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Exploring how mobile application projects, in small scale farming communities, can enable social learning and boundary crossing in a multi-stakeholder landscape of practice

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Abstract

In South Africa, one third of the food produced for consumption is wasted, whilst 26% of all household's experience hunger. Excessive food surplus in countries such as South Africa, that experience high levels of food insecurity is a topic of national and global concern. Food surplus occurs in many contexts, including communities of emerging small-scale farmers, many of which aren't able to find markets for their produce resulting in wastage. In a time of mobile technology expansion, the wide infiltration of internet enabled smartphones into diverse communities has increased dramatically with the uptake of mobile applications being a key area of interest amongst environmental educators. The Food for Us project, in which this study is located, aims to develop a mobile application that meets such needs. The application is being trialled by 40 voluntary participants in the Western and Eastern Cape, linking producers with potential alternative consumers to reduce potential food waste. The study, which this paper draws from, is investigating how the initial use and development of the Food for Us mobile application has enabled social learning through particular application affordances across the Raymond Mhlaba municipality landscape of practice, involving selected producers and consumers. This paper will explore the preliminary findings that have emerged after initial analysis of the data that has been collected. A series of interviews, surveys, WhatsApp data, application use meta-data and ongoing observations were conducted over the length of the Food for Us project. Analysis of initial data has indicated that personal and collective value has emerged strongly amongst the application users in the Raymond Mhlaba municipality. Social learning has started to emerge in the form of inter-generational and inter-disciplinary boundary crossing which has been enabled by the application and its supporting platforms which have been used as a mediating tool to connect people. This paper is part of a Masters thesis and hopes to inform the understanding around the use of mobile application to enable social learning within the context of the South African small scale farming green economy value chain.

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1. Introduction: Understanding the Food waste challenges within a rapidly developing technologically enabled society

With changing global climate, increased pressure on the world's natural resources and a continually growing population, the presence of large amounts of wasted food has become a major international concern juxtaposed against a backdrop of mass malnutrition and hunger in many developing countries. According to the most recent 2014 Food and Agriculture Organization (FAO) statistics year book, 24,8 % of people in Africa are undernourished (FAO, 2014), yet it is believed that up to 37% or 120 -170kg /year per capita of food is wasted in sub-Saharan Africa (Sheahan & Barrett, 2017). While South Africa produces enough food for its 53 million citizens, roughly 26% of South African households are food insecure (von Bormann, 2017). This wastage predominantly occurs in the agricultural production part of the agricultural value chain with 2.7 million tons lost a year (Oelofse, 2015).

Additionally, Khapayi and Celliers (2016) and Mpandeli and Maponya (2014) note that one of the key challenges that hinder small scale emerging farmer's development is their lack of participation in appropriate local markets. In a study conducted in King William's Town, Eastern Cape, it was found that 55% of the small scale emerging farmers had no access to market information, therefore no exposure to new markets, prices, or information regarding produce supply and demand. Many farmers complained that their produce would be spoiled due to the lack of markets in close proximity (Khapayi & Celliers, 2016).

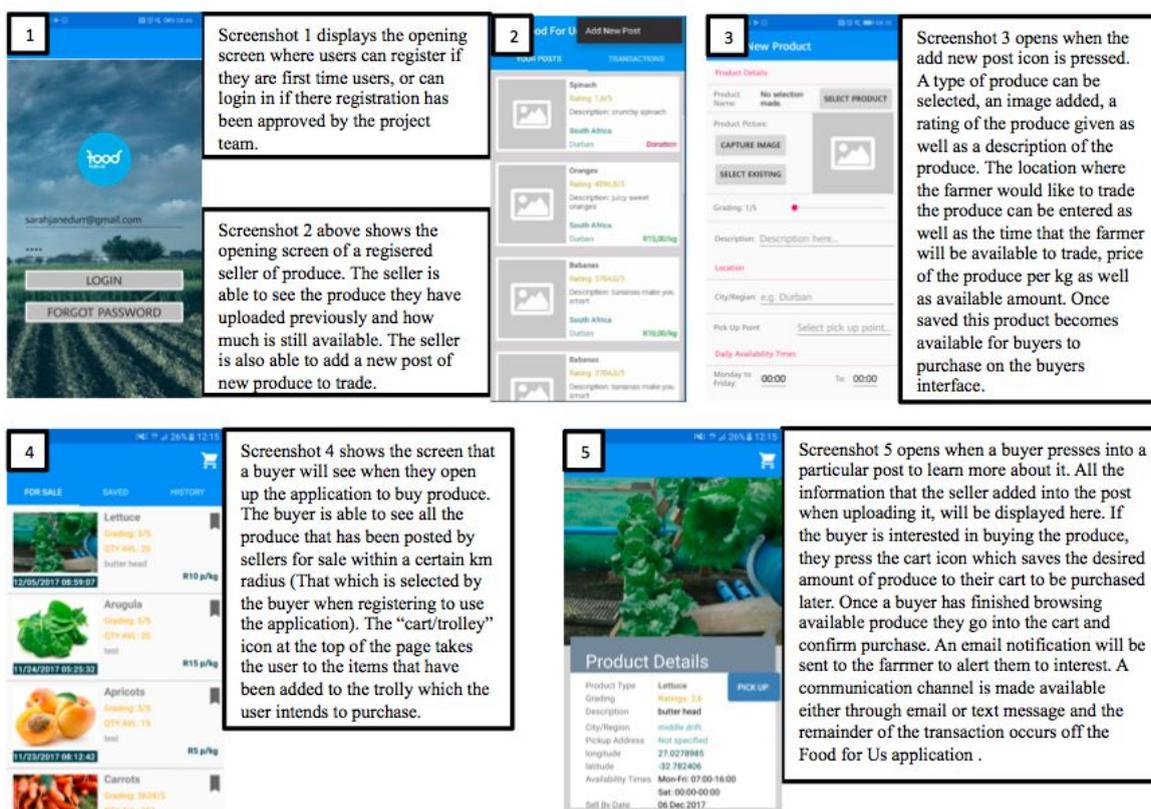
This issue of food waste and lack in market access is occurring in a time of increased use of and surge in ownership of mobile phones and the use of internet on hand held mobiles (Donner et al., 2011) in the postmillennial decade. Donner et al. (2011) argues that a mobile phone's portability, flexibility and ability to be personalized has the potential to increase productivity and agency within the global south. Brown et al. (2003) agrees, concluding that cell phones offer great opportunities for services to reach critical masses (Brown et al., 2003). Mobile phone subscriptions have increased dramatically with subscriptions rising from 8 million in 2008 to 76 million in 2016 (International Telecommunications Union (ITU), 2016). In a recent national survey, 53% of households had at least one member who had access to the internet with more than a third of this, (33,7%) being through mobile devices (Statistics South Africa, 2016). Aker and Mbiti (2010) note that recent app developments are designed to make life easier and more efficient (Aker & Mbiti, 2010).

The Food for Us project, funded by the United Nations Environmental Programme (UNEP) under the 10-year framework of programmes (10-YFP) One Planet initiative, aims to trial a mobile application as a solution for diverting surplus food to feed an alternative market whilst also looking to transform market access and promote the building of local circular economies. The Food for us project also aims to encourage the establishing of community learning which will be supported by educational research

to increase employment opportunities and other forms of value within food waste streams by using this type of technology (Jenkin, 2016).

2. Food For Us project intervention, what we did

This paper investigates the preliminary findings that emerged from the greater Food for Us project, which involved a number of interventions. The aim of the project was to design and introduce a mobile application that can be used as a tool to connect local buyers and sellers of fresh produce to reduce on-farm surplus, to increase market access and contribute towards strengthening a local circular economy. The application provided a platform on which buyers and sellers could connect and advertise and buy fresh locally produced produce (figure 1 below explains some of the functionalities of the first version of the Food for Us application which were informed by user participation). The



Food for Us project was introduced in two different case-study areas, Worcester in the Western Cape and the Raymond Mhlaba municipality in the Eastern Cape. The preliminary results discussed in this paper arise from the Eastern Cape case study, which is also the focus of my Masters research study.

In August 2017, two introductory workshops were held in each of the two case study areas to work together with a diverse range of stakeholders in collectively envisioning the Food for Us project and functionalities of the application. The first version of the application was made available to potential users later in mid-September 2017. The introduction of the Food for us application was coupled with important training workshops that were run in both study sites to assist users on how to download, register and use the new application. In conjunction with the training, a support WhatsApp group was developed for the Easter Cape case study to provide a support platform for users to discuss challenges,

to navigate solutions and communicate with diverse stakeholders about available and demanded produce.

Within the Eastern Cape case study, the Food for Us project partnered with a similar social learning research project situated in the area, Amanzi for Food (Pesanayi, 2018). The Food for Us project was incorporated into the Amanzi for Food Training of Trainers course, which enabled the Food for Us project to reach more people and be exposed to more comments and suggestion. The Food for Us application was workshopped on three occasions within the Amanzi for Food course which was held in November 2017, February 2018 and May 2018. The final intervention that occurred in the Eastern cape case study was the #MatchMaking event, which took place in April 2018. This event provided an opportunity for local buyers, sellers and intermediary stakeholders to network, build partnerships and come together to discuss supply chain challenges and potential solutions and the disconnect between

*Figure SEQ Figure * ARABIC 1 Series of screenshots showing the workings of the version 1.0 of the Food for Us application which was informed by the introductory workshops held in August 2017.*

buyers and sellers in the local supply chain, which was identified as a major issue.

The value created through this project was tracked through the application use as well as through surveys that were conducted at the beginning of the trial, baseline surveys, and end of the trial final surveys. A sample of 20 users were surveyed and an additional eight were engaged in more in-depth interviews. Data was collected from the #MatchMaking workshop, Amanzi for Food discussions and from the discussion that emerged on the Food for Us WhatsApp support group.

This data was collected and the preliminary findings that emerged from the first phase of analysis are been discussed in section 3 below. Further detail and more in-depth perspective on these findings are being reported in my Masters Thesis (Durr, in press).

3. Preliminary findings

3.1. Local mobile user culture and learning to use the Food for Us Application

The introduction of the Food for Us application, in its first version, was an exciting and daunting task as many of the users had not used this type of application technology before. Application training sessions were held to assist potential users on how to navigate the application. The important learning that came out of this training exercise was that in order for learning to take place, and new skills to be mastered, the trainees needed to be able to go through the applications by themselves on their own device. One of the largest hurdles that arose from this training was that many mobile users did not feel confident to download the application off Google Play store (for android devices), as well as navigate the registration process alone. The user registration after these training workshops was incredibly low, due to a combination of a lack in users confidence in their ability to successfully download and use as well as technical issues with the application software.

Ongoing training sessions were conducted throughout the Amanzi for Food Training of Trainers modules. These sessions worked through the registration process slowly explaining the different

terminology, the need for the requested information and the meaning of the various icons (see Figure

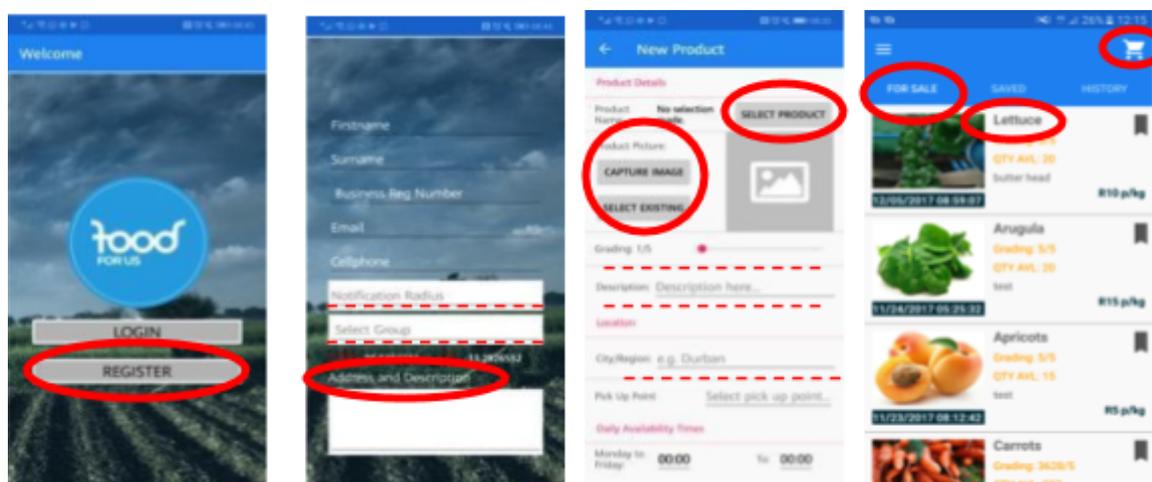


Figure SEQ Figure * ARABIC 2 This collection of screenshots, shows the registration process and product uploading process that was emphasized (those components circled or underlined) that made up part of the potential user's application training workshop that was conducted in Grahamstown and Alice in the Eastern Cape caste study. .

2 below)

What was observed in these sessions was the absence of technical knowledge surrounding email communication; email management, application downloading and password creation and password management. In a number of instances, users did not have an email address, or had let their email address become dormant. This required an explanation and demonstration on how to set up and use an email account as well as to explore the best way to manage passwords, contributing to developing information communication technology literacy.

The concern of data costs of application download and application use was raised a number of times during these sessions. Working through the registration process and explaining the process of uploading the produce was a lengthy process as much of the terminology and the technical application processes needed to be explained to the users.

Activities were planned to assist this knowledge transfer, but unfortunately these activities were not achieved as much of the sessions were spent troubleshooting technical issues that users experienced on their mobile phones. The concern of mobile storage capacity was raised during these sessions, as well as different versions of smartphones not being able to support the application. In each instance personal one on one support was required to successfully assist users to overcome challenges encountered. This process became more resource intensive and time consuming than previously anticipated, but also provided useful insight into the assumptions that accompany socio-technical innovation, and which also provided useful insight into the processes of learning associated with new socio-technical innovations.

As previously described, the cost of data was raised as a challenge and so was the availability of mobile phone signal availability. One of the users explained that when she went out to look at her fresh produce, she wanted to upload the produce straight away while she was in the field but unfortunately was not able to because of the poor service connections. This issue of signal resulted in

her not uploading the produce immediately and only uploading the produce when she left the field in the evening, by which time, she explained, she might be too tired to upload the produce.

The most complex part of the application use appeared to be the navigation of the application between portfolios (between the buyer and seller portfolio) as well as completing a transaction through the application. In the time of the trial, only 2 transactions were successfully made through the application, whilst close to 10 transactions were made informally outside of the application. These transactions were conducted through means of WhatsApp and voice call as users found this means communicating to do business more familiar than the application with its largely unfamiliar discourse and operational procedures. This is despite users of the application being very supportive of the application and its intentions in principle.

Thus, importantly, and also interestingly, there has been persistence amongst users, especially the youth, to continue to use and experiment with the application, and to contribute to improving the application so that it enables farmers to connect more easily with buyers and more easily with each other, as this is a real need on the ground amongst these farmers. Through the use of the WhatsApp group as a troubleshooting platform, many users have been able to seek advice and assistance from the application development team on matters concerning the application, and this in itself has provided an interesting and useful learning platform for users, researchers, and App developers alike. The Food for Us WhatsApp Group has played a very important supporting role as it assisted not only the people who are experiencing issues, but also other users who might have experienced this issue before and hadn't voiced their challenges. An example of this was when one of the users explained that they were having issues with logging into the application. Once this issue was asked about on the WhatsApp group, a number of users expressed that they had experienced the same problem but thought that it meant that the application was not working and the issue could not be resolved. Through being part of the Food for Us WhatsApp group, which served as a learning support platform, many users explained that they became more aware of how to solve technical challenges. This shows that while socio-technical innovations may initially seem difficult to navigate, people are willing to learn about them, and to persist in learning how to use them.

3.2. Improved network collaborations and exchange of knowledge

One of the key successes of the Food for Us application Eastern Cape case study was the effective network building that the Food for Us project encouraged. Through the application, supporting WhatsApp group, workshops and #MatchMaking event, network building has been a main focus.

In the base line surveys, one of the dominant expectations for the application and involvement in the project was to reach more people and build networks so that farmers would have more markets and buyers would have information about local farmers. In the final survey the users were asked whether their expectations of the project were met as the first phase of the project comes to a close. Many of the users expressed concern that their expectations had not been fully met, however they did believe that one of the best components of the project was being introduced to new people and becoming part of a new network where knowledge is shared. One of the users explained that even though they might not have completed any additional transaction through the application so far, she has met and made

very good connections through the WhatsApp group and #Matchmaking event that she believes she will collaborate with on business ideas in the future. This shows the importance of supporting learning interactions while learning of a particular socio-technical innovation is taking place.

The buyer base was not as strong as the farmer and intermediary base and therefore there seemed to be a lot of discussion and collaboration between farmers and occasionally buyers more so than between commercial buyers and traditional farmers. A maize farmer from Middeldrift explained that she was very thankful for the opportunity to attend the Food for Us #MatchMaking event as she was able to connect with a chicken farmer nearby who she has now sold her maize to. The WhatsApp group has created a space for buyers to be sellers and sellers to be buyers so that anyone within the network is able to buy and sell produce (see figure 3 below).



Figure SEQ Figure * ARABIC 3 Series of WhatsApp screenshots from the Food for Us WhatsApp group showing selling and buying of chickens.

One of the challenges that is experienced in the Raymond Mhlaba area is a disconnect within the local supply chain where consumers are not buying produce from local farmers therefore leaving farmers without a market. Produce had to travel far distances, which resulted in higher prices and more wastage. As a result of the piloting of the application, and the associated learning support processes, a greater Food for Us network has developed where buyers, sellers and intermediaries are encouraged to communicate with one another to address this challenge of supply chain disconnect to facilitate a more sustainable and efficient local supply chain.

The #MatchMaking event, held in April 2018, was a highlight of the Eastern Cape case study as it enabled good discussion between a diverse group of stakeholders. This event used the application screenshot flashcards as a tool (see Figure 4 and 5 below) to assist participants in recognizing the current market challenges that is being experienced in the community. Participants were given an opportunity to introduce themselves and explain where they fit in the local supply chain. Through group discussion and a solution building activity, participants were given the opportunity to engage with different stakeholder, such as the municipality, extension officers, retailers, caterers, bakkie

[small van] sellers, intermediary groups and various farmers whom they had not engaged with before. The event concluded with a discussion around a number of solutions that were designed to address the issue of supply chain disconnect in the Raymond Mhlaba area that the community and the members of the Food for Us network need to take forward. These included the following; 1) the maintenance of networks such as the Food for us network which provides a place for diverse stakeholders to discuss challenges and solutions, 2) to develop a local brand for the produce in the local area, 3) to start producing according to niche demands and exploring the possibility of high value crops that can then be advertised on the application, 4) to nurture and foster partnerships with different stakeholders (sure as Rhodes University and the Food for Us project , as well as 5) suggestions on developing



*Figure SEQ Figure * ARABIC 4 Discussing the Food for Us introductory Flashcards at the #Matchmaking workshop held in Alice, Eastern Cape.*



Figure 5 Food for Us flash cards were scattered on the boardroom table for participants to look at during the #Matchmaking workshop.

agro-processing to increase the economic value in the local supply chain as well as reduce the likelihood of wasted food.

The success of the first phase of Food for Us project in the Eastern Cape Raymond Mhlaba areas can be attributed to the existence of an already strong and well-established learning network, the Imvotho Bubomi Learning Network. The Imvotho Bubomi Learning network is a network of farmers and local agricultural learning system actors who share their knowledge on farming practices, specifically rainwater harvesting techniques and seed security (Pesanayi, 2018). The Food for Us network developed out of this network as a subsidiary network that drew on the existing network for support. This strong relationship with the existing Imvotho Bubomi Network made the extension of a subsidiary network much easier as participants already trusted and had confidence in the network building process.

3.3. Transformative learning and boundary crossing enabled by the Food for Us application

The application was successful in raising a varied degree of interests and especially grabbed the attention of the young farmers in the Raymond Mhlaba area who had not be included in farming Networks prior to the introduction of the Food for Us project and the development of the Food for Us network. The use of new technology acted as a tool that facilitated intergenerational boundary crossing with young farmers being encouraged to engage with new technology, an area of expertise that they felt comfortable with. The Mxumbu Youth Co-operative, based in Middeldrift was one

example where a youth co-operative was introduced to an established intergenerational and interdisciplinary knowledge network, the Imvotho Bubomi Network, through their involvement in the Food for Us project. The Mxumbu Youth Co-operative leader, became a champion for the Food for Us project within the Middeldrift area, encouraging other young farmers to try and use the application as a network-building platform. He also became part of several other networks and recently completed the Amanzi for Food ToT course therefore growing professionally through being connected to this knowledge network.

The application also enabled boundary crossing between communities of practice within the food supply food system landscape. The application and the supporting tools, such as the WhatsApp group and the various meetings and events, provided opportunities for buyers to meet and talk with sellers (farmers) and discuss challenges and potential solutions for these challenges. The project therefore helped in enabling the opening up of communication channels between important members of the supply chain in the Raymond Mhlaba municipality.

The application might not have worked as anticipated in the time allocated to the pilot phase (only 18 months), but, during its technical development phase, it was successful in acting as a double stimulation tool that highlighted the challenges of food waste and inefficient food systems in the Raymond Mhlaba area. The application highlighted the inefficiencies and challenges whilst the #MatchMaking event and Food for Us workshops provided opportunities for solutions to be discussed and explored by all stakeholders in the local supply system, leading the project team to identify the importance of supporting local food systems in their quest for supporting sustainable food systems and sustainable development more broadly through use of tools such as the Food for Us Application.

As discussed in section 3.1, the WhatsApp group provided a good platform via which transformative learning could occur. The Food for Us WhatsApp group provided a platform for users to discuss challenges, to make suggestions, to discuss the posts that were made and in some instances discuss farming techniques and different methods of production. They also were able to engage directly with the technical staff involved in designing the App, which in turn shaped the learning of the technology design teams. This is significant as there is also a need to support technical design teams to produce tools and technologies that support the needs of users on the ground in southern Africa, if the emerging 'fourth industrial revolution' is to gain significant traction in such contexts.

The WhatsApp group not only supported the use of the application but also enabled the development of an active network of farmers, buyers and intermediaries, and learning associated with organic farming practices which associated itself with the Amanzi for Food Imvotho Bubomi Network. One of the important discussions that arose through this group was the debate around organic agricultural practices versus commercial agricultural practices. This debate displayed the strong feelings around organic farming and agro-ecology as well as the associated cost implications for those farmers who wish to grow their farming entities to become large commercial farmers, as shown in the discourse exchange below:

[18:09, 1/17/2018] ██████████: No ██████████ and ██████████, for the ToT we only want organic produce sourced from farmers in the ██████████ to be prepared as meals for the 2 days we are on training. The service providers were to be named in ██████████ and I guess I am still the only one who brought the name forward. Then the service provider will have to buy from us.

[18:15, 1/17/2018] ██████████: Meaning those that aren't farming organically will be excluded from this opportunity of being supported. I'm not against organic products but why can't we suggest that certain quantities of the produce sourced from the farmers will be let's say 50% organic and 50% inorganic. Just to please all the farmers that are in this group and those that will attend the training programme. Just a suggestion because the trainees of the ToT will go out and train not only organic producers but all the farmers.

[18:19, 1/17/2018] ██████████: ██████████ we are only talking about meals on the training and it was decided on the 1st day of training by people on training, which you did not attend. Other farmers can advertise on the App for selling to whoever wants the products but not for cooking on the training....

...

[18:52, 1/17/2018] ██████████: My point is why are we excluding the other group of farmers and this is done by the very same people that should be representing our farmers but now they are taking decisions that are decisive amongst the farmers. My next question is am I in the right platform that selects and support few farmers when it come to procurement of the produce. I understand that this is not ██████████ and it is a structure that is representing all the farmers including organic producers. My appeal is let's not be selective and we should strive to give support to all our farmers.

....

[19:53, 1/17/2018] ██████████: ...A difference in ideas doesn't mean we are against each but it's a sign a willing to hear and learn from others. This group is exactly for that kind of engagement. Keep well ██████████ and all the ██████████ and ██████████ team.

The debate came to a close with participants agreeing that it is important to work together and accept each others' farming techniques and to work towards improving the local supply chain together.

Despite these learning-centred benefits, there were also large sections of the supply chain that were not able to partake in the trialing of the application and associated social learning, due to them not having access to smartphone technology. The hawker level of the supply chain did not partake due to none of the leaders of this community of practice having access to smartphone technology. According to an intermediary user, the hawkers are made up of predominantly older women who only have text and voice enabled cell phones. This is where there is opportunity to get young entrepreneurs to become involved in the project who will be able to connect the hawkers to other farmers therefore growing the network and encouraging intergenerational learning - similar to what was occurring in the farming communities lead by the Mxumbu Youth co-operative.

Another important learning was the cultural aspect of produce trade in the Eastern Cape. The Food for Us application started by being purely designed for fresh produce trading, however this limitation on what could be traded was soon contested by many Eastern Cape interested parties. The users started to use the application according to their own needs by uploading livestock onto the application even though there was no category for this. By way of example, a farmer uploaded broiler chickens under

the category of 'Asparagus' due to his need to sell not only fresh produce, but more importantly livestock. Through this, he raised the issue of a lack of categories for livestock on the application. And through this, the users of the application started to use the application to their own specifications, ignoring categories and assigning their own meaning to values displayed on the application. The quantity and the pricing were all displayed in kg, however most of the people sell per bunch or per item and not per bunch. It was therefore presumed that the pricing was not per kg but per bunch. The screenshots below show some of this interaction on the Application. Due to farmers using their agency in this way, in Version 2, categories for Livestock were included on the Application

3.4. Understanding food system transformation, and learning's surrounding sustainable consumption and production learning

Through the Food for Us application, and its association with the Imvotho Bubomi and Amanzi for Food project, many of the application users and project participants were introduced to agro-ecology methods of food production as well as the incorporation of sustainable water harvesting farming techniques. For many farmers, this sustainable production learning was unfamiliar. Through photographs being shared on the Food for Us WhatsApp group, group participants were able to see the types of farming techniques that were possible and the quality of the produce that those techniques produce.

One of the users explained in the final survey that he believes the Food for Us application and the WhatsApp group were very effective in making farmers and buyers of produce aware of the good quality produce that is being produced locally through organic means of production. He believes that the photographs shared made people envious and encouraged them to investigate these new methods of production. The application and the WhatsApp group was therefore a tool to spread ideas and discussion about sustainable farming practices.

Sustainable consumption, and the importance of supporting local farmers was another point of learning. One of the buyers interviewed explained that she did not realize that there were so many farmers selling such good food close to Alice. She explained that the photographs of the produce that she was receiving on the WhatsApp were very good and she had been unaware of its availability.

In going forward, the Food for Us project has decided to focus on scaling its activity in ways that promote transformation of the food system at local level, where local produce is consumed by the local market instead of being brought into the area, which has carbon saving, economic development, and social and nutritional value creation outcomes. This was confirmed in a business planning meeting for the Food For Us project near its end, where the application and social learning process was identified as 'working together' to support local food economies, food surplus reduction, and more sustainable consumption and production relations in ways that bring society, economy and environment closer together in practice (Food for Us final report, 2018). As shown through the various interactions around the application trialing, promoting the growth of the local supply chain has potential to support the local economy in ways that can thrive, and in ways that can contribute to alleviating poverty and other similar social challenges.

4. Conclusion

In this study one can see that the introduction of a mobile application and associated support has proved to support sustainable value creation in various ways. In a short time (less than 18 months), it has enabled a diversity of social learning opportunities and outcomes. The building of knowledge sharing networks and the use of technology as a tool to cross boundaries have been two of the most significant preliminary findings from this research thus far (see Durr, in press, for further detail). Introducing a mobile application and WhatsApp group to support its uptake and use, also illuminated how mobile phones are used in small-scale farming communities within the Eastern Cape. Many assumptions were made by the project developers on how the application would be adopted and used, however these assumptions were not accurate, and led to substantial learning by the researchers and project developers on topics such as mobile use, existing food surplus and the type of produce that communities wished to trade. These initial findings will be refined further by exploring the type of social learning and value creation that was enabled (Durr, in press).

NOTE: This paper reports on research in progress. A more final report on the project will be released in my Masters Thesis Report at the end of 2018 / early 2019 (Durr, in press)

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