Table 1. The research is conducted in the pragmatic tradition. Pragmatism view the meaning of an idea or concept as the practical consequences of the idea or concept (Hookway, 2013). It denies such things as functions and intentions and rejects the rigid subject-object divide (Rammert, 1999). Pragmatism is associated with action, intervention and constructive knowledge that is appreciated for being useful in action with practical value (Goldkuhl, 2007; 2012). Goldkuhl (2012) describes constructive knowledge as a collection of knowledge forms that includes descriptive,

explanatory, prescriptive, normative and prospective knowledge. A pragmatic study is concerned with how things work, what works and what does not work (Goldkuhl, 2007). Action is the way to change existence (Goldkuhl, 2004).

| | |
|-------------------------|--|
| Ontology | Subjectivism |
| Research philosophy | Pragmatism |
| Research approach | Inductive |
| Research strategy | Design science research and case study |
| Research population | A group of women working as domestic workers in Johannesburg, South Africa A selected group of cross-sector organisations |
| Data collection methods | Design thinking methods and workshop Semi-structured interviews Participant observation |
| Data analysis methods | Qualitative content analysis |

Table 1: Summary of the research design elements

Design science research (DSR) and case study research are used as a mixed qualitative method approach with an artefact as the research output. As a deeper understanding and an artefact that could lead to a change in action in future ICT4D projects are the intent of this study, design science and case study research satisfy the pragmatism research paradigm.

DSR, also referred to as design and creation research strategy (Oates, 2006), focuses on the construction of a wide range of socio-technical artefacts such as decision support systems, modelling tools, governance strategies, methods for IS evaluation, and IS change interventions (Gregor & Hevner, 2013). Design science methods are used with the research participants to define the information needs they find meaningful and design artefacts following the three DSR cycles namely the relevance cycle, the design cycle and the rigor cycle (Hevner, 2007).

The case study is a research strategy which focuses on understanding the dynamics present within single settings (Eisenhardt, 1989; Myers, 2009; G. Payne & Payne, 2004). Case study research can be used to describe, test or build theories (Eisenhardt, 1989). A characteristic of a case study is that the case is studied in depth, using a variety of data generation methods, to obtain a rich, detailed insight into the “life” of that case and its complex relationships and processes (Oates, 2006). The case study is within the relevance cycle and the design cycle of the DSR to understand the requirements and evaluate the artefact (Hevner, 2007).

The data collection techniques are design thinking, interviews, self-documentation journals, WhatsApp chat, workshop tools and participant observation. The study aims to discover an effective way of translating information needs of a developing community through ICT following a pragmatist research paradigm. The relationship between the research elements is illustrated in Figure 1.

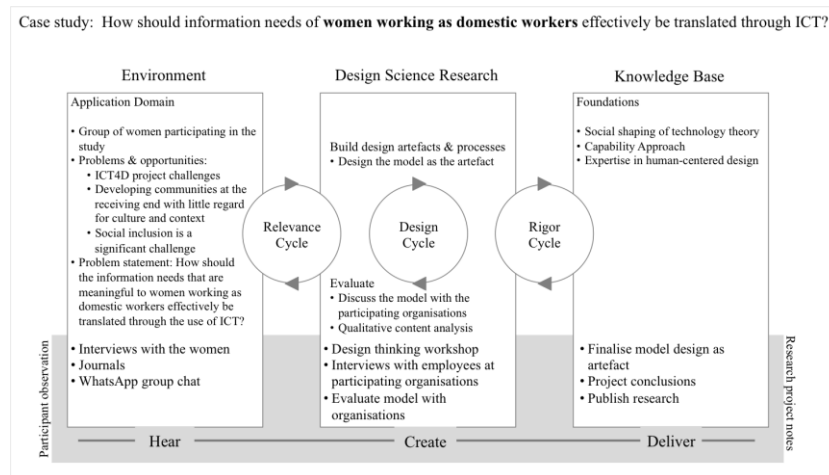


Figure 1: Relationship between research design elements with reference to Hevner’s (2007) DSR cycles

3.1 ICT4D and DSR

DSR is a methodology that has the potential to bring balance between the two opposing criticisms of technology determinism and explanatory theories given that the community is involved as co-creators and the goal of the research is to create an artefact (Islam & Grönlund, 2011; Walsham, 2012). Identifying characteristics of DSR are the knowledge and understanding of the problem domain and the solution artefact (Hevner, March, Park, & Ram, 2004). DSR is not only concerned with understanding the problems, but also to offer solutions (Hevner et al., 2004; Islam & Grönlund, 2011).

DSR contributes to ICT4D research’ three strategic questions namely what sort of technology or artefact (instrument); for what sort of development (goals); and how these two can be fitted together in order to achieve these goals (effectiveness) (Islam & Grönlund, 2011). However, the use of DSR in ICT4D research is significantly lacking with ICT4D over focused on evaluating the feasibility of existing technologies than designing new technology solutions (Islam & Grönlund, 2011; Mramba, Apiola, Kolog, & Sutinen, 2016). Examples of ICT4D research where DSR is applied are deploying AMIS, a mobile phone based solution, in rural Bangladesh (Islam & Grönlund, 2011); a mobile phone solution for home-based healthcare in South Africa (la Harpe, 2014); ICT for rural education development in South Africa (Herselman & Botha, 2014); and technology for street traders in Tanzania (Mramba et al., 2016).

3.2 Research instruments

Myers and Newman (2007) depicted the qualitative interview as a drama. Using their descriptions of the elements of the drama, with an addition of the duration of the run of the drama, the description of the study and research instruments can be directed as follows:

3.2.1 Drama

As in a drama, the interviewer has to give stage directions and pay attention to stage management (Myers & Newman, 2007). The study has three acts. The first act starts with the enrolment of participants from women working as domestic workers using a snowball sampling strategy, aligning on the purpose of the study and directing the participants to self-document their interactions with information in journals. The second act is the design thinking workshop with the participating group of women. The third act is the interviews with participating organisations selected by using purposive sampling on their views on information inclusivity

and vision for the future on interactions with developing communities as represented by the participating women and to test the concept of the framework used in the research project. All the interactions and data gathered in the three acts are weaved together to form the drama and outcome of the study.

3.2.2 Stage

The stage is the location in which the interview takes place (Myers & Newman, 2007). The study has multiple stages for the various acts located in Johannesburg and Pretoria, South Africa. The stage for the first act varies between the work places and homes of the participating women. The stage for the second act is a venue for the design thinking workshop in Johannesburg. The stage for the third act is the offices of the participating organisations. In addition to the physical stages, a digital stage is used through mobile phones using the communication application, WhatsApp, and SMS. We created a WhatsApp group with the participating women who are willing to use the application. The type of phone and cost of data are prohibiting factors for some of the women to use applications such as WhatsApp. SMS messages are used to communicate to those participants who do not use WhatsApp.

3.2.3 Actor and audience

Both the interviewer and the interviewees can be seen as actors and the audience as the interviewer should listen intently while interviewing and the interviewee should listen to the questions or other participants' responses (Myers & Newman, 2007). The cultural interpreter who assists us, the women working as domestic workers, employees from the participating organisations and us form the cast of actors and audience. We explained the roles of the researcher and the participants at the start of the study and lead the discussions supported by the cultural interpreter depending on the language preference of the participating group. South Africa has nine official languages with English as the recognised business language. The women represent diverse cultural groups for example Sotho, Xhosa and Zulu as well as migrant workers from other African countries. We encouraged active participation and language inclusivity. An important characteristic of design thinking is observation by the facilitator, in this instant, the researchers. We have to be active listeners and observers, in other words, become the audience, for a successful workshop.

3.2.4 Script

The interviewer has a research instrument of questions to put to the interviewees, to guide the conversation and the interviewee normally has no script and has to improvise (Myers & Newman, 2007). The script for this drama is carefully designed to guide the actors in their various roles with sub-scripts for each of the acts following the principles of the Human-Centered Design (HCD) (IDEO, 2012) as aligned with the DSR cycles (Hevner, 2007). The goal is to collect data to support the formulation of answers to the primary and secondary research questions of the study applying a human-centered approach.

The human-centered design approach starts with a specific design challenge that is human centered and proceeds through three main phases namely Hear, Create and Deliver. The Hear phase (preparation, interviews and observation) guides the researcher through the process of preparing for the research and maps to Hevner's (2007) DSR relevance cycle and the first two steps of the DSR process created by Peffers et al. (2006) namely problem identification and motivation, and objectives of a solution. The Hear phase includes six steps and are fulfilled in the study (IDEO, 2012):

1. **Identify a design challenge:** The primary research question is the design challenge.

2. **Recognise existing knowledge:** Existing knowledge is gathered through the literature review, self-documentation in journals and interviews.
3. **Identify people to speak with:** The study includes two groups. The first group is 26 women working as domestic workers in the Johannesburg area. The second group includes six organisations across various industries. The organisations are selected based on the following initiatives:
 - A public sector organisation: urban development planning and public participation
 - A public sector organisation: inclusive trade platform and small-buyer programs
 - A global financial institution: ICT4D community projects
 - An international financial organisation: initiatives in developing countries focusing on women
 - An insurance company: insurance product innovation for low income groups
 - An international telecommunications company: Handset insurance project in Africa
4. **Choose research methods:** Self-documentation and individual interviews are selected as the HCD toolkit methods (IDEO, 2012).
5. **Develop an interview approach:** The self-documentation journal and an approach for the individual interview for the recruitment orientation are designed.
6. **Develop your mindset:** The HCD toolkit encourages the researcher to adopt a beginner's mind and observe first before attempting to interpret. The beginner's mind is a reminder to set own experiences aside and prevent assumptions based on prior experiences.

The first act of the drama is part of the Hear phase. In the first act, the actors are the group of women working as domestic workers and their script is the journals with the purpose of the study and guided questions. The journal entries contribute to the answer formulation of the first, second, and fourth secondary research questions, and inform the design of the design thinking workshop in the Create phase. Regular in-person or digital contact sessions are held to provide motivation for the participants to continue with the self-documentation process, ensure quality of the information and build empathy.

The journal contains a combination of blank pages and guided pages. The guided pages have sections prompting the participant to write about when information is needed, where she needs the information for example at home or at work, what information she needs, why she needs the information and how she resolves the information need. The prompts on the guided page are provided in English, Afrikaans, isiZulu and Sesotho to accommodate the language diversity of the participants and strengthen the inclusivity approach of the project.

The next phase of the human-centered design process is the Create phase (workshop and framework prototype). In the Create phase, we facilitate the research participants to distil the collected learning and observations and collaborate in a design thinking workshop in the second act to co-create frameworks, solutions, opportunities and prototypes (IDEO, 2012) with the resulted prototype evaluated with participating organisations in the third act. The Create phase maps to design cycle and the rigor cycle of Hevner's (2007) DSR cycles and steps three to six of the DSR process model as defined by Peffers et al. (2006).

Templates are used in the workshop to facilitate the surfacing of information. A combination of templates from the Human-Centered Design toolkit and the Design for Growth Field Book are used (IDEO, 2012; Liedtka, Ogilvie, & Brozenske, 2014). The seven steps of the Create phase are fulfilled by the study as follows:

1. **Develop the approach:** The design thinking workshop is a co-design workshop that is facilitated by us with active participation by the group of women. At the start of the

workshop, the participants create a **persona** who represents the women working as domestic workers and evokes empathy.

2. **Share stories:** Sharing stories allow the experiences to be codified and used as data. The participants are invited during the workshop to share their experiences with the group while the group members take notes on post-it notes that are displayed on a big sheet of paper. Referring to their experiences, the **jobs-to-be-done** tool is used for the persona created in the first step.
3. **Identify patterns:** Patterns are identified during the workshop by extracting key insights, finding themes and creating frameworks. The jobs-to-be-done information is used to identify patterns and find themes as input to the next step.
4. **Create opportunity areas:** Opportunities are stepping-stones to idea generation and start with the question “**How might we...?**”. Using the themes identified in the previous step, the participants create “how might we” statements without jumping into solutions. Three to five “how might we” statements are selected to use in the next step by giving each participant three vote-dots to mark their three favourite opportunity areas. The three or five opportunity areas with the most votes are the input for the next step.
5. **Brainstorm new solutions:** For each of the “how might we” opportunity areas, follow the seven brainstorming rules (defer judgement, encourage wild ideas, build on ideas of others, stay focused on topic, be visual, one conversation at a time, go for quantity) and generate ideas using the “**Current, Barriers, Future**” framework. The barriers are grouped and then flipped to identify possible solutions as the future solutions.
6. **Make ideas real:** Ideas are made real through prototyping in the Human Centered Design process. The importance of prototyping is to develop a deeper understanding of the idea and reveal questions that still need to be answered (IDEO, 2012). In this study, the artefact is the research design framework that is tested through the research activities and the prototype framework evaluated with the participating organisations.
7. **Gather feedback:** The prototype of the artefact and other results from the data analysis are shared with the participants from the organisations. The feedback is used to enhance the artefact further.

The second act is the design thinking workshop and relies on improvisation with the script directed by the selected templates as specified in the Create phase. The templates used in the workshop are defining a persona, story telling, jobs-to-be-done journey map, “how might we” opportunity areas, and ideation using the “Current, Barriers, Future” framework. The script for the third act is a set of questions to guide semi-structured interviews.

The third phase of the Human Centered Design process is the Deliver phase (finalise the framework). The Deliver phase maps to the rigor cycle of Hevner’s (2007) DSR cycles and step six of the DSR process model as defined by Peffers et al. (2006). In summary, the Deliver phase provides the implementation tools to promote the prototype and ideas to solutions and plans (IDEO, 2012). It has six steps, namely:

1. Develop a sustainable revenue model
2. Identify capabilities for delivering solutions
3. Plan a pipeline of solutions
4. Create an implementation timeline
5. Plan mini-pilots and iteration
6. Create a learning plan

The artefact designed by this study is evaluated through the discussions with the participating organisations in the Create phase. Following the guidance of the DSR rigor cycle and communication step of the DSR process model, the framework is completed and documented (Hevner, 2007; Peffers et al., 2006). The steps defined by IDEO's Deliver phase are not relevant for delivering the study's artefact, because the artefact is a framework to improve ICT4D information requirement definition and relevance and delivered through publication.

3.2.5 Entry, performance and exit

Impression management is important, particularly first impressions as an entry, and it may be important to dress appropriately to the situation (Myers & Newman, 2007). We rely on our experience as South Africans and our relationship with the cultural interpreter for guidance on the various interactions and for acceptance by the community. Business etiquette is followed for the interviews with the participating organisations.

All of the above, together, produce a good or a bad performance. The quality of the performance affects the quality of the disclosure that in turn affects the quality of the data (Myers & Newman, 2007). All the elements of the research are purposeful designed to deliver on the study's objectives and deliver in a good performance.

The exit involves leaving the stage, possibly preparing the way for the next performance or another performance at a later date (Myers & Newman, 2007). We explained the purpose of the study to the participants and manage the expectations for feedback. The findings of the research are available to all the participants.

3.2.6 Duration

Expanding on the analogy of the drama, the duration of the drama is added to the elements. The various acts of the drama are the participants using the self-documentation journals, the contact sessions, the design thinking workshops, the interviews at the participating organisations and the feedback sessions. The duration of the acts is over a period of four months.

4. Conclusion

The research design is part of a doctoral study and directed by the criticism of ICT4D projects as technology determinism and explanatory theories. A DSR and case study mixed method approach are followed using journals as a self-documentation data collection technique as well as digital chat, a design thinking workshop, observation and interviews. The objectives of the study is to develop and evaluate a framework to improve the way information needs of people in developing communities are surfaced through understanding what is meaningful information; determining if change is needed from the current practice of fulfilling information needs; understanding if information inclusivity is important to organisations that are primary information providers; and confirm the relevance of this study to the development agenda through the lens of Sen's (1999) capability approach.

The study is relevant to the development agenda because of the inclusive approach to enable people to increase their choices through access to information to live a life they have reason to value and contribute to the body of knowledge with the framework to increase the potential for success of ICT4D projects.

The novelty of the resulting framework is the combination of DSR with ICT4D, the use of journals as a self-documentation technique to collect data, followed by a design thinking

workshop and interviews. The effectiveness of the framework and utility to the community of users are demonstrated through the participatory approach to facilitate the community to shape solutions that they value and the empowerment experienced through both the activities as well as the impact of the solution as an expansion of choice.

The departure point of the project and the framework is not ICT and allows for solutions to surface given the capability set of the participants and the capability of the project. The journals and the design thinking workshop allow everyone to participate to share what information they value and the sponsored data bundles (project capability) allow everyone to interact using their mobile phones or tablets through WhatsApp and SMS messages thereby illustrating the balanced determinism of social and technology in the project.

The framework draws on the capability approach as a way to measure development and the social shaping of technology theory for the positive role in integrating people and technology concerns by offering a greater understanding of the relationship between scientific excellence, technology innovation and social well-being (Williams & Edge, 1996).

DSR is applied as a method to shape the solutions that they value with the community. DSR is a relatively new field in ICT research with Walsham (2012) and Österle et al. (2010) encouraging the application of design-orientated and mix-methods research. The framework artefact produced by this study is a contribution to and application of DSR.

Next the data collected by the study will be analysed and presented as part of the doctoral thesis followed by the study's conclusion, contribution and suggestions for future research. We agree with Heeks and Krishna (2016) that hope is a precursor to action and the relevance of the relationship between hope and ICT4D. Engaging the community in shaping solutions can be a way to realise hope as a capability and enable choice as a way to experience development.

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