RESILIENCE ASSESSMENT BENCHMARKING AND IMPACT TOOLKIT (RABIT)

Benchmarking Resilience of Agricultural Livelihoods

Piloting the Resilience Assessment Benchmarking and Impact Toolkit (RABIT) in Uganda

Angelica V. Ospina, Richard Heeks, Loretta Ishida,
Stephen Ssenkima, Geoffrey Mabirizi, Nicholas Mugabi, Tabitha Namarome and Emmanuel Wandega

2016

Centre for Development Informatics (CDI)
Global Development Institute, SEED
University of Manchester, UK

cdi@manchester.ac.uk
http://www.manchester.ac.uk/cdi

Lutheran World Relief (LWR)

lwr@lwr.org
http://lwr.org

Gumutindo Coffee Cooperative Enterprise (GCCE)

info@gumutindocoffee.co.ug
http://gumutindocoffee.coop/

Acknowledgements

The authors wish to thank the staff and members of Busamaga Growers Cooperative Society, Konokoyi Growers Cooperative Society, Bukalasi Growers Cooperative Society, and Bumayoga Growers Cooperative Society, as well as the Grameen Foundation for their valuable contributions to this work.

The authors also extend their gratitude to Irene Nanjekhe, Peter Wamako, David Mukoya, Lawrence Weboya, Agufibo Bosco and Taabu Robert – Gumutindo Certification Officers – who contributed to the design and implementation of the research instruments.

Additional information and materials relating to this report can be found at:

- Nexus for ICTs, Climate Change and Development (NICCD), http://www.niccd.org/
- Lutheran World Relief Programs in Uganda, http://programs.lwr.org/africa/Uganda

For enquiries please contact:

Prof. Richard Heeks, University of Manchester, richard.heeks@manchester.ac.uk
Dr. Angelica V. Ospina, University of Manchester, angelica.v.ospina@gmail.com
Loretta Ishida, Lutheran World Relief, LIshida@lwr.org

Disclaimer

The views expressed in this publication are those of the authors and do not necessarily reflect the views of the University of Manchester, Lutheran World Relief, or the contributory organisations.

Mention of and references to specific organisations, products or initiatives do not in any way imply that they are endorsed by the authors, or any other organisation that the authors are affiliated with, in preference to others of similar nature that are not mentioned.

Copyright

The contents and results of this study are available on a Creative Commons Attribution-Non-Commercial basis.

Table of Contents

List of Figures and Tables

Figures

Tables

Executive Summary

The objective of this case study is to present the main findings and suggested areas of action emerging from a six-month pilot implementation of the "Resilience Assessment Benchmarking and Impact Toolkit" (RABIT) in Mount Elgon, Uganda. The pilot was implemented by the University of Manchester's Centre for Development Informatics (CDI) in collaboration with Lutheran World Relief (LWR) and Gumutindo Coffee Cooperative Enterprise (GCCE).

This document is addressed to practitioners, decision makers and researchers working on:

- information and communication technologies for development (ICT4D) and/or
- resilience (including climate change and disaster response) and/or
- community development.

It is for those interested in new approaches (a) to benchmarking community resilience, and (b) to assessing and strengthening the impact of development interventions – particularly the use of ICTs – to build resilience, including resilience to climate change.

This pilot project was focused on the 'benchmarking' component of RABIT. It sought to identify the resilience to climate change of Ugandan coffee farmers and the associated role of ICTs, in order to inform the design and implementation of climate change- and resilience-related strategies.

Two shorter summaries of this case – one on resilience; one on e-resilience – and a RABIT Implementation Handbook can be found at: http://www.niccd.org/resilience

Key Points

- A systemic understanding of resilience is both useful and necessary in designing, implementing and assessing development interventions. Resilience is defined as the ability of systems (such as a community) to withstand, recover from, adapt to, and potentially transform amid change and uncertainty. It consists of three foundational attributes (robustness, self-organisation, learning) and six enabling attributes (redundancy, rapidity, scale, diversity, flexibility, equality).

- The "Resilience Assessment Benchmarking and Impact Toolkit" (RABIT) adds value in three ways. First, by offering an in-depth understanding of a community's resilience. Second, by providing a robust means to measure both resilience baselines and the impact on resilience of interventions. Third, by identifying strategic priorities for action that will maximise the resilience impact of climate change initiatives or other development interventions at community, district and national levels.

- RABIT was used to measure and benchmark the relative strength and weakness of the nine different attributes of resilience among Mount Elgon coffee farmers (see Figure i). In this particular case, the perceived strengths related mainly to *redundancy* (e.g. linked to the availability of substitutable resources, including sources of support in case of emergencies), *robustness* (e.g. linked to the presence and perceived capacity of multiple institutions in the community), *learning* (e.g. information and knowledge sharing, capacity building opportunities) and *self-organisation* (e.g. existence of community groups, sense of belonging and trust). The perceived weaknesses were especially related to attributes of *equality* (e.g. gender differentials, marginalisation) and also to the farmers' *robustness* (e.g. lack of emergency preparedness, weak infrastructure).

- These findings provide a valuable starting point for development interventions as they (a) identify current resilience strengths that can be built upon as part of new or ongoing initiatives, (b) provide a 'snapshot' of issues that are perceived as priority areas for action at the local level, and (c) give an indication of areas that need to be strengthened as part of efforts to build the resilience of coffee farmers.

- The potential of ICT tools to impact the resilience of Mount Elgon coffee farmers is perceived in multiple areas (see Figure ii). The strongest perceived impact is that of mobile phones on the farmers' *self-organisation* (e.g. networking and coordination), *equality* (e.g. enabling access/inclusion of marginalised groups), *rapidity* (e.g. access to support in an emergency, financial resource mobilisation), and learning (e.g. information sharing, capacity). Lower levels of ICT usage were found in regards to attributes of *diversity and flexibility, robustness*, *redundancy*, and *scale*.

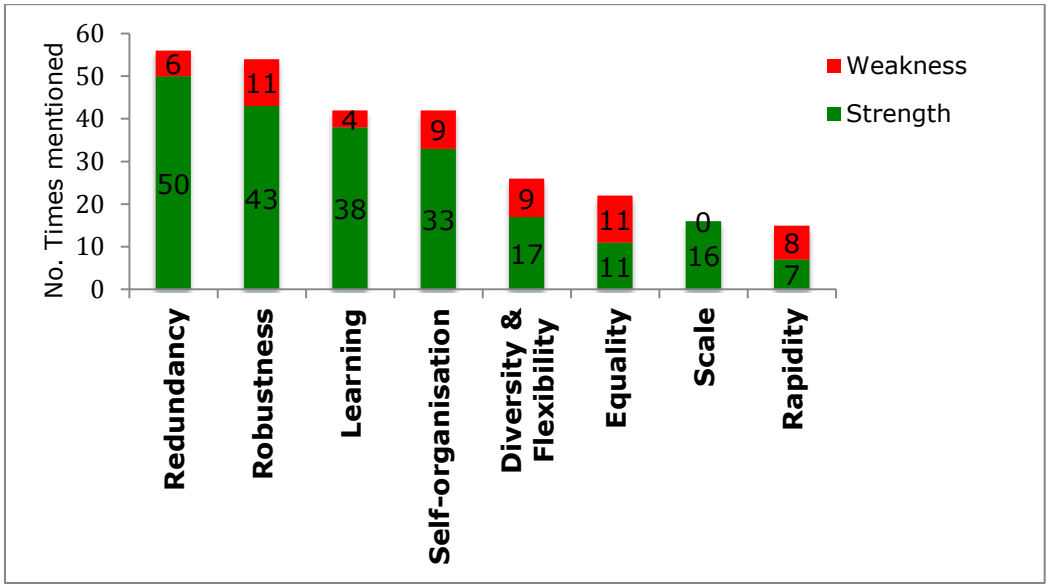


Figure i. Relative salience of strength vs. weakness of resilience attributes, Mount Elgon

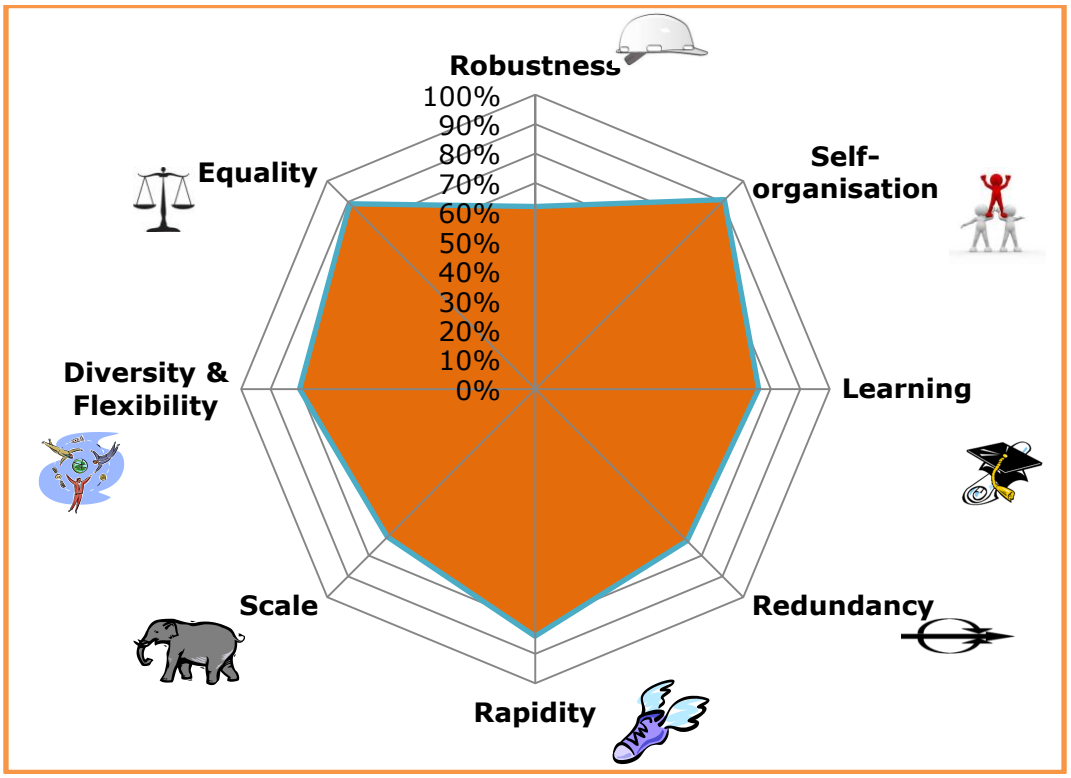


Figure ii. Contribution of ICTs to resilience attributes, Mount Elgon

- The evidence on current benchmark levels of ICT usage in relation to resilience attributes and markers can be turned around to identify the level of shortfall from the pinnacle of

100% usage. This gap can then create a 'traffic light' system of priorities for action: red for high priority, yellow for medium priority, and green for low priority, as shown in Table i. The table provides a detailed level of prioritisation for action by assigning a weight to each colour (red=2, yellow=1, green=0), and then adding attribute weight plus marker weight to give an overall priority weighting. (Blue indicates data was not available from the pilot survey. These constitute areas for future investigation).

Resilience Attribute	Resilience Marker	Priority Weighting
Rapidity (2)	Rapid Resource Access (0)	**2**
	Rapid Resource Assessment/Coordination (0)	**2**
	Rapid Resource Mobilisation (1)	**3**
Equality (2)	Competency Gap Reduction	**-**
	Inclusiveness (0)	**2**
	Openness and Accountability (0)	**2**
Diversity & Flexibility (2)	Different Actions/Opportunities (0)	**2**
	Adaptable Decision-Making (1)	**3**
	Innovation Backbone (1)	**3**
Scale (2)	Multi-Level Networks (1)	**3**
	Resource Access and Partnerships (2)	**4**
	Cross-Level Interactions (0)	**2**
Robustness (1)	Physical Preparedness (2)	**3**
	Institutional Capacity (1)	**2**
	Multi-Level Governance (1)	**2**
Self-Organisation (1)	Collaboration and Consensus Building (0)	**1**
	Social Networks (0)	**1**
	Local Leadership and Trust	**-**
Learning (1)	Capacity Building	**-**
	New and Traditional Knowledge (0)	**1**
	Reflective Thinking (1)	**2**
Redundancy (0)	Resource Spareness (1)	**1**
	Functional Overlaps and Interdependency (2)	**2**
	Resource Substitutability (0)	**0**

Table i. e-Resilience attributes and markers: Priority weighting, Mount Elgon

- A whole series of priority actions can then be identified relating to resilience generally and also to ICTs and resilience ("e-resilience") specifically. Full details are in the main case study, but examples for the highest-priority attributes for action include:

  (a) Resilience actions: Implement a campaign to foster the active participation / inclusion of women farmers in local decision-making processes that affect coffee livelihoods in Mount Elgon; hold participatory workshops aimed at vulnerable groups (e.g. women, youth, elders) to raise awareness on disaster prevention and response, and discuss traditional and emergent climate change adaptation strategies.

  (b) e-Resilience actions: Use ICT tools (e.g. mobile-enabled social networks, radio, SMS) to strengthen the collaboration between coffee farmers and stakeholders at multiple levels (e.g. donor institutions active in the Mount Elgon area, local government representatives, national government); explore the use of GIS and ICT-enabled visualisations to identify areas of high vulnerability to climate change impacts, and to inform the design of adaptive strategies; raise awareness and provide coffee farmers with the contact information (e.g. mobile number) of institutions that can be contacted in the case of disasters/climatic emergencies, so as to improve resource mobilisation efforts.

This full case study report has four sections. Section 1 provides an overview of the context of study and the research methods used as part of the pilot. Section 2 presents findings on the vulnerability of coffee livelihoods in Mount Elgon, and benchmarks the farmers' resilience in the face of stressors such as climate change. Section 3 benchmarks the role of ICTs (mainly mobile phones) vis-a-vis coffee farmers' resilience, assessing the contribution of these technologies to the nine resilience attributes. In sections 2 and 3, the analysis of findings includes data visualisation in various formats. The final section provides a series of recommendations for practitioners and decision-makers, to help strengthen community resilience through general and ICT-specific interventions, based on the experiences of Mount Elgon coffee farmers.

Understanding Resilience

Resilience is an essential capacity of communities if they are to survive and thrive amid the environmental, economic and social shocks likely to arise during the 21st century. Defined as the ability of vulnerable systems to withstand, recover from, adapt to, and potentially transform amid change and uncertainty (Ospina and Heeks, 2010), resilience plays a crucial role in the achievement of development outcomes. It provides a holistic, long-term and community-centred approach that is rising up the development agenda.

Recognising the need for robust tools for baseline measurements of resilience, and for assessing the impact on resilience of interventions such as ICT projects, the University of Manchester's Centre for Development Informatics (CDI) developed RABIT: the "Resilience Assessment Benchmarking and Impact Toolkit".

Drawing from a combination of systems thinking and fieldwork in the global South, RABIT was launched in September 2013 through a pilot project in Costa Rica that sought to test the tool's contribution to benchmarking or assessing the impact of ICT projects on the resilience of low-income urban communities. Recognising the importance of testing the toolkit in a vulnerable rural context, a partnership was established with Lutheran World Relief (LWR) to implement RABIT in Uganda, focusing on the resilience to climate change of coffee farmers.

Building on LWR's ongoing collaboration with Uganda's Gumutindo Coffee Cooperative Enterprise (GCCE), RABIT was implemented in Mount Elgon, an area characterised by low-income farmers whose livelihoods depend heavily on coffee production.

The selection of the location was based on the convergence of several factors that were key for the pilot's implementation:
(a) proven vulnerability to/awareness of climate change impacts,
(b) widespread use of ICT tools, specifically mobile phones,
(c) existence of an ongoing partnership between LWR and GCCE, including efforts to improve coffee value chains for over 6,000 smallholder farms as part of the SMART (Sustainable Marketing of Arabica through Technology) Coffee Project (Annex 1),
(d) demonstrated interest in the notion of resilience, including efforts by LWR to integrate it as part of its strategy.

The selection of the location also took into account the existence of local awareness about the role of ICTs for development due to the activities of the SMART Coffee project, the partnership between LWR and the Grameen Foundation, and in particular, the provision of mobile phone-enabled agricultural extension and financial services to strengthen Ugandan smallholder farmers (Annex 2).

The RABIT pilot set out to benchmark the coffee farmers' resilience to climate change, and to benchmark ICTs' contribution to resilience, while identifying the potential of these tools to contribute further. The analysis was based on establishing linkages between ICT usage and a series of resilience attributes that form the conceptual foundation of the toolkit. As discussed next, those attributes are: robustness, self-organisation, learning, redundancy, rapidity, scale, diversity, flexibility and equality.

Further details on the conceptual foundation of RABIT are provided in the Implementation Handbook. As a reference to the analysis that follows in sections 2 and 3, the attributes of community resilience and their key "markers" are summarised in Table 1.

Resilience Attribute	Definition	Key Markers/ Characteristics
FOUNDATIONAL ATTRIBUTES OF COMMUNITY RESILIENCE		
Robustness	• Ability of the community to maintain its characteristics and performance in the face of environmental shocks and fluctuations.	• Physical Preparedness • Institutional Capacity • Multi-level Governance and Networking
Self-Organisation	• Ability of the community to independently re-arrange its functions and processes in the face of an external disturbance, without being forced by external influences.	• Collaboration/Consensus-building and Participation • Social Networks • Local Leadership and Trust
Learning	• Capacity of the community to generate feedback with which to gain or create knowledge, and strengthen skills and capacities. Closely linked to the community's ability to experiment, discover and innovate.	• Capacity Building • New and Traditional Knowledge • Reflective Thinking
ENABLING ATTRIBUTES OF COMMUNITY RESILIENCE		
Redundancy	• Extent to which community resources and institutions are substitutable; for example, in the event of disruption or degradation.	• Resource Spareness • Functional Overlaps and Interdependency • Resource Substitutability
Rapidity	• Speed at which assets can be accessed or mobilised by community stakeholders to achieve goals in an efficient manner.	• Rapid Resource Access • Rapid Resource Assessment/ Coordination • Rapid Resource Mobilisation
Scale	• Breadth of assets and structures a community can access in order to effectively overcome or bounce back from or adapt to the effects of disturbances.	• Multi-level Networks • Resource Access and (intra/inter) Partnerships • Cross-level Interactions
Diversity and Flexibility	• Ability of the community to undertake different courses of actions with the resources at its disposal, while enabling them to innovate and utilise the opportunities that may arise from change.	• Different Courses of Action/Emerging Opportunities • Adaptable Decision-making • Innovation Backbone
Equality	• Extent to which the community provides equal access to rights, resources and opportunities to its members.	• Strengthened Competencies/ Gaps' Reduction • Inclusiveness • Openness and Accountability

Table 1: Attributes of resilient communities: Summary of definitions and key markers[1]

Building upon this conceptual approach, the next section provides a brief overview of the context of RABIT's implementation in Uganda.

[1] Ospina, A.V. (2013) *Climate Change Adaptation and Developing Country Livelihoods: The Role of Information and Communication Technologies*, PhD thesis, IDPM, University of Manchester, UK.

Section 1. Context of Study and Methods

This section presents an overview of the context in which RABIT was implemented, and of the methods used for data collection. The first sub-section provides a general background of Mount Elgon, Eastern Uganda. The second describes the pilot's approach to data gathering through three key instruments: surveys, semi-structured interviews, and focus groups. These instruments were used with the objective of benchmarking the resilience of coffee farmers to climate change impacts, and of benchmarking the role of ICTs in resilience.

1.1. Context of Study: Mount Elgon, Eastern Uganda

Located in East-Central Africa (Figure 1), west of Kenya, east of the Democratic Republic of the Congo and south of South Sudan, Uganda is a landlocked country with an area of approximately 241,000 sq km (Figure 2).

Figure 1. Location of Uganda in Africa
Source: Worldatlas, 2014[i]

Figure 2. Map of Uganda
Source: Worldatlas, 2014[ii]

Uganda's population is estimated to be 37.6 million inhabitants[iii], the majority of which lives in rural areas. Uganda's territory is formed by four administrative regions (Central, Eastern, Northern and Western region) (Figure 3), divided into 111 districts and one city (the capital, Kampala). Each district is in turn divided into counties (with sub-counties), and municipalities. According to World Bank data, approximately 24.5% of the population lives below the national poverty line[iv]. 71% of the rural population has access to improved water sources (e.g. piped household water connections, public taps, standpipes), and life expectancy at birth is 59 years old.

While poverty rates have been declining since 1990 and economic growth has increased, there are numerous barriers to the country's development. These include slow agricultural productivity growth, combined with a high population growth that have resulted in increased pressure on the natural resource base, as well as inadequate financing and financial services, poor infrastructure and poorly developed human capital, which have affected economic diversification efforts[v]. In terms of human development, Uganda faces disparities between different areas of the country (the northern part has had historically higher rates of poverty), and between rural and urban areas[vi]. Challenges persist in regards to education provision (particularly higher education), health (related to prevalent AIDS and malaria, and the lack of

appropriate safety nets and infrastructure), and gender inequality. In this last regard, women constitute 70% of the labour force in agriculture, but most lack ownership of the land and tools used, as well as control over livelihood resources[vii].

Figure 3. Administrative regions of Uganda
Source: Nations Online (2014)

The country's economy depends heavily on agriculture, a key sector that employs 80% of the workforce[viii]. As identified in a study supported by the UNDP[ix], "agriculture continues to form the backbone of Uganda's economy, and most industries and services in the country depend on it. Agricultural households are estimated at 3.95 million (representing 19.3 million people)" (p.16).

Uganda is East Africa's largest coffee producer, with coffee exports providing the bulk of the country's revenue. Commercial coffee production dates back to the early 1920s[x]. While coffee is the major cash crop exported by Uganda, other crops such as maize and beans are used mainly for food security. It is estimated that the country accounts for approximately 2.5% of global coffee production[xi].

Coffee is grown predominantly by smallholders with average farm sizes that range from 0.5 to 2.5 ha and with limited external inputs, which makes the country highly sensitive to the impacts of climate variability and climate change[xii]. In addition to climate and weather impacts (e.g. irregular rains, drought, excess sunshine), factors that influence Uganda's coffee production include high price fluctuation, foreign exchange risk and loss of global market share, reduced soil fertility, pests and diseases (e.g. coffee borer, leaf rust), transport-related risks, theft, fraud, adulteration and mismanagement[xiii].

As recognised in research conducted by OXFAM[xiv], predictions show that climate change will have an impact on the suitability of Arabica coffee in Uganda, rendering most coffee areas less suitable for production, particularly those located at lower altitudes (1500m).

Arabica coffee is predominantly grown in the slopes of Mount Elgon (Mbale region), a dormant volcano located in the Uganda-Kenya border where the RABIT pilot was implemented (Figures 4 and 5).

Figure 4. Eastern Uganda (red). Source: UHOA (2014)[xv]

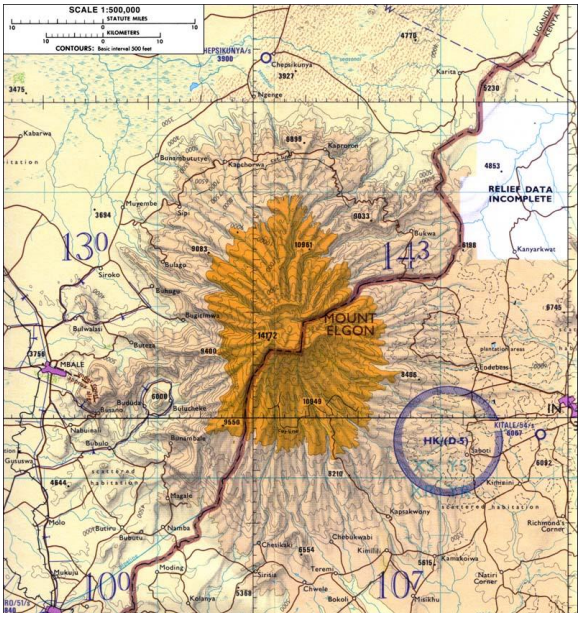


Figure 5: Mount Elgon, border of Uganda and Kenya. Source: SM (2014)[xvi]

The Mbale region is one of the most densely populated parts of Uganda (approximately 1000 persons per km²)[xvii]. Its vulnerability to stressors such as climate change is closely linked to prevailing poverty and marginalisation. The region is characterised by rugged terrain and steep slopes, high rainfall and subsistence farming. Crops like maize, millet, cassava, sweet potato, rice and vegetables are mostly grown in lower areas, while coffee-banana systems dominate at higher elevation. Most households also own livestock[xviii].

Mbale town is the major urban area with more than 150,000 inhabitants[xix]. The region also encompasses two protected areas, the Mt. Elgon National Park and the Namatale Central Forest Reserve.

Images of the Mount Elgon Region

Gumutindo Coffee Cooperative Enterprise

Founded in 1998, GCCE is an organisation of smallholder coffee farmers who produce washed Arabica coffee on the slopes of Mt Elgon, Uganda. GCCE obtained organic certification, registered as a cooperative union, obtained its export license and was certified under International Fair Trade standards between 2002 and 2004. By 2008, GCCE comprised six primary societies (smaller, local cooperatives) and over 5,000 members. Today, GCCE is 7,000-member strong and growing.

Various development partners have worked with GCCE and its member farmers on improving the livelihoods of smallholder coffee farmers. From the premiums earned from the sale of Fair Trade and organic certified coffee, GCCE has invested in clean water, solar energy, and education for the local community.

Organisations like Lutheran World Relief (LWR) have supported GCCE to become a stronger cooperative and improve its organisational viability. GCCE and LWR have worked together since 2008 to enable coffee farmers to adopt new farming techniques, increase yields, and increase income levels. Currently, LWR is supporting GCCE to market higher quality and quantity of coffee, while at the same time helping smallholder farmers enhance productivity through increased investment in production and post-harvest handling. The use of ICTs is being fostered to strengthen smallholder farmers' access to agricultural extension, financial services and marketing. Further details about this initiative, including the mobile solution implemented by LWR with Community Knowledge Workers (CKWs), are provided in Annexes 1 and 2.

Images of Gumutindo Coffee Cooperative Enterprise, Mbale, Uganda

Climate Change Impacts in Uganda

Climate change manifestations in Uganda have being recognised in the country's national communication to the United Nations Framework Convention on Climate Change (UNFCCC) in 2002[xx]. A number of climatic manifestations have been reported in more recent studies[xxi], including:

- More frequent and intense droughts than historically experienced.
- Rise in temperatures (0.37 C per decade since 1960).
- Increase in heavy rainfall, floods and landslides.

In addition to these changes, climate forecasts suggest that temperature will continue to rise, along with the frequency and intensity of extreme weather events.

Although the direct correlation between climatic manifestations and coffee production is difficult to estimate mainly due to the lack of robust time-series weather data, serious effects have been already identified and projected (Box 1).

Box 1. Climate change impacts on coffee production

- Climate change will affect crop physiology. It will have an impact on the flowering stage and fruit filling stage of Arabica coffee. The unpredictable rains will cause coffee to flower at various times throughout the year, causing the farmers to harvest small quantities continuously. Shorter rainfall periods damage coffee production by preventing coffee trees from reaching full floration, impacting both quality and volume.

- Rainfall distribution directly controls effective floration and cherry maturation, which in turn determine bean size (i.e. coffee quality).

- Prolonged droughts can cause flower abortion.

- Increased temperatures and sunshine can cause premature ripening of the beans, which will have a direct negative impact on the quality of the coffee and yield quantities.

- Climate change is anticipated to have a strong impact on the incidence and severity of certain pests and diseases. For example, the incidence of leaf miners has been associated with drought conditions, while coffee leaf rust is associated with warmer temperatures and is recorded to be moving up the mountain slopes.

- Quality control measures (e.g., farmers' ability to properly dry coffee) also become more problematic as rainfall variability increases.

Sources:
Parizat, R., Hilten, J. Wunderlich, C., Nsibirwa, R. (2011) *Ugandan Coffee Supply Chain Risk Assessment*. Washington DC; World Bank.
Jassogne, L, Laderach, P., Van Asten, P. (2013) *The Impact of Climate Change on Coffee in Uganda*, Oxford UK: OXFAM Research Reports.

Models of future climates for East Africa indicate that the region is almost certain to become wetter[xxii]. While this could translate into more rain, it can also be linked to more drought, ultimately affecting the effectiveness, timing and distribution of rain throughout the coffee's crucial growing seasons[xxiii]. Heavier rainfall could also damage crops and wash away topsoil.

The general overview presented up to this point evidences that Uganda is highly susceptible to climatic variations and shocks. In the face of projected changes and uncertainty (e.g. associated with erratic rainfall and rainy seasons, more frequent floods, temperature

increases, changes in seasonality, increased intensity and frequency of La Nina and El Nino phenomena) the role of adaptation and resilience is becoming increasingly important.

Despite the lack of robust historic climate data, studies indicate that the Mbale region is subject to climate variability, to the increased frequency of extreme events and slow onset climate change, which have been linked to landslides, flooding and cholera outbreaks[xxiv]. According to the Integrated Territorial Climate Plan prepared for the region, "during the period 2001-2011, temperatures increased by about 1^{o}C in the warmest and coolest month over the 1961-1990 average. Projections indicate an increase in temperature for the next 30 years. More rainfall has been projected in the 2010-2039 period" (p17).

The expected impacts of climate change and variability in the Mount Elgon region could exacerbate the spread of pests and diseases such as the coffee berry borer (linked to higher temperatures), increase water stress, erode agricultural livelihoods, heighten the risk of malaria and waterborne diseases, weaken property and infrastructure, increase environmental degradation (e.g. due to cultivation in steep slopes and protected areas around Mt. Elgon to compensate for lower productivity), as well as cause the loss of lives (e.g. in the case of disasters such as landslides, already experienced in the area)[xxv].

Within this context, as per the focus of the RABIT pilot, the following sub-section will identify the role of information and communication technologies (ICTs) in the country.

ICT Usage

According to data from the International Telecommunication Union (ITU) (2014)[xxvi], there has been a considerable growth in mobile usage in Uganda. The number of mobile-cellular telephone subscriptions increased from 776,169 in 2003, to 16,568,786 in 2013. ITU data also indicates that the number of mobile subscriptions per 100 inhabitants increased from 2.89 in 2003 to 44.09 in 2013.

Mobile telephony services in the country are provided by five main network operators (MNOs): MTN Uganda, Orange Uganda, Uganda Telecom (UTL), Warid Telecom and Airtel. According to a study supported by the Bill & Melinda Gates Foundation in 2012[xxvii],

> *"Network traffic in Uganda is still dominated by voice, although SMS (text) and mobile Internet usage grew notably in 2011 thanks to promotions, free new services (e.g., missed call alerts), cheaper bandwidth via undersea cables, and increasing 3G-network coverage" (p.7).*

Since 2009 the country has experienced a rapid diffusion of m-money services offered by four of the five MNOs operating in the country (i.e. MTN m-money, M-Sente from UTL, Airtel M-money and Warid Pesa from Warid). Mobile money services allow registered users to load money into their accounts (cash-in), make transfers to other users (both registered or not), buy airtime and withdraw money (cash-out)[xxviii]. Registration for these services is free of charge and users are not required to open a bank account, but all transactions have a predetermined fee.

Images of mobile money diffusion in Mbale, Uganda

M-money services have become very popular among low-income, unbanked segments of Uganda's population. A survey conducted by InterMedia in 2012, estimated that one in five households in Uganda has at least one user of these services, which primarily involve sending/receiving regular remittances (used for routine financial support among relatives living in different households) and, to a lesser extent, sending/receiving emergency help[xxix]. Despite the potential for further expansion of these services, barriers identified include the lack of awareness of the full range of available services, an insufficient number of m-money agents, inconsistent service quality and low liquidity, particularly in rural areas.

Internet usage in the country remains relatively low. ITU data suggests that the percentage of individuals using Internet in the country increased from 0.46 in 2003, to 16.20 in 2013[xxx] but access in rural areas is much lower than these average figures.

Key Stakeholders

The identification of the key stakeholders operating at the intersection of climate change, ICTs and development at the micro, meso and macro level constitutes an important step to gain a better understanding of the local context, and to set the basis for the RABIT implementation. In the Mount Elgon region, key stakeholders are as shown in Table 2.

MICRO Level
Coffee Farmers
Farmers' Associations
Primary Society
Local Council level 1
Farmers' Committee
Agricultural input dealers
Committee Zones
Community-based organisations (CBOs)
MESO Level
Gumutindo Coffee Cooperative Ltd.
Local Council 2 (Parish level)
Local Council 3 and 4 (Sub-county level)
Local Council 5 (District level)
NGOs (e.g. GIZ, Grameen Foundation, Red Cross, LWR, Oxfam, World Vision, Ecotrust, Heifer International)
Zonal Agricultural Research and Development Institutes
Private sector (finance institutions, commodity traders, internet service providers and telecom companies, coffee buyers)
MACRO Level
Uganda Coffee Farmers Alliance
Uganda Coffee Farmers Federation

Uganda Coffee Development Authority
Uganda Wildlife Authority (UWA)
Ministry of ICT
Ministry of Agriculture, Animal Industry and Fisheries
Ministry of the Environment
Ministry of Disaster Preparedness
National Agricultural Advisory Services (NAADS)
National Agricultural Research Organisation (NARO)
National Forestry Authority (NFA)

Table 2. Key stakeholders at the intersection of climate change, ICTs and development: Micro, meso and macro levels

1.2. Research Methods

This section presents an overview of the data gathering tools that were used as part of the RABIT pilot in Uganda. Each of the tools was adjusted in collaboration with the project's partners through several rounds of online and face-to-face interactions, in order to ensure that their scope and the wording used responded to the characteristics of the local context and participants.

RABIT Uganda team adjusting the research instruments

The research instruments described below were reviewed, adjusted and implemented by a team comprised by GCCE staff, Certification Officers (COs), Community Knowledge Workers (CKWs), LWR staff, and University of Manchester researchers.

Further details about the research methods recommended for the implementation of RABIT (i.e. versions of the tools in their original format, to be adjusted according to the specific goals and context of implementation) can be found in the RABIT Implementation Handbook.

In Uganda, the data collection process focused on five coffee grower cooperatives, also known as "Primary Societies". The selection of the cooperatives was done in collaboration with the GCCE and LWR considering the following criteria:

(a) Geographic location (i.e. societies located at different altitudes), so as to have a varied sample of climate change manifestations/impacts on coffee livelihoods,
(b) Good level of organisation of the society, to facilitate the coordination of interviews and focus groups, and
(c) Accessibility (i.e. cooperatives located in areas that could be easily reached by car or by motorcycle, even during rainy periods).

The following primary cooperatives[2] participated in the pilot:

- **Busamaga Growers Cooperative Society**. Joined GCCE in 1999. It has 715 registered members.
- **Konokoyi Growers Cooperative Society**. Joined GCCE in 2004. It has 374 registered members.
- **Bukalasi Growers Cooperative Society**. Joined GCCE in 2007. It has 449 registered members.
- **Bumayoga Growers Cooperative Society.** Joined GCCE in 2000. It has 746 registered members.

The following sub-sections provide details on the data collection tools that were used as part of RABIT's implementation.

a. Survey

A total of fifty-four survey interviews were conducted with coffee farmers. Table 3 summarises the basic information of the survey's respondents. A sample of the survey questionnaire is available in Annex 3.

Number of Surveys	• 54 survey questionnaires.
Survey Implementation	• The questionnaires were implemented by local Certification Officers (COs), face-to-face. • Data was recorded using a mobile phone-based template provided by the Grameen Foundation, and uploaded into a centralised system at the end of each survey.
Survey Location	• Busamaga Growers Cooperative Society (low altitude) • Konokoyi Growers Cooperative Society (middle altitude) • Bukalasi Growers Cooperative Society (high altitude)
Characteristics of Survey Respondents	• **Age groups:** 46 years old or older: 24% 36 to 45 years old: 52% 26 to 35 years old: 22% 18 to 25 years old: 2% • **Occupation:** Coffee farmer (100%) • **Education level:** Primary: 54% Secondary: 39%

[2] Further information about these cooperatives can be found at: http://www.gumutindocoffee.co.ug/2013/oursocieties.html

	No formal education: 4% Tertiary/University: 2% Other (specify): 2% • **Gender:** 67% of the survey respondents were male, 33% were female.
Stages of Implementation	• The survey's implementation involved five main stages: (a) **Initial design stage**, through which a first version of the questionnaire was produced integrating the lessons learned from the RABIT Costa Rica case study. (b) **Pilot stage**, through which the instrument (paper copy) was tested (in the local languages) among a limited number of respondents in the area (10 coffee farmers). (c) **Adjustment stage**, through which the survey questionnaire was revised and adjusted based on the feedback received from participants and surveyors. (d) **Systematisation**, through which the revised version of the questionnaire was digitalised and converted into a mobile phone-based tool. **(e) Roll-out stage**, through which the revised questionnaire was implemented in the field.
Survey Duration	• Considering the target population (i.e. coffee farmers), the time and resources available for the activity (e.g. surveys conducted during the day/working hours, offering no economic compensation for the participant's time) the survey was designed to last between 20 and 25 minutes.
Systematisation and Analysis of Results	• The completed surveys were directly uploaded by surveyors into the Grameen Foundation Salesforce.com system, using the CWK's **smartphones**. • From the Salesforce system, a CSV (Comma Separated Value) report was generated, and exported into Microsoft Excel. Data was analyzed using MS Excel in order to generate descriptive statistics (frequencies, graphs and charts).

Table 3. RABIT's data gathering tools: Survey

The following summary points provide further insights into the survey's implementation:

- The predominance of two age groups among survey respondents (36-45, and 46+) is consistent with the aging tendency of Ugandan coffee farmers reported by several interviewees.

- Previous to the stage of the survey's implementation (i.e. pre-pilot stage) the questionnaire was designed and adjusted through numerous drafts and revisions. The adjustment of the survey took into consideration the following aspects:

  (a) the formulation of the questions and the language used needed to be clear and appropriate for the intended respondents (i.e. coffee farmers with relatively low education levels),
  (b) the formulation of the questions needed to be clear so it could be easily translated by the surveyors into the local languages of the respondents (Lumasaba and Lugishu),
  (c) the key areas of interest to the research (i.e. questions about ICT usage and resilience attributes/markers) had to be integrated as key components of the survey questionnaire,
  (d) the length of the survey had to be adjusted to allow for a reasonable implementation time, in order to limit the disruption of the respondents' daily activities, and
  (e) the survey's format/layout needed to be based on yes/no and multiple choice answers, so the survey could be conducted using a smartphone interface.

- The pilot stage was crucial to identify problems and adjust the survey to the local context. Issues that were corrected include repetitive questions, confusing language, unclear response options, the length of the questionnaire, and the flow of the questions.

b. Semi-structured Interviews

A total of sixteen interviews were conducted, as summarised in Table 4. The sampling approach was purposive, targeting key local stakeholders at both the meso and micro levels. A sample of the interview protocol is available in Annex 4.

Number of Interviews	• 16 semi-structured interviews.
Interviews Location	• Mount Elgon, Eastern Uganda
Interview Respondents	• **Micro level:** Coffee farmers and Community Knowledge Workers (10 interviews) • **Meso level:** Primary Societies staff and GCCE (6 interviews). • **Gender:** 6% of the interview respondents were females, and 94% were males.
Key Interview Themes	• The semi-structured interviews sought to address **four main issues**: a) Understand the local context: identify the strengths and weaknesses of the community. b) Identify the climate change impacts and the local responses to climatic stressors. c) Identify the role of ICTs and the challenges to their use. d) Assess the presence of resilience attributes, based on the resilience markers (identified in

Interview Duration Results systematisation	RABIT's conceptual framework). • The average duration of each interview was between 40 and 50 minutes. • The interviews were recorded, transcribed and coded for analysis. • One interview was conducted in the local language of the respondents (Luganda) and translated.

Table 4. RABIT's data gathering tools: Semi-structured interviews

The following summary points provide further details of the interviews' implementation:

- Field notes and photographs taken during the field visits were used to complement the data gathered through the interviews, and helped to contextualise the analysis of findings.
- Most of the interviews were conducted by a team comprised by local LWR staff and University of Manchester researchers, so as to help build the trust of respondents, and to have the option of conducting the interview in the local language.
- The coding process of the interview transcripts was largely based on the identification of the resilience attributes and markers identified in Table 1.

c. Focus Groups

Five focus groups (FGs) were implemented as part of the RABIT pilot in Uganda, as follows:

(a) Three focus groups were conducted with coffee farmers. The FGs took place in three of the cooperatives selected for the pilot's implementation (Bukalasi, Bumayoga and Konokoyi Cooperatives).

(b) Two focus groups were conducted with GCCE staff and CKWs involved in the pilot's implementation. The FGs took place at the GCCE's Headquarters in Mbale.

Further details about the focus groups are summarised in Table 5.

Number of Focus Groups (FG)	• 5 focus groups.
Focus Group Participants and Location	**a. Coffee farmers:** • **FG 1:** Coffee farmers (Bukalasi Coffee Cooperative) • **FG 2:** Coffee farmers (Bumayoga Coffee Cooperative) • **FG 3:** Coffee farmers (Konokoyi Coffee Cooperative) **b. Gumutindo/Project staff:** • **FG 4**: GCCE headquarters' staff/CKWs, Mbale. • **FG 5:** GCCE headquarters' staff/CKWs, Mbale •
Number of Participants	**a. Coffee Farmers:** • **FG 1:** 12 farmers • **FG 2:** 31 farmers • **FG 3:** 18 farmers **b. Gumutindo staff and CKWs:** • **FG 4:** 16 participants • **FG 5:** 15 participants

Methodology	• Focus groups **1, 2 and 3** were led by CKWs and included the use of a FG Facilitator's Guide (Annex 5) and participatory mapping techniques. • Focus groups **4 and 5** were implemented using the KETSO[xxxi] methodology to foster creative and participatory engagement.
Focus Group Duration	• The average duration of the focus group sessions was **2 hours.**
Systematisation of Results	• The results of the FGs conducted with coffee farmers were documented in **reports** prepared by the facilitators (CKWs) (Annex 6). • The results of the FGs conducted with GCCE staff were systematised using software designed for writing up the results of **Ketso** workshops[xxxii]. • Data was complemented with field notes and photographs taken by the research team during the sessions.

Table 5. RABIT's data gathering tools: Focus groups

Further details about the methodology used in the focus groups are presented below.

Focus Groups: Coffee Farmers

Objectives

The focus groups conducted with coffee farmers were carried out at the primary societies of Bukalasi, Konokoyi and Bumayoga.

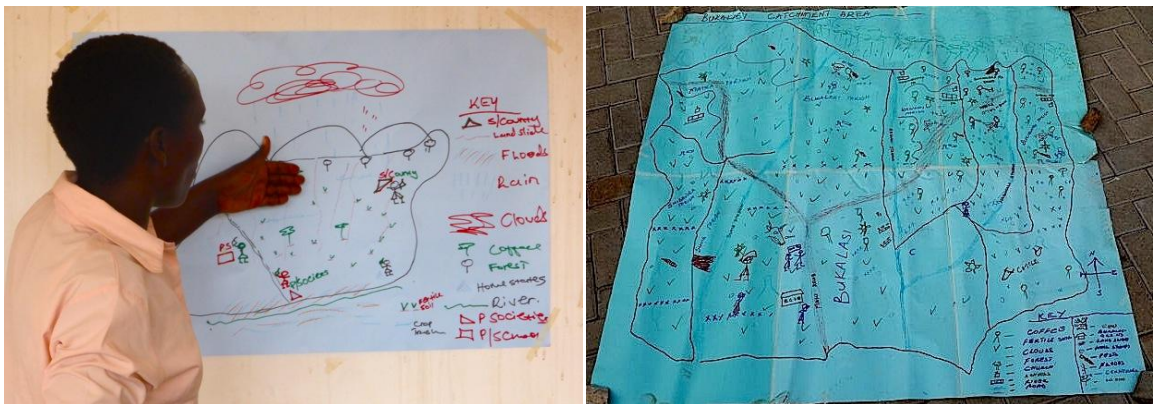
The specific objectives of the focus group discussions were:

- To identify and learn from the coffee farmers' experience in regards to climate change manifestations and impacts on their local livelihood.
- To identify the farmers' experience with the use of ICT tools (i.e. mobile phones, Internet) including the opportunities and challenges of using these tools.
- To raise local awareness about the RABIT pilot (i.e. issues/themes), and validate its potential contribution and local relevance.

The guidelines used by the facilitators for conducting the focus groups are available in Annex 5. The methodology involved participatory mapping, so as to provide a voice to all the participants in the identification of local climate change manifestations and technology usage.

Images of the Focus Groups conducted with coffee farmers

Guided by certification officers, participants drew community maps showing areas that have been affected by climate change impacts, identifying heavy rains linked to floods, erosion, landslides, prolonged dry spells, increased incidences of pests and diseases, among others. They also plotted available services and infrastructure, including learning centres, primary society premises, shops, mobile money points and roads, which helped the group to visualise and discuss areas of vulnerability and local strengths.



Images of participatory mapping exercises conducted during the Focus Groups with coffee farmers

Focus Groups: GCCE Staff

Two focus groups were conducted with GCCE staff, including personnel involved in different aspects of the coffee supply chain (e.g. assistant coffee manager, Information and Communications Manager, supervisor of the Primary Societies, coffee-buying clerk, Certification Officers (COs) and Community Knowledge Workers). The sessions took place at GCCE's headquarters in Mbale using the Ketso methodology detailed in Annexes 7 and 8.

The objectives of **Focus Group 1** were:

- To gain a better understanding of the context of RABIT's implementation and of the linkages between climate change impacts, resilience and ICTs in Uganda's coffee livelihoods.
- To gather feedback from participants on the vulnerability dimensions of coffee livelihoods, climate change manifestations and impacts, the potential of ICTs, and the challenges that coffee farmers face for the effective use and appropriation of these tools.

Participants interacting during the Ketso session (Focus Group 1)

The objectives of **Focus Group 2** were:

- To foster buy-in and appropriation of the RABIT toolkit by the local project partners/GCCE staff.
- To gather feedback on potential adjustments of the toolkit based on its main components (i.e. data collection, stakeholder engagement, analysis and presentation of findings, local impacts and ICTs and resilience).
- To collectively identify ways of implementing the pilot responding to the partners' expectations and the local priorities, so as to obtain maximum benefits.

Participants interacting during the Ketso session (Focus Group 2)

The focus groups were a valuable method to gather input on key components of RABIT's implementation, to provide a participatory space for key stakeholders to identify and discuss areas of vulnerability, and to reflect on the potential role of ICTs vis-a-vis coffee farmers' resilience.

The results of the focus group discussions have been integrated into the following sub-sections in order to strengthen the analysis. Summary results of those discussions are available in Annexes 9 and 10.

Having presented the data gathering tools used in the pilot's implementation, the following section focuses on the RABIT's findings.

Section 2. RABIT Findings: Community Resilience

This section presents an assessment of coffee farmers' resilience in Mount Elgon, based on the analysis of data gathered through semi-structured interviews with local stakeholders. In order to strengthen the validity of the findings, focus group data has been integrated, when available, to relevant sections of the analysis.

The section is structured into three parts. The first one provides an overview of the vulnerability dimensions and climate change manifestations that affect coffee farmers in Mount Elgon, based on the perceptions of local stakeholders. The second explores the coffee farmers' resilience, linking perceived areas of strength and weakness of coffee livelihoods with the set of resilience attributes that constitute RABIT's conceptual framework (Table 1). The third part presents an overview visualisation of resilience findings in Mount Elgon.

2.1. Vulnerability and Climate Change Impacts in Mount Elgon

The first step of the analysis consisted of gaining a better understanding of the local vulnerability context of Mount Elgon coffee farmers, particularly as it relates to climate change-related stressors. This sub-section presents an overview of perceived vulnerability dimensions and climate change manifestations at the local level.

In regards to prevailing vulnerability dimensions, interview findings suggest that coffee farmers prioritise problems related to livelihoods and finance, particularly those that have a direct effect on their income (e.g. problems of coffee quality, pests and diseases, challenges to farming planning, climatic manifestations that affect the coffee yield). The proportion of interviewees that mentioned vulnerabilities related to livelihoods and finance was 83% (Figure 6).

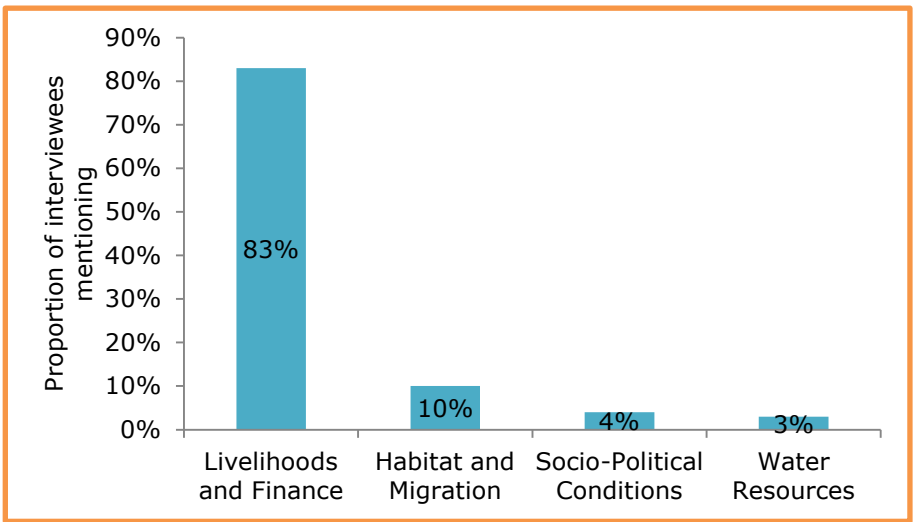


Figure 6. Climate change impacts linked to vulnerability dimensions (interviews)

As identified previously in the analysis, existing vulnerability dimensions (e.g. coffee price fluctuations/market instability, lack of farming equipment, weak infrastructure) exacerbate the impacts of external stressors such as climate change.

In terms of climate change manifestations, interviewees perceive both short and long term impacts as reflected in Figure 7[3]. Short-term impacts include episodes of intense precipitation and drought, followed by landslides, floods and hailstorms. Long-term or chronic climate change impacts include changes in seasonality (e.g. changes/uncertainty in the 'dry' and 'rainy' seasons) and changes in temperature.

Findings evidence the existence of mutually-reinforcing linkages between climate change impacts and vulnerability dimensions (i.e. climate change impacts exacerbate, and are exacerbated by, pre-existing vulnerability dimensions). These linkages are represented in Figure 7 with a two-way arrow.

[3] Figure 7 summarises the findings related to perceived climate change manifestations and perceived vulnerability dimensions in Mount Elgon, based on the analysis of interview transcripts. It classifies the data according to short and long-term climate change impacts and vulnerability dimensions, ranking the issues in order of importance based on the number of interviews in which the issue was mentioned ('I#'=Interview number).

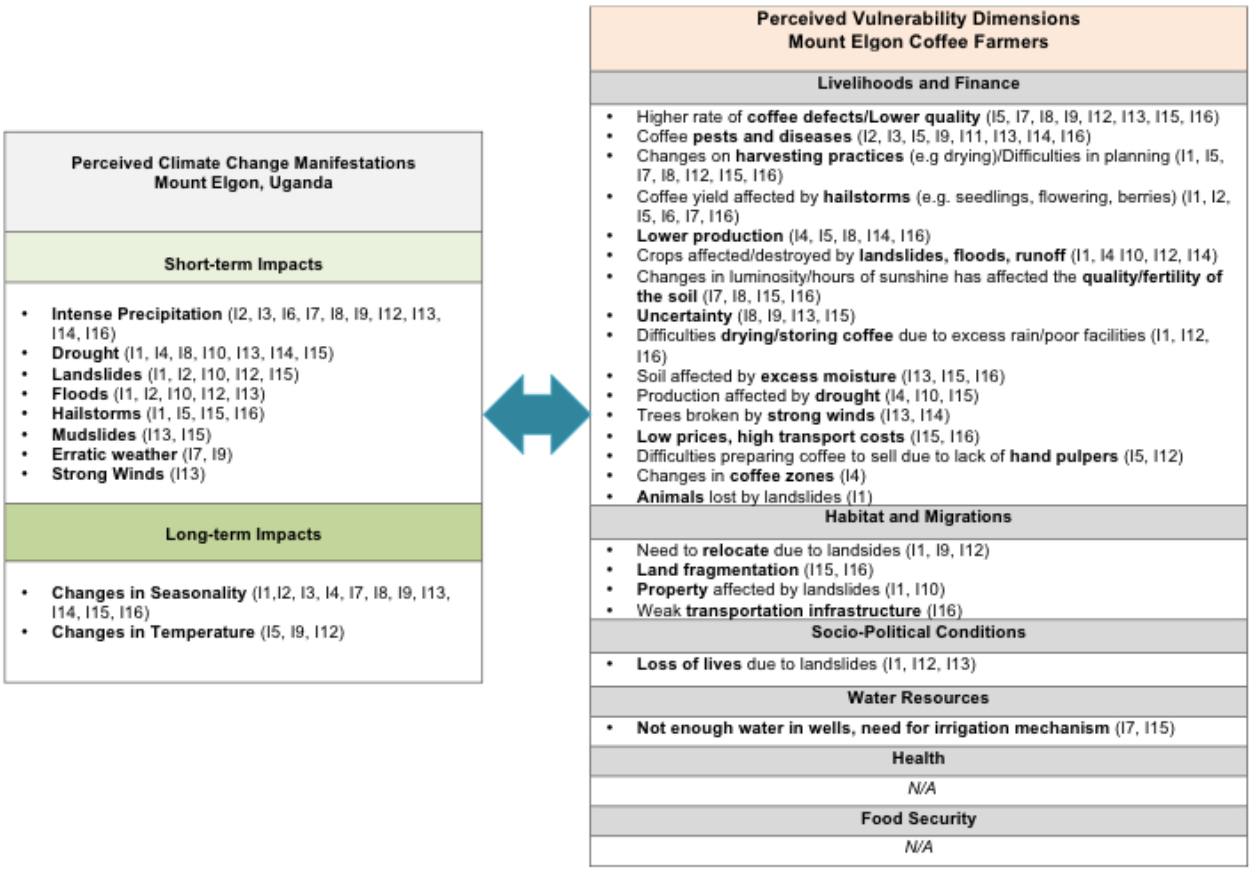


Figure 7. Linkages between perceived climate change manifestations and vulnerability dimensions in Mount Elgon (interviews)

While respondents perceived a more diverse range of short-term impacts (e.g. landslides, flood, hailstorm, mudslides), the changes in seasonality were identified by the highest number of interviewees (Figure 8), suggesting the increasing relevance of chronic trends/long term impacts in the adaptation and resilience of coffee farmers.

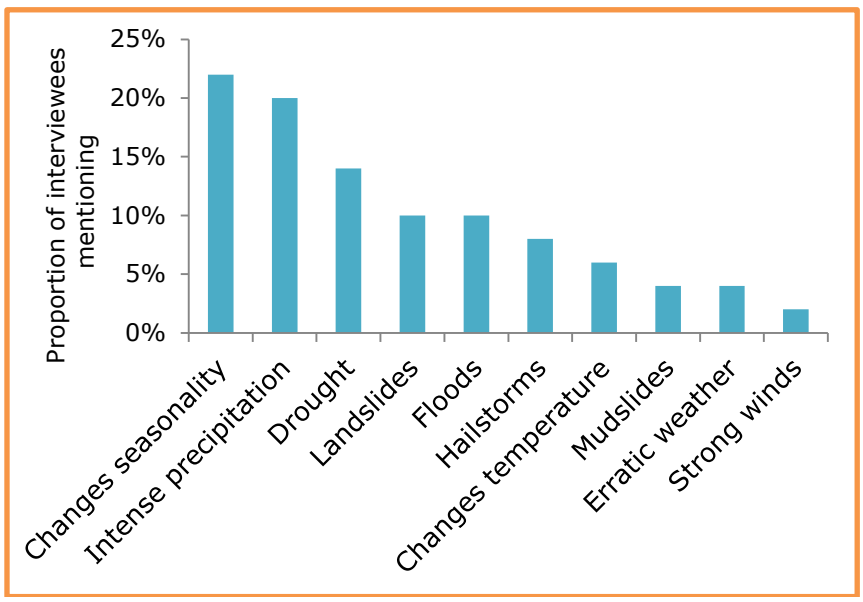


Figure 8. Climate change manifestations perceived in Mount Elgon (interviews)

In regards to perceived changes in seasonality, interviewees explained:

> *"Farmers used to get rains in March, but it comes any time now, and it rains any particular time in the day. For example, the rain used to come at 1pm, and it would rain for one hour and stop. But now, it can be a beautiful day, or it can rain the whole day or during night…It is unpredictable!" (I7p32).*

> *"When you see the rainy seasons…all the seasons, you can't be so sure, you can't predict when the rain will come and when it will not come…So [the farmers] are experiencing prolonged rain, which is heavy, and prolonged droughts…and we can attribute it to climate change" (I9p42).*

Impacts of floods and runoff, Mount Elgon

Transportation challenges: Poor road condition during episodes of heavy rain, Mount Elgon

As seen in Figure 6, the majority of **perceived climate change impacts** were related to negative effects on agricultural livelihoods. 83% of the impacts mentioned by interviewees relate to their livelihood, followed by 10% related to local habitat, 4% to social aspects, and 3% to water resources. No data was gathered in regards to health and food security dimensions, which suggests a low level of awareness on the impacts of climate change in these areas (e.g. incidence of malaria, respiratory conditions, changes in local nutrition).

Figure 9 provides a more detailed look at the perceived impacts of climate change in the Mount Elgon region. The main impacts reported by interviewees were (a) higher rate of coffee defects (and a corresponding decrease in the quality of the coffee sold to the farmers' cooperative, and of the price paid for the yield), and (b) an increase in pests and diseases affecting the coffee trees. These were followed by changing farming practices (e.g. difficulty to plan ahead due to climatic uncertainty and fluctuating seasonality), and lower coffee yield due to the effects of hailstorms, landslides and floods, among others.

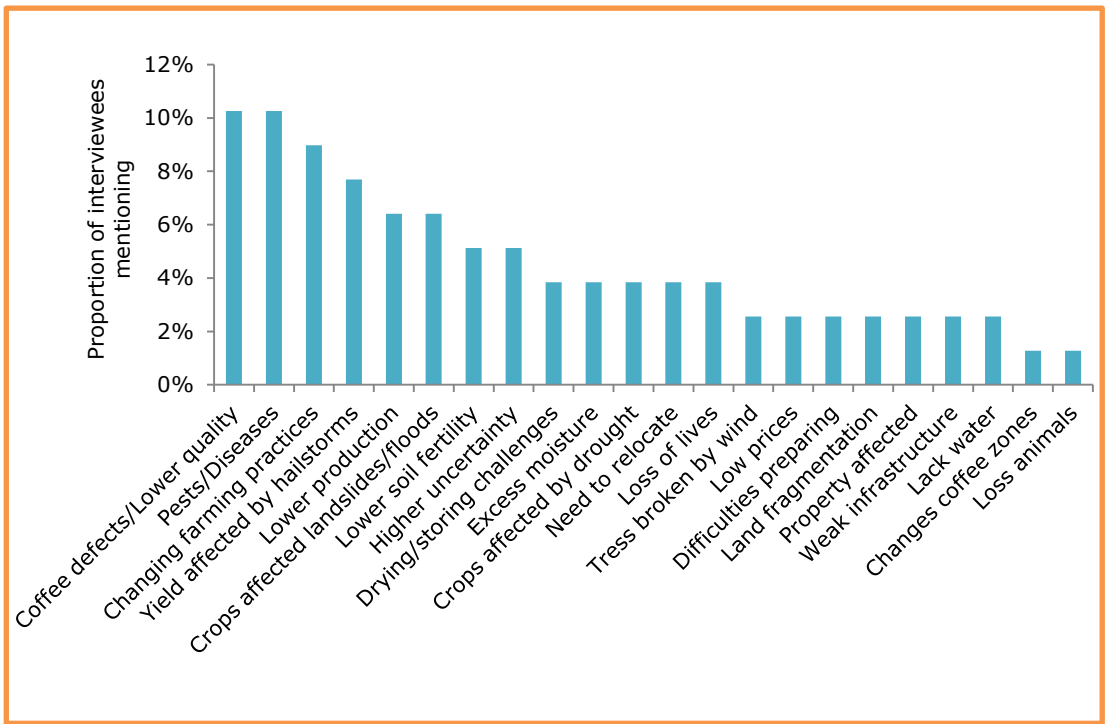


Figure 9. Perceived climatic impacts on coffee livelihoods (interviews)

Images of CKWs assessing coffee pests and diseases, Mount Elgon

The interview statements included in Table 6 provide further insights into these perceptions:

Farmers' testimonials: **Impacts of climate change manifestations on coffee livelihoods**
Coffee defects/Lower quality
"It rains, and the rain comes with hail storms, and it becomes a problem because the hail hits the coffee berries…that causes the coffee not to ripen well, because the berries will get scars, giving us the problem of coffee defects being too high (…) So the coffee is rejected [by the Cooperative], because it has defects. That defect rate is also attributed to insects that have bitten it." (I5p22)
Pests/Diseases
"They never used to be diseases and pests, specially for coffee. We are surprised that in most of the areas where we expected not to have [pests],

like in high altitude areas, now there are cases of coffee steam borer, and we attributed it to climate change, maybe [to changing] temperatures…because, as the temperatures keep increasing uphill, the steam borer also gets adapted to that environment…it has been a very big challenge." (I9p42)
Changing farming practices / Uncertainty
"These last five years we have been experiencing these changes. We would target March –that is the season when we could start planting our garden, planting beans and maize, we start in March- but January we would prepare our gardens. But these days… we are seeing… changes. Rain comes when we are not aware. Just comes when you are not prepared. For example, now is the season when we harvest our beans that we have planted. But because it is over-raining, we don't experience good sunshine, our plants are not becoming ready on time. So that has made us to change. You can find other areas that are experiencing drought…Here, we are experiencing rain…so things are not coming out in an informed manner." (I8p37)
Coffee yield affected by hailstorms
"Where I come from, we were affected by huge hailstorms that hit the coffee …and dismantled all the coffee seedlings…EVERY [emphasis] plant that was in the garden was totally destroyed!!…and there was totally no coffee harvest, there was no crop to be harvested, and it was really a disaster to us. So the production of coffee in that area…was poor because of the hailstorms". (I1p2)
Lower production
"You want to dry the coffee for example from 7am up to 1pm, because you knew that it would not rain…but now is not the case. You can't know when it will rain, whether in the morning or in the evening, so it has affected the process of drying the coffee. And the sunny days and sun hours have been reduced. And that affects the flowers and ripping of the beans…the moisture has changed. So they have different fruits…Sometimes the beans are small, and sometimes they are empty!…"(I7p32)
Higher uncertainty
"If someone asks me about the seasons in Uganda, it would be hard to tell. Because even when we expect rain, there is drought. When you expect drought, then rain comes in. When there is hail rain, everything is flooded and washed off…so there is a lot of erosion. When you expect average rain, it rains for the whole year…so it becomes hard to plan…" (I15p79)
Drying/storing challenges
"Yeah, when it over-rains like this…it affects the quality of the coffee. Because sometimes, when you wash your coffee…the washing requires some sun to dry. But when you wash, and you want to dry, and it rains, automatically you store the coffee, even though it is not dry. So, automatically the quality of the coffee will be affected." (I8p39)
Crops affected by drought
"We have the coffee stem borers, who enter the coffee trees and affect the quality. We also have some caterpillars, but those ones they used to come and eat the leaves, when there is too much drought". (I13p68)
Relocation
"The coffee zones are changing…the zones where coffee was grown, are no longer growing coffee…or the production is going down. Why? Because of the climate (…) we realise that coffee zones are moving to other areas now, to higher grounds than they were before…to higher altitudes!" (I4p15)

Loss of lives
"You have the mudslides and the like. I happened to stay in slopes in the hill, and at one time all the people had to clear around the hill, and all the stones moved because of the erosion, almost killing people in terms of the houses, due to the extreme rain… So climate change, I would say that it is evident…"(I15p79).

Table 6. Selected interview testimonials: Impacts of climate change on coffee livelihoods

The overall perceptions of interviewees in regards to climate change manifestations and the vulnerability of coffee livelihoods were confirmed by the results of the focus groups held with coffee farmers.

Focus group findings corroborate the high level of awareness that exists among farmers on vulnerabilities related to livelihoods and financial aspects, particularly in terms of low coffee prices and market fluctuations, and the impact of pests and diseases on their production (e.g. lower yield and lower quality, which translates into lower farmers' income). Issues related to health and food security vulnerabilities also emerged during the focus group discussions. Participants identified similar climatic manifestations (short and long term impacts) to those reported by interviewees (Figure 10), thus confirming earlier findings.

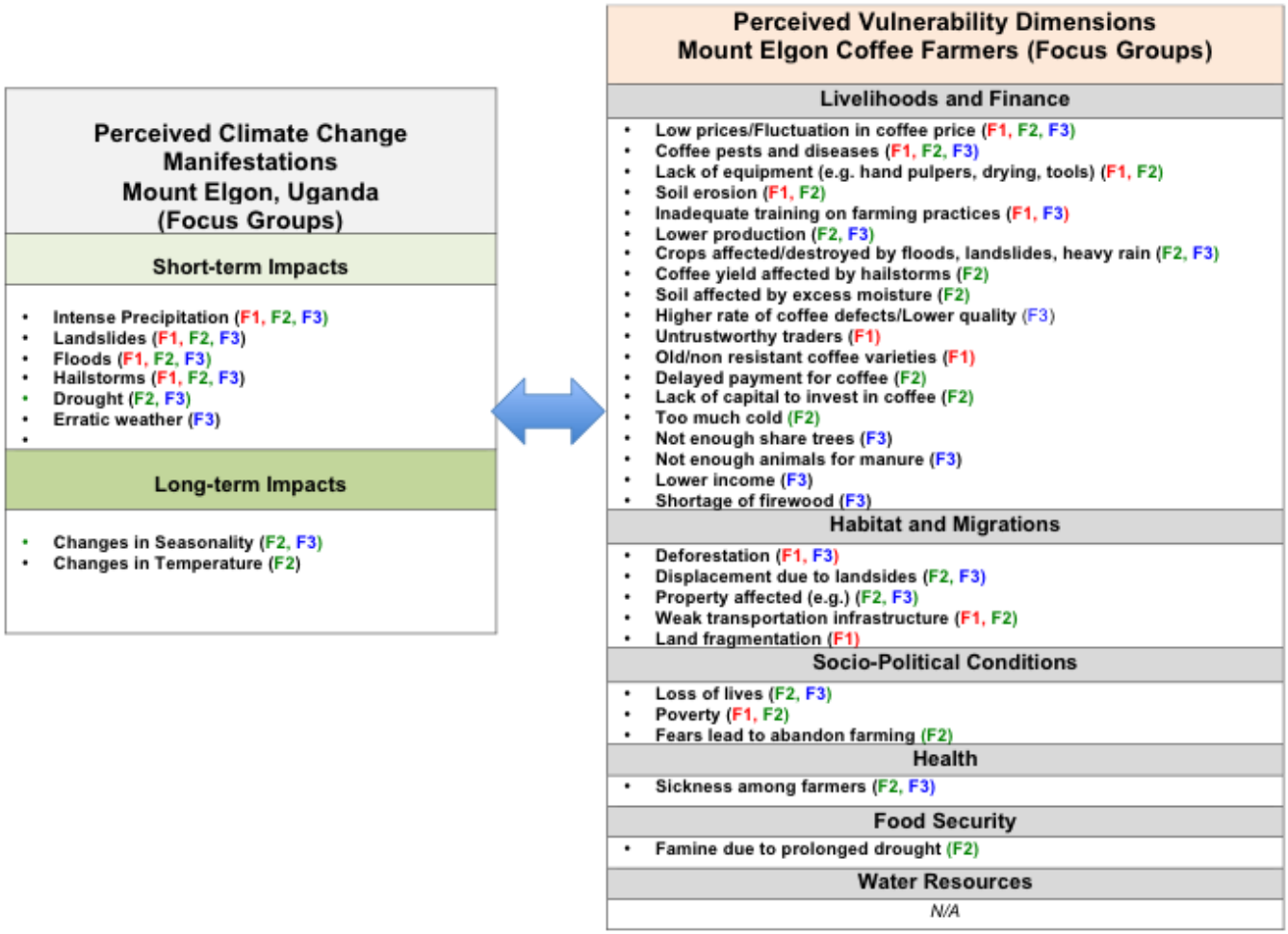


Figure 10. Linkages between perceived climate change manifestations and vulnerability dimensions in coffee livelihoods (Focus Groups)

Having identified the overall vulnerability context within which RABIT was implemented, particularly the climatic stressors and impacts to which coffee farmers must respond in order

to survive, let alone thrive, the following sub-section presents findings related to the resilience attributes of Mount Elgon coffee farmers.

2.2. Resilience Attributes: Community Strengths and Weaknesses

The analysis presented in this section assesses the resilience of Uganda's coffee farmers, by linking the perceived strengths and weaknesses of coffee livelihoods with the nine attributes of resilient systems (identified in Table 1). The analysis is based on interview and focus group data, and discusses most of the markers/characteristics of resilience (as per the conceptual approach presented in Section 1, and detailed in RABIT's Implementation Handbook).

2.2.1. Community Strengths and Resilience Attributes

The following are the main attributes that contribute to the resilience of Mount Elgon coffee farmers to stressors such as climate change, as identified through the analysis of interview findings.

Robustness

Interview respondents identified the presence of diverse **institutions** that can help coffee farmers respond to the impact of both climatic and non-climatic stressors. Institutions identified included government institutions, primary societies (i.e. farmers' cooperatives), as well as NGOs. As explained by an interviewee:

> *"The farmers do have contact [with several institutions operating in the area], because we have the government programmes, like the national agricultural advisory services that is providing extension services to the farmers…Then we have local NGOs…" (I9p43).*

The presence of institutions in the community is also linked, in some cases, with physical preparedness to respond to and cope with emergency situations (e.g. availability of shelters to protect farmers in case of landslides). In this regard a respondent stated:

> *"Before we even approach the ever-rains, in the wet season, the NGOs, together with the Red Cross, prepare tents in the low-lying areas. In cases of disasters, they normally move those people from hilly places, and relocate them in low places…(…) Also in our Primary Societies…we have a shelter, that serves as infrastructure. In the case of anything, of course, we advise them [the farmers] to go there, and wait for [the situation] to stabilise, and then go back. Those shelters are provided mainly by NGOs and by the government of Uganda" (I1p3).*

In regards to the farmers' **physical preparedness** to the impact of climatic manifestations and weather-related emergencies, interviewees mentioned a variety of farming-related measures that contribute to their preparedness. These include the implementation of natural barriers against runoff and floods, the use of shade trees to protect the crops from the wind, as well as soil management practices to improve fertility. These practices are illustrated in the following statements:

> *"When [the rain] is too heavy, it can get flooded. And we have some mountains there, with small hills which can fall if the water becomes too much. Sometimes we advise [farmers] not to dig up the cliff, so that can help…the grass can grow, and it can help to stop the water." (I2p10)*

> *"Through the Primary Society…[farmers have received support] for planting more trees, so they can resist the strong winds that have emerged. Specially the winds. Yes, to plant more trees so we can have enough shade, and these trees are supposed to protect the coffee trees themselves, and aid the soil cover."(I13p67)*

"[Farmers] are building trenches to control erosion, they are planting… the trees are helping in two ways: managing the temperature, as well as controlling landslides and erosion. The Primary Society is also promoting soil fertility, by providing cows to the farmers…for fertilisation, to give manure." (I9p42)

Interviewees also mentioned the adoption of different practices (e.g. more resistant varieties, shade trees, trenches, intercropping, water collection) to strengthen the (physical) preparedness of their livelihood to the vulnerabilities exacerbated by climatic impacts, such as the increased incidence of coffee pests and diseases. As some interviewees explained:

"We have one [coffee] variety called 'SL14', which is a resistant variety, yeah, and most of the farmers plant it. That is the coffee they plant. It is resistant to leaf rust, it is also resistant even to the weather conditions." (I2p13)

"So [farmers] are looking at adopting appropriate trees that could be planted to provide shade to the coffee trees. And where those trees are growing, you can see that the production is increasing again." (I4p160)

"We have come up with the interesting idea…of promoting sustainable agriculture, land-management practices…[for example] When it rains, making sure that the runoff doesn't stay within the farm…so [farmers] put trenches along the farm, they do mulching, they do intercropping with the trees, and terracing…" (I4p16)

"There is always that preparation, because for us, we know that from November until April, that is a drought period…so the farmers prepare for it. During April up to September they are busy planting some cassava, potatoes…because those crops, sometimes, they can dry them, so they can reserve them for future use." (I10p50)

"We advise farmers to construct contours and terraces in the gardens…Alongside those terraces or contours, they plant 'elephant grass'…That grass holds the soil so it can break down the speed of the water flow that can cause erosion, and it is also good for feeding the animals. Then you also plant trees, so their roots can hold the soils." (I13p67)

"So during the rainy season, we advise [farmers] to collect water. Because we may experience then a long drought spell." (I13p68)

Soil and water conservation on hilly area

Tree planting

Also related to physical preparedness, interviewees mentioned investment in improving local housing infrastructure, when the returns from the sale of coffee allow it:

"Basically, if they get good returns, then they invest in the fields in good infrastructure…In their housing, yes, you definitely see that…" (I4p16)

Interview findings suggest strong linkages between the perceived robustness of coffee livelihoods and the adoption of organic coffee farming practices, as explained by a CKW:

> *"Being organic farmers, they are not facing a lot of problems as far as pests, diseases and erosion issues are concerned...Because they use organic practices, so they do more prevention, and that has had a very big impact. When you look at the conventional farmers vis-à-vis our organic farmers, we find that cases of pests and diseases, and erosion and fertility issues in their farms are clearly very different." (I9p40)*

Related to the adoption of shade trees (which provide protection against the wind, but also are a source of organic manure to strengthen soil fertility), an interviewee added:

> *"The coffee plants are now covered from the sun, most of the time. And also the leaves when they fall…they plant these shaded trees, which are also productive to the plant: the leaves decompose and become manure, contributing to the nutrients of the soil." (I5p24)*

Interviewees also mentioned existing networks that can contribute to the community's capacity to respond to stressors, and to continue operating amidst change. This is reflected in the following statement:

> *"Naturally in Africa there is a lot of social capital. Naturally. So people have the tendency of belonging and cohesion, as part of a network…" (I15p79)*

Self-organisation

Interview findings suggest the existence of **collaboration and consensus building** among farmers, particularly in regards to the ability of farmers' organisations (e.g. coffee growers' cooperatives) to mobilise community members and coordinate actions. An interviewee explained:

> *"You'll find that most of the farmers are [associated] in cooperatives, in organisations like Gumutindo, others are in the Bugishu Cooperative Union (BCU), their members are farmers. And in the whole nation, everything is done in annual general meetings, like committee meetings." (I1p3)*

Findings suggest that farmers have multiple motivations to self-organise, including negotiating coffee prices, engaging with institutions operating in the area, and dealing with local security issues. In this regard, interviewees stated:

> *"Forming cooperatives has been a very huge strength, because it helps [farmers] negotiate the prices for their coffee". (I9p40)*

> *"The best way for the farmers to get in touch with these guys [institutions that operate in the area] is by having groups…by forming small groups of 10, 15 or 20 people, but not all of them have done that. So those few that have formed groups are the ones that are in touch with these organisations." (I9p43)*

> *"Sometimes we have issues of safety. And the [group] members help us out, they brainstorm on that, people come up with ideas…[for example] If someone has done wrong, we put some measures in place, bylaws, for example when it comes to the destruction of crops, or to people leaving animals free-range…" (I10 p51)*

Examples of self-organisation also include support in cases of the death of a community member, as well as mobilisation of volunteers to help farmers at risk, or to maintain the local infrastructure. An interviewee explained:

"If there is a person by the [river] stream, and there is no assistance from the government, [farmers] can come together. They organise a day in which they can use the local [construction] materials, and help". (I10p51)

Closely linked to the above, findings suggest that there is a sense of **trust and sense of belonging** to local organisations, particularly to farmers' cooperatives:

"In fact, [farmers] trust one another…[for example] here we work at the interface of religions: Muslims, Christians and Jewish…they work together. So there is trust among farmers. When there is a problem they come together…for example when it comes to death, maybe it is a Muslim, but they all come together. Maybe if there is road maintenance needed, they all come together, or if there is a problem at school. They all work together, that is why I say that there is trust." (I10p50)

"Where the cooperatives are working, then the [social] networks zeros into the cooperative…and the farmers BELIEVE [emphasis] in the cooperative (…). The cooperative is the central point where the farmers can meet…(…). The cooperatives act as an intermediary, as a middle ground." (I4p17)

"Trust is very high…it is very high. Even when the farmers, when bring their coffee to the Primary Societies…sometimes they don't get their money immediately, but they trust us, and give us their coffee. And then we would bring back their coffee payments." (I1p3)

"The majority of [farmers] bring their coffee here [to the Primary Society], so they support their society, this is THEIR [emphasis] society, they bring their coffee here rather than sell it to outsiders, to outside traders. They bring their coffee, we buy and take it to Gumutindo." (I12p60)

"I have seen that, is a kind of social network because they collaborate with each other, because of that 'attachment' that they have. I've seen it in most of these communities. It is like a 'pool network'." (I9p43)

Images of local self-organisation, Mount Elgon

These feelings are reinforced by the existence of structures that are deeply rooted in the local culture and traditions, such as local councils and tribal groupings. As some interviewees explained:

"[Farmers] still have strong clan structures, which fall under government structures - which is the Local Council 1- they usually hold meetings and discuss the local challenges, and after that, they share it with the political wing, and the Chairman for the clan comes up with the solution or recommendations."(I7p33)

"Communities are organised into cultural / tribal groupings as well as common interest groupings ranging from common interest groups, primary societies, associations and cooperative unions. These make it easy to mobilise for action." (I16p84)

The attribute of self-organisation among coffee farmers is closely linked to other resilience attributes such as *redundancy* (e.g. financial resource surplus through collective saving schemes) and *learning* (e.g. knowledge sharing mechanisms, including local leaders disseminating knowledge through social networks).

In this regard, an interviewee explained:

"In the cooperatives, the Primary Societies, we mobilise farmers to form "circles"…those are for savings (…). They open an account, deposit their money, and in the case of anything [e.g. an emergency], they go and withdraw it. We also organise them through 'connected farmers'…you'll find that a 'connected farmer' has assigned a certain number of farmers in a location, so it is the 'connected farmer' who passes on the information to the rest. If there is an activity to be done, the extension worker works with the 'connected farmer', and the knowledge is then passed to the rest." (I1p4)

Learning

In regards to learning, interviewees identified local **capacity building/training** opportunities provided by institutions working in the area (e.g. by NGOs, and by Primary Societies through the role of extension workers/CKWs who build farmers' capacity on how to improve agricultural practices). As stated by interviewees,

"There are a lot of trainings that are taking place by the NGOs, by the research leaders. They are about climate change, and climate change is taking place rampantly."(I1p5)

"Most farmers have been advised, they have been sensitised to plant shade trees in their gardens…and not to be cutting these shaded trees, because they'll be helping the farmers." (I5p24)

Findings also suggest that farmers have access to learning opportunities (e.g. agricultural programmes) through the radio. As a farmer explained:

"We listen to some agricultural programmes in 'OPG', from 8:00 to 8:30am, we have "Farmer's Voice"…The radio is Open Gate Radio…we also have "Elgon FM" that also has "Farmers' Voice", from 7:00 to 8:00am." (I14p75)

The role of social memory was also mentioned as part of the farmers' capacity to learn from past experiences, and to use that knowledge to inform future practices. In this regard, interviewees stated:

"Even now, when you go to a rural area, you'll find that a local farmer is able to explain how to sustain himself in regards to the landslides, therefore they have acquired knowledge, yes." (I1p4)

"For example…with landslides. It is common in Mount Elgon that farmers are aware, they have acquired awareness of disasters like landslides, and they are able to move to better places [relocate], and they have continued to practice the methods of farming that they have been told to implement, so that we eliminate the [risk of] landslides through tree planting…." (I2p3)

This capacity is also linked to **reflective thinking** among farmers, which contributes to their ability to cope with and adapt to the impact of climatic stressors:

"Let me give you an example. We had the landslide in 2010, and then one in 2013…so [the farmers] are reflecting about what is happening, and they are able to stand firm, to withstand the problem."(I1p5)

Related to the existence of **trust** and a strong **social capital**, as reported previously in the analysis, findings suggest the role of **traditional knowledge** and **knowledge sharing** among coffee farmers, as reflected in the following statements:

"Coffee farmers have been in this business for quite a long time…So they have a lot of skills in terms of production…" (I4p14)

"Coffee was brought to this area by the Europeans. First, it was brought to the [tribal] Chiefs to start planting, and then to the lower Chiefs, and those people also gave it to a few farmers. In this area, specially, it was adopted around 1952. That is when most of the farmers here started planting." (I5p23)

"[Farmers] are also able to expand the knowledge that they have received to other farmers, other neighbours…in the neighbourhood where they live. And… they are also able to resist landslides, due to the knowledge that they have acquired. And more so drought, they know ways in which to abolish…drought. They know how to control famine…" (I2p3)

"Social capital is one of the biggest assets that we do have… Actually, if you ask [farmers] what is their main source of information, they would say that it is their neighbour…For example, if they want to know who is paying a better price for coffee…So it is about 'word of mouth'…trust is still there." (I15p81)

"Yes, [farmers] they share. Especially when there is a coffee pest outbreak. Like him, he is a farmer. They had a problem with a pest. When I am far [CKW], he goes to another farmer and ask him about the pest….so they share ideas, so they can solve it." (I6p31)

In terms of knowledge sharing practices, findings confirm that existing social networks (e.g. among neighbours, among farmers, certification officers and CKWs) serve as the main basis for the dissemination of agricultural knowledge and farming practices. In turn, information and knowledge sharing is closely linked with institutional efforts to build local capacity on organic farming practices, which are required to participate in some local groups (e.g. primary societies/cooperatives). As explained by interviewees:

"It is very common [to share knowledge among farmers], yes. Normally, when a farmer has a problem, he goes to the next farmer to ask him "what do we do?". (I4p18)

"People are also acquainted with coffee planting itself, and maintaining it…with agricultural practices. When the certification officers visit them…they follow the procedures of post-harvesting and all processes of harvesting…In fact, they know them." (I5p23)

"When they see that a member is not taking good precautions and measures for post-harvesting or harvesting their coffee, they do tell him: "Mr or Madam, these are not the proceedings we have for preparing the coffee"…When you find out that you spray it [with chemicals]…they can even dismiss you from the [primary] society because you are not practicing the correct [organic] measures…." (I5p26)

This suggests the existence of linkages between learning and other resilience attributes such as robustness (i.e. institutional capacity) and self-organisation (e.g. social networks).

Redundancy

Interviewees identified the availability of **different** (and potentially substitutable) **sources** of support that are available in case of emergency situations, including family members who have migrated (e.g. to the city or to other towns), as stated by an interviewee:

> *"Most of our farmers are always able to seek knowledge from other people…and you realise that it was rampant, most of them have shifted from the poor places to better places, but they are still connected to those places…to family members. Families usually get external support." (I1p5)*

In relation to redundancy (i.e. **functional overlaps and interdependency**), findings suggest the availability of multiple institutions and services that can be accessed at the local level (as reported before, under robustness). This is reflected in the following statements:

> *"Sometimes [farmers] call for support from NGOs who are around…because we [Primary Society] may not be able to support them with some problems, but NGOs like World Vision or the Red Cross can intervene and maybe give them some assistance." (I10p49)*

> *"Yes, there are very many [institutions/organisations that work on issues of climate change]. Very many. It is the "new darling" of projects and donors…everybody wants to be in that phase. Is the 'sexy thing'" [laughs]. I4p18*

> *"Like now we have…an NGO that gave us a solar system that we are using -OXFAM?-, and then we have some other institution [African Coffee Academy] that gave us a moisture meter for the coffee, which we are using, and a micro-scale…And also Gumutindo gave us the same things…" (I5p27)*

> *"The trainings have been there. Many people have done trainings on climate change (…) But the trainings have been there, many organisations have done that." (I9p44)*

> *"I say that World Vision is also a helpful NGO here, the Red Cross, but they normally just come when accidents happen…but World Vision also provides some training, specially on environment and climate change, they also bring some technical advice to teach the community." (I10p49)*

> *"The area has two farmer organisations, Kapchorwa Commercial Farmers Association and Sebei Growers Cooperative Union, and a host of NGOs including private sector foundations, World Vision, CARE international, IFCDC…." (I16p85)*

> *"I think that, since the phenomena [landslide] happened in 2010, and it was a huge one on Mount Elgon's slopes, there has been massive sensitisation to farmers through many stakeholders…" (I1p4)*

In terms of potential sources of **spare resources**, respondents mentioned practices of intercropping and animal husbandry, both for the purposes of sale (i.e. gain additional income) and for the maintenance of the households' food consumption. In this regard, interviewees explained:

> *"For our farmers the main crop is coffee, but they also have animal husbandry…and they are able to get some money selling the animals, selling milk from the animals, so there are other incomes apart from coffee…there is also what we call 'matoke', that is bananas, they also commercialise nowadays, they sell and make money, so they are able to buy more pieces of land. They also other crops like cassava, maize, millet, so they are also other sources of income." (I1p5)*

"One interesting thing that is also happening is that [farmers] are growing bananas…so they are intercropping bananas with the coffee trees…and that also brings more income to the farmers. Now they have an income stream with the bananas, as compared to only relying on coffee, as before." (I4p16)

Images of agricultural produce redundancy (beans, bananas, coffee) in Mount Elgon

Respondents identified as an additional reason for crop diversification the expectation of quicker financial returns, especially in the case of youth that are starting their farming business. As explained by a farmer:

"Youth are getting into high value crops, the crops that take shorter periods and have higher returns…like vegetables…tomatoes, cabbages, green peppers, hot peppers…Coffee of course not, because you need to own land…and to wait for more than 6 months. Tomatoes you only wait for 3 months, and the profits are much higher." (I15p81)

The attribute of redundancy can also be linked to the availability of multiple sources of information, as suggested by interviewees:

"First of all, farmers do get information from the society here, from the certification officers when they visit them. They also have the 'model farmers', whereby when one comes here with [good] practices, those people from that area can go to his or her place, look at what they have done, and rely on that idea. Now we have government extension workers, agriculturalists, who also pass through the villages, sensitising people, for awareness raising." (I5p27)

"For example in coffee, we access information from Gumutindo employees [e.g. CKWs], who give us some hints…then we get another information from agriculture extension farmers, from our sub-county…Then another information we receive it from radios…there are some trainings… And sometimes from our field farmers [e.g. 'model famers], you go and ask…we share." (I14p73)

"[Farmers access information] Basically through their coffee factories…because within the coffee factories they have information points…so they have notice boards, in the coffee cooperatives, and they also have regular meetings. They have meetings where they share the information, and they bring people who talk to them." (I4p20)

Suggesting the availability of redundant mechanisms to disseminate information (in addition to face-to-face communication, radio or mobile phones, a member of a Primary Society stated:

"When we see that there is a need, we write posters, and give them to our 'zone leaders' who can put them in their zones, informing farmers that we will have visitors or that we will be having a meeting in such and such dates…" (I5p28)

Notice board to display the daily price of dry coffee and red cherries, Mount Elgon

Findings also suggest that the availability of redundant – and potentially substitutable resources – is closely linked to the adoption of organic farming practices, by which farmers can save resources (e.g. not having to acquire expensive chemicals and fertilisers) and re-utilise resources to respond to various farming needs (e.g. animal husbandry and manure for fertilisation purposes). As interviewees explained:

"Every homestead has grazing cows, so that gives enough manure to the farmers, which they take to their gardens." (I5p23)

"On the rivers or in our plots, where we dig and make some banks, we have to plant some grass around the banks…so at the same time it is conserving water, and we are using it to feed our animals. It serves both purposes…and at the same time we are keeping soil fertility." (I1p74)

The implementation of 'saving circles' among farmers is also contributing to foster (financial) resource redundancy and to create saving routines, as stated by interviewees:

"There are 'circles' in which farmers can save money collectively. Once he generates resources, they open an account and begin saving their money… saving, saving, and if he has a problem, or for example need to pay school fees, he goes and withdraws part of his money, and maybe after certain time, when he earns money, he goes and deposits again…so it becomes a routine." (I1p4)

"The farmers of this area put in place a 'savings scheme'. When someone sells their coffee, then they give the money to the society, he is given a receipt and he is given a passbook, and then he comes back when he has a problem…to get help. Some of them, for purposes of paying the school fees for their children, and even if they want to buy some coffee seedlings to plant."(I5p27)

"What they have done, the social network they are making now, is like…like a pool network where people can collect money…They all contribute, then the next week they collect again and give it to another [farmer]." (I9p43)

Redundancy is also linked to the role of local institutions (e.g. Primary Societies, Gumutindo) that are supporting the coordination of farmers' saving schemes, loan provision, and coffee 'premiums' (e.g. special prices to motivate organic production, the involvement of women farmers in production, the implementation of coffee certification practices), thus fostering the generation of spare financial resources. In this regard, interviewees explained:

"We [Primary Society] teach them about savings through coffee. So, if they sell [the coffee] in December, we don't want them to misuse the money, but to save some money for future use…For the period without coffee. So we have been teaching them about savings." (I2p11)

"[Farmers] even have a [savings] 'circle' here. Not all, but some. We are encouraging them to save with the cooperative. We have some members who are even getting loans from here [the Primary Society]." (I10p51)

"We already have a circle of savings among farmers. A few have registered, and we are trying to mobilise more, to come and join. It is organised by the Primary Society." (I12p63)

"Gumutindo is willing to give a good premium price for your product as long as farmers obey certain [organic] practices…" (I15p80)

"When the price of coffee had been at UGS3,500 per kilo [USD 1.35] at other societies, then Gumutindo has been buying at UGS 5,000 [USD 1.92], because they have been buying quality, organic coffee. So now they are going to improve the coffee, because they have seen that the prices are changing…They are moving to organic to get a better price. Also to get the 'social premium', which they also give to the ladies…so they get a bonus [for women farmers]." (I2p12)

"Another thing is that they get 'social premium' [from the Cooperative]. We [the cooperative] also provide some services to them…maybe contributing with some local materials, we contribute with bricks, sand and stones…so we give them some…money." (I10p48)

The analysis suggests that redundancy is the most commonly perceived resilient attribute among coffee farmers, and is linked to the role played by multiple institutions at the local level, with the opportunities for livelihood diversification, the adoption of saving schemes, as well as with the availability of various sources of emergency support (e.g. family members, institutions) and information. Thus, redundancy is linked to attributes that are related to robustness, self-organisation and scale, as explained below.

Rapidity

Rapidity was the lowest perceived attribute of coffee farmer's resilience.

Findings suggest that some interviewees perceive a **swift** government response in cases of emergencies, as reflected in the following statement:

> *"Yes, yes, of course [the government reacts fast]. In cases of a landslide you have that the whole place is destroyed, and people don't have a place to stay…so [the government] has to do react very fast, relocating those people, take them somewhere, because gardens are destroyed and so on…and after they relocate them, provide them with food and all services!" (I12p63)*

Rapid **coordination** and **resource mobilisation** was also linked to existing structures operating in farming communities (e.g. local councils):

> *"Each village has a Local Council 1, and that person has to immediately report when such incident [an emergency] has come up." (I5p27)*

Although none of the interviewees reported having access to 'Early Warning Systems', findings suggest the existence of informal mechanisms to rapidly disseminate warnings and alerts among local stakeholders (e.g. weather alerts among farmers and CKWs, updates and announcements during emergency situations).

> *"That technology [EWS] is not yet established, but we have the CKWs who are able to predict the weather, the pesticides and insecticides that may be harmful for our crops…so they transmit that information." (I1p6)*

This suggests links between rapidity and the attributes of robustness, self-organisation, and scale.

Scale

Interview findings suggest that the role of coffee farmers' cooperatives (e.g. Primary Societies) has had a positive impact in fostering **multi-scale interactions and collaboration**, especially in regards to the exchange of farming practices and local coordination. This is reflected in the following statements:

> *"For example, there is a group of cooperatives in Western Uganda which normally come to visit our farmers and give them knowledge about how they have been going about their coffee production, and we also exchange ideas, we brought ideas from there and form here, so we are able to strengthen the farm, as we compare the two parties." (I1p6)*

> *"I went to Nairobi to see some of the washing stations, and then I happen to visit one of the primary societies…I interacted with the manager of the community, about how they have been managing the station, what were the challenges, so we have been exchanging ideas, sharing ideas." (Ip1p6)*

> *"External actors come to act as a 'catalyst'…and when you catalyse them, they are able to organise themselves. As an example, you have to invest in the local systems…like train their local people to take over the role of extensionists." (I4p17)*

Suggesting the existence of **multi-level networks** and **cross-level interactions** in emergency situations, such as those caused by climate change impacts, interviewees explained:

> *"In case that there are no such organisations [NGOs for emergency response], they [the farmers] have their own systems: they may go to the church, they may go to the government representatives…" (I4p19)*

"We have our Local Councils, L1. [Farmers] have to inform them… so these people can take measures. L1 connects to 2 and then 3 at the district level, and from there it goes to the national level." (I5p25)

"The government itself…we have a Ministry of Disaster Preparedness. So, in the case of any problem…in fact, the first person to run towards [the farmers] is the government…is always the one that supports the farmers." (I9p45)

Reflecting the role of **inter-scale partnerships**, interviewees stated:

"There is a project called "Send a Cow", and that was launched in one of our primary societies… and the communities are benefiting, so many farmers have bought cows. An NGO gives the money for that, through Gumutindo (…) Partnerships are strong, as well as cross-level interactions". (I1p6)

Diversity and Flexibility

Interview findings suggest that coffee farmers have the ability to adapt to change, particularly given the impact of climate change-related manifestations. The adoption of new farming practices were mentioned as examples of the farmers' ability to undertake different courses of action, and adapt their decision-making process. In this regard, a farmer stated:

"Yes, about the farming practices mainly in Mount Elgon we use terracing, we use mulching, and…there is contour breaching, there is planting more trees…Every farmer is able to make terraces, is able to plant more tress, do mulching or whatever. So they are taking measures to adapt to change." (I2p2)

Findings suggest the role of institutions in fostering the adoption of new farming practices and **adapting to change**, as well as the close linkages that exist between diversity (i.e. innovation) and learning (e.g. 'eagerness' to learn), as reported by several interviewees:

"Most farmers, they still have the traditional way of rearing animals, and the traditional way of farming, and now there is a massive sensitisation, and the farmers are now adopting new methods of farming, and you notice that we are moving from indigenous to exotic animals (e.g. pheasants), and we are able to generate income from them." (I1p5)

"Farmers do, they do [adapt well to change]. And usually [farmers] are eager to receive people with such [new] information, so they learn when they are together…that would contribute, because you have questions from different sides, and that is what they need. So they are eager to receive ideas from outside." (I5p27)

"Yes…[farmers] are ready to change. When something happens, if someone comes in and talks about the issues taking place, then the farmer automatically wants to change. They are not resistant, they're not. When something happens and you have to intervene, they also respond."(I10p52)

[The farmers] they are flexible, when you introduce something new…they have that 'urge', they want to learn more, when you bring in something they want to know how would it help them." (I12p60)

"Yeah, yeah...I think that I've seen many people do that [implement innovative practices]…like the system of manure, some people started it without even Gumutindo going there…They just started with the thought of it, and then went for it…and it worked. I have seen people handle their coffee in different ways, and it has worked. Yeah." (I9p45)

Another influencing factor in the adoption of new practices and **experimentation** among farmers is the role of social networks (e.g. knowledge sharing among neighbours/community members) and social memory (e.g. past experiences with climatic emergencies/disasters) as explained by an interviewee:

> *"Yes, with continuous assistance, they [farmer] adapt. Most specially if they see a friend that has done something that has worked…very fast, they adapt." (I9p45)*

> *"They do [adapt to change], because they are already scared…Like with floods, they hit them so much, that when you advise them to do this, they respond…And they do it!! So that means that they have seen what has happened in the past, and they have to adjust, they know they have to take measures in order to get rid of it…" (I12p62)*

> *"Farmers are capable to innovate. A strong capability to take advantage of opportunities." (I1p7)*

Equality

In regards to **openness** and **participation**, interviewees mentioned the participatory nature of community groups such as farmers' cooperatives, as explained in the following statement:

> *"[The farmers] are the ones that come up with decisions…for example in the local councils. Sometimes they call the members around in the village, and ask them what do they need in their area. In [doing] that, the members are the ones who take the decision, it is not the government or the cooperative who are bringing what they want…specially when it comes to tree planting. They normally ask them which kinds of trees do farmers think that could do better, either for shade trees or for environmental protection…So they decide on what kind of trees they need." (I10p53)*

> *"Of course, as a Primary Society we have a Committee that are immediate people to the farmers, and that would report the problems and challenges of the farmers to the Board, and the Board then votes on the matters." (I1p3)*


Images of women farmers and coffee sorters, Mount Elgon

Findings suggest that the emergence of community-based saving schemes is also contributing to foster social **inclusion** in farming communities by providing access for marginalised groups, such as women, to financial resources that otherwise would be out of their reach. A respondent explained:

> *"And interestingly, the so called 'poor farmers', who we thought were poor, they are organising a good amount of resources…they come together, lend money to themselves…In my area, I initiated a group of 30 ladies…Before, it was SO HARD*

[emphasis] for them, for a woman, to borrow [money]. But right now, at the end of the cycle, they share 5 million shillings! [USD 1,900]." (I15p80)

Findings suggest that Gumutindo has played an important role fostering local inclusiveness and participation in local organisations (i.e. primary societies), including an improved representation of vulnerable groups such as women and youth. For example, Gumutindo's role fostering the inclusion of women through the "Women-coffee" programme, which offers social premiums for coffee grown by women farmers. In this regard, a farmer explained:

"At the Primary Societies we work with mixed groups of farmers, male and female, but women have their organisation, 'women-coffee' we call them…and it is being organised by the women, so we sell it as 'women coffee', independently. So these women, they have a council and guidance, in their meetings. They appoint a Chair, they have their secretary, and they deal with a number of issues. (…) Old people are also there [in the Primary Society], and also youth...And you realise that, all the categories are represented in the primary society, and more so, in Gumutindo."(I1p4)

"So we [Primary Society] have been now teaching the farmers to reserve some plots in their farm…like this one, it is for the wife of one of the CKWs…is coffee for the wife, so they can sell their coffee and get the social premium….because you want her [to be able] to buy something, [for example] to buy airtime…" (I2p12)

"[laughs] Some time back…there are men, who didn't receive it well….because Gumutindo added a hundred shillings for ladies who sold the coffee with us [coffee premium for women farmers]. So these men became sort of jealous, saying that we should take those earnings away… but the Committee said "No, this is the procedure of Gumutindo, and of other [external] organisations where we are selling our coffee"…because the consumers want to know if there are women also participating in the processes of coffee." (I5p27)

"For those groups that have been there longer, maybe they are more attached to Gumutindo, they have done a lot of sensitisation, they understand, and now there is participatory decision making, participatory discussions, and you find women, children, and so on." (I9p46)

Respondents also perceive that the role of CKWs in the field has broadened the access to knowledge and capacity building for farmers:

"I think that for now, EVERYONE [emphasis] is being sensitised, especially knowledge is the priority. Our farmers are able to be sensitised in all levels, and even in decision-making, they are included." (I1p7)

2.2.2. Community Weaknesses and Resilience Attributes

Findings also suggest community weaknesses that undermine the resilience of coffee farmers. Evidence of these attributes is presented below, based on the interviews conducted in Mount Elgon.

Robustness

In regards to the robustness of coffee livelihoods, findings suggest the existence of several factors that constrain the farmers' preparedness to respond to emergency situations, including those related to climate change effects. Factors mentioned by interviewees include the perception of unpreparedness due to uncertainty, as stated below:

"When [farmers] look at a catastrophe, then they start thinking "what's next?". But…the challenge is, because it is an emergency, they don't know when it is going to come again, so they may not be prepared for it." (I4p18)

"This people here…no, no [are not prepared]…Sometimes when you forecast that something is going to happen, you can prepare yourself…but now something happens when they are unaware, so it's very hard for them to prepare." (I12p63)

Limited awareness/training for emergency preparedness was linked to existing constraints in the farming extension services in rural areas (e.g. limited number of extensionist/CKWs for a high number of farmers), as explained below:

"I think that [farmers] are not very prepared, I would say. Because we've done some training, but not all farmers are aware, because we have many of them. So the few that have been sensitised, they are trying to prepare…but they are not there yet." (I9p42)

"What is happening is that…government intervention, in terms of extension, has really dwindled. [Farmers] see less of the government agricultural officers coming to them. Why? There has been a lot of re-structuring within the agricultural extension systems…Because the government does not have the resources…and it is not a priority to put money in that direction. So the farmers see less and less of the government extension people." (I4p17)

Findings suggest that the factors affecting the physical robustness of coffee farmers (e.g. limited institutional capacity, insufficient training resources) also affect the attribute of learning (e.g. awareness raising about climatic risks and adaptation measures), as explained below.

Physical preparedness has also been influenced by weak infrastructure (identified through interviews and focus groups, section 2.1), which limit the ability of farmers to both prepare and respond to climatic events. In this regard, a respondent stated:

"Issues of transportation have been a big challenge for the farmers. You find that they have coffee but they can't transport it from the mountains because of the roads…bad roads…the weather is bad, it rains every day… Those are the biggest challenges." (I9p41)

Self-organisation

Findings suggest that, despite the existence of various groups operating in the Mount Elgon area, the capacity of farmers to self-organise independently from external influences remains limited. The role of external actors and the risk of creating dependency to external assistance was emphasised by several interviewees, as follows:

"Ah….not so much [farmers are not prepared to respond to disasters]. Until you get external interveners, to tell them [what to do]. Unless you come and train them and tell them "this is the situation and this is how you address it"…Then farmers who don't get such intervention are not prepared. But for the ones who are prepared, an awareness has been created…but from outside." (I4p16)

"[Farmers] get used to receiving assistance…Yeah. If there is a problem, then you see these agencies running in. If people are suffering, they are trying to help them. And that is short-lived, in my view." (I4p19)

"Unfortunately, when they form these groups it is because they expect to get money from the government. There are very, very few individuals who just sit and think of

something, and form a group, and go with that goal. So I would not say that they have full capacity on this." (I9p43)

"They can only do that IF [emphasis] there is someone pushing…like an organisation that is coming and there is mobilisation, or government programmes…but just farmers by themselves, to mobilise…I have not seen much of that." (I9p44)

Learning

Interview findings suggest that local capacities have been affected by the limited extension services and training resources available in rural areas. This, in turn, has exacerbated the dependence to external actors, as explained by a respondent:

"Unless an NGO comes, then they don't get the extension service. Those actors are withdrawing because there aren't enough resources for them to go and meet the farmers." (I4p17)

"Ah, in areas where you have NGOs that have come to train the farmers, they would be able to apply [new practices]…but in areas with no extension services, then the farmers would continue business as usual. (…) The role of those external stakeholders is very important." (I4p20)

Findings suggest that there is some resistance among farmers, particularly among the elderly, towards the adoption of new farming practices:

"Some farmers still believe in their traditional farming. When you come to introduce them to new ways of farming, to how to withstand and to recover from the problem, it takes them a bit of time. There is some resistance. Especially from the elderly." (I1p5)

Learning from past climatic events has also been limited by the perception of 'inevitability' of these events, as explained by interviewees:

"A few [farmers] have learned [from past climatic events], but most of them have not learned because they believe that it is a "natural disaster"…it can happen anywhere, 10 times…so they haven't really learned…you tell them to relocate, and they don't do it. They say they have been born here, and they shall die here." (I9p43)

"So far…[sigh] I don't know. I don't know how are [the farmers] fighting that [the effects of climate change]!! I think that they just accept whatever they get." (I12p61)

Redundancy

Findings indicate that the farmer's capacity to save (and therefore, to generate spare resources) is dependent on the coffee cycle, and therefore, it is not constant throughout the year. In this regard, a farmer explained:

"Actually, on times like these [not harvesting time] people are not saving, because they claim that it is not the season for coffee, so there is no money." (I12p63)

Also connected to the attribute of redundancy, data suggests that the expansion of the coffee market (e.g. the availability of a higher number of coffee buyers in the area) may be affecting the farmers' motivation to produce high-quality coffee (and thus lowering the potential to generate additional income through coffee premiums). As explained by an interviewee:

"I believe that competition has brought a very big problem. Because of competition, farmers are failing to manage the quality of their coffee. As a result, the following year you find that the price of their coffee is going down. When the competition is high for

the coffee, there are many coffee buyers in the market, farmers would not be keen on managing their coffee well, because they want to sell their coffee very fast…as a result, they end up doing sub-standard work." (I19p41)

Rapidity

Data suggests that, in addition to the **lack of early warning systems** (EWS), the capacity of farmers to respond swiftly to climatic emergencies and weather-related events is constrained by weak infrastructure, particularly weak transportation infrastructure and lack of farming equipment. In this regard, an interviewee explained:

> *"In case of emergency, the response could be slow as there are chances that roads would be impassable, so rapidity is compromised. There are no early warning systems..." (I16p85)*

> *"If there is a long drought, the farmers don't have any options because they don't have an irrigation system, or a mechanism to irrigate their plants when there is no rain. So they don't have the capacity to respond rapidly". (I4p19)*

The ability to rapidly assess the information and mobilise resources is also affected by low levels of trust in weather forecasts, as stated below:

> *"The other problem is, like with the government of Uganda, when they announce [a forecast], people don't take it seriously. They can announce that there will be too much rain, and it doesn't rain. Or that there will be too much drought, and… it rains. So people do not trust the government [forecasts] so much. The information is not accurate". (I9p45)*

The capacity to respond and act swiftly is also limited by local resistance (e.g. resistance to relocate from high-risk areas in the case of landslides), as explained by an interviewee:

> *"[The farmers] response was slow, like in the case of the landslide. And even now, some communities are still resistant. They are still [located] in places that are not recommended…they are still resistant." (I1p6)*

Data indicates that the low rapidity of local responses and emergency assistance is also linked to complex institutional procedures (across scales) that involve numerous steps and stakeholders (e.g. verification procedures to confirm that the information/emergency affectation is accurate). In this regard, an interviewee explained:

> *"[The response] is gradual, not fast. Some things just take time to be…handled, especially when it comes to NGOs and governments. Because they also need to send some people [to the field] to verify whether the problem is there… they want to confirm if it's there, and take back the information to their office. That is why I say it's gradual…They don't react so quick. (…) For example, in an episode of flooding, we need to contact the relevant authority, maybe we need to report to the sub-county, and to the NGOs, that there is a flood that happened and that really destroyed some people's crops and maybe their households…So we write down the names of people that faced the problem, and then file it to those high offices. They respond, but they don't respond so quickly." I10p51*

The ability to organise swiftly is also affected by limited local capacity, and by the amount of time required to coordinate actions among farmers, as stated by an interviewee:

> *"Of course there are a few things that you always try to respond to. When you look at the farmer who does so many things, …organising them takes a bit of time…Unless someone realises tangible benefits, it takes a bit of time." (I15p80)*

Scale

While no specific data was collected in regards to negative effects of scale on farmers' resilience, complex (inter-scale) institutional arrangements/partnerships could affect attributes such as rapidity (as reported above), and could also increase the level of dependence on external resources (thus limiting the capacity or motivation of local actors to self-organise).

Diversity and Flexibility

In regards to diversity and flexibility, interview findings suggest constraints related to the adoption of innovative practices among coffee farmers. When asked if farmers are prone to innovate, an interviewee stated:

> *"Not with coffee. It is more traditional." (I4p20)*

The adoption of innovative practices, as well as the flexibility needed to adapt to changing circumstances is also limited by resistance to change and feelings of distrust among local leaders, as explained below:

> *"Local leaders sometimes interfere with us [primary societies], for example, in the case of projects like [installing] washing stations in coffee…We are implementing that, and you find that local leaders, the chairman of the area, would say "Why do they bring this, why do they bring this?"… Because they think that you are offering empowerment, and [therefore] taking the authority away from them" (I1p4)*

The farmers' motivation to innovate and experiment (e.g. explore alternative pathways of action) is also influenced by market fluctuations and uncertainty, as reported before. Their capacity to make informed decisions within a market characterised by price fluctuations is further constrained by limited knowledge of trends' analysis and market forecasts, as stated by an interviewee:

> *"[Farmers] produce, and then they take the prices, which are mostly determined by international prices…which do fluctuate a lot…It is cyclical, you find that the price is going up, and after two years is goes down again, and then it peaks up…So it is very difficult for a poor farmer to be motivated…because when the prices are down, they don't take care of their trees…and then when the prices are up, they assume that they are going to stay up the next year, so they go into production… and they have not studied the trends…So, if they manage to study the trends, they would know, surely, that the prices are going to come down, and that they need to address that…So it affects their decision-making process." (I4p15)*

Innovation and change have also been influenced by the demographics of the sector, in particular by the advanced age of coffee farmers and by the limited engagement of youth in the continuation of farming activities, as explained below:

> *"I would say that...[farmers] are slow [adapting to change]. And the reason why is that, unfortunately, coffee is mainly a crop of old people. You don't compare with the young people who are in horticulture…when there is business in tomatoes, they grow tomatoes, if not, they move on to something else. But for coffee, it is 'business as usual'. The average age of the coffee producer is 55-60 [years old]" (I4p20)*

Confirming the potential dependence to external support, when asked about the ability of farmers to identify options to do things differently, a member of a primary society explained:

> *"So far I have not heard that. Most of them, they complain…they run to us for help, if we can come up with something that can help them…" (I12p64)*

Equality

In terms of equality, data gathered suggests the persistence of power differentials and women's marginalisation in decision-making processes. In regards to the lack of participation of women in local groups, interviewees reported the following:

> *"The cooperative law would like to believe that [decision-making is participatory]… But if you go deeper inside, then you have challenges. Because you can ask yourself what is the engagement of women in terms of those meetings…and when you call for elections, are women given equal opportunity to be elected?...In terms of making decisions over coffee, do women take those decisions? In most instances you realise that women are mainly engaged in terms of production, in terms of picking, in terms of delivery…but when it comes to getting the money, the men are the ones who collect the money. And they determine how are they going to use that money." (I4p21)*

> *"Yes, mainly issues of gender… it has been a very big challenge. But I think that the farmers inside of Gumutindo are ready to adapt to a new system of…. 'being equal', because of the new projects that have come on board and the promotion of women, but you may find even in the [primary] society, the committee or the board of the society have no women…So gender has been a big issue. Lack of participation of women in decision-making and in the [farmers'] groups." (I9p46)*

> *"Actually, what I see here [is that] of course women are being looked at as 'inferior'… Even I can use my chart there….[pointing to the wall]. When you look at the [primary society] Committee members, the majority are men. We have only two women there." (I12p64)*

Evidencing the existence of marginalisation and power differentials, farmers stated the following:

> *"The disabled. The elderly, the orphans and the widows. I think those are some of the most vulnerable people." (I1p7)*

> *"The difference which I've seen is that men, they think that they are the 'owners' of the coffee…sometimes they don't share with the women…SOME [emphasis] men don't share with the women…So when the coffee is ready maybe for sale, it is the man who is responsible…she can't, is the man who takes responsibility for organising. So men have more power." (I10p52)*

> *"You know, the problem with the women is that they tend to be shy…so when someone brings up a point, they look at it as if… it will not be of any effect to the community…And you know, men are ever more confident when they are bringing up something…so they consider their points to be stronger!!" (I12p64)*

> *"I would say that coffee business is like a "club". A "club" in this way: for you to belong to a coffee cooperative you have to have coffee trees. And for you to have coffee trees, you have to have a farm. And the people who have coffee trees and a farm, are men. Women don't have that…So the issue of "inclusion" [laughs] is basically, you have the children of the men, and the spouses are not included. So the only women who come on board are the widows, because their husbands have died, and they have taken over the assets of the husband. So it is a big challenge!" (I4p21).*

Issues of marginalisation also emerged in regards to the lack of participation of certain groups in local training opportunities, and were mostly linked to the lack of financial resources (e.g. lack of money for transportation):

"Many people have done training on climate change…although we have not covered many… To me, we have not captured everyone within the community, because in many cases, when you enrol people in these trainings, they don't come…" (I9p44)

The analysis presented up to this point has shown evidence of attributes that strengthen the resilience of Mount Elgon coffee farmers in response to short-term shocks and long-term stressors. The analysis has also revealed factors that undermine or weaken the farmers' potential for resilience-building, and thus constrain their capacity to effectively withstand, cope with and adjust to change and uncertainty. These findings are visualised in the following sub-section.

2.3. Visualisation of Coffee Farmers' Resilience

The visualisation of resilience attributes found among Mount Elgon coffee farmers is based on discourse analysis conducted on interview transcripts: quantifying the number of times that issues related to the resilience attributes were mentioned during the interviews with local stakeholders.

The first visualisation – shown in Figure 11 – indicates the total number of times an attribute-related issue was mentioned. This provides an indicator for the relative salience of resilience attributes among coffee farmers. The most predominant attributes perceived by respondents are an enabling attribute of resilience – redundancy – and a foundational attribute – robustness. In aggregate terms, the three foundational attributes of resilience (robustness, self-organisation and learning) draw greater attention and concern.

Looking at individual attributes, the evidence shows that redundancy and robustness are present in the minds of local stakeholders more often than other resilience attributes, with self-organisation and learning close behind.

Although not a direct measure, we can take this to be some type of proxy for the relative importance and value that coffee farmers for this particular area – at least on the basis of this particular data-gathering approach – ascribe to the different attributes of resilience. Pushing further, and making the connection more tenuous, it could be argued that Figure 11 gives some sense of prioritisation for action; prioritising the attributes with higher salience. However, that requires further data.

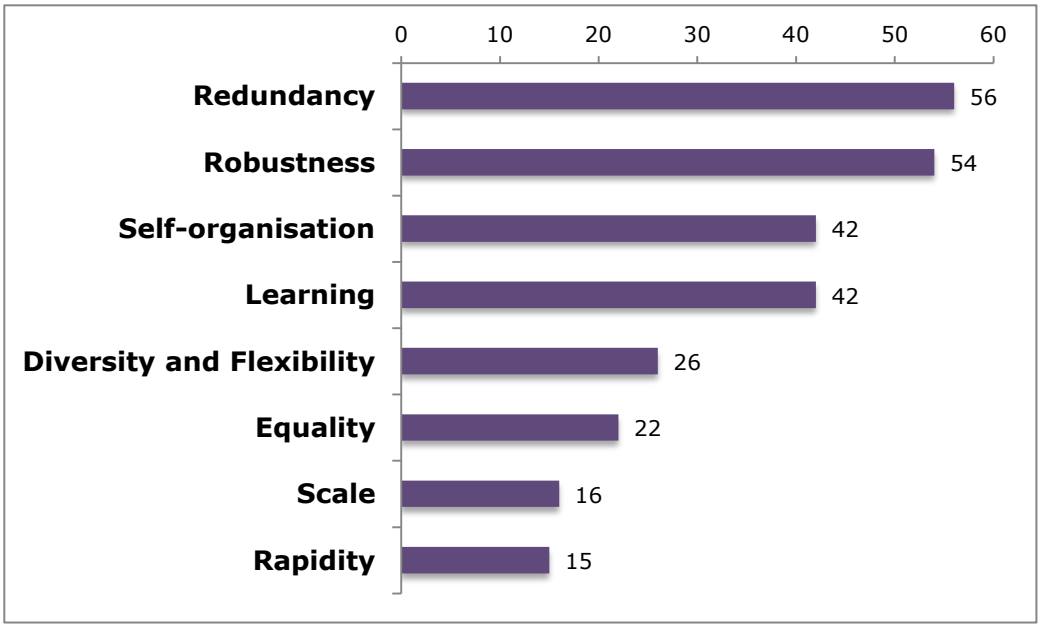


Figure 11. Relative salience of resilience attributes, coffee farmers, Mount Elgon

A starting point for that further data is shown in Figure 12: the breakdown of overall mentions into those related to resilience attribute strength and those related to resilience attribute weakness. The overarching conclusion is that perceptions about positive resilience attributes significantly outnumber discussion of resilience weaknesses among coffee farmers.

In particular, Mount Elgon coffee farmers are seen to have strengths in the areas of redundancy (e.g. linked to the availability of various sources of support: institutions and social networks, crop diversification and saving practices), robustness (e.g. linked to a certain strength of local institutions, some physical preparedness linked to organic farming practices and information access, and some broader networking), learning (e.g. linked to the knowledge exchange/capacity building between CKWs and farmers), and self-organisation (e.g. linked to the collaborative nature of farmers' groups/cooperatives, trust and sense of belonging).

The highest number of weaknesses correspond to the attributes of equality (related to power differentials, gender inequality and marginalisation) and robustness (related to infrastructure, financial and physical resource constraints). Findings suggest an imperative for actions seeking to strengthen coffee farmers' resilience in these areas.

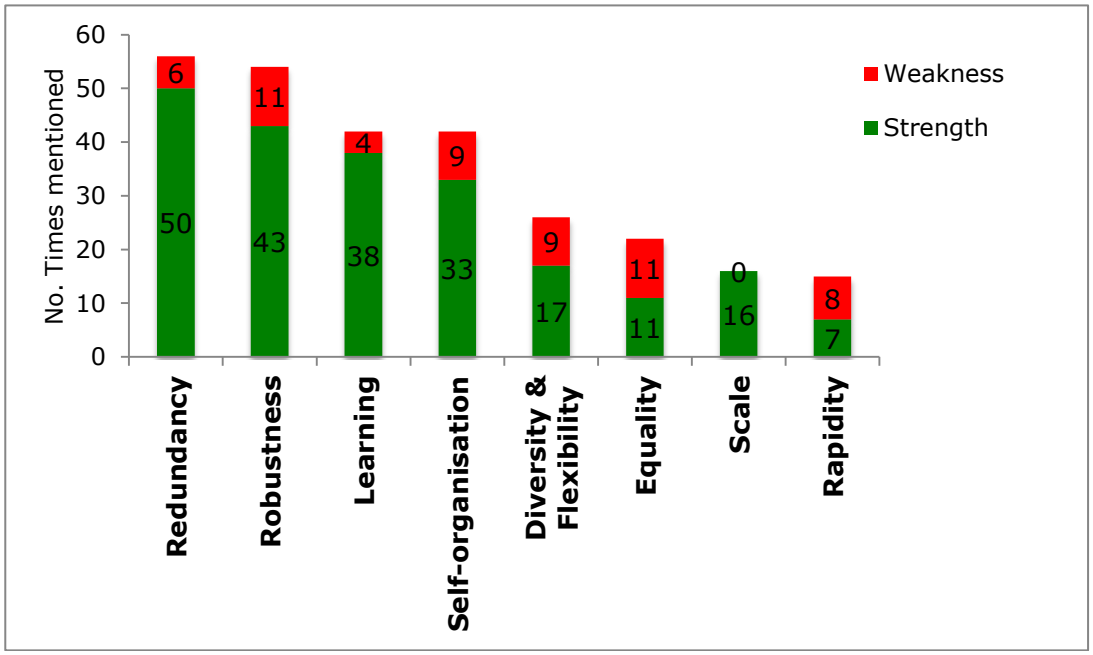


Figure 12. Relative salience of strength vs. weakness of resilience attributes, coffee farmers, Mount Elgon

There are two ways in which this data could be used to prioritise resilience interventions.

Figure 13 removes the strengths, and orders the attributes just in terms of the relative extent of weakness identified by stakeholders.

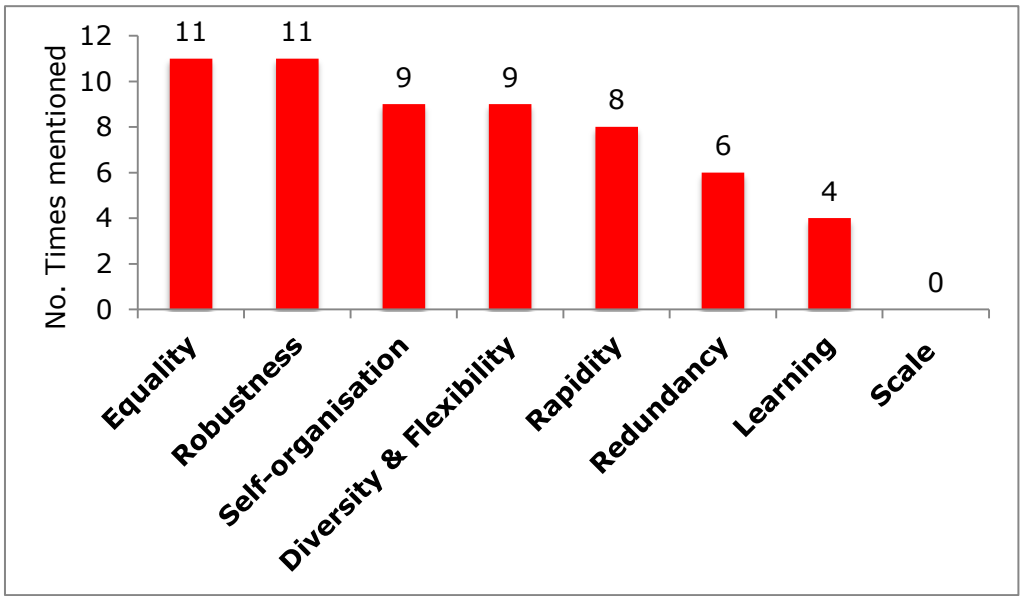


Figure 13. Relative prevalence of resilience attribute weakness, coffee farmers, Mount Elgon

In Figure 14 both strengths and weaknesses are visualised separately.

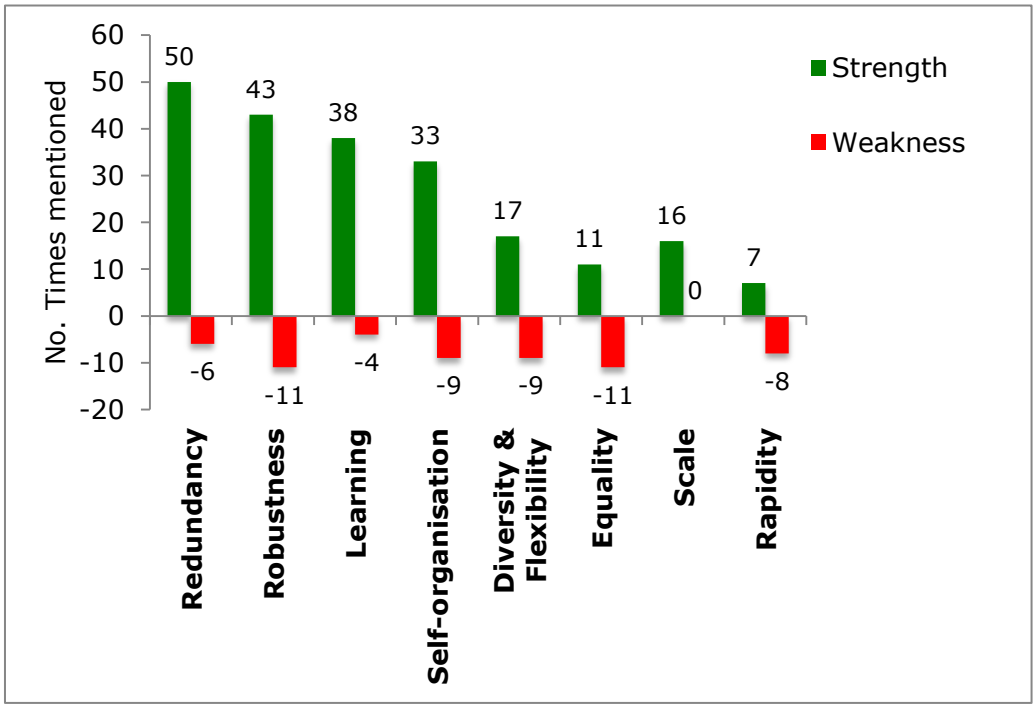


Figure 14. Overview of resilience attribute strength/weakness, coffee farmers, Mount Elgon

Figure 15 subtracts weaknesses from strengths to provide an overall view from the stakeholders of whether particular aspects of resilience are "in credit" or "in debit".

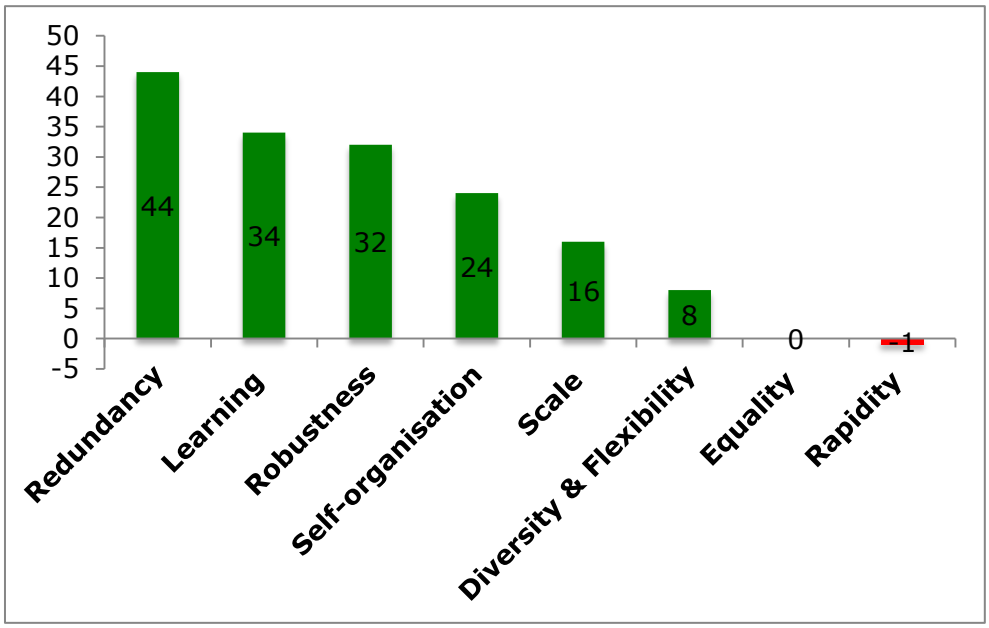


Figure 15. Summative view of resilience attribute strength/weakness, coffee farmers, Mount Elgon

Taking the data from Figure 15 (i.e. subtracting weaknesses from strengths, to establish the net salience of each attribute), we can summarise that interventions seeking to strengthen the resilience of Mount Elgon coffee farmers should prioritise actions that build rapidity and equality. Following this comes a set of second-tier priorities to address diversity and flexibility, scale and self-organisation. Third-tier priorities will be actions on robustness, learning and redundancy. All these will improve the community's capacity to withstand, cope with and adjust to the impacts of stressors such as climate change impacts.

Another way of visualising interview data on the salience of resilience attributes is presented in Annex 11 (Arrow Diagram).

Benchmarking Resilience: Focus Group Findings

Focus group data on perceived strengths related to resilience attributes (summarised in Table 7) confirms the importance of redundancy-related strengths among coffee farmers, as well as the lower ranking (and thus, higher priority for action) attributed to issues of rapidity, diversity and flexibility, and equality.

Resilience Attributes	Focus Group findings: Resilience attribute strengths
REDUNDANCY	• Availability of animals that provide manure for soil fertility (F1, F2) • Motivation by GCCE in terms of premiums i.e. social premium, second payments (F2, F3) • Tourist attraction in the Mount Elgon area provides borrowing power (F1) • Coffee tree provides nectars to bees to produce honey (F1) • Other cash and food crops in the area (F2) • Employment opportunities in coffee industry (F2)
SELF-ORGANISATION	• Linked to the [primary] society (F1) • Sense of belonging to the society (F1) • Enough labour provided by the farmers' family and cheap hired labour (F2) • Good co-operative organisation (F3)

LEARNING	• Knowledge about local environment and crop production (F1, F2) • Access to training by GCCE (F1) • Have access to trainings on coffee management (F3)
SCALE	• Good relationship with buyers including GCCE, BCU and other middlemen (F1, F3) • Availability of market (F2)
ROBUSTNESS	• Availability of shade trees (F1) • Provision of planting materials provided by GCCE and government (F2)
EQUALITY	• Women empowering through new programmes (F1) • Transparency in transactions (F3)
DIVERSITY & FLEXIBILITY	• Good extension support from Gumutindo staff and CKWS (F2)
RAPIDITY	N/A

Table 7. Summary of Focus Group findings related to resilience strengths

Focus group findings on weaknesses related to resilience attributes (summarised in Table 8) confirmed the importance of actions targeting the attributes of diversity and flexibility, and equality. The highest number of weaknesses identified by focus group participants were related to the robustness of coffee livelihoods, evidencing their vulnerability to climate change stressors.

Resilience Attributes	Focus Group findings: Resilience attribute weaknesses
ROBUSTNESS	• Low production due to pests and diseases (F1, F2, F3) • Soil erosion, deforestation (F1, F3) • Infrastructural weakness (F1, F2) • Poor/old coffee varieties (F1) • Long drought that affects crops (F2) • Floods that destroy coffee fields (F2) • Hail, landslides, heavy rains that affect crops (F2) • Lack of shade trees (F3)
DIVERSITY & FLEXIBILITY	• Lack of equipment (F1,F2) • Lack of enough capital to invest in coffee production (F2) • Bulkiness of organic manure to transfer to distant fields (F3) • Lack of animals for manure (F3)
EQUALITY	• Theft of coffee (F1) • Poverty (F1) • Health problems (F3)
REDUNDANCY	• Low prices / changes in coffee prices (F1, F2, F3)
LEARNING	• Inadequate training (F1, F3)
RAPIDITY	• Delayed payment for coffee (F2)
SELF-ORGANISATION	• Un-trusted traders who cheat farmers (F1)
SCALE	N/A

Table 8. Summary of Focus Group findings related to resilience weaknesses

Having assessed local resilience based on the perceived strengths and weaknesses of Mount Elgon coffee farmers, the following section will focus on the role of ICT tools in the resilience to climate change of coffee farmers.

Section 3. RABIT Findings: ICTs and Coffee Farmers' Resilience

This section presents an assessment of the linkages between ICTs and resilience (i.e. e-resilience) of Mount Elgon's coffee farmers. The findings presented are based on the analysis of survey responses. Where possible, the results are complemented and validated with interview and focus group data.

The section is structured in three main parts. The first one presents an overview of ICT access and usage among coffee farmers (3.1). The second analyses the role of ICTs in regards to the nine resilience attributes that constitute the conceptual core of this investigation (Table 1), while the last sub-section presents a series of data visualisations of the findings, including an overview 'Resilience Wheel' to facilitate the identification of priority areas for action on e-resilience (detailed in section 4).

3.1. ICT Access and Use by Mount Elgon Coffee Farmers

This sub-section presents the findings related to local access and use of mobile phones (3.1.1) and the Internet (3.1.2) among Mount Elgon coffee farmers, based on survey data.

3.1.1. Mobile Phones

Survey results indicate that the most widely ICT adopted at the local level is the mobile phone: 94% of survey respondents reported owning a mobile phone (Figure 16). From that total, 80% owns one mobile phone, and 14% reporting owning two[4] (Figure 17).

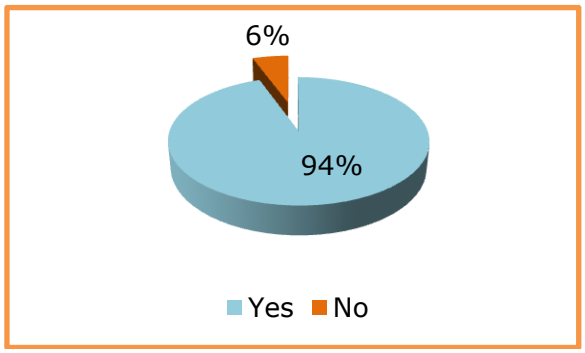


Figure 16. Mobile phone ownership among coffee farmers

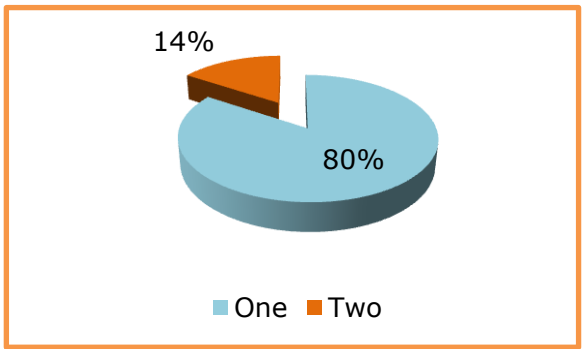


Figure 17. Number of mobile phones owned by coffee farmers

The high level of mobile usage evidences the wide diffusion of this ICT tool as a medium to access and share knowledge and information. Interview findings confirmed this level of access and use, as explained by coffee farmers:

> *"Mobile phones are very strong in our communities. You might find in one family more than two phones!" (I1p7)*
>
> *"You ask [the farmers] 'Can I see your mobile phone?' and they will all show you a mobile phone. So everybody has a mobile phone. Everybody." (I4p21)*
>
> *"I think that 95% of the farmers now have phones…but of course they have them just to make calls. Calling friends, relatives…that is the biggest area of usage of the phone." (I9p46)*

[4] In terms of total ICT access (mobile and the Internet) therefore only 6% of the total number of respondents lacked any form of direct ICT access.

"In my family we have two [mobile phones]. My wife has one and I have one." (I8p37)

Findings suggest that the reasons for owning more than one mobile phone include ensuring network coverage (7%) and privacy (7%), as show in Figure 18.

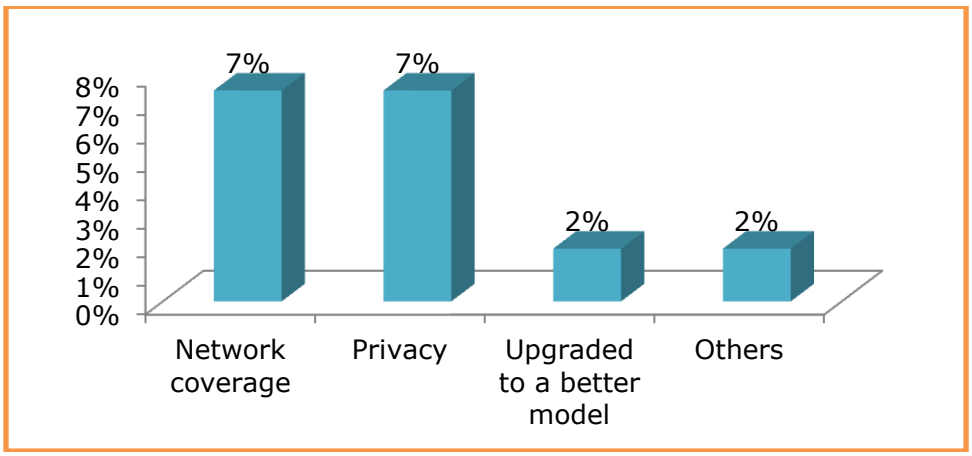


Figure 18. Reasons for owning more than one mobile phone

Coffee farmers were also asked about **SIM card ownership**. 48% reported owning one SIM card, 24% owning two, and 6% owning three SIM cards (Figure 19).

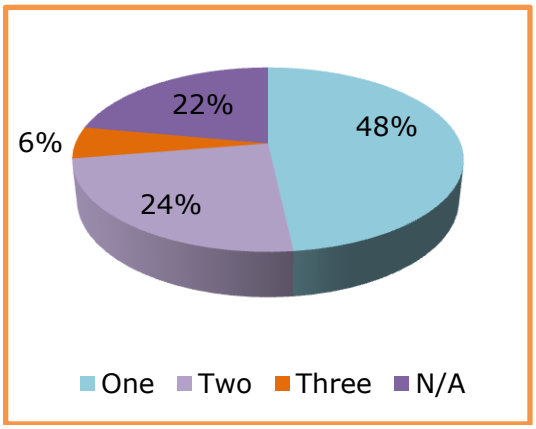


Figure 19. SIM Card ownership among coffee farmers

The ownership of various SIM cards also emerged during one of the **focus groups** held with coffee farmers (FG1). Reasons cited by participants confirm survey findings in regards to improved network coverage and privacy/confidentiality. Other reasons mentioned include cost savings, mobile money access, and (data) storage (Table 9).

REASONS FOR HAVING MORE THAN ONE SIM CARD: FOCUS GROUP (FG1) FINDINGS
• To access different networks • Reduce costs of making calls (i.e. benefit from promotions) • To access mobile money services. • Storage was not enough for one SIM card • Confidentiality

Table 9. Summary findings of focus group (FG1) discussions on reasons for multiple SIM card ownership

The main perceived **benefit of mobile phone usage** identified by survey respondents is easy access to information (78% of the respondents), followed by savings of money and transportation costs (76%), and easy access to cash transfers (e.g. mobile money services) (61%). Respondents also identified the improvement of family relations/networking with friends (56%), as well as the contribution of mobile usage to time savings (52%) and ease of business (43%) (Figure 20).

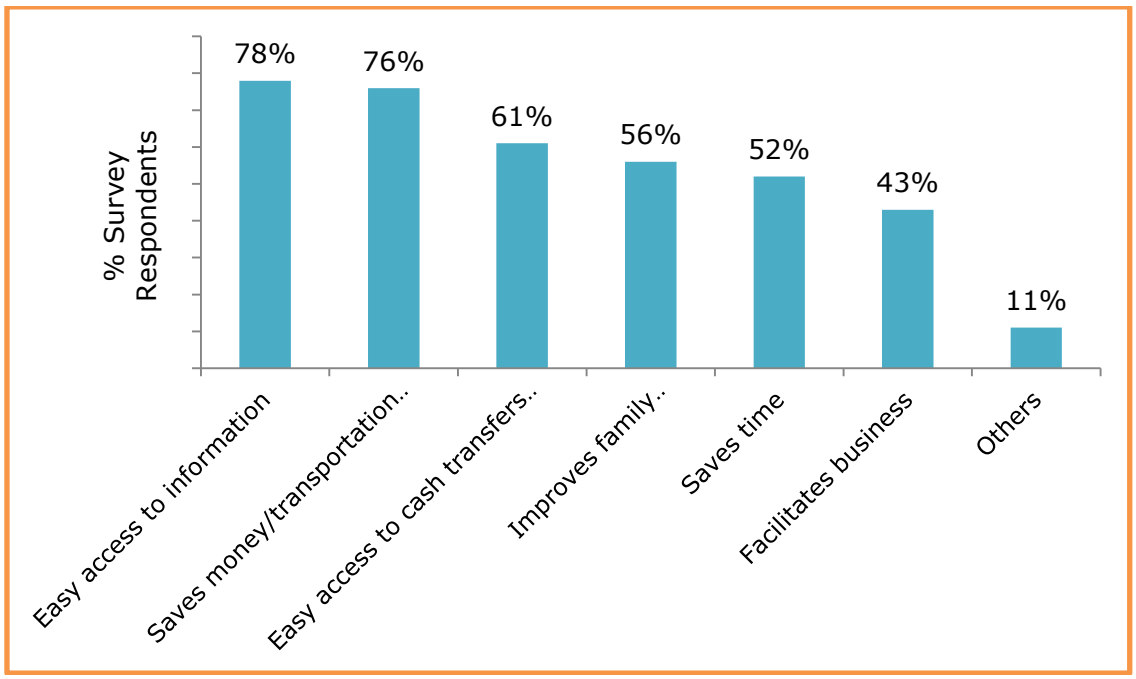


Figure 20. Perceived benefits of mobile phone usage among coffee famers

Findings suggest that the mobile phone is playing an increasing role as a backbone of social networking and information access, and increasingly as a source of redundant economic resources (e.g. by enabling cost savings, mobile money transactions).

Confirming these findings, interviewees explained:

> *"The information is obtained [by farmers] through the [mobile] phone, through radios, handouts, newspapers and advice… mainly from CKWs and the [mobile] phone." (I1p7)*

> *"The farmers use the mobile for making and receiving calls, and even using them for mobile money, for sending money and receiving money from friends." (I11p57)*

Images of mobile usage by coffee farmers and CKWs, Mount Elgon

In terms of the **perceived problems or disadvantages** associated with mobile phone usage, the main problem identified by survey respondents is that of high costs (85%). A much lower percentage of respondents reported the unreliability of information (37%), followed by family instability/mistrust fostered by mobile usage (33%), and the reduction of face-to-face interactions (26%), among others (Figure 21).

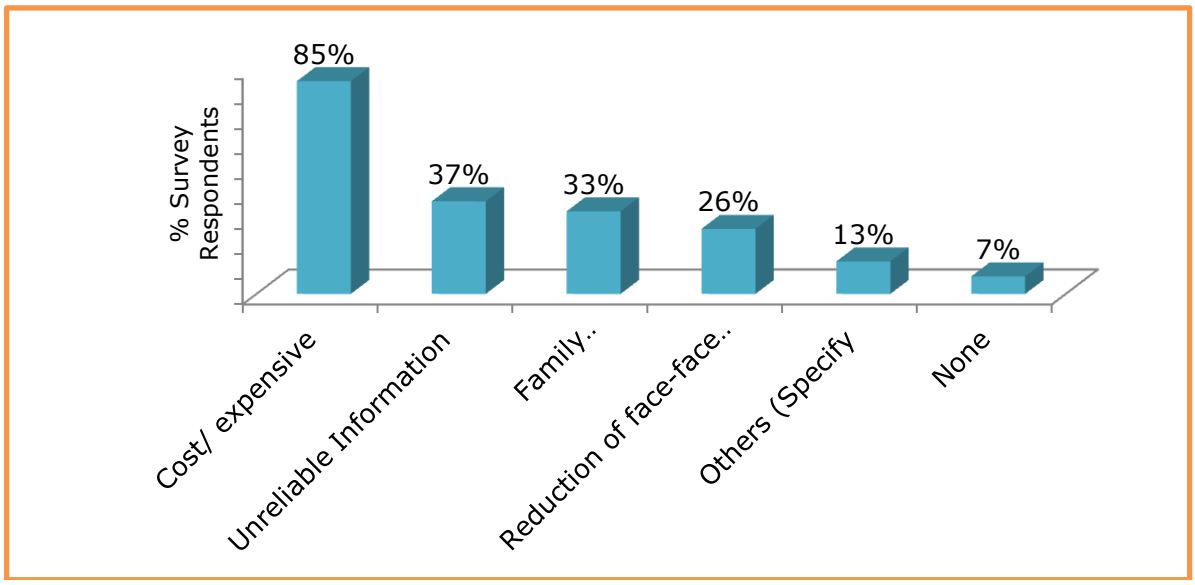


Figure 21. Perceived problems of mobile phone usage among coffee farmers

While these results suggest an overall positive perception of mobile phone usage, the problems identified evidence an increasing level of awareness about the negative, unintended effects of mobile usage. This is reflected by effects such as: (a) access to 'unreliable' information (which can affect the farmers' decision-making or lead to maladaptation), (b) the generation of 'mistrust' and 'instability' within the family (which can exacerbate pre-existing gender inequality or deepen other power inequalities), and (c) the reduction of face-to-face contact (which plays a key role in the maintenance of social networks in rural areas).

Some of these challenges also emerged as part of the interview findings (Figure 22). Interviewees highlighted connectivity problems, followed by lack of capacity/training, age and cost barriers for usage.

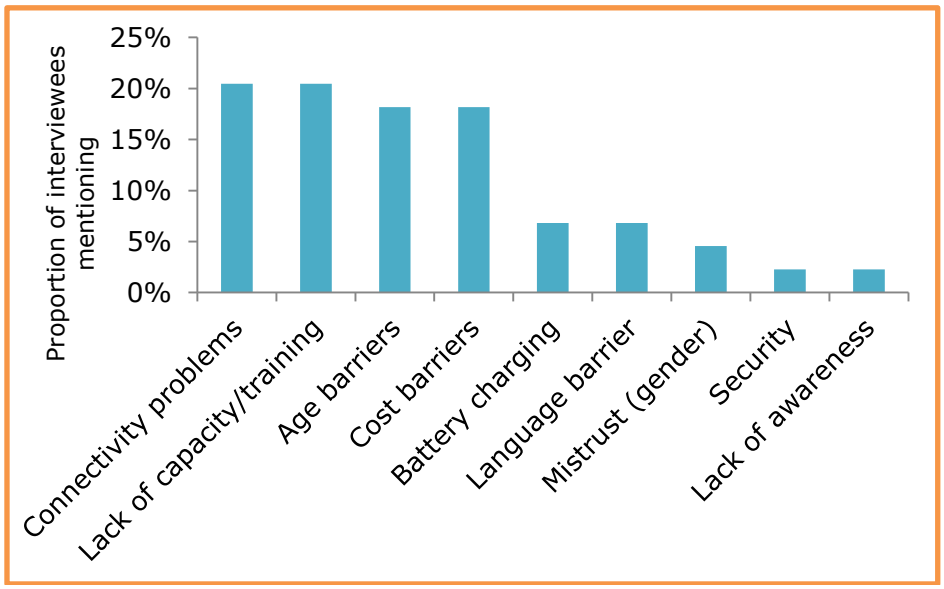


Figure 22. Challenges to mobile phone usage (interviews)

These challenges are also reflected in the following interview statements:

> *"One of the challenges is the network…is a problem. The connectivity." (I1p8)*

> *"[In terms of challenges] I think that literacy…most of the farmers of course are illiterate, and may not know much about the functions of the phone. The second, the prices of the phones themselves…of the better phones that have Facebook, they are quite expensive and these farmers cannot afford them…and maybe the cost of airtime. And network in some areas…the connection is not that clear in some places". (I9p47)*

> *"At first it was a bit complicated because of the technologies, of the phones themselves, and the little knowledge of the farmers. Not most [farmers] have acquired an education. But, with time, as you keep on interacting with them and they interact with the phones themselves, they are now familiar with it."(I1p8)*

> *"For me, the main challenge is how to use the technology. [Farmers] may not be aware. It is an issue of awareness, really (…) It is mainly about capacity and training." (I4p22)*

> *"The potential [of new technologies] is great, I would say, but on the condition that they must be user-friendly…for example, the keyboard, instead of using the normal alphabet, using symbols…using the visuals is much stronger…So, if these technologies are to be taken, these technologies have to be adapted to the conditions of the farming community." (I15p83)*

In regards to mistrust and family instability, a farmer explained:

> *"When it comes to phones…women do have some phones, but not all. The majority doesn't have. Because some… men…they think that maybe the women have phones and are able to talk to…What I'm saying is that men are biased towards the phones…you find some that allow women to have those phones, but those who are illiterate, they don't, in that maybe they feel that their women can be…can 'engage with*

others', they think that other men can call their wife…[laughs] so they have bad feelings about those phones." (I10p53)

Interview respondents also mentioned among the problems of mobile usage the adverse weather conditions that are affecting the area, as adverse/rainy weather limits connectivity and constrains the use of solar panels to charge the phones.

Image of mobile phone usage during strong rains, Mount Elgon

Reflecting some of these challenges, a CKW stated:

"[The Primary Society] gives us air time: UGX10,000 [USD$4] per month…It has not been enough. Because sometimes you buy some bandwidth, then the weather will stop the Internet, and that bandwidth goes! Yeah. So it has been so not enough. The challenge that we also face is with the GPS and with the solar set that we use for charging [the mobile phone battery] (…) It is working well…but you can use it only when the weather is good…and now it is raining" (I2p11).

"[Farmers] don't have power within the community, so charging [the mobile battery] is challenging. But that challenge is decreasing, because sometimes they take the mobile to the CKWs to be charged…So they charge it from the CKWs. Otherwise it is really a problem. Some farmers can't buy a phone [because of its cost], and also problems with the network [connectivity] and airtime [scratch cards are expensive]" (I7p34).

Image of CKW with mobile phone solar charging device

3.1.2. Internet

Only 6% of the survey respondents reported using a computer to access the Internet. 63% of the respondents don't use it, while 31% did not respond (Figure 23).

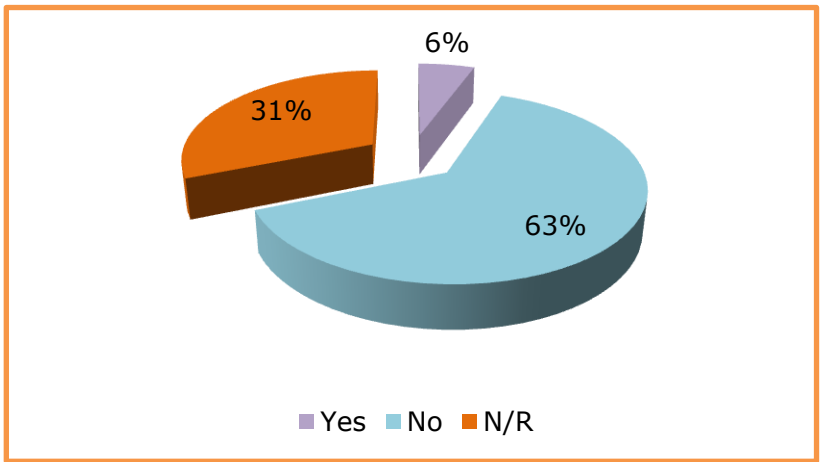


Figure 23. Use of computers to access the Internet by coffee farmers

Although the data regarding Internet access was very scarce due to the limited number of users among the survey respondents, findings suggest that access takes place at home, at Internet cafés, or at resource centres (e.g. in the nearest villages or towns). Reasons for usage include e-mail, social networking (e.g. Facebook), and access to work-related information.

Interview statements provided additional information on Internet usage, confirming survey findings. Interviewees explained:

> *"Access to computers? Only if you go to town. In the village…Our CKW phones have Internet. And then there are some farmers who are rich, and have bought phones that have Internet. But most of them, they go to town for the Internet. Some farmers know how to use the computer…like for e-mail. Or to communicate with relatives that are in America." (I6p31)*

> *"I don't have a computer… But when I want to use it I can go to an Internet café in Mbale, and surf any information that I want to know with the help of those people who are in the café. (…) I can use the e-mail, sending [messages], or maybe chatting with my friends. Sometimes, when I want to know about the price of coffee, I can also surf and know how the world market is moving." (I8p39)*

Responses suggest a growing awareness about Internet access through smartphones, as explained in the following statement:

> *"Very few farmers have got computers. But, interestingly, with the new [mobile] phones, you can access Internet…So, it is an issue of how do the farmers learn to use the new phones…Because as long as you have the data bandwidth, you can go to the Internet, on your phone (…) The computers are becoming irrelevant, to me, especially for a normal person…except if it is a person [working] in an office…But in terms of getting information, you don't need a computer anymore." (I4p21,22)*

In terms of the **benefits of Internet usage**, survey respondents identified financial savings/savings in transportation costs, saving time, and ease of information access.

Problems or disadvantages associated with Internet usage correspond to the high cost of access, and family instability/mistrust.

These findings were complemented by interview data, as respondents also identified challenges related to language barriers, as stated below:

> *"Yeah, there are farmers who feel like having a phone [that allows Internet access], but they don't know how to use it. Because of the language…because to use the Internet you have to speak English…So the language is a problem. Very few of them can speak English. They have simple, simple phones…" (I6p31)*

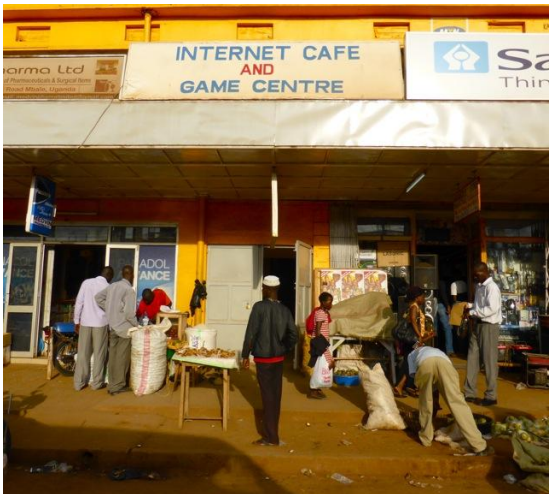
Both survey and interview respondents indicated that access to social media application is very limited among farmers. The few examples of Facebook usage were from CKWs who have access to a smartphone, and have a higher level of ICT training than the average farmer in the Mount Elgon area. Barriers for Facebook usage corroborated earlier findings, as they included airtime (cost) and concerns over privacy. As interviewees explained:

> *"Facebook? Ahhh, not really. Maybe 2% or 1% of the farmers [have it]..." (I9p46)*

> *"This is my Facebook page [showing the page in the mobile phone]. I use it to communicate with my friends, the ones that studied with me…most of them are not really in the community, they are outside the community. That is why I use Facebook with them. But I do it on rare occasions…I don't always have 'airtime'. " (I13p70)*

> *"I do have a Facebook account, but I never open it or use it, because I do not control what is there. I got Whatsapp, and Gmail. But Facebook…It is mainly for gossip, rather than for productive things..."(I15p83)*

CKW showing access to Facebook using a CKW smartphone



Images of Internet cafés in Mbale, Uganda

In summary, findings related to ICT access and usage by coffee farmers indicate that mobile phones are widely adopted, while Internet penetration remains low among coffee farmers. In addition to facilitating communication and information dissemination, mobile phones are playing an increasing role in the farmers' livelihoods in terms of cost savings (e.g. journey substitution) and financial transactions using mobile money services.

The perceived negative impacts of ICTs are useful reminders of the need to acknowledge the social implications of mobile usage, particularly in terms of the risks associated with the exacerbation of gender differentials/power relations at the household and community levels.

ICT ACCESS AND USE: FOCUS GROUP FINDINGS

Data gathered through the three focus groups held with coffee farmers confirmed the survey and interview findings presented before.

In terms of ICT usage, focus group data confirmed the predominance of mobile phones among farmers, and suggested that several users have more than one SIM card available (Table 10).

ICT USAGE: FOCUS GROUP FINDINGS
Mobile phone Usage
• **Focus Group 1:** 83% of participants reported having a mobile phone 33% have more than one SIM card • **Focus Group 2:** 94% of participants reported having a mobile phone 16% have more than one SIM card • **Focus Group 3:** 83% of participants reported having a mobile phone **No data available on SIM cards*
Internet Usage
• Only one of the focus group participants (F3) reported having access to Internet.

Table 10. Summary of focus group findings: ICT usage among coffee farmers

In regards to the benefits associated with mobile phone usage, the ease of communication, access to coffee prices, mobile money, use of mobile phone applications, and Internet access, were issues mentioned in all three of the focus groups. In terms of challenges, participants of the three groups mentioned family instability and high costs (Table 11).

ICT BENEFITS AND CHALLENGES: FOCUS GROUP FINDINGS	
ICT Benefits	**ICT Challenges**
• Ease of communication (FG1, FG2, FG3) • Access to coffee prices (FG1, FG2, FG3) • Mobile money (FG1, FG2, FG3) • Use applications: Watch, Calculator, Torch, Calendar, Music, Camera, Record, Games (FG1, FG2, FG3) • Internet access (FG1, FG2, FG3) • Time savings (FG1, FG3)	• Family instability (FG1, FG2, FG3) • Expensive, costly maintenance (FG1, FG2, FG3) • Unreliable information (e.g. lies, gossip) (FG1, FG3) • Encourages theft/insecurity (FG1, FG2) • Causes sickness (FG1, FG3) • Distracts children/waste time (FG3) • Pornography (FG3) • Wrong numbers (FG1)

• Planning methods/Information about coffee (FG1, FG2) • Radio (FG1, FG2) • Transportation savings (FG1, FG2) • Facilitates business (FG1, FG2) • Access early warning/alerts (FG2, FG3) • Text messages (FG1, FG2) • Access innovative ideas (FG1, FG3) • Access weather information (FG2) • Access extension support (FG2) • Access support (e.g. Red Cross) (FG2) • Helps even the illiterate (FG2) • Strengthens relationships (FG2) • Improves security (FG2) • Helps travelling (directions) (FG1) • Confidentiality (FG1)	

Table 11. Summary of focus group findings: ICT benefits and challenges

3.2. ICTs and Climate Change Resilience: Coffee Farmers

The analysis presented in this sub-section links the survey findings with the attributes of resilient communities, identified in Table 1.

a. Robustness

In terms of robustness, the research aimed at identifying the role of ICT tools in the coffee farmers' ability to maintain their performance in the face of environmental shocks and fluctuations. Evidence of ICT's role was sought with regards to three resilience markers: (a) physical preparedness, (b) institutional capacity, and (b) multi-level governance and networking.

In terms of **physical preparedness**, 43% of survey respondents reporting using ICTs to access weather-related information (Figure 24).

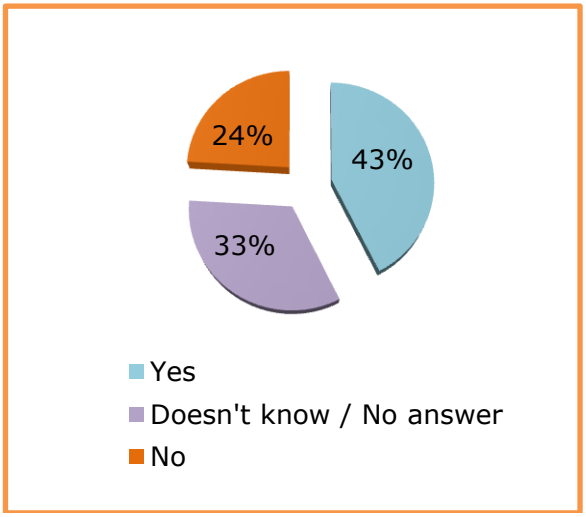


Figure 24. Usage of ICTs to access weather information

Findings suggest that a high percentage of coffee farmers (83%) access weather-related information through the CKWs (i.e. face-to-face contact, receiving weather information that the CKW accesses through his/her smartphone).

These findings suggest that coffee farmers are accessing mobile-enabled information that can help them to better prepare and respond to climate change manifestations. For example, information about heavy rains forecasted for their area, and associated measures that can be adopted to control runoff, channel waters, and protect the soil (and/or property) in their farms.

Further data on robustness indicates that 65% of coffee farmers use ICTs (i.e. mobile-enabled information) to better prepare for weather-related emergencies (Figure 25).

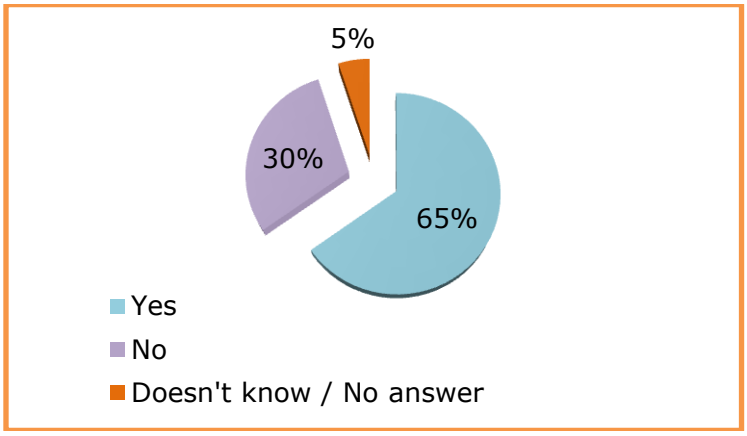


Figure 25. ICT use to prepare for weather-related emergencies

Interview findings confirm the use of mobile phone-enabled data to enable robustness (e.g. farmers' preparedness), as shown in the following CKW statements:

> *"[Farmers] ask us [CKWs] about the weather, they even ask how do you get some of the coffee diseases, and how do you prevent it…You can now give them the information from the [mobile] phone. You can even give the weather…through the [mobile] phone." (I2p8)*

> *"[The weather] has changed. Yeah. Because at first it used to rain by February. We would get some rain. But we can get now up to March without rain. It can reach even June…with no rain. So this [mobile] phone has been helping us [CKWs] to tell the farmers….because it updates us. That such and such month will be dry…so we tell them to plant short-term crops like beans…cabbage, some also plant sukuma and also onions…as they wait for the coffee [to be ready]." (I2p12)*

> *"[CKW reading from the mobile phone interface] "Farmers advice: to make use of seasonal rains by optimising crop yield through appropriate land use….CKW should encourage farmers to plant enough food that will carry forward to the dry conditions expected from June to August…it should be noted that variations are likely to occur…for example flash floods"] (I2p10)*

Image of CKW accessing weather information via smartphone

The majority of survey respondents (78%) use ICTs (i.e. mobile phones) to report problems and emergencies to institutions or authorities (Figure 26), which suggests a potential contribution of ICT tools to **institutional responses** and **multi-level governance** (e.g. by reducing barriers to communication among community members and institutions, and by helping to form networks among farmers and institutions).

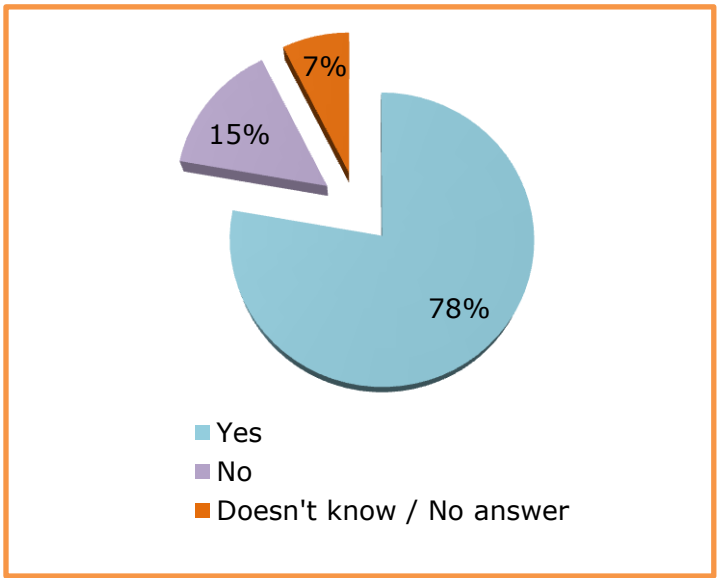


Figure 26. ICT used to report emergencies to institutions

Data indicates that ICTs are used to contact institutions that operate at the local, the municipal and the national levels (e.g. local councils, sub-county, NGOs/Red Cross, Primary Society, local community leaders) (Figure 27). More than half of the survey respondents (57%) use the mobile phone to contact their local councils/sub-county in cases of emergency. The predominance of contact with local councils suggests the strong role played by these structures in rural agricultural contexts, as well as the role of mobile phones towards the resilience attribute of scale (e.g. by connecting farmers with institutions that operate at various levels), which will be discussed below.

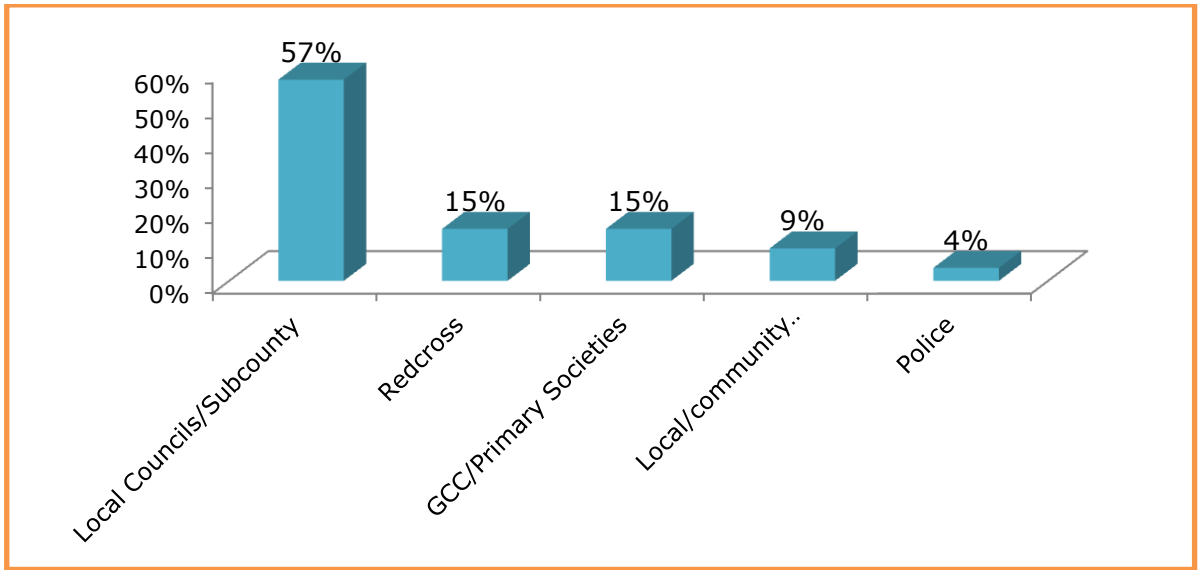


Figure 27. Institutions contacted by farmers using ICTs

Corroborating the role of the mobile phone in the linkages between farmers and institutions, an interviewee stated the following:

> *"Farmers are [in close contact with institutions]. In September last year, the local sub-county headquarters gave us coffee seedlings to sell to our farmers, because some of their trees are old…So they could plant new trees, in order to get a good yield next time." (I5p25)*

In the case of reporting emergency situations to institutions, interview findings confirm the use of mobile phones and the preference for voice communication (instead of text messages), as explained by an interviewee:

> *"[Farmers] do [use the mobile to contact institutions in case of emergencies]. They will call and inform them about the challenge…a landslide, for example. Or a hailstorm….to relief agencies and even the government, who come and give them support. Voice calls, they do. Very limited texting…They are more into voice here in Uganda. With text you don't get feedback…you don't know if they get the message, or the response won't be that fast. They prefer the voice [rather] than texting." (I15p83)*

Interview findings also suggest that the role of CKWs has been strengthened by the use of mobile-enabled data, which, in turn, has contributed to the role of primary societies in the field (i.e. institutional capacity, influence in local practices and presence/acknowledgement by farmers). In this regard, a member of a Primary Society stated:

> *"Yeah, the [CKWs] are doing good work…It is good for them and for us [Primary Society]. Of course they have been coming every week, getting more information to deliver to the farmers…" (I5p29)*

ICTs and Robustness: Coffee Farmers

- ICTs are contributing to robustness by helping to improve the physical preparedness of coffee livelihoods to the impacts of climate change. 43% of respondents access weather-related information, mainly through the CKWs, and 65% of coffee farmers use ICT-enabled information to better prepare for weather emergencies.

- ICTs are also helping strengthen institutional response capacity and multi-level governance in and around coffee farming communities, considering that more than three-quarters of survey respondents (78%) use these tools to report emergency situations to institutions that operate at the national, municipal and local levels.
- Overall, findings suggest that the use of ICTs could be improved, particularly by strengthening the role of these tools in local preparedness to both short and long term climatic manifestations. This constitutes an area of potential for future action.
- Further research needs to be conducted on the role of ICTs in institutional resilience, including institutional capacity building and governance strengthening, which were beyond the scope of this pilot.

b. Self-organisation

In regards to self-organisation, the research sought to identify the role of ICT tools in the coffee farmers' ability to independently re-arrange functions and processes in the face of external disturbances, without being forced by external influences. Data gathered focused on identifying ICT's role with respect to three resilience markers: (a) collaboration / consensus-building and participation, (b) social networks, and (c) local leadership and trust.

In regards to the first marker, 91% of survey respondents reported that ICTs have made it easier to **organise or participate** in community activities and/or projects (Figure 28)[5].

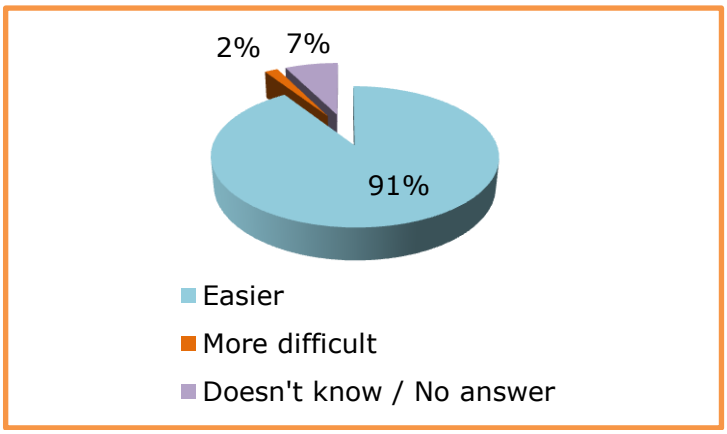


Figure 28. Role of ICTs in the organisation of/participation in community activities

Interview findings suggest that mobile usage has facilitated coordination between farmers and CKWs/extension officers, including the coordination of visits to the field, as explained by an interviewee:

> *"The CKW calls him and asks him to prepare so they can go to the garden together (…) [or] calls him [and asks him] to advise other farmers not to leave the community [if there is a visit scheduled]." (I7p34)*

Survey findings suggest that the role of ICTs in self-organisation is closely linked to the role of these tools in **social networking**. The majority of respondents (94%) reported that ICT tools have helped them strengthen relationships with other people (e.g. by improving meeting attendance, helping others, forming groups) (Figure 29).

[5] In the case of survey questions that refer to 'easier' and 'more difficult' tasks with the use of ICTs, the latter was subtracted from the former in order to get an overall percentage.

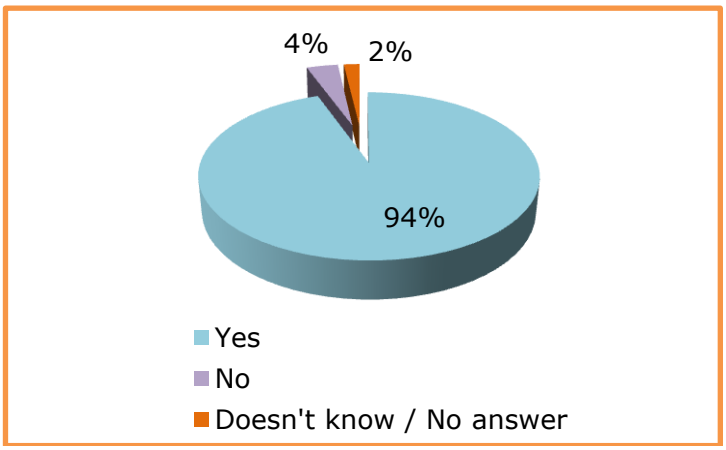


Figure 29. Role of ICTs strengthening relationships among people

Interview findings also suggest that mobile phone-enabled data transmitted by the CKWs to the farmers is contributing to social networking, and although not directly measured, that it also seems to improve **leadership and trust**. As explained by an interviewee:

> *"Farmers feel that the information that these guys [CKWs] are using, is from a CLEAR source [emphasis]…And they feel so confident that, whatever they are telling them, they take it, they have trust in it (…) They feel that the information from there is correct information." (I12p60)*

> *"The CKWs inform some farmers, who are leaders, and they pass the information to others. So, the leaders have mobile phones. We [CKWs] inform the leaders, and they pass the voice to others, in person." (I5p28)*

Images of coffee farmers, coffee sorters and a CKW using mobile phones, Mount Elgon

ICTs and Self-organisation: Coffee Farmers

- Findings suggest that ICTs are playing an increasing role in the coffee farmers' capacity to self-organise, mainly through voice communication. 89% reported that ICTs have made it easier to organise/participate in local activities. While the use of social networking applications (e.g. Facebook) is very low given the scarcity of Internet access among farmers, respondents indicated the positive impact of mobile usage (e.g. voice, and in the case of farmers with literacy skills, also text messages) in the organisation of / participation in community activities.

- ICTs usage for self-organisation is closely linked to social networking (94% reported that ICTs help to strengthen relationships with other people). This suggests that mobile usage is complementary to traditional forms of face-to-face communication (e.g. by helping to strengthen existing social networks), as well as to local leadership (e.g. the role of 'model farmers').

- Data also suggests that ICTs seem to be contributing to trust building, which may be related to the role of CKWs in facilitating access to farming information through their smartphones, as well as to the farmers' perception of that information being trustworthy and accurate.

- While the overall use of ICT for self-organisation is strong, areas for future work include the role of local organisations (e.g. primary societies) in self-organisation, as well as the risks related to ICT adoption (e.g. widening knowledge gaps between farmers and CKWs, creating dependencies).

c. Learning

In regards to learning, the research sought evidence of ICTs' role in the coffee farmers' ability to generate feedback and experiment, as well as to strengthen local skills and capacities. The role of ICT tools was explored in regards to three main markers that are indicative of the 'learning' capacity of resilient communities: (a) capacity building, (b) access and use of new and traditional knowledge, and (c) reflective thinking.

The majority of respondents (87%) reported that, since having access to ICTs, they are able to share more experiences about weather-related emergencies with members of their community/neighbours (e.g. regarding emergency responses, measures taken, best practices) (Figure 30). This suggests that ICTs are facilitating the access (and use) of new and traditional knowledge, thus contributing to learning.

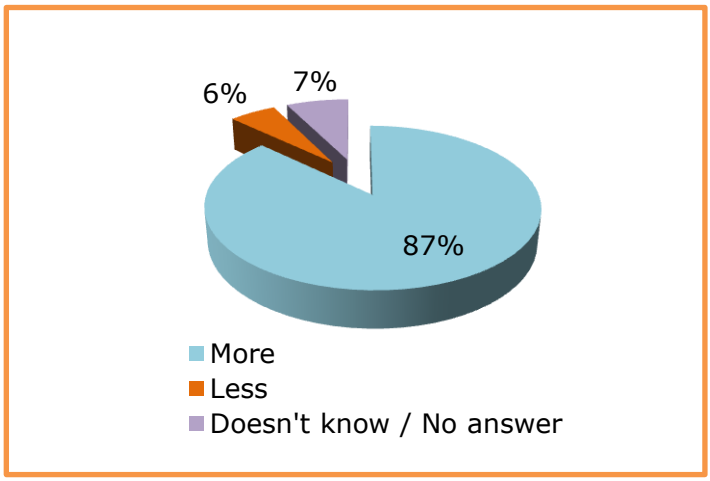


Figure 30. Role of ICTs in sharing information about weather-related emergencies

In regards to the role of ICTs in **reflective thinking**[6], 72% of survey respondents use ICTs to identify ideas to improve farming practices (Figure 31).

[6] For the purposes of this study, reflective thinking involves an active and careful assessment of what is known, what needs to be known, and how that gap can be bridged (Dewey, 1933).

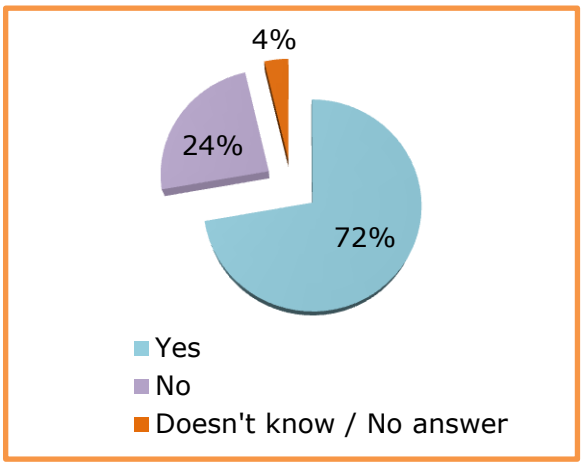


Figure 31. Role of ICTs to identify ideas to improve farming practices

The majority of survey respondents (96%) report that these ideas are mediated mainly via the CKWs, who themselves sometimes both source those ideas via their smartphones, and may also communicate some of those ideas to the farmers by phone.

These findings confirm earlier data on the importance of CKW-enabled information and knowledge sharing in local learning, particularly in terms of building the farmers' capacities on agricultural practices, and raising awareness about climate change-related manifestations. As explained by a CKW:

> *"This coffee pest has not been there [in the past]. We only discovered this pest last year, so farmers got this surprise, and wondered what is happening to their coffee…So now, you can go to the [mobile] phone [to find out information about it]" (I2p13)*

Images of CKWs in Mount Elgon, using the mobile phone as part of their activities

Interview findings also suggest that mobile-enabled knowledge and information sharing is constrained by cost-related barriers, as reported in section 3.1.

> *"Farmers share through voice data, yes. [For example] "Hey, I've seen this in my coffee, do you know what it is, can you tell me, have you ever had it?". Through voice data…but of course, the one limitation is the cost…A farmer may find it easier to walk to his neighbour, to ask him, spending an hour walking, compared to using 50 or 200 shilling [USD0.10] of voice data or text message to get some information…so I think that the cost is a big issue (…) because, for them, 200 shillings is a lot…he'd rather 'beep' you, and you call him back." (I15p83)*

Only 9% of survey respondents reported access to training opportunities through the Internet (e.g. online courses), which is consistent with earlier findings on the low level of Internet usage among coffee farmers.

Interview results provide further insights in regards to the linkages that exist between mobile phone usage and **capacity building**. One aspect identified by respondents is the strengthened capacities of CKWs as part of the training received from Gumutindo and the Grameen Foundation, and linked to their improved access to agricultural information via the smartphone. In this regard, CKWs' statements suggest that they have undergone a 'learning curve' in terms of mobile phone usage, which has allowed them to improve their ability to access, interpret, transmit and foster the appropriation of relevant information by the farmers:

> *"They [Gumutindo/Grameen Foundation] gave us [CKWs] training in Mbale, and then they gave us the forms [smartphone-based information]." (I2p10)*

> *"At the beginning it was hard to learn [to use the CKW mobile phone]…because, of course, this is new technology, and we were not used to smartphones…But the good thing is that we received the training on how to do it." (I13 p70)*

> *"The [farmers] ask me [CKW] about local knowledge of growing coffee…and even about rearing animals, how to feed their cows, the timetable for vaccinations, de-worming… these are some of the questions they ask me." (I11p56)*

Related to mobile-phone enabled learning, interview findings suggest that the information and knowledge sharing that takes place among CKWs and farmers is contributing to trust building.

As a farmer explains:

> *"I always communicate with him [CKW], and ask him when I have a problem with my coffee…maybe when I see a disease affecting my coffee, which I don't know or I don't have any technical know-how…I ask him because I understand that the CKW knows… So I have his number, as well, and he knows who is calling, that is a farmer from such and such a place. That is how my mobile phone is helping me." (I8p37)*

Face-to-face interactions also play a very important role in that exchange, as stated by a CKW:

> *"[The farmers] always call us [CKWs], and we give them the information. But, to make it simple, we stay within this locality…so we stay with the farmers…and they know us, they know that we are there. Yeah, it is face-to-face…and in most cases we go to the farm and we do everything in the farm…"(I13p69)*

Findings also suggest that knowledge exchange is not limited to agricultural information, but that CKWs are also helping farmers with questions related to broader mobile phone usage, including providing assistance with mobile phone charging:

> *"Most of the farmers, they have cheaper phones, and they have the capacity to use them. In the case of any failure they come to us, and we help them, if they have any questions about the phone." (I11p57)*

As reported in the previous sub-section, the role of mobile-enabled information in local learning processes is strengthened by the existence of trust and credibility in the information provided by CKWs. Interview findings suggest that both CKWs and farmers perceive the CKW mobile-enabled information to be credible and trustworthy, as explained below:

> *"[CKWs] deliver this information knowing that it [comes] from a clear source…they are confident on it, and there are few questions about the information by the farmers." (I12p65)*

> *"Firstly, this information is verified. It is not something that has been just generated, but it has been verified. It comes from the right sources…from EXPERTS [emphasis].*

So, whatever information I receive in my [mobile] phone, I am confident to use it! And the farmers do believe in it." (I13p69)

Images of a coffee farmer and a CKW using the mobile phone, Mount Elgon

ICTs and Learning: Coffee Farmers

- Findings suggest that the main role played by ICTs in terms of capacity building is indirect, as it is linked to the mobile-based system used by CKWs. Learning and capacity-building opportunities are being enabled by the asynchronous access to farming information by CKWs. This information is then transmitted to farmers via face-to-face communication (e.g. farm visits), and translated into measures that can help them mitigate or adapt to the impacts of climate change (e.g. natural flood defences) or strengthen their livelihood (e.g. organic farming practices).

- Because of the low level of Internet usage among Mount Elgon farmers, the learning potential of this tool has not yet been realised in practice.

- The level of ICT usage for knowledge sharing purposes is high (87% share more than before having ICT access), which suggests the farmers' interest to learn from past experiences, and use them to better cope with the impact of future events. Findings also indicate that ICTs' role towards knowledge sharing is deeply rooted in the social capital that exists at the local level.

- The use of ICTs to improve farming practices (reported by 72% of the respondents), mainly through CKWs, shows the need to further understand the way in which these tools are fostering new processes of learning, and to explore how/if this knowledge is interacting with traditional/indigenous farming practices, and how/if it is being implemented/translated into actual adaptive practices.

- The potential contribution of ICT tools to learning (e.g. capacity building, access and application of new/traditional knowledge, reflective thinking) could be constrained by the perceived disadvantages of these tools at the local level (e.g. connectivity, cost, distrust/family instability, privacy concerns) reported in sub-section 3.1. Efforts to foster resilience of coffee farmers should address these issues.

d. Redundancy

In regards to redundancy, understood as the extent to which community resources and institutions are substitutable in the event of a disruption or degradation, the research explored ICT's role vis-a-vis three resilience markers: (a) resource spareness, (b) functional overlaps and interdependency, and (c) resource substitutability.

Related to ICTs' role towards **resource spareness**, 76% of survey respondents reported using ICTs to generate/access additional money to their normal income (e.g. complementary income sources) (Figure 32).

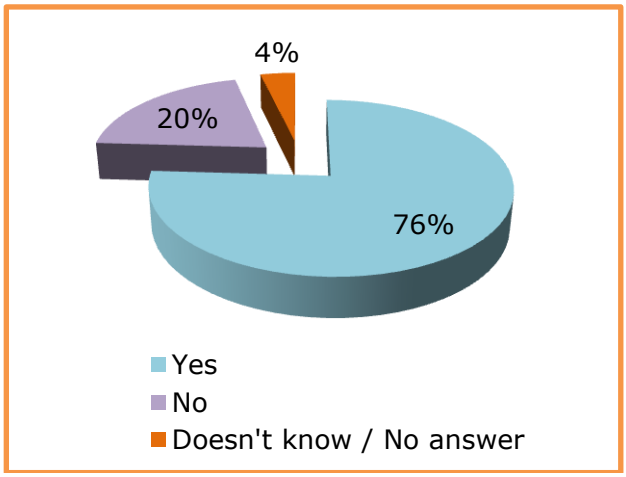


Figure 32. Role of ICTs in the generation/access to additional money

This percentage could be linked to mobile-related income-generating opportunities that may supplement local livelihoods, such as mobile phone repairs, mobile money-related services, or mobile charging (in the case of farmers with electricity supply, or with solar chargers). It could also be related to access to complementary income sources through mobile money services (e.g. money transfers from relatives).

Images of mobile-related services offered in the Mount Elgon region

Interview findings also suggest that mobile-enabled resource spareness is linked to financial savings derived from mobile usage (voice and text communication), particularly savings in transportation costs. In this regard, interviewees stated:

> *"When you are moving from 3 km to here, you need transportation. So, automatically, when this technology [mobile phone] is there, you save money….because [you avoid] having to move to ask for information." (I8p39)*

"Sometimes it is easier for [farmers] to ask whether there is cash at the primary society, maybe if he wants to deliver his coffee there he can call a secretary or the manager to ask if cash is on hand [before transporting their coffee]…" (I10p53)

"Sometimes it helps me know what is exactly happening, and save some money in transportation…like in consultation…because I can get free consultation using the phone…minus costs…transport costs. Sometimes I used to go to Mbale or to the cooperative…but since I have access to the phone, and I have their contact number, I just ring them and they tell me what is happening." (I14p76)

"Sometimes I text, and sometimes I just call…sometimes the CKW, sometimes the agricultural assistant…because text messages are a bit cheaper than phoning." (I14p77)

"Another benefit [of the mobile phone] is that it saves money…because, instead of moving two miles…it saves money and time…to check on somebody, I do it from this chair…I sit here [in the farm], then I communicate with somebody." (I14p77)

Interviewees also mentioned the generation of spare financial resources associated to using the mobile phone to find out coffee prices, and based on that information, decide to either hold the coffee for a few days (e.g. until the price increases) or to sell immediately (e.g. if the price is favourable). As explained by a farmer:

"When farmers hope to sell the coffee and they find out that the price is low [through the mobile phone], they say "let me wait a bit", and hold it for some days until the price increases…" (I8p40)

In regards to **resource substitutability**, the majority of survey respondents (89%) use ICTs to obtain or to provide help to neighbours when weather emergencies take place (e.g. heavy rains, landslides) (Figure 33).

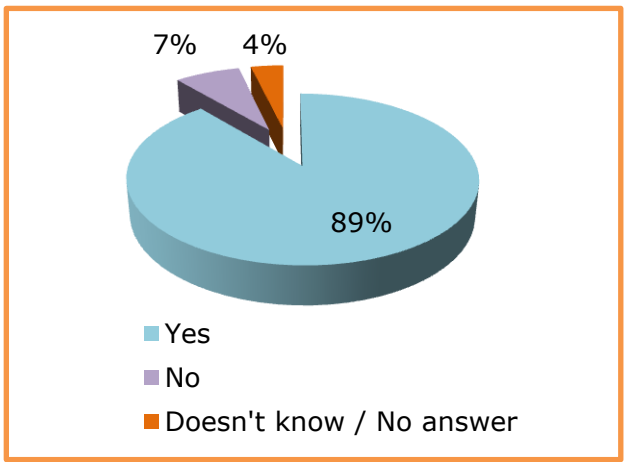


Figure 33. Role of ICTs to obtain/provide help in weather emergencies

These results suggest a contribution of ICTs towards resource substitutability, as they enable the role of local social capital/social networks that can substitute the support provided by local institutions in cases of weather emergencies, as reported in the sub-section on robustness (e.g. local councils, sub-county, NGOs/Red Cross, Primary Society, local community leaders).

Survey findings also suggest that coffee farmers access information about coffee production from a variety of (substitutable) sources, the main one being ICT-enabled. 96% of the respondents reported that the main source of livelihood-related information is the CKWs,

followed by the radio (89%). In a much lower proportion, respondents identified the role of government extension workers (50%), of other farmers (41%), and the mobile phone (i.e. direct access) (31%) (Figure 34). Consistent with earlier findings on low Internet usage, none of the survey respondents identified the Internet as a source of coffee-related information.

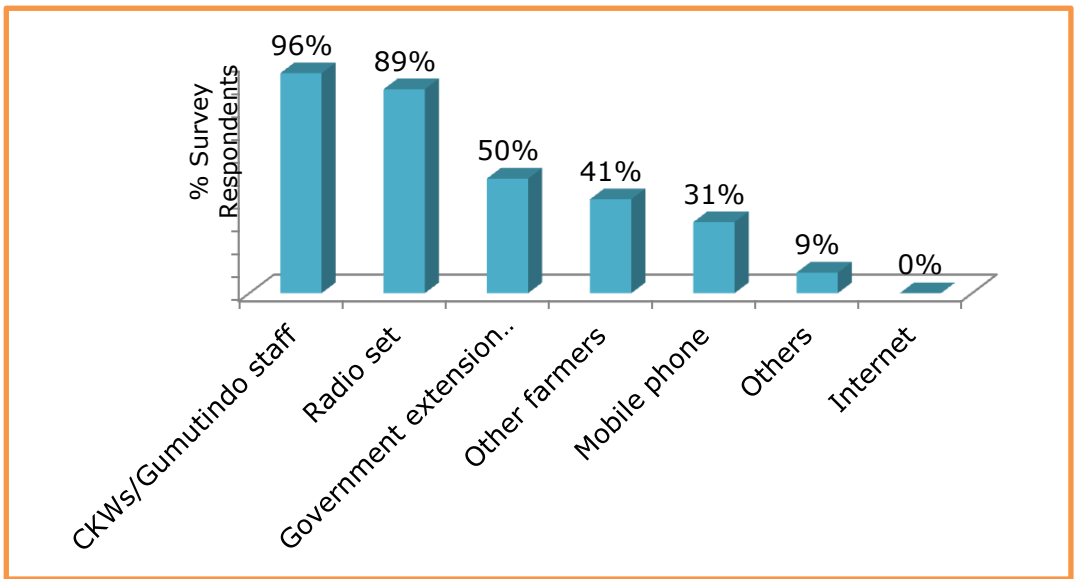


Figure 34. Substitutable sources of information about coffee production

The availability of substitutable sources of information (e.g. CKW, mobile phones, radio) was confirmed by interview findings:

> *"As CKWs, we get information from here [the mobile phone]…[such as] local knowledge, market information, and we also give [the farmers] mobile money information, regional weather information…if you want, you can look for the weather, and it will show you 5 days [forecast] (…) We have different districts…and it will show you the local [weather] information". (I2p10)*

> *"The source of information, we get it from the radio, and it is good. The phones that we have, have radio and we can listen it from the phone itself…there are FM radios…It is good, BBC also. We listen to the BBC." (I8p38)*

> *"In the mobile phone (…) well, some [farmers] listen to music, and others to good programmes…like [about] growing crops, and pests and diseases that attack the crops, and they give them solutions, those programmes." (I11p59)*

> *"Yeah, we've seen that [using the mobile phone] when there are landslides, people call the radio (…) So every morning you hear someone calling, to state what is happening in their area of residence…so people call and they report problems, and it works very well. These are local radio stations in local languages." (I9p47)*

Image of coffee farmer accessing a radio station through the mobile phone

Interview findings also suggest a role of ICTs in resource substitutability through the wide diffusion and adoption of mobile money services (i.e. by providing an additional channel through which money can be received or paid). These services allow farmers to both send and receive financial resources (e.g. from family members that live away or have migrated) that can supplement their agricultural income, and also support their ability to cope with emergency situations (e.g. death, illness, climatic shocks). As interviewees explained:

> *"The farmer receives and also sends money to his children using mobile money. He receives money from his other sons, and also sends money. One son works at the dam and another is a taxi driver -he drives Kampala routes. They send him money, and then he pays fees using mobile money, like school fees." (I7p34)*

> *"Making mobile money transactions…for example sending money to me, is very fast, when I am far away. Paying school fees…paying loans to their bank…[farmers] use mobile money."(I6p31)*

> *"I can use the mobile phone to send my money…Sometimes when we use it…like when you want a solar panel, you can get it, and use the mobile money to pay for it." (I8p37)*

Images of mobile money diffusion, Mount Elgon

Data also suggest a role of ICTs as enablers of **functional overlaps and interdependency** by enabling farmers to access the resources provided by various institutions in cases of

emergencies (e.g. weather-related). 54% of survey respondents reported using ICTs to request or receive resources in cases of emergency (e.g. from government, aid organisations, NGOs) (Figure 35), thus broadening and/or complementing existing resources.

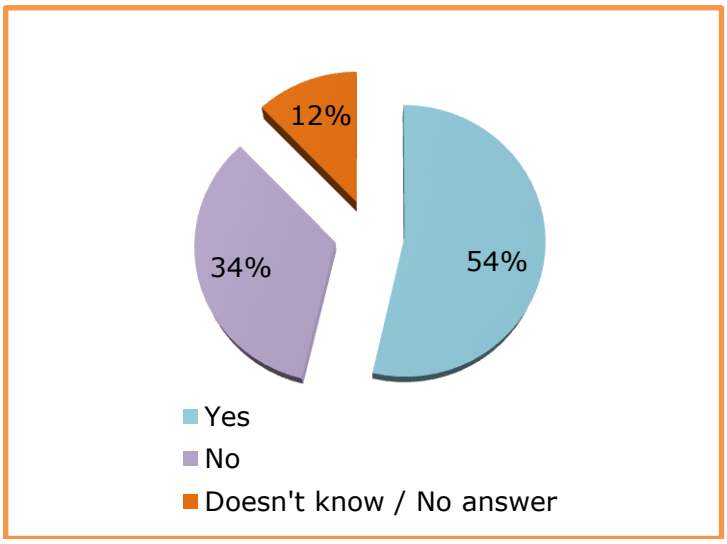


Figure 35. Role of ICTs to request/receive emergency support from institutions

This type of resource redundancy can help to improve the farmers' ability to operate amidst shocks and disturbances, such as those related to climate change.

ICTs and Redundancy: Coffee Farmers

- Findings suggest that ICT tools are enabling the access to and mobilisation of financial resources among coffee farmers, particularly due to the increasing adoption of mobile money services (e.g. used to transfer support in case of emergencies, to receive help from relatives). 76% of survey respondents reported using ICTs to generate/access additional money to their normal income. These resources could potentially be used to strengthen the farmers' capacity to cope with climate change impacts (e.g. construction of flood defences or better infrastructure).

- ICTs are also facilitating access to alternative/substitutable support mechanisms (e.g. social networks, friends and family) and financial resources that can be used to cope with emergency situations. In this regard, 89% of respondents use ICTs to obtain or to provide help to neighbours when weather emergencies take place, 54% to request or receive resources in cases of emergency (e.g. government support).

- Mobile phones are also offering new/redundant channels for information dissemination (e.g. CKWs' information, radio access, calls to other farmers/family members, institutions), thus helping foster functional overlaps to mitigate the impacts of acute shocks and long-term change. Future research could look into innovative mechanisms to ensure articulation between these different information channels, with emphasis on the quality and relevance of the content disseminated.

e. Rapidity

In regards to ICTs' role towards rapidity, or the speed at which assets can be accessed or mobilised by local stakeholders to achieve goals in an efficient manner, the research focused on three resilience markers: (a) rapid resource access, (b) rapid resource assessment / coordination, and (c) rapid resource mobilisation.

91% of survey respondents reported that ICTs have made their access to support faster (e.g. from neighbours, family) in emergency situations, suggesting the role of these tools for **rapid resource access and coordination** (Figure 36).

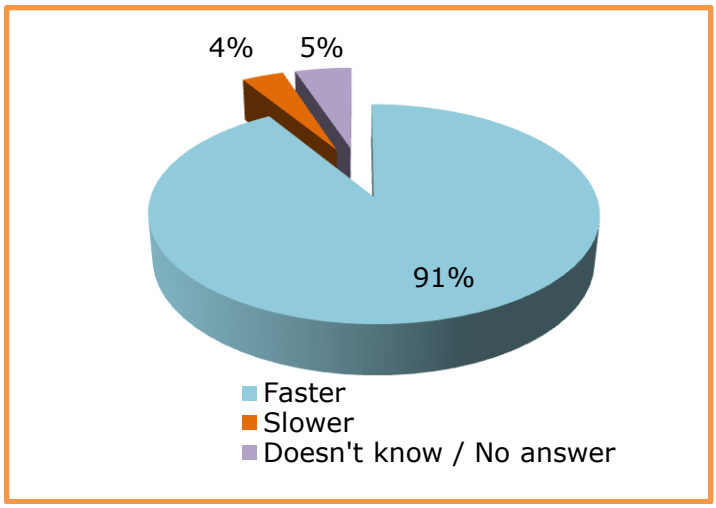


Figure 36. Role of ICTs in the speed of access to emergency help

Survey findings related to rapidity were corroborated by interview findings, particularly in terms of increased rapidity in the implementation of CKWs' functions in the field. As explained by a CKW:

> *"[The work of CKWs] has become very fast. Now with the field officer we have been making out a timetable, and meeting the farmers. We have divided those farmers by persons. We are three CKWs, in this region. I take care of 40 farmers. I have to tell them that I am coming such and such day, to meet, and I use the mobile phone…I give them the information, and after I send [an online form] to Gumutindo, through the mobile. And they send us 'air time' to facilitate that work." (I2p11)*

Mobile usage is also seen as having improved the speed at which the farmers access information, in some cases, saving them time and resources (e.g. transportation costs). As explained by interviewees:

> *"The way I see it, this technology can make greater improvements…because farmers can easily access the information, because a farmer can just sit at home, instead of moving from down there, 3 km, to come to the primary society to ask for information…But [he] just sits there, and just calls to the society, and then the information is received within a shorter time." (I8p39)*

> *"The information is in the [mobile] phone, so when they [CKWs] go to the farmers, the information is displayed…so they have the information ready for the farmers..." (I12p65)*

> *"Just imagine, everything that the farmer needs is with the CKW, who stays around with him…Don't you think that this farmer is very happy to receive this information on time, and not having to go to headquarters [e.g. primary society]?" (I13 p70)*

> *"We have some farmers who are staying at a distant place, so when you are making an appointment, then you get in touch with them [using the mobile phone]. In most cases it saves my time…and it helps me to be very cautious with time management. You know, for us farmers, the moment you miss time, you lose money…" (I14p76)*

"[Compared to the past], The situation has improved [with mobile phone access] because… most of the farmers can interpret information by themselves, they can know what is happening right now in the ground, they can get that information as quickly as possible, and they are always informed with first-hand information." (I1p7)

"For expenditure…[mobile money usage] is diverse. For paying school fees, for medical treatments, others transfer cash…I find it quicker and easier than going to the bank, if I'm busy. It is more accessible, allows meeting the regular obligations." (I15p82)

Suggesting a role of ICTs in **rapid resource assessment** and **mobilisation**, 74% of survey respondents reported using ICTs to access early warnings (e.g. informal alerts) (Figure 37).

Figure 37. ICT-enabled access to early warnings/alerts

Findings suggest that a significant number of respondents (72%) access early warning/alerts information through the CKWs (i.e. mobile-enabled information), and through their own mobile phone (57%).

Interview findings corroborate the role played by mobile-enabled information in terms of rapidity of information assessment and mobilisation. Interviewees stated the following:

"Some people who were staying far away, they got the information from their phones, about landslides that have occurred in such a place, and about people that have lost their lives. So ICTs helped very much as an alert mechanism and to call for help." (I1p8)

"If the new technologies come and these people are near them, and there are climatic changes… and they know that at such time we have to use such measure…extension workers, or certification officers, or CKWs…if they get this knowledge immediately [to the farmers]…they are quick to respond." (I5p24)

"It has improved, because in the past it was so difficult…you had to move to get information from the farmer, you needed to go to [different locations]. But now it is easier to just call her or him, and get the information that you want." (I10p53)

"A farmer calls and says that his plants are dying, if he has my mobile number, he calls me and I go there and verify." (I10p53)

In regards to the speed at which coffee farmers are able to **mobilise/coordinate support** (e.g. from neighbours, family, institutions) in the case of weather-related emergencies, the

majority of survey respondents (91%) reported that ICTs help them organise support faster than before[7] (Figure 38).

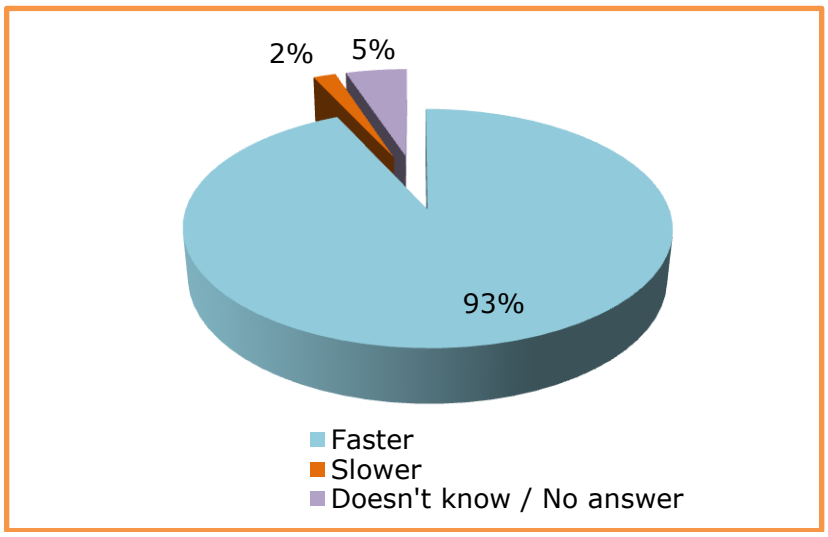


Figure 38. Role of ICTs in the speed of support mobilisation

Interview findings suggest that the high rate of mobile usage for mobilisation of support (identified in the survey) may be linked to the availability of mobile money services to quickly access and mobilise financial resources in the event of emergencies.

Regarding mobile usage to mobilise support in case of family-related emergencies, a farmer stated:

> *"When he has lost a relative, he uses [the mobile phone] to make an announcement. They also inform him when there are emergencies, like losing relatives." (I7p34)*

In regards to the use of mobile money to swiftly mobilise financial support, interviewees explained:

> *"We are [located] deep into the village, and now mobile money is extended to this village by trading centres, so the farmers are very happy. Maybe [the farmer] has a child at school and he wants to send money…it is very easy using mobile money to send the school fees. Maybe somebody is sick and there is some distance from where he is, so he can send some assistance through mobile money. It is so useful to them!" (I10p54).*

[7] The overall percentage of ICTs role is 91%, after subtracting the percentage that reported support organisation being 'slower' than before.

Images of mobile money services available in the Mount Elgon region

The use of mobile money was also linked to the farmers' personal security against theft, particularly in the case of large amounts (e.g. payment for the coffee harvest) that are transferred to a mobile money account instead of being delivered in cash. In this regard, a staff member of a primary society explained:

> *"If a farmer is to be paid a lot of money, like 3 million [shillings] [USD 1,140] we feel that it is unsafe to come with it here [to the primary society]…so we just send the money to the farmer [using mobile money]…when there's a lot of coffee [harvest time], that is when we do it." (I12p66)*

Some farmers interviewed added:

> *"Yes, I do use mobile money. My two daughters are not here, they are at school, so in most cases, when I want to send some pocket money, I can access it. And sometimes, when I sell my produce, they can do some payments in my phone…minus travelling long distances…and it is safe…and it is a 'local bank', you can bank here, for security purposes. Nobody knows that you have the money in your phone…It is like a 'secret bank' for a rural farmer like me." (I14p77)*

> *"Things have changed a lot, a lot. A farmer can get in touch with their colleagues anywhere. There are new developments of money…of money transfer, is now very easy. I remember a few years ago, if you had to send money, that used to be [through] the post office…Which failed. So what used to happen is that people would put the money in an envelope and send it by bus! (…) But that has changed now. Mobile money has taken off, everywhere!!" (I4p22)*

ICTs and Rapidity: Coffee Farmers

- Findings suggest that ICTs are increasing the speed of information access, transactions and services in coffee farming communities, particularly for resource coordination in cases of acute shocks (e.g. natural disasters, landslides). 87% of survey respondents reported that ICTs sped up their access to support in emergency situations.

- Rapidity was also linked to the role of ICTs in financial resource mobilisation (e.g. mobile money). 74% of survey respondents reported using ICTs to access early warnings (e.g. alerts). A high percentage of respondents have swift access to farming information via CKWs (e.g. by calling them, or by receiving the information that they access through their mobile phones).

- ICTs' role is associated with rapid communication with institutions (as reported in discussing robustness, above), thus enabling faster access to, or mobilisation of financial and human support. 91% reported that ICTs help them organise support faster than before.

- Interview data indicates that ICTs can speed up the accessibility of information needed for local decision-making and action, particularly in the case of early warnings (e.g. weather alerts).

- The implications of increasing access to mobile services, particularly in the case of emergency situations related to climate change impacts, constitute an area for further research.

f. Scale

In relation to scale, understood as the breadth of assets and structures a community can access in order to effectively overcome, bounce back from, or adapt to the effects of disturbances, the role of ICTs was explored around three resilience markers: (a) multi-level networks, (b) resource access and partnerships, and (c) cross-level interactions.

In regards to **multi-level networks**, the role of ICTs is considerable. 67% reported that ICTs have allowed them to network with new groups or organisations from outside their immediate community (e.g. other Primary Societies, Red Cross, government) (Figure 39).

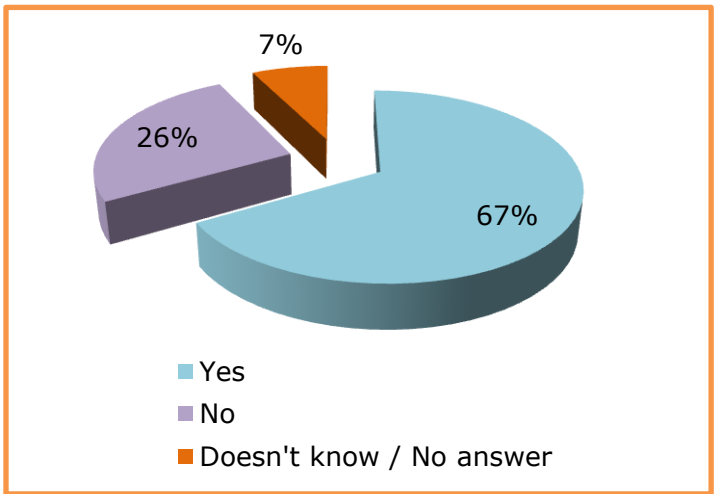


Figure 39. Role of ICTs in networking with new groups/organisations

More than half of the respondents (57%) reported that ICTs have allowed them to get involved in **partnership projects** or initiatives, which increase the scale of resources that can be directed to protect coffee livelihoods from climatic emergencies (e.g. landslides, floods) (Figure 40). Examples of initiatives mentioned include tree planting (as reported by 50% of respondents), contours (24%), and a mix of the two (15%) (Figure 41). These examples are linked to agricultural projects that were under implementation in the Mount Elgon region during the period in which the data was gathered.

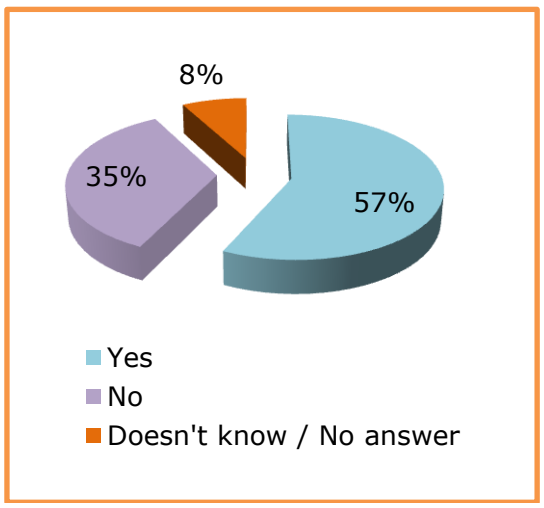


Figure 40. Role of ICTs in facilitating partnership resources

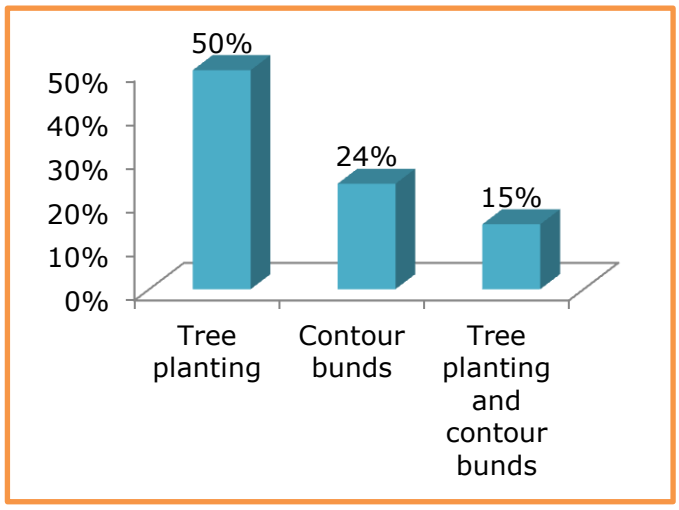


Figure 41. Examples of projects in which farmers are involved in

Regarding ICTs' role in **cross-level interactions**, 88%[8] of survey respondents reported that ICT access has allowed them to have more interactions than before with institutions such as Primary Societies, cooperatives, NGOs, and committees that operate in their area (Figure 42).

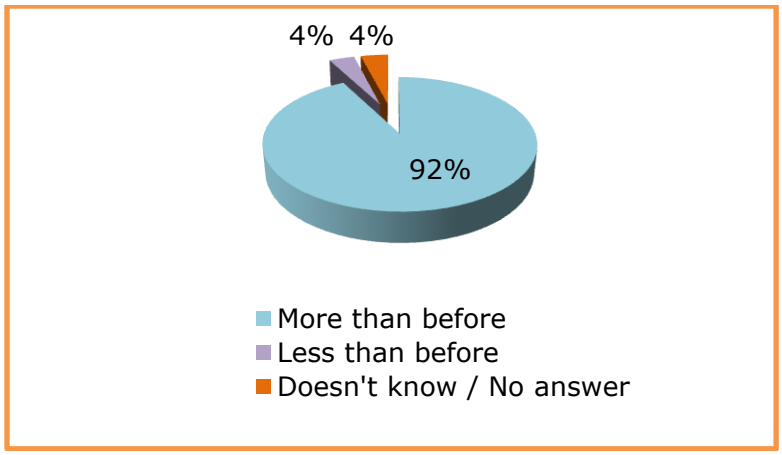


Figure 42. Role of ICTs facilitating cross-level interactions

Interviews corroborated these findings, and provided further insights into the type of cross-scale interactions enabled by mobile phones.

In terms of mobile usage to strengthen the linkages between CKWs and farmers (micro level) and meso- and macro-level institutions for the purposes of information sharing, coordination and emergency support, interviewees stated:

> *"You can get the information from the [CKW's] phone and then tell the farmers…about the business of coffee, the marketing of coffee, the digging, the pruning…and I also send the messages to the Grameen [Foundation, based in Kampala]." (I6p30)*

> *"I [CKW] can also call the farmer, maybe if there is information that I want to get from the farmer…maybe I want to go for a visit, for an internal inspection. I can announce that I am coming, and ask if he is around. So it is basically for communication." (I10p53)*

[8] Overall percentage, after subtracting the percentage of those that consider it being less than before.

"The farmer uses his mobile to call friends who are far, and in case of danger he calls the police stations. He uses it for emergency calls, in the case of the police stations." (I7p33)

"[In cases of climatic emergencies] We have some local councils, and our local leaders, and maybe we can call them [via mobile phone], and they write a letter to the relevant authorities." (I10p51)

"In case that I can't find the information, there are many ways in which I can find it…I still use my phone (…). I go to 'Support'…type [the question], and they get back to me. You put your problem or your question, and it is sent back to the Grameen Foundation, and they get you the data that is missing. They text me or they can call me, using the call centre." (I13p69)

Interview findings also suggest that mobile usage is enabling farmers to access and assess information related to the international coffee market (e.g. prices, competitors, exchange rate). A farmer who accesses radio programmes through the mobile phone explained:

"The BBC has many programmes that they put on air. We can get information about coffee, and how coffee has been affected in Brazil…I can know if the coffee in Brazil is affected, they can also tell us about the price...we can also know how much is the US dollar selling for…those are the things that, in my case, I can get from the radio." (I8p38)

ICTs and Scale: Coffee Farmers

- Findings suggest that ICTs are playing a role as enablers of multi-level networks. 67% reported that ICTs have allowed them to network with new groups, fostering contact between coffee farmers at the micro level, and meso- and macro-level institutions, thus helping to improve the scale of structures to which farmers have access.
- Findings suggest the role of ICTs enabling farmers' involvement in projects/initiatives (57%), facilitating resource access through new partnerships.
- Further research is required in order to understand the nature and timescale of such involvement (e.g. if it is limited to short-term responses/real-time information sharing during emergency situations, or longer-term partnerships and resource access).
- Data indicates that 88% of respondents are using ICTs more than before to interact with institutions that operate at various scales, thus contributing to cross-level interactions. This high rate of usage suggests the need to investigate if such interactions have translated into, or influenced collaborative projects, and if ICT tools are fostering two-way knowledge exchange among stakeholders (as opposed to one-way information dissemination).

g. Diversity and Flexibility

Closely linked to flexibility and combined into a single sub-property for the purposes of what follows, **diversity** refers to the availability of a variety of assets, institutions and institutional functions in the community, which enable a range of response options by coffee farmers. **Flexibility** refers to the ability of the community to undertake different courses of actions, address problems and utilise the opportunities that may arise from change.

In regards to these two attributes of resilient systems, the analysis of ICTs' role focused on three markers: (a) different courses of action/emerging opportunities, (b) adaptable decision-making, and (c) innovation backbone.

78% of survey respondents stated that they use ICTs to **access innovative ideas** that can be applied to their farming practices (Figure 43). This suggests a potential for ICT tools to enable new, collaborative forms of innovation, particularly agricultural innovation.

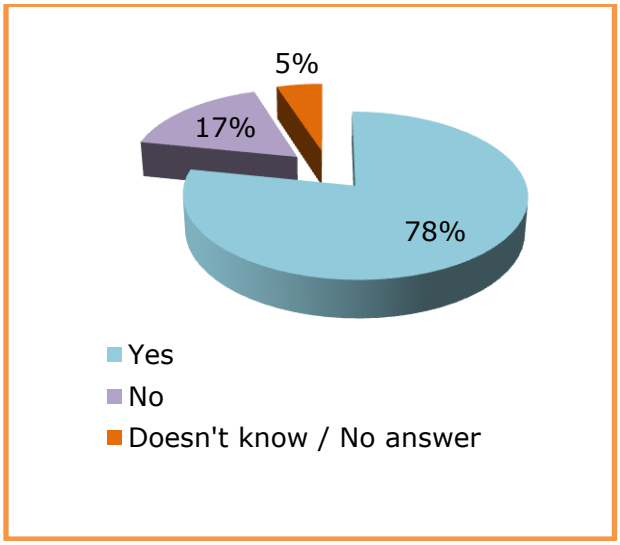


Figure 43. Role of ICTs in accessing innovative ideas for farming

Findings indicate a high level of ICT usage to access **new knowledge on opportunities** and actions that can help farmers improve their family life (e.g. loans/credit opportunities, government programmes) as reported by 83% of survey respondents (Figure 44). Access to different actions/opportunities can, in turn, foster innovation (including innovative climate change responses).

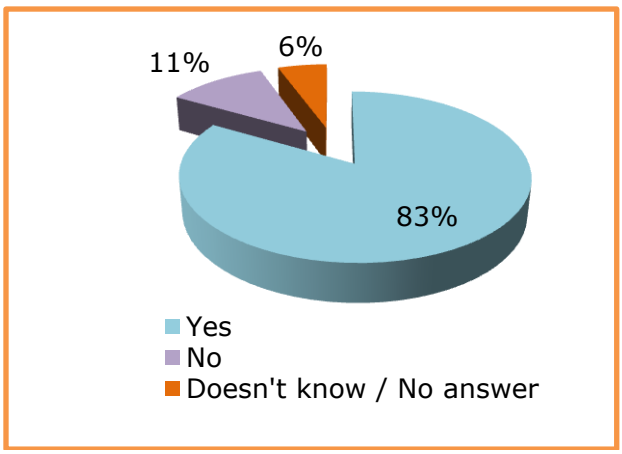


Figure 44. Role of ICTs in accessing information about new actions/opportunities

As stated by a CKW,

> *"Yeah, I have benefited [from mobile-enabled farming information], because it has provided me with some ideas of growing… I even have a group who wants to start with chicken, poultry systems, so I use this [mobile] phone to help them know how to keep poultry. That information is here, in the phone." (I11p56)*

Another CKW added:

> *"Through this [mobile] phone you find that it is easy to pass information on how to preserve or conserve our environment…and at the end, the climate is changing, so we need to try to adapt to any changes, and also create what is needed…" (I13p71)*

Suggesting ICTs' role informing **adaptable decision making**, 78% of respondents reported using ICTs to access new information and to inform farming decisions more than before (Figure 45), thus contributing to the flexibility of farmers' responses to climate change impacts.

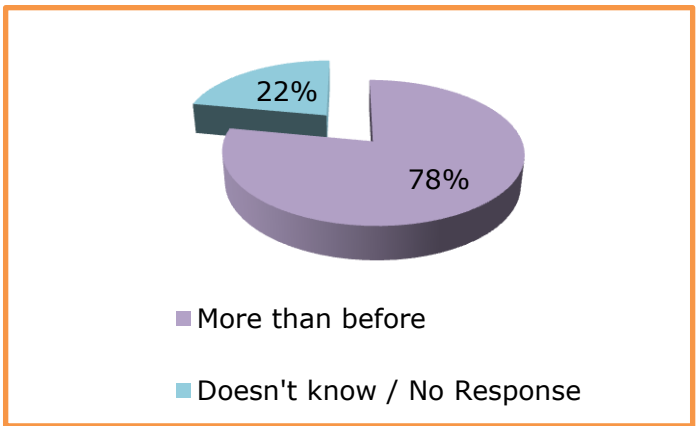


Figure 45. Role of ICTs informing adaptation decision-making

93% of survey respondents reported getting information to inform their farming decisions from CKWs (i.e. mobile-enabled information). 59% reported accessing this information using their own mobile phone.

Interview findings suggest that the use of ICTs to inform adaptive decision-making constitutes an area of potential to improve farmers' preparedness and response to both short-term and long-term stressors (e.g. weather information can help them prepare and plan short-term farming activities, while market and agricultural information can inform longer-term adaptive decisions). In this regard, interviewees stated the following:

> *"The information that they ask the most [from the CKW's mobile phone]…is about coffee. Farmers always want to know about the planting and the maintaining [of coffee crops]…" (I13p69)*

> *"If the farmer can know what the weather will be tomorrow, he can plan better, instead of planning when you don't know what will happen tomorrow….you may plan to go and pick your coffee, and yet tomorrow will be a raining day…So these mobile phones can play a very big role!." (I12p66)*

> *"Yes, in most cases it helps me…because, when I want to do something, I can ask the CKW if is going to rain today, then he can tell me that today is not going to rain…so I can dry my beans. I can bring them to the sunshine, and I don't have to endure the losses. That is one benefit that we get from the phone." (I14p77)*

> *"Yeah, [mobile-enabled information] has been useful. For example now I've been planting my coffee seedlings, because the phone has told me that the rain will be there up to mid June…so by mid June, the seedlings must have developed the roots, and dried. (…) Before I would not have planted, because we used to plant by April. But this time we have excess…[rain]" (I3p13)*

"If I hear in the radio [accessed via mobile phone] that coffee in Brazil has been affected, and Brazil is the highest producer of coffee in the world, so automatically, [I know that] the production will be low, and when production is low, the demand will be high. So the implication that I will have in my production, is that, in that season, the price of coffee may be high, because…maybe Brazil is affected and will not produce enough coffee." (I8p38)

Images of mobile phone usage in Primary Societies, Mount Elgon

Although relatively few farmers do this at present, when asked about the use of mobile-enabled price information to inform their decisions on where/when to sell their coffee, interviewees explained:

"Yes, they [farmers] do [use price information to inform their decisions]. Now there is a farmer who is calling me [primary society] to enquire if we are still buying coffee…he wants to know." (I12p65)

"Information about the weather can be sent to their phone, so the [CKWs] can tell their farmers what is happening. You get content, so they can know what to do. Another shock [that affects the farmers] are the changing [coffee] prices…so they want to get updated market information in their phones, so they can alert the farmers about the prices… that is also very important." (I7p34)

"When I want to communicate, maybe if I want to ask about the price of coffee, I can use my [mobile] phone." (I8p37)

"Sometimes [I use the mobile to] make some contacts for selling my produce…or for accessing market information…and it tells me how the market is moving in some crops. I can also access information if I want to know about rainfall. Sometimes we have local dealers who also have phones…Sometimes I have to know the market, in the central market of Mbale, how the prices are ranging. Sometimes it can give me information about the world market… if I want to know the price of coffee." (I14p76)

ICTs, Diversity and Flexibility: Coffee Farmers

- The level and purposes of mobile usage among coffee farmers suggest that these tools are contributing to the diversity of local information mechanisms and channels for resource access.

- By enabling access to diverse information flows (e.g. through broader social networking, inter-scale communications), ICTs can increase the diversity of options and potential (adaptive) actions for local decision-makers. Findings suggest a high level of local awareness about ICTs' role in the identification of new ideas to improve local livelihoods (78%), particularly through the role of CKWs (and thus, through indirect access to mobile-enabled information). Further data needs to be collected in this regard.

- While findings suggest a high level of ICT usage towards access to new knowledge on opportunities/actions (83%), further data is needed to understand how this knowledge is being used towards innovative actions and novel adaptive practices.

- Survey data indicates the use of ICT informing decision-making processes (i.e. adaptable decision-making). 78% reported using ICTs to access new information and inform farming decisions more than before. Interview findings suggest that ICT tools are starting to play a role in this field by allowing farmers to access real-time information (e.g. weather alerts, price changes, market conditions) and to consider different courses of action (e.g. long-term planning).

- Future investigations could seek evidence on whether increased access to information and knowledge (e.g. via CKWs, own mobile phones, mobile-enabled networking across scales) has translated into innovative actions and livelihood improvement, including adaptive actions to climate change impacts. It could also help to gain a better understanding of the role of ICTs in both short- and long-term decision-making, particularly as it pertains to climate change stressors.

h. Equality

In relation to equality, or the extent to which the community provides equal access to rights, resources and opportunities to its members, the research focused on ICT's role in regards to three resilience markers: (a) strengthened competencies / gap reduction, (b) inclusiveness, and (c) openness and accountability.

85% of survey respondents agree that ICTs play a role in inclusiveness (i.e. access to opportunities for vulnerable members of the community such as the elderly, women, and persons with physical disabilities) (Figure 46).

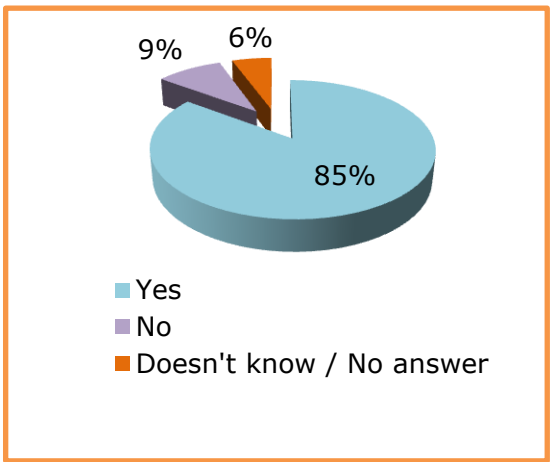


Figure 46. Role of ICTs in local inclusiveness

In regards to the role of ICTs towards inclusiveness of elders who are not familiar with the technologies, a CKW stated:

> *"It becomes very interesting if you are showing them [elders] what you are doing [the mobile's functionalities], now we use that instead of pen and paper…" (I2p12)*

Indicating an increase in access to radio information using mobile phones, an interviewee stated:

> *"And now [farmers] are using this new technology of the [mobile] phones…they access the radio…so you find even a person that is 40 years old, who uses the phone…but to listen to the radio. And there are radio stations that have come up in town, and many people are very eager to listen to the news, first of all." (I5p29*

Accessing local radio stations (via mobile phone) can contribute to more inclusive information access by bridging language barriers (e.g. access to local stations that broadcast in local languages) as well as age-related barriers (e.g. elders' difficulties using the mobile's keyboard, illiteracy barriers).

Image of women farmers and coffee pickers, Mbale

ICTs' contribution to strengthen the '**sense of belonging'** to the community was reported by 89% of survey respondents (Figure 47)[9]. Interview findings suggest that these results may be linked to the role of mobile phone usage strengthening social networks/existing social capital

[9] 89% is the overall percentage of ICTs' contribution to strengthen the sense of belonging, resulting from subtracting 2% from 91%.

in coffee-producers' communities, and it constitutes an important factor towards local inclusiveness. The sense of belonging can also contribute to other resilience attributes such as self-organisation and intra-scale collaboration.

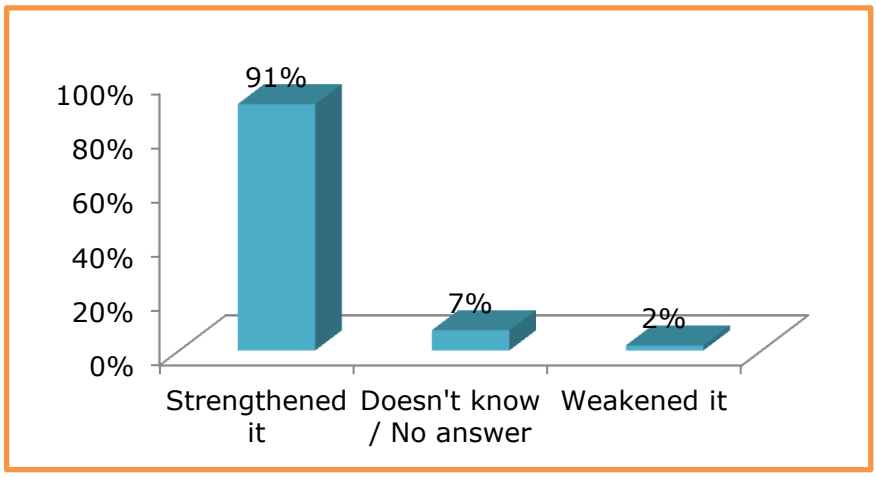


Figure 47. Role of ICTs in sense of belonging to the community

Related to **openness and accountability,** 93% of respondents use ICTs to inform themselves about activities (e.g. training, meetings) taking place at the primary societies/cooperatives (Figure 48).

Figure 48. Role of ICTs informing farmers about the cooperatives' activities

No specific survey data was gathered in regards to competency gap reduction.

Interview findings corroborate the role of ICT access towards openness and accountability in various ways, including through the improved access of farmers to price information. As explained by a CKW:

> *"Farmers will be there, knowing how is the [coffee] price moving. Because sometimes middlemen tend to…misuse [cheat] the farmers…because sometimes farmers are ignorant about the price…So middlemen can go there and tell them, "please, give me your coffee" and sometimes there are some farmers that have problems, like sickness, so they sell. But [now] a farmer would call directly the primary society, telling them that "So and so is here and is telling me here that the price of coffee is down"…So,*

when the farmers possess this technology [mobile phone], some false information will be no more, because the farmer can call directly and find out." (I8p39)

Findings also suggest the role of mobile phones in the improvement of (broader/more open) information about Gumutindo's activities, as stated by interviewees:

"Even the information that you want to pass on to the farmers, we may sometimes use a phone. Maybe price…Or, if something is happening, if there's something new in the [Gumutindo] system, he [information officer] has almost every contact of the farmers, and can pass the information at once, and it reaches. So you can now say what is happening in Gumutindo, and what is happening in the world." (I1p8)

"Maybe the price changes, or agricultural services, in the case of projects that are running…things that they [Gumutindo] want to tell farmers about…[such as] payments, or meetings…" (I9p46)

Findings also suggest that the use of mobile phones has improved the accountability of CKWs working in the field, as phones allow capture of the GPS location of surveys conducted during farmers' visits. In this regard, a CKW explained:

"You can capture the data [using the mobile phone], and send it directly [from the location where the data has been captured] (…). Also other people capture it [the Grameen office], because we are connected. So they know that I am doing some work." (I1p9)

No evidence was gathered on mobile usage's contribution to women's inclusion or participation, evidencing the need to conduct further research in this field.

ICTs and Equality: Coffee Farmers

- Evidence suggests an emerging role for ICTs in coffee livelihoods equality by strengthening inclusiveness for a range of stakeholders (e.g. farmers, local institutions, marginalised groups), as reported by 85% of the respondents. ICTs are enabling opportunities to vulnerable groups (e.g. farmers with low levels of literacy, elders, women) by facilitating access to information and knowledge, agricultural markets, training and business opportunities. Social networking through ICTs is facilitating contact with extended networks, thus helping reduce marginalisation and exclusion.

- Corroborating the role of ICTs towards inclusion, 89% of respondents reported that ICTs strengthen the 'sense of belonging' to the community, which also contributes to attributes such as self-organisation and scale.

- However, the impacts of the "mobile revolution" on coffee farmers' equality are less clear, particularly in terms of the impacts of broader access on power/gender differentials and participation at the household and community levels.

- The potential of ICTs towards equality remains underutilised, particularly given the low level of Internet usage among farmers (which makes unviable, for example, the use of social media applications such as Facebook or Twitter for local campaigning or civil activism, or for local monitoring for transparency in the delivery of local services).

- While most of the respondents agreed with the role played by ICTs towards openness and accountability (93%), these results need to be studied further in order to understand, for example, the impact of ICT usage on women's resource access and in their role within local decision-making.

Images of women farmers and coffee sorters, Mbale

ICT and e-Resilience: Interview Findings

Most of the linkages between ICTs and resilience identified through the analysis of survey results were confirmed by interview respondents (Annex 12). Looking at individual attributes, the interview evidence shows that the role of ICTs in redundancy was present in the minds of respondents more often than other resilience attributes, followed by rapidity. Redundancy was also identified as the top resilient attribute of coffee farmers (section 2.3) (Figure 49).

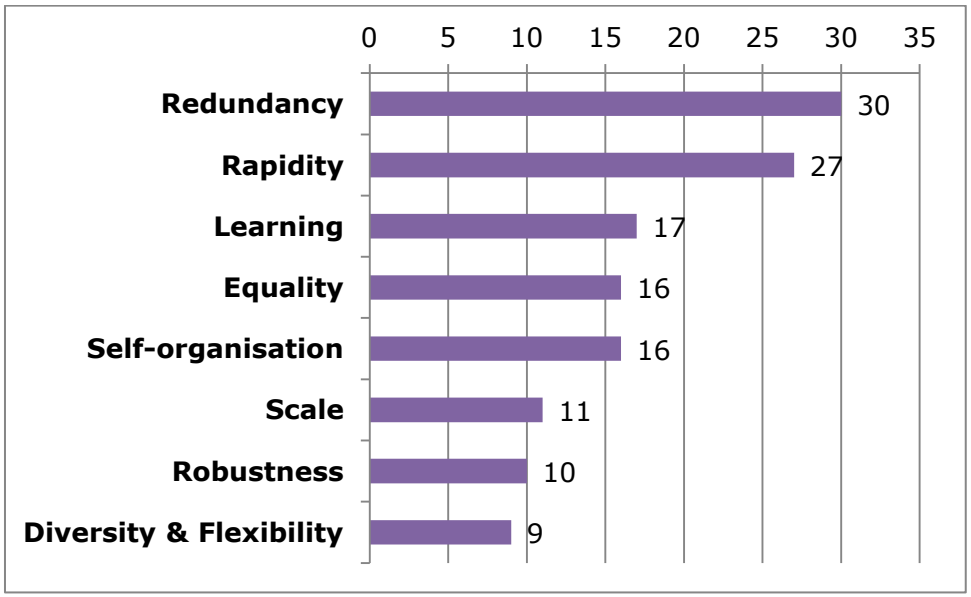


Figure 49. Relative salience of e-resilience attributes among coffee farmers, Mount Elgon

Figure 50 subtracts ICT contributions to resilience weaknesses from strengths, to provide an overall view from the stakeholders of whether ICTs' role vis-a-vis particular resilience attributes is "in credit" or "in debit", as perceived by coffee farmers.

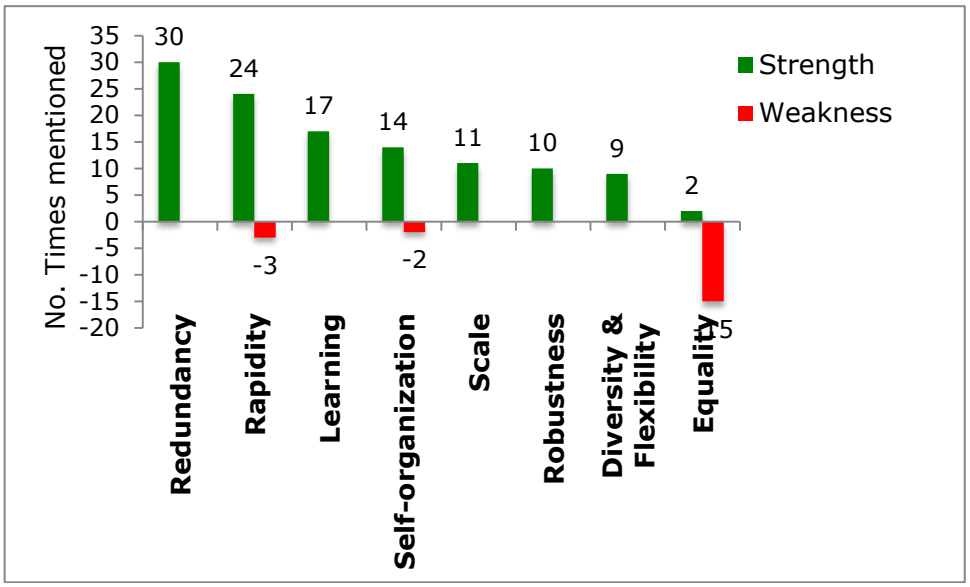


Figure 50. Relative salience of strength vs. weakness of e-resilience attributes, coffee farmers, Mount Elgon

Table 12 presents selected testimonials from interviewees in regards to the potential role of ICTs in weakening coffee farmers' resilience. These testimonials have been linked to the corresponding resilience attributes (equality, rapidity and self-organisation) identified in Figure 50.

INTERVIEW FINDINGS LINKED TO THE POTENTIAL ROLE OF ICTs WEAKENING RESILIENCE **FARMERS' TESTIMONIALS**
a) EQUALITY
Widening existing divides (e.g. between those with/without information access; e.g. between CKWs with mobile phone access and elders without, between elders and youth, between those with higher levels of education/skills and those with lower levels)
"[Farmers] They have their own mobile phones, but not like these ones [not smart phones, but more simple models]. Yeah, the simple ones, only for calling….not like this one. This one has Internet. The others, they don't have Internet. They don't have the information that we have." (I2p11). *"You know, our elders can't use the phone, because most of them are not educated. So it is only the youth…and a bit the elders who have gone to school. But those that have not gone to school, they don't have a phone…they don't even know how to call it [how to refer to the mobile phone]. Some even have not seen a [mobile] phone…." (I2p12)* *"Some [barriers of usage] are related to cost…but some [farmers], they don't know how to use it, as you see in the case of elderly persons. Only youth…but not elderly persons. They wait to receive calls [they don't use it for anything else]" (I5p28)* *"Most of the farmers are old. The new farmers are just starting…so most of them are elders…they don't know how to use technologies*." (I6p31) *"The farmers…Yeah, most of them don't have phones, actually. Most of them can't even operate the phone…they are OLD!! [emphasis] And they lack the capacity….Because even if the phone is there, they say "I can't see", so how can they operate the phone…" (I12p65)*

"The language on the phone is a difficulty, people don't know what they are trying to do, just the button to press to make a call. If they get a miscall they don't know how to check, or if they receive a message…" (I9p47) *"Ahhh…if it is in terms of them accessing the phones, it may be quite hard. Because the farmers who are old, they cannot operate this technology…then we have farmers who are still young but are not educated." (I13p70)* *"I have used it and seen it…but my father, asking him to go into browsing [using the mobile]…it does not cross his mind!! So it is an issue of capacity. And also the age barrier" (I15p82)* *"Maybe the young ones are [using mobile phones to access Internet]…but the old ones, the only thing that they know that the phone can do for them is to call, and send a text message." (I4p21)*
Exacerbating gender/power differentials
"No, [his wife doesn't have it], I am the only one who knows [the pin to access mobile money services]…[laughs] I'm not cheating, I don't cheat, but we plan it like that. After all, when the need is there, I give them so that we solve it." (I14p77)
b) RAPIDITY
Affecting the efficiency of CKWs' role
"Sometimes the network is a problem, then it delays the submission of the [CKW's] information. (…) I connect with the technicians and field officers, sometimes they have to take the [mobile] phone to Gumutindo, and then [from the office] upload the content". (I6p30) *"The challenge is maybe…charging the phone. When the network is down you cannot communicate. When you don't have airtime, you cannot communicate. The other thing is for those [farmers] that don't have money to buy a mobile phone, so automatically they can't communicate." (I8p38)* *"There is also a complication we face entering farmers' information in the phones…the GPS. Some phones do not capture the GPS… so I have been only doing inspections, but when entering the farmers' [data], the GPS is refused. So I've taken that complain to Grameen, and they told us that is a general problem." (I2p9)*
c) SELF-ORGANISATION
Creating (new)/deepening existing dependencies *(e.g. to CKWs for information access, for mobile phone charging, for trouble-shooting, to ask for help with the use of mobile money, for text messaging) and communication barriers*
"Some of the farmers don't have the technology for using mobile money…he has to go somewhere [to ask for help]…Some don't know how to check their balance..that is also a problem. The [limited] capacity to use it." (I10p54) *"As someone that has gone to school, I know how to write…then I can text some messages….But there are other farmers who don't know how to text messages, then the CKW has to go to the farmer [to help]…." (I8p38)*

Table 12. Selected testimonials from interviewees on the potential role of ICTs in weakening resilience

3.3. Visualisation of e-Resilience Benchmarking

In order to benchmark the extent to which ICTs are currently contributing to the resilience of Mount Elgon coffee farmers, we need to utilise the survey data in a way that provides a simple association between data and resilience. Table 13 below provides a summary from the data that was covered by the pilot survey. There are sometimes limitations in the correspondence between survey question and resilience marker; limitations imposed by time and other constraints experienced on the survey. Overall, though, the questions were designed to act as best-fit indicators given the survey constraints.

Resilience Attribute	Resilience Marker	ICT Usage	Aggregate Score
Robustness	Physical Preparedness	43% use ICTs to look for climate change information	**62%**
	Institutional Capacity	78% use ICTs to report problems / emergencies to institutions or authorities	
	Multi-Level Governance	65% use ICTs to access information to better prepare for emergencies	
Self-Organisation	Collaboration and Consensus	89% report that ICTs have improved organisation/participation in activities and projects in the community	**91%**
	Social Networks	94% use ICTs to strengthen social networks	
	Local Leadership and Trust	N/A	
Learning	Capacity Building	N/A	**76%**
	New and Traditional Knowledge	81% report that ICTs have improved the identification of ideas for community improvement	
	Reflective Thinking	72% use ICTs to access ideas to improve farming practices	
Redundancy	Resource Spareness	76% use ICTs to generate additional income	**73%**
	Functional Overlaps and Interdependency	54% have used ICTs to access emergency resources	
	Resource Substitutability	89% use ICTs to obtain/provide help in emergencies	
Rapidity	Rapid Resource Access	87% report that access to emergency support is faster with ICTs	**84%**
	Rapid Resource Assessment/Coordination	91% report that organising support is faster with ICTs	
	Rapid Resource Mobilisation	74% use ICTs to access early warning [i.e. alerts]	
Scale	Multi-Level Networks	67% use ICTs to interact with multi-level institutions	**71%**
	Resource Access and Partnerships	57% reported that ICTs have allowed them to work with new groups/organisations	
	Cross-Level Interactions	88% report that ICTs have improved the involvement in projects/initiatives	
Diversity & Flexibility	Different Actions/Opportunities	83% use ICTs to identify options and opportunities	**80%**
	Adaptable Decision-Making	78% use ICTs to access new information and inform farming decisions more than before	
	Innovation Backbone	78% use ICTs to access innovative ideas	
Equality	Competency Gap Reduction	N/A	**89%**
	Inclusiveness	85% report that ICTs enable opportunities for vulnerable people	
	Openness and Accountability	93% use ICTs to inform themselves about local activities	

Table 13. Summary of quantitative data on ICTs and resilience (survey data)

A quick overview benchmark of the extent to which ICTs are contributing to resilience in the community can be obtained by plotting the aggregate attribute data and the individual marker data, as shown in Figures 51 and 52. Figure 51 includes some potential icons that can be used to summarise each of the attributes.

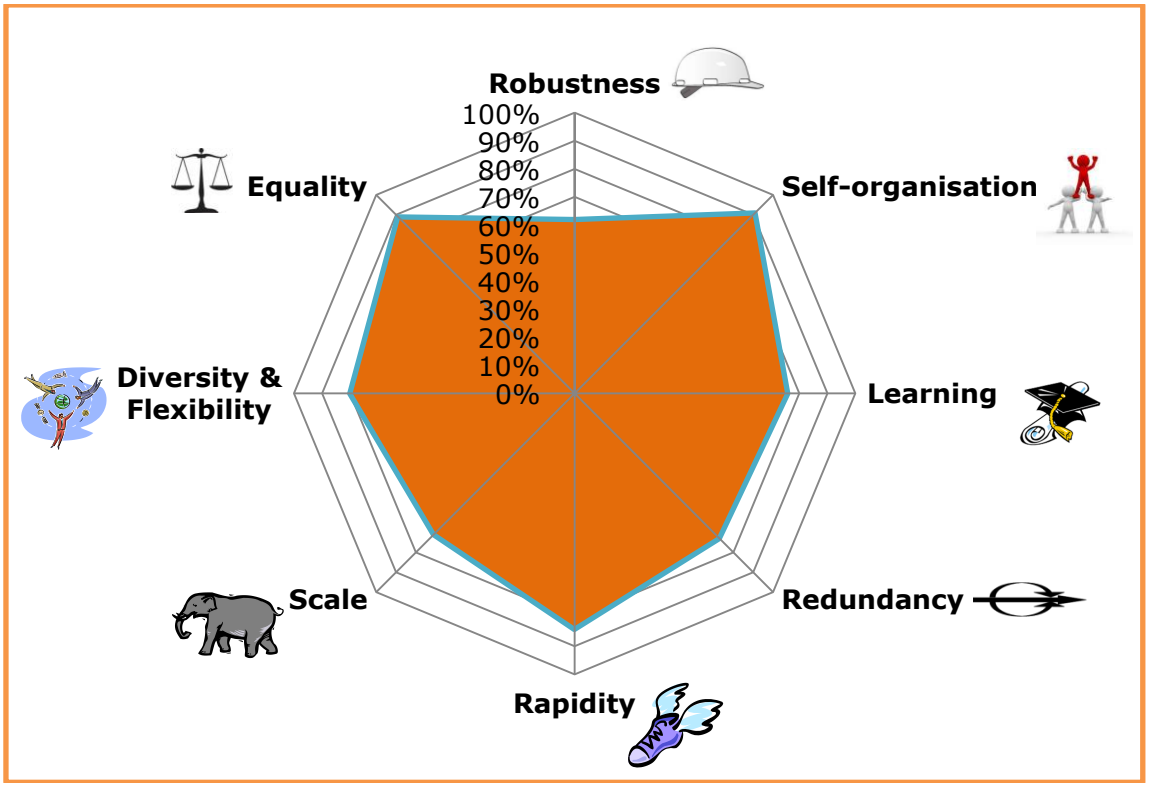


Figure 51. Contribution of ICTs to resilience attributes, Mount Elgon

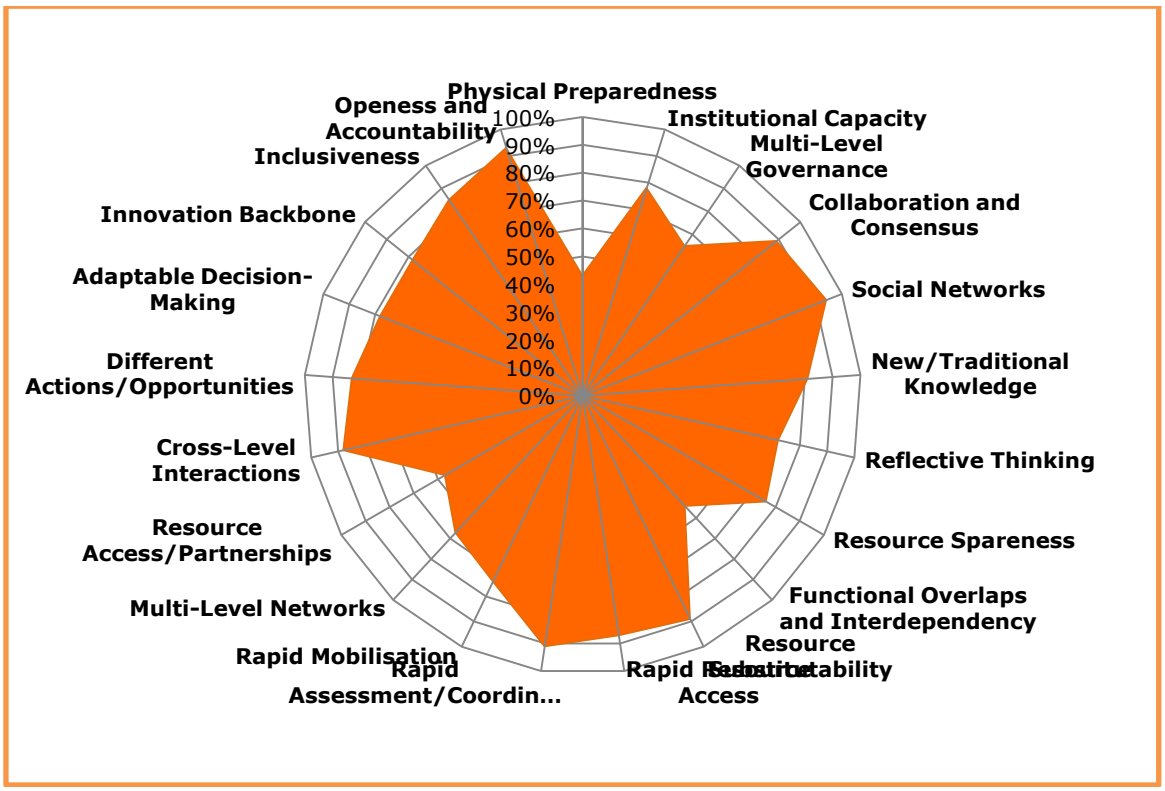


Figure 52. Contribution of ICTs to resilience markers, Mount Elgon

The relatively limited amount of white space on each of the diagrams provides a general indication that ICTs are making a contribution to the resilience of coffee farmers in Mount Elgon, although there are several areas that need to be further explored in order to maximise their potential[10] (this would also provide a useful basis for comparison between communities if RABIT were applied in multiple locations.)

What should be the priorities for future ICT-related actions with coffee farmers in this area, seeking to enhance resilience?

Table 13 and Figures 51 and 52 do provide a basis for understanding this: looking for those attributes and markers that score lowest.

However, priorities are probably better conveyed through alternative visualisations. For example, Figure 53 provides a simple "traffic light" approach to understanding priorities:

- Resilience attributes scoring **0-60%** ICT aggregate use are rated red, and are high priorities for future ICT-related intervention.
- Resilience attributes scoring **61-80%** ICT aggregate use are rated yellow, and are medium priorities for future ICT-related intervention.
- Resilience attributes scoring **81-100%** ICT aggregate use are rated green, and are low priorities for future ICT-related intervention.

Figure 53. "Traffic light" prioritisation of areas for action on ICTs and coffee farmers' resilience

A similar approach can be used for the individual markers, as shown in Table 14, but adding blue for those 'n/a' items that require further investigation.

[10] Note that these presentations ignore non-available (n/a) data.

Action Priority	Resilience Marker: Coffee Farmers, Mount Elgon
HIGH	1. Physical Preparedness 2. Functional Overlaps and Interdependency 3. Resource Access and Partnerships
MEDIUM	4. Multi-Level Governance 5. Multi-Level Networks 6. Reflective Thinking 7. Rapid Resource Mobilisation 8. Resource Spareness 9. Institutional Capacity 10. Adaptable Decision-Making 11. Innovation Backbone
LOW	12. New and Traditional Knowledge 13. Different Actions/Opportunities 14. Inclusiveness 15. Rapid Resource Access 16. Collaboration and Consensus 17. Resource Substitutability 18. Cross-Level Interactions 19. Rapid Resource Assessment/Coordination 20. Openness and Accountability 21. Social Networks
Further Investigation	22. Local Leadership and Trust 23. Capacity Building 24. Competency Gap Reduction

Table 14. Priority e-resilience markers for future action

The same components are presented more visually in Figure 54.

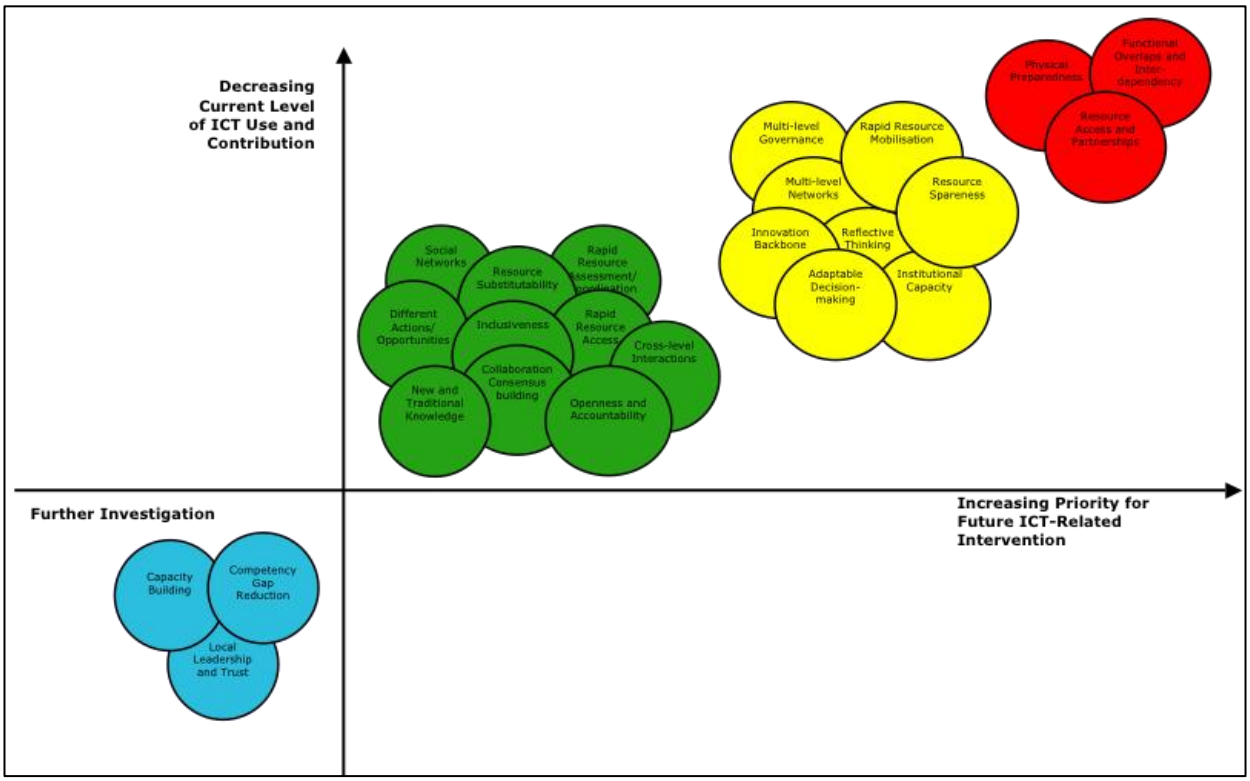


Figure 54. Bubble visualisation of priority e-resilience markers for future action

However, each of the data visualisations given so far is a strong simplification that presents only parts of the overall picture. A richer overview can be provided through the "Resilience Wheel" summary shown in Figure 55.

In order to ensure consistency, the Resilience Wheel also uses the traffic light system to visualise the level of ICT usage among Mount Elgon farmers, and to indicate areas of priority action for future ICT intervention.

A **red** ranking (resilience attributes scoring 0-60%: low level of usage) indicates high priorities for future ICT-related intervention, **yellow** (resilience attributes scoring 61%-80%: medium level of usage) indicates medium priorities for future ICT-related intervention, and **green** (resilience attributes scoring 81%-100%: high level of ICT usage) are low priorities for future ICT-related intervention.

This form of visualisation is able to incorporate all the attributes and markers, the nature of the survey data, as well as overview ratings for both markers and overall attributes. It therefore brings together in one place a number of the visualisations provided earlier. As noted above, pilot survey constraints mean the quantitative data presented here has its limitations. But the resilience wheel – like the other visualisations here – is an attempt to provide practitioners and decision makers with a practical tool that can be easily implemented and understood, and that provides an overall 'snapshot' of ICTs' contribution to resilience-building at the local level.

The wheel visualises the linkages between ICTs and resilience attributes clearly and holistically, thus helping to evaluate current initiatives or to inform the design of future actions on coffee farmers' resilience and climate change. It also facilitates the identification of resilience markers for which no data is available (marked as 'N/A') and, therefore, where further research is needs to be conducted.

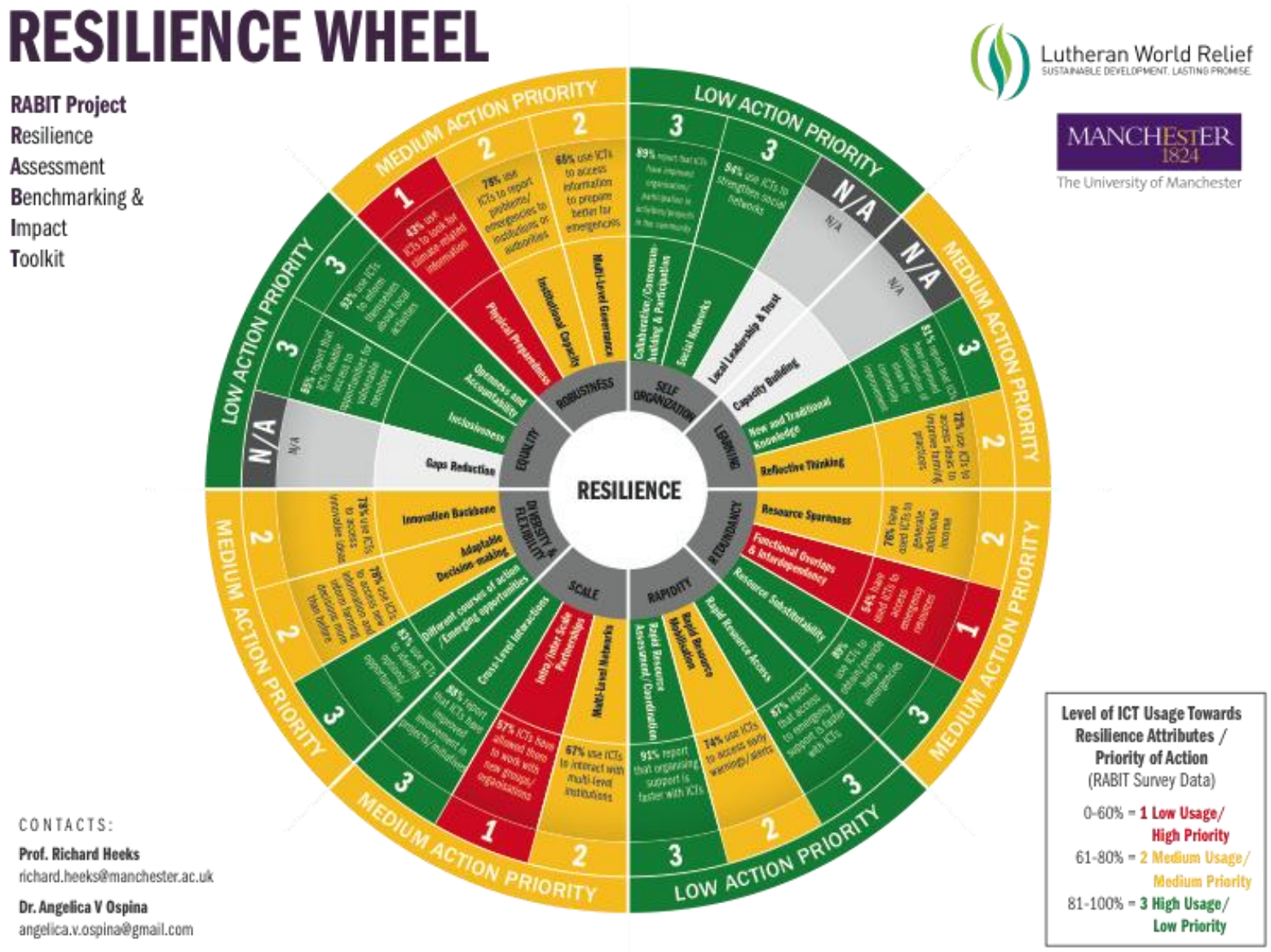


Figure 55. Resilience Wheel – Mount Elgon coffee farmers, Uganda

The data visualised above prioritises solely on the basis of current levels of ICT usage among Mount Elgon coffee farmers. We could argue that this represents **the e-resilience opportunity index:** the gap between the maximum potential use of ICTs, and their actual level of current use.

But we can also use the earlier data benchmarking community resilience attributes, taking into account the relative state of particular resilience attributes, which can be derived from the summative view of resilience attribute strength/weakness (see Figure 15). Combining the current extent of ICT use figures (Table 13) with the summative view (Figure 15)[11] we can create a **composite e-resilience priority index**. For consistency, the colours chosen for each of the categories are based on the traffic light scoring system, with red being the highest priority.

Resilience Attribute	Composite e-Resilience Priority Index	Priority
Rapidity	41%	First-Tier
Equality	45%	
Diversity & Flexibility	49%	
Scale	54%	
Robustness	67%	Second-Tier
Self-Organisation	73%	
Learning	77%	
Redundancy	87%	Third-Tier

Table 15. e-Resilience action priorities by composite index

[11] Because ICT use is expressed in percentages (Table 13), the summative numbers (Figure 15) were also converted into percentages (each one a percentage of the biggest score – redundancy). An average of both percentages was then calculated to create the composite score shown in Table 15. For example, the summative score for robustness (32) is divided by score for redundancy (44) to give a resilience strength % of just under 73%. When averaged with the e-resilience opportunity score in Table 13 of 62%, that produces a composite score of 67%.

Tables 14 and 15 can be combined to provide an overview of priorities at the level of both resilience attributes and markers, as shown in Table 16. Again, for consistency, the colours chosen for each of the categories are based on the traffic light scoring system.

Resilience Attribute	Resilience Marker
Rapidity	Rapid Resource Access
	Rapid Resource Assessment/Coordination
	Rapid Resource Mobilisation
Equality	Competency Gap Reduction
	Inclusiveness
	Openness and Accountability
Diversity & Flexibility	Different Actions/Opportunities
	Adaptable Decision-Making
	Innovation Backbone
Scale	Multi-Level Networks
	Resource Access and Partnerships
	Cross-Level Interactions
Robustness	Physical Preparedness
	Institutional Capacity
	Multi-Level Governance
Self-Organisation	Collaboration and Consensus Building
	Social Networks
	Local Leadership and Trust
Learning	Capacity Building
	New and Traditional Knowledge
	Reflective Thinking
Redundancy	Resource Spareness
	Functional Overlaps and Interdependency
	Resource Substitutability

Table 16. e-Resilience attribute and marker priorities for action

Recognising the importance of combining the different measurement approaches used for attributes (Table 15) and markers (Table 14), Table 17 provides a more detailed level of prioritisation for action by assigning a weight to each colour (red=2, yellow=1, green=0), and then adding attribute plus marker to give an overall priority weighting. Actions are recommended for those markers with a score of 2 or above.

Resilience Attribute	Resilience Marker	Priority Weighting
Rapidity (2)	Rapid Resource Access (0)	**2**
	Rapid Resource Assessment/Coordination (0)	**2**
	Rapid Resource Mobilisation (1)	**3**
Equality (2)	Competency Gap Reduction	**-**
	Inclusiveness (0)	**2**
	Openness and Accountability (0)	**2**
Diversity & Flexibility (2)	Different Actions/Opportunities (0)	**2**
	Adaptable Decision-Making (1)	**3**
	Innovation Backbone (1)	**3**
Scale (2)	Multi-Level Networks (1)	**3**
	Resource Access and Partnerships (2)	**4**
	Cross-Level Interactions (0)	**2**
Robustness (1)	Physical Preparedness (2)	**3**
	Institutional Capacity (1)	**2**
	Multi-Level Governance (1)	**2**
Self-Organisation (1)	Collaboration and Consensus Building (0)	**1**
	Social Networks (0)	**1**
	Local Leadership and Trust	**-**
Learning (1)	Capacity Building	**-**
	New and Traditional Knowledge (0)	**1**
	Reflective Thinking (1)	**2**
Redundancy (0)	Resource Spareness (1)	**1**
	Functional Overlaps and Interdependency (2)	**2**
	Resource Substitutability (0)	**0**

Table 17. e-Resilience attribute and marker: Priority weighting

Section 4. Recommendations: Strengthening Coffee Farmers' Resilience

4.1. Priority Actions on Resilience

The analysis and visualisation of data on community resilience benchmarking shown in sub-section 2.3 suggested three tiers of priorities for future action, based around the current state of the different resilience attributes. As shown in Table 18, the first two tiers alone (Tier 1 in red, Tier 2 in yellow) will provide a detailed and extensive agenda for action. 'Level of involvement' indicates which of community-level, municipality-level and national-level stakeholders would be involved.

Resilience Attribute	Resilience Marker	Intervention	Level of Involvement		
			C	M	N
RAPIDITY	Rapid resource mobilisation	• Support a multi-stakeholder, integrated plan to strengthen the local disaster preparedness and the rapidity of local response mechanisms, building on existing social networks, and addressing local priorities.	X	X	X
	Rapid resource access	• Ensure that there is an emergency action plan in place, including individual contact points within coffee farming community with clear/ established access to appropriate institutions.	X	X	
	Rapid resource assessment/ Coordination	• Implement a programme to raise local awareness on the roles and responsibilities of different institutions and actors in the case of disasters, including contact mechanisms and available resources.	X		
EQUALITY	Gap reduction	• Ensure the integration of gender components, including the monitoring of gender-related resilience impacts, as part of ongoing and future development initiatives.	X	X	
	Inclusiveness	• Design a campaign aimed at increasing women farmers' participation in community organisations, particularly in decision-making bodies (e.g. boards, committees).	X	X	
	Openness and Accountability	• Improve the dissemination of information and knowledge related to projects and initiatives implemented at the local level (e.g. project reports, evaluations, case studies, lessons) in formats that are appropriate for local audiences.		X	X
DIVERSITY AND FLEXIBTY	Adaptable decision-making	• Design a programme to foster women farmers' entrepreneurship, including training on new income opportunities and informed decision-making.	X	X	
	Innovation backbone	• Motivate and acknowledge local innovation through a competition for novel climate change adaptation practices.	X	X	X

Resilience Attribute	Resilience Marker	Intervention	Level of Involvement		
			C	M	N
	Different actions/emerging opportunities	• Foster the exchange of experiences and best practices among coffee farming communities of different regions of the country, promoting knowledge exchange on diverse adaptation and mitigation actions.	X	X	X
SCALE	Resource access and partnerships	• Organise a workshop among the different institutions involved in climate change projects in the Mount Elgon region, in order to share lessons and form new partnerships.	X	X	X
	Multi-level networks	• Foster a series of presentations to community organisations from municipal/national actors; or visits for community organisation representatives to municipal and national organisations in order to strengthen cross-scale collaboration.	X	X	X
	Cross-level interactions	• Foster multi-stakeholder collaboration (e.g. between ministries, private sector, community groups, NGOs) to invest in climate monitoring networks for data collection, in order to strengthen the accuracy of weather and climate forecasts.	X	X	X
SELF-ORGANISATION	Collaboration and participation	• Invest in community-based disaster risk reduction initiatives that have a strong component of self-organisation, building on existing social networks.	X	X	
	Social networks	• Deepen local awareness on the role of social capital and social memory in the adaptation of coffee farming communities.	X		
	Local leadership and trust	• Implement an initiative to strengthen the capacity of local leaders in areas that are key to the community's adaptive priorities to climate change impacts.	X		

Table 18. Priority actions to improve coffee farmers' resilience in Mount Elgon

4.2. Priority Actions on e-Resilience

We can similarly use the analysis and visualisation of data shown in sub-section 3.3, which benchmarks ICTs and resilience in the community. Any of the visualisations could have been used as the basis for prioritising future ICT-related interventions. However, here we make use of Table 17, itself an amalgamation of Tables 14 and 15. Following prioritisation principles, actions are initially recommended only for those markers with a score of **2 or above** as those are key priorities. The results are shown in Table 19 and, as in the previous sub-section, 'Level of involvement' indicates which of community-level, municipality-level and national-level stakeholders would be involved.

Priority actions reflected in Table 19 include the suggestions gathered from the participants that attended the RABIT learning event held in Kampala, Uganda, on September 2014 (further details about the event are available in Annex 13).

Resilience Attribute Priority	Resilience Marker Priority	Overall Priority Weighting	e-Resilience Intervention	Level of Involvement		
				C	M	N
RAPIDITY (2)	Rapid Resource Access (0)	**2**	• Implement a system to track the performance of e-payments for farmers' coffee (introduced by LWR/GCCE), and its impact on the rapidity of local responses to stressors such as climate change. • Ensure rapid resource access through the improvement of information delivery to farmers (e.g. by sending relevant information directly to the farmers' mobile phones, from different sources).	**X**	**X**	
	Rapid Resource Assessment/ Coordination (0)	**2**	• Strengthen and formalise early warning systems by maximising the CKW network to disseminate information quickly, and collect information about emergencies at early stages.	**X**	**X**	
	Rapid Resource Mobilisation (1)	**3**	• Develop an effective early warning system combining diverse communication methods and technologies e.g. alerts via SMS, radio and face-to-face interactions among community members and institutions.	**X**	**X**	**X**
EQUALITY (2)	Competency Gap Reduction	**-**	**-**	**-**	**-**	**-**
	Inclusiveness (0)	**2**	• Use ICTs to improve women's access and participation in the various stages of the coffee supply chain, including their understanding of the coffee market and financial services. • Use ICTs to foster a more inclusive engagement of community members in projects and activities, especially youth, elders, and people with disabilities. • Use ICTs to increase the access of women, elderly and other vulnerable groups to locally relevant information, both directly (e.g. providing extra support to use new technology for elderly) and indirectly (e.g. providing extra support from CKWs or youth). • Identify and implement ICT applications that help vulnerable groups to better adapt to the impacts of climate change.	**X**	**X**	
	Openness and Accountability (0)	**2**	• Use ICTs to improve accountability and transparency (at the household level and within farmers' groups) by providing updated information about coffee prices offered locally. • Design a mobile app to increase the transparency and accountability of community savings schemes (e.g. for members to be able to	**X**	**X**	

			track their balance, the amounts owed by the members, and the transactions made).			
DIVERSITY AND FLEXIBILITY (2)	Different Actions/ Opportunities (0)	**2**	• Use ICTs to provide access to a database of insurance companies and banking institutions that offer services to farmers, allowing them to identify diverse services / opportunities. • Use ICTs to match the demand and supply of services to coffee farmers, fostering partnerships with private sector institutions and the identification of new business opportunities.	**X**	**X**	
	Adaptable Decision-Making (1)	**3**	• Ensure that actions aimed at fostering new access to weather information, agricultural practices, sharing of ideas, knowledge brokering, etc, provide new information to enable new decisions.	**X**	**X**	
	Innovation Backbone (1)	**3**	• Use ICTs to foster local access to best farming practices/adaptive experiences from other regions of Uganda and/or other countries, ensuring that the content is appropriate and from trusted sources, and that farmers can adapt it or gain inspiration to address local priorities.	**X**	**X**	**X**
SCALE (2)	Multi-Level Networks (1)	**3**	• Use ICTs to facilitate multi-stakeholder dialogue and information sharing on climate change-related projects/issues in the Mount Elgon region (e.g. sharing project information and local activities through Facebook, mailing list, Twitter, etc).	**X**	**X**	**X**
	Resource Access and Partnerships (2)	**4**	• Foster the farmers' ability to make use of external weather information from national-scale organisations such as FEWSNET (a well established food security system that provides seasonal forecasts and makes the information available online). • Use ICTs to engage stakeholders at multiple levels in the development of climate information services that address local information needs. • Use ICTs to raise farmers' awareness about financial services that are available at various levels (e.g. local, regional).	**X**	**X**	**X**
	Cross-Level Interactions (0)	**2**	• Work with national and local governments to ensure effective use of ICTs in communications with coffee farming communities.	**X**	**X**	**X**
ROBUSTNESS (1)	Physical Preparedness (2)	**3**	• Foster investment in the improvement of network coverage, including the use of local signal boosters to expand connectivity in rural areas. • Use ICTs to provide coffee farming	**X**	**X**	**X**

			communities with well-visualised overviews of climate change impacts, and priorities for adaptive actions at the local level. • Make greater use of geographic information systems to map climate change, and to plan development of physical defence infrastructure. • Use ICTs to strengthen meteorological services, including the localisation of climate science for non-scientific audiences.			
	Institutional Capacity (1)	**2**	• Use ICTs to strengthen the institutional capacity of farmers' organisations, and to make them more efficient (for example by using mobile money to reduce cash-based transactions).	**X**		
	Multi-Level Governance (1)	**2**	• Use ICTs to improve multi-level governance by fostering information sharing from farmers to Primary and Secondary societies. • Use ICTs to create and maintain an updated database of farmers' organisations.	**X**	**X**	
SELF-ORGANISATION (1)	Collaboration and Consensus Building (0)	**1**	• Post an updateable (e.g. as wiki) list of relevant community, municipality and national institutions of relevance to environmental and community development (e.g. including contacts, responsibilities and resources). • Use mobile phones to share information between coffee cooperatives and to coordinate actions.	**X**	**X**	
	Social Networks (0)	**1**	• Foster peer-to-peer learning and interactions among farmers using social networking tools (e.g. "Coffee farmers' Facebook"). • Use ICTs to inform and involve local leaders in local projects and initiatives, improving their ability to mobilise community members and strengthen existing networks.	**X**		
	Local Leadership and Trust	**-**	**-**	**-**	**-**	**-**
LEARNING (1)	Capacity Building	**-**	-	**-**	**-**	**-**
	New and Traditional Knowledge (0)	**1**	• Develop an interactive e-learning course on climate change, local impacts, and adaptive practices. • Use ICTs to document, visualise and share existing/traditional knowledge on adaptive practices. • Use ICTs to disseminate, share and explore local/community knowledge on adaptation, and to strengthen local adaptive capacity. • Use ICTs to document traditional	**X**	**X**	**X**

			climate-resilient farming methods, and to assess if they can be adapted and adopted under different scenarios. • Use ICTs to improve the synthesis, structure and management of information, including information about market prices for coffee farmers. • Use ICTs to enhance learning of young people (from primary school) particularly on innovative agricultural practices, contributing to their involvement in farming, and to the generational transfer of farming activities. • Provide access to technologies and capacity-building opportunities on ICTs to strengthen the technical assistance provided by CKWs and extension officers.			
	Reflective Thinking (1)	**2**	• Implement programmes that combine mobile-enabled information and face-to-face dissemination, to foster discussion among farmers/peer-to-peer learning and reflective thinking.	**X**		
REDUNDANCY (0)	Resource Spareness (1)	**1**	• Run a basic training programme to create capacity among farmers on how to use ICTs to increase their income level. • Foster the use of mobile phones to disseminate information about intercropping and organic farming practices, to increase farmers' income.	**X**	**X**	**X**
	Functional Overlaps and Interdependency (2)	**2**	• Use ICTs to raise awareness about organic farming practices that contribute to multiple purposes (e.g. shade trees, organic manure).	**X**		
	Resource Substitutability (0)	**0**	• Create local awareness on how to use ICTs to access emergency resources from various sources/institutions. • Design an online list of resource-providing institutions; including volunteer resources that are available to local organisations and farming communities.	**X**	**X**	**X**

Table 19. Priority actions to improve coffee farmers' e-resilience in Mount Elgon

4.3. Future Research Agenda on e-Resilience

In addition to these recommendations, Table 20 provides a list of (non-exhaustive) examples of topics that could form the future research agenda in this field. While the examples pertain to the role of ICTs in the resilience of Mount Elgon coffee producers, they could be applied to agricultural communities more generally.

Robustness
Further research could be conducted on the role of ICTs towards institutional resilience, including institutional capacity building and governance strengthening.
Self-organisation
Future research could focus on the role of local organisations in self-organisation, as well as on the risks related to ICT adoption (e.g. widening knowledge gaps between farmers and CKWs, creating dependencies).
Learning
Future research could explore strategies to overcome the perceived disadvantages of ICT tools at the local level (e.g. connectivity, cost, distrust/family instability, privacy concerns), in order to foster their role in resilience building, including learning processes related to climate change.
Redundancy
Future research could look into innovative mechanisms to ensure articulation between redundant information channels, with emphasis on the quality and relevance of the content that is disseminated. Research could also look at the role of ICTs in the generation of redundant financial resources in agricultural communities.
Rapidity
Areas for future research include the implications of increasing access to mobile services, particularly in the case of emergency situations related to climate change impacts.
Scale
Future research could look at the linkages between mobile-enabled inter-scale interactions and collaborative projects in the field, as well as at the role of ICTs in fostering two-way knowledge exchange among stakeholders (as opposed to one-way information dissemination).
Diversity and Flexibility
Future research could help identify if increased access to information and knowledge (e.g. via CKWs, own mobile phones, mobile-enabled networking across scales) has translated into innovative actions and livelihood improvement, including adaptive actions to climate change impacts. Research could also look at the role of ICTs in both short- and long-term decision-making, particularly as it pertains to climate change stressors.
Equality
Future research is needed on the role played by ICTs towards openness and accountability in order to understand, for example, the impact of ICT usage on women's resource access and their role within local decision-making.

Table 20. Examples of topics for the future research agenda on e-Resilience

ANNEX 1: SMART Coffee Project, LWR

Source: LWR, http://lwr.org/

SMART Coffee Project (Sustainable Marketing of Arabica through Technology)

LWR has been working in Uganda since 1985, with a concentration in the Bugiri, Busia, Kapchorwa, Mbale, and Rakai Districts. LWR's partnership with large coffee and maize cooperatives in Uganda has improved the quality as well as increased the volume of sales for both commodities. LWR's coffee partnerships have enabled over 13,000 small-scale coffee farmers to directly export to specialty coffee and retail marketing outlets. With improved coffee quality, the farmers now receive a higher return than the organic and fair trade premiums.

The Project

Since 2008, LWR has partnered with GCCE to improve the coffee value chain for over 6,000 smallholder farmers in Uganda. This partnership has transformed GCCE from an organisation that was registering losses of $250,000 in 2007, into an internationally-recognised specialty coffee brand, generating annual net profits of over $500,000. The main lessons learned from this project and new realities on the ground were the basis for the development of this new 39-month project targeting 15,000 smallholder coffee farmers. LWR leveraged resources ($479,986) from a wide variety of stakeholders, including GCCE, the Grameen Foundation, Opportunity Bank Uganda, MicroEnsure and We Effect, to support this project.

In order to achieve its goal, the project uses a two-pronged approach to strengthen the farmer organisations to market higher quality and quantity of coffee, while at the same time helping smallholder farmers enhance productivity through increased investment in production and post-harvest handling and the use of ICT-enabled provision of agricultural extension and financial services and marketing to bring about positive and sustainable improvement in their lives.

Further information: http://programs.lwr.org/africa/uganda/smart

ANNEX 2: Community Knowledge Worker (CKW) Initiative

Source: Grameen Foundation, http://www.grameenfoundation.org

(a) Community Knowledge Worker (CKW) Initiative

The Community Knowledge Worker (CKW) initiative is a social enterprise that empowers smallholder farmers and rural communities to improve their livelihoods through the utilisation of innovative mobile technologies. This initiative was founded in 2009 by Grameen Foundation as a way to address information poverty. The CKW network is comprised of over 1,000 Community Knowledge Workers in over 40 districts to engage with hard-to-access populations across Uganda.

Grameen Foundation believes that the combination of a network of human intermediaries armed with mobile technology can reach the poorest and most remote farmers and has the power to transform the agricultural extension service through cost reductions, reaching masses but also as a platform for delivering other products and opportunities like financial services and establishing social enterprises.

Grameen identifies and trains trusted community members – who are also farmers – to disseminate to and collect agriculture-related information from their farmer neighbours via smart phones. CKWs are nominated by peers within their communities based on their reputation as trusted community leaders with a spirit of service to share information about:

- Best practices to increase yields
- Information about crop rotation and terracing
- Up-to-date market prices
- Weather forecasts
- Local supplies and service providers
- Cost-effective ways to deal with pests and diseases

Farmers benefit in two ways from the services of their trusted CKW:

1. They immediately get access to up-to-date and relevant information on weather, agronomy practices, crop disease prevention, and markets; and
2. By answering the CKW's survey questions on their farming habits and challenges, they provide critical data that organisations serving them can analyse to improve services and better meet their needs.

Each CKW receives performance-based incentive pay for the number of farmers reached and agricultural tips provided. In addition, Grameen trains CKWs as enumerators so they can conduct surveys for a number of other agricultural government and non-governmental organisations, collecting real-time farmer-level information on plot size, commodities, income levels, and technology use. The information gathered from such surveys has proven very useful in better understanding farmer needs and how best to serve them.

Source: Grameen Foundation (2011) 'Uganda Survey Creation Portal: User Manual'
Further information: http://www.grameenfoundation.org/what-we-do/agriculture/community-knowledge-worker

(b) CKW's Mobile Solution Features

- **The App Suite:**

  There are in-house developed mobile applications that were started in Uganda to support the CKW programme which focused primarily on agricultural extension and comprise Search, Surveys, and Pulse. CKW tools have been used for the last 4 years in the field and have been under active development in support of the Uganda programme.

- **Search:**

  CKW search is a menu-driven knowledge base accessed via a user on a phone or tablet. It is built on Salesforce.com and Android devices. Salesforce.com acts as the data repository and is used to administer the system. Salesforce.com is cloud-hosted, so requires Internet access to use it. Android devices are used by CKWs to interact directly with farmers. The Android client can connect across the Internet and then work in an offline mode. CKW Search allows a CKW to share resources from an information library with Search. A CKW can do on-location inquiry into any issues supported by the knowledge base. To date, the Search content has been configured for agriculture-related use. CKW Search is in use in Uganda out of the CKW Salesforce instance.

- **Survey:**

  The Survey App is a data collection application that hosts custom-designed surveys. Survey allows CKWs to navigate a series of survey questions, respond to each of them, and automatically transfer the data to a database hosted on Salesforce. The Technology Team used open-source code from Open Data Kit as its initial foundation, and then expanded upon it to meet the custom needs of CKWs and partners. The App is designed to support data-rich surveys that include a variety of question formats and response styles and are linked to GPS locations and performance tracking systems.

- **Pulse:**

  CKW Pulse provides messaging from an admin user to a user on a phone or tablet. And ticket logging from the field to the head office. CKW Pulse is built on Salesforce.com and Android devices. Salesforce.com acts as the user and data repository and is used to administer the system. Android devices are used by CKWs to interact directly with farmers. CKW Pulse allows a CKW to communicate with headquarters. Pulse allows direct communication with the CKW with data messages, which are cheaper than SMS.

Source: Grameen Foundation (2011) 'Uganda Survey Creation Portal: User Manual'
Further information: http://www.grameenfoundation.org/what-we-do/agriculture/community-knowledge-worker

ANNEX 3: RABIT Survey, Uganda Pilot

RABIT UGANDA SURVEY: ICTs and Climate Change Resilience

Dear farmer, I am a Certification Officer working with Gumutindo. This survey is part of a project between LWR-Gumutindo and the University of Manchester in your locality. Our goal is to collect information about the use of new technologies (mobile phones and Internet), and how these technologies could contribute to strengthen the livelihood of coffee farmers. All information will be used for research purposes only, and it will be kept confidential. We won't be using your name. When you agree to participate in this research project you still have every right to quit at any time if you want, or not to answer any questions you are uncomfortable with. Your responses will be entered in the mobile phone [**SHOW MOBILE PHONE TO THE FARMER**], so your opinions can be processed in an efficient manner. We will do our best to share the results through your primary Society.

DO YOU HAVE ANY QUESTIONS?

DO YOU AGREE TO PARTICIPATE IN THIS STUDY?

Ⓐ. Yes

Ⓑ. No

PART I: Characteristics of the Interviewee

1. Gender	**2. Age range**	**3. Are you a coffee farmer?**	**4. In addition to coffee farming, what other economic activities are you engaged in? [Select all that apply]**
Ⓐ. Female Ⓑ. Male	Ⓐ 18 to 25 years old Ⓑ 26 to 35 years old Ⓒ 36 to 45 years old Ⓓ More than 46 years old	Ⓐ Yes Ⓑ No	Ⓐ Sell other crops Ⓑ Employed formal (e.g. teacher, shop tender) Ⓒ Self-employed beyond coffee (e.g. trading) Ⓓ None

5. What is the highest level of education you have achieved?

Ⓐ No formal education
Ⓑ Primary
Ⓒ Secondary
Ⓓ Tertiary/University
Ⓔ Other [specify]

PART II: Information and Communication Technologies (ICTs)

6. Do you own a mobile phone?	**6.1 If yes, how many mobile phones do you own?**	
Ⓐ. Yes Ⓑ. No [If No, go to question 6.5]	Ⓐ 1 [If 1, go to question 6.3] Ⓑ 2	Ⓒ 3 Ⓓ More than 3

6.2 If more than one mobile phone, Why? [Select all that apply]

Ⓐ Network coverage
Ⓑ Lower rates/savings
Ⓒ Gift (e.g. from relatives/friends)
Ⓓ Privacy
Ⓔ Upgraded to a better model

Ⓕ Provided by employer
Ⓖ Others

6.3. How many SIM cards do you own?

Ⓐ 1 [If 1, go to question 6.6]
Ⓑ 2
Ⓒ 3
Ⓓ More than 3

6.4 If more than one SIM card, Why? [Select all that apply]

Ⓐ Network coverage
Ⓑ Lower rates/savings
Ⓒ Gift (e.g. from relatives/friends)
Ⓓ Privacy
Ⓔ Provided by employer
Ⓕ Others

6.5. If you don't own a mobile phone, do you have access to one?

Ⓐ Yes
Ⓑ No

6.6 What do you use the mobile phone for? [Select all that apply]	**6.7 In your opinion, what are the main benefits of using a mobile phone?**
Ⓐ Make and receive calls	Ⓐ Saves money/transportation costs
Ⓑ Send/receive text messages	Ⓑ Saves time
Ⓒ Games	Ⓒ Easy access to information
Ⓓ Internet	Ⓓ Improves family relations/networking with friends
Ⓔ Mobile money services	Ⓔ Easy access to cash transfers [e.g. mobile money/banking]
Ⓕ Mobile banking	Ⓕ Facilitates business
Ⓖ Listen to the radio	Ⓖ Others [specify]
Ⓗ Others [specify]	

6.8 In your opinion, what are the main disadvantages of using a mobile phone?

Ⓐ Costly/expensive
Ⓑ Family instability/mistrust
Ⓒ Reduction of face-to-face interactions
Ⓓ Unreliable information
Ⓔ Others (specify)
Ⓕ None

7. Do you use a computer with Internet?	**7.1 If yes, where do you access it? [Select all that apply]**
Ⓐ Yes	Ⓐ Home
Ⓑ No [If No, go to question 8]	Ⓑ Internet Café/Community Resource Centre
	Ⓒ School/ Training institution
	Ⓓ Work
	Ⓔ At family or friends'
	Ⓕ Others (specify)

7.2 What do you use the Internet for? [select all that apply]	**7.3 In your opinion, what are the main benefits of using the Internet? [Select all that apply]**
Ⓐ E-mail	Ⓐ Saves money/transportation costs
Ⓑ Social networking [e.g. Facebook]	Ⓑ Saves time

Ⓒ Work-related information Ⓓ School homework Ⓔ Others (specify)	Ⓒ Easy access to information Ⓓ Improves family relations/networking with friends [e.g. Facebook] Ⓔ Facilitates business Ⓖ Others [specify]

7.4 In your opinion, what are the main disadvantages of using the Internet? [Select all that apply]

Ⓐ Costly/expensive
Ⓑ Family instability/mistrust
Ⓒ Reduction of face-to-face interactions
Ⓓ Unreliable information
Ⓔ Others [specify]

7.5 Which Internet social networks do you use and for what purpose? [Select all that apply]

Social Networking Tool	Usage (YES/NO)	YES: For what purpose?
Facebook		
Whatsup		
Twitter		

Other:

7.6. Have you received training through the Internet [e.g. online courses, distance learning on the Internet]?	7.7 If yes, which online training have you received?
Ⓐ Yes Ⓑ No Ⓒ Doesn't know / No answer	

PART III: Resilience Sub-properties

ROBUSTNESS

8. Do you use the mobile phone/Internet to access information about the weather?

Ⓐ Yes
Ⓑ No
Ⓒ Doesn't know / No answer

8.1. Do you get weather information from your own mobile phone/Internet, or from the CKW? [Select all that apply]

Ⓐ Own mobile phone
Ⓑ Community Knowledge Worker
Ⓒ Others [specify]

8.2 Do you use the mobile phone/Internet to access information that helps you prepare for weather-related emergencies [e.g. floods, landslides]?

Ⓐ Yes
Ⓑ No
Ⓒ Doesn't know / No answer

8.3. Do you use the mobile phone/Internet to report emergencies to institutions/authorities [e.g. local councils, sub-county, NGO-Red Cross, police, primary society]?	8.4 If yes, to which institutions do you report to?
Ⓐ Yes	

Ⓑ No Ⓒ Doesn't know / No answer	
SELF-ORGANISATION	
9. Has the mobile phone/Internet made easier or more difficult to organise and participate in community activities? [e.g. in community projects]	
Ⓐ Easier Ⓑ More difficult Ⓒ Doesn't know / No answer	
9.1 In your opinion, has the mobile phone/Internet helped you to strengthen relationships with other people? (e.g. helping others, attend meetings, forming groups)	
Ⓐ Yes Ⓑ No Ⓒ Doesn't know / No answer	
LEARNING	
10. Since you have access to the mobile phone/Internet, do you share experiences about weather-related emergencies more or less with your neighbours?	
Ⓐ More Ⓑ Less Ⓒ Doesn't know / No answer	
10.1 Do you use the mobile phone/Internet to identify ideas to improve your farming practices?	
Ⓐ Yes Ⓑ No Ⓒ Doesn't know / No answer	
10.2 Do you get ideas to improve your farming practices from your own mobile phone/Internet, or from the CKW? [select all that apply]	
Ⓐ Own mobile phone Ⓑ Community Knowledge Worker Ⓒ Other	
REDUNDANCY	
11. Do you use the mobile phone/ Internet to generate some additional money to your normal income (e.g. do business)?	**11.1 Do you use the mobile phone/Internet to obtain or provide help to neighbours when there are weather emergencies [e.g. heavy rains, landslides, droughts] in your community?**
Ⓐ Yes Ⓑ No Ⓒ Doesn't know / No answer	Ⓐ Yes Ⓑ No Ⓒ Doesn't know / No answer
11.2 From what sources do you get information about coffee production? [Select all that apply]	
Ⓐ Radio set Ⓑ Mobile Phone Ⓒ Internet Ⓓ CKWs/Gumutindo staff Ⓔ Government extension workers Ⓕ Other farmers Ⓖ Others	

11.3 Do you use the mobile phone/Internet to request or receive resources in cases of emergency [e.g. government aid, donations, NGO]?	
Ⓐ Yes Ⓑ No Ⓒ Doesn't know / No answer	
RAPIDITY	
12. Has having a mobile phone/internet made access to help in cases of emergency [e.g. landslide, heavy rain, floods] faster or slower for you?	**12.1 Do you have access to Early Warning Systems through the mobile phone/Internet?**
Ⓐ Faster Ⓑ Slower Ⓒ Doesn't know / No answer	Ⓐ Yes Ⓑ No Ⓒ Doesn't know / No answer
12.2. If you do access Early Warning Systems, do you access them through your mobile phone, or through the CKW? [select all that apply]	
Ⓐ Own mobile phone Ⓑ Community Knowledge Worker Ⓒ Other	
12.3 Has having a mobile phone/internet access allowed you to organise support in case of a weather-related emergency faster or slower? [e.g. organise support from neighbours, family, friends, institutions].	
Ⓐ Faster Ⓑ Slower Ⓒ Doesn't know / No answer	
SCALE	
13. Has the mobile phone/Internet allowed you to work with new groups or organisations from outside your community? [e.g. other primary societies, CBOs, Red Cross, primary societies, government]	**13.1 If yes, mention the groups/organisations**
Ⓐ Yes Ⓑ No Ⓒ Doesn't know / No answer	
13.2 Has the mobile phone/Internet allowed you to get involved in projects related to weather emergencies [e.g. landslides, floods]?	**13.3 If yes, which projects related to weather emergencies are involved in?**
Ⓐ Yes Ⓑ No Ⓒ Doesn't know / No answer	
13.4 With the access to the mobile phone/Internet do you have more or less interactions than before with institutions? [e.g. primary societies/cooperatives, NGOs, committees)	
Ⓐ More than before Ⓑ Less than before Ⓒ Doesn't know / No answer	

DIVERSITY AND FLEXIBILITY	
14. Do you use the mobile phone/Internet to access innovative ideas that you can apply to you farming practices?	**14.1. Has the mobile phone/Internet allowed you to get information [e.g. about new opportunities, loans/credit, government programmes] that helps improve your family's life?**
Ⓐ Yes Ⓑ No Ⓒ Doesn't know / No answer	Ⓐ Yes Ⓑ No Ⓒ Doesn't know / No answer
14.2 Has the mobile phone/Internet helped you understand practices to prepare/adapt for weather emergencies? [e.g. planting more trees, terracing, trenches]	
Ⓐ Yes Ⓑ No [If No, go to question 14.4) Ⓒ Doesn't know / No answer	
14.3 Do you get information to prepare/adapt for weather emergencies from your own mobile phone/Internet or from the CKW? [select all that apply]	
Ⓐ Own mobile phone Ⓑ Community Knowledge Worker Ⓓ Others (specify)	
14.4 Do you get information from the mobile phone/Internet more or less often to inform your farming business decisions? [e.g. production or marketing decisions]	
Ⓐ More than before Ⓑ Less than before Ⓒ Doesn't know / No answer	
14.5 Do you get information to inform your farming decisions from your own mobile phone/Internet, or from the CKW? [select all that apply]	
Ⓐ Own mobile phone Ⓑ Community Knowledge Worker Ⓒ Other	
EQUALITY	
15. Has the mobile phone/Internet access helped vulnerable people in your community [e.g. elderly, women, disabled] to access resources?	**15.1 Has mobile phone/Internet access strengthened or weakened your belonging to the community?**
Ⓐ Yes Ⓑ No Ⓒ Doesn't know / No answer	Ⓐ Strengthened it Ⓑ Weakened it Ⓒ Doesn't know / No answer
15.2.Do you use the mobile phone/Internet to inform yourself about activities [e.g. training, meetings] taking place at the Primary Society/Cooperative?	
Ⓐ Yes Ⓑ No Ⓒ Doesn't know / No answer	
THANK YOU! **CAPTURE GPS IN SMARTPHONE**	

ANNEX 4: RABIT Interview Guidelines, Uganda Pilot

Interview Guidelines: MICRO/MESO Level Actors RABIT – UGANDA
A. LOCAL CONTEXT
• What are the positive characteristics/strengths of the community? • What are the problems faced by the community? And what are the external problems that do not originate in the community, but that affect it? • In the time that you have lived in this community, what have been the situation of emergency or risk that you have had to face? For example, moments of crisis or disasters that needed to be overcome?
B. CLIMATE CHANGE IMPACTS AND LOCAL RESPONSE
• In your experience, has there been any incident related to climate change that has affected the community? • What was the response to those impacts? What did you do, why, and who helped you? • Are there any measures that have been taken to prevent or mitigate those impacts in the future?
C. COMMUNITY RESILIENCE [coffee farmers]
Robustness
• In your opinion, is the community prepared to respond to disasters or climatic events/emergencies? • Is there any physical infrastructure/physical measures that have been adopted in the community to prevent damages in case of climatic emergencies? • Are members of the community in contact with the institutions that operate in this area? (e.g. committees, authorities)? Do they coordinate actions with those institutions? • How vulnerable is the community's infrastructure/ housing to the impact of climatic emergencies or events? • Do you know of any laws, policies that help to reduce the risk of the community to climatic events?
Self-organisation
• What can you tell me about the capacity of the community members to organise among them, in case of crisis or problems? • Is there a high or a low degree of trust among members of the community? • Are there social networks or networks of collaboration operating in the community? How strong are those networks? • Are you a member of local groups or associations?
Learning
• Do you think that the community has learned from past experiences, for example in the case of natural disasters or climatic events? If yes, how did that learning took place? (for example, with the help of which tools or which groups) • Is it common for people in the community to share their experiences and their knowledge with each other? Or are they rather guarded with their knowledge? • Has any training/awareness raising activity about climate change taken place in this community? Do you know if those issues are taught to youth at school? • Do you think that traditional knowledge/indigenous practices are being taken into account, or are being lost?
Redundancy
• Do community members generally depend on a single income source, or do they have access to multiple sources? (e.g. do they sell different products, receive remittances) • In this community, are there several institutions/organisations that work on the same issues? (for example, multiple cooperatives, multiple NGOs)

- If you were not able to access support from family and neighbours in times of emergency, who would you go to for help?
- Community members have the custom of saving money? In cases of disasters or emergencies, do they have contingent financial resources that they can use?

Rapidity

- Do you consider that, in case of emergency or climatic events, the community responds and acts rapidly?
- Do you consider that community members can access resources swiftly? For example, immediate support from friends/institutions/insurances, in case of need?
- Do you know of any Early Warning System operating in this area?

Scale

- In your opinion, members of the community are in contact with institutions/organisations that are not based in this area? For example, with institutions that operate at the regional or national level? Which institutions? For what purpose are they in contact?
- In situations of emergency or crisis, have community members received support from institutions or groups that are not part of the community?
- Do you know of any examples of associations or collaborative work between the community, the private sector, NGOs and/or local/national authorities?

Diversity and Flexibility

- Do you consider that the community adapts well to change? For example, to changes in the economic, political or environmental situation
- In your opinion, do community members identify options to do things differently from the past? For example, in cases of emergencies or disasters, do they look for options, or apply the same measures that they have always used?
- What are the main sources of information for community members? Where do they access information?
- Do you think that the community implements innovative practices? Can you give me any examples?
- Do you consider that community members see change as a threat or as an opportunity?

Equality

- In your opinion, the decisions that affect the community are taken in a participative manner?
- Are there gaps among different community groups, for example between seniors and youth, or among people with higher and lower income?
- Do you consider that the needs and opinions of all community members (including seniors, youth, women head of households) are being heard and considered? (for example as part of community projects/initiatives, local organisations)

D. ROLE OF ICTs

- In your opinion, what is the rate of usage or adoption of mobile phones in the community? And of the Internet?
- What have been the main benefits of using ICTs in the community? Has anything improved or change for better, from the way it was in the past? Has anything worsen?
- What are the main challenges that exist locally to access and use the mobile phone? And the Internet? For example, do you face any difficulties when using these tools?
- When there has been climatic emergencies or events [such as the ones you mentioned before] have ICTs been used? For what purpose?

Any final comments? **THANK YOU**

ANNEX 5: Focus Group Facilitator's Guide

Climate Change, Resilience and ICTs: RABIT Uganda
Focus Group Facilitator's Guide

Participants: Coffee farmers (15-20), including women, youth +18, elders.
Setting of the chairs: CIRCLE
To start: Each farmer introduce him/herself (e.g. name and region where they come from). Ice-breaker activity.
Time management: One hour of intensive discussion + half and hour of clarifications/wrap-up

1) INTRODUCTION:

Explain the purpose of the focus group:

- To LEARN from the experience of farmers.
- To GATHER and UNDERSTAND their opinion about the weather events/climatic changes that are affecting their livelihood.
- To IDENTIFY how are the farmers using new technologies: Mobile phones and Internet, including the opportunities and the challenges of using these tools.

2) GROUND RULES OF THE FOCUS GROUP:

- This is NOT a training session, the opinion that matters is not the opinion of the facilitator, but the opinion and experiences of the farmers. The role of the facilitator is to animate and moderate the discussion.
- Participants have the right to leave at any time.
- Respect for each other's opinion. Participants should not be shunned in any way for having opinions that are different from the rest of the group.
- Use of proper language not to offend the other participants.
- Not speak while others are speaking- avoid simultaneous discussions. Respect the opinion of others.
- Encourage expression of different opinions.
- Efforts will be made to protect the confidentiality of the participant's' comments. However, due to the group setting, participants should be aware of the disclosure of any sensitive information.
- The information that they will be provided will remain anonymous – no names will be associated with the opinions shared.

3) GROUP DISCUSSION: MAIN ISSUES TO ADDRESS (to generate farmers' feedback)

The following are the main research topics to be addressed during the focus group discussion. The moderator will pose additional questions at different stages (according to the group's dynamic) in order to animate the discussion and ensure that the focus group's objectives are met.

3.1. THEME ONE: Introductory Stage: Context of Uganda's coffee farmers

- What are the main strengths or positive qualities of coffee farmers [of this region]? [could be physical characteristics, economic or social aspects, knowledge etc]

- What are the main problems or development challenges faced by coffee farmers [of this region]? [could be for example economic problems, infrastructure, natural resources, problems with the crops etc]

WHAT ACTIVITIES CAN YOU IMPLEMENT TO ANIMATE THIS DISCUSSION?

3.2. THEME TWO: Climate change impacts on coffee livelihoods

- Have you noticed or experienced changes in the climate? [e.g. **MANIFESTATIONS:** more frequent/intense rainfall, changes in the seasons, more extreme/prolonged drought]
- Have you experienced more extreme weather events?
- Can you share with the group your experience?
- How have those changes affected your livelihood? / What have been the effects of climatic changes on your crop? On your farming practices? [e.g. **IMPACTS**]

WHAT ACTIVITIES CAN YOU IMPLEMENT TO ANIMATE THIS DISCUSSION?

3.3. THEME THREE: Use of new technologies: Mobile phones and Internet

- How many of you have a mobile phone? [raise your hand]
- How many do you have? [ask individual farmers]
- What do you use it for? [give examples]
- Has your quality of life improved or worsen since you have access to the mobile phone?
- How has it improved/worsen? Can you give us examples?
- What is the main usage of the mobile phone in your livelihood? [i.e. for livelihood purposes/ related to coffee farming]
- Do you have access to the Internet? Where do you access the Internet?
- What are the main challenges that you face to use the mobile phone and the Internet? [cost, network etc]
- What are the main areas of potential of these technologies? How could they help improve coffee livelihoods/the farming business?
- How could these technologies help overcome some of the challenges that we were discussing at the beginning of the session? [e.g. mention challenges, climate change impacts).

WHAT ACTIVITIES CAN YOU IMPLEMENT TO ANIMATE THIS DISCUSSION?

4) SUMMARISE KEY POINTS THAT EMERGE IN THE DISCUSSION *(*throughout the session- write the key points, as they emerge, on a flip chart, including drawings/icons for participants to visualise the discussion points)*

5) THANKS AND CLOSING REMARKS

REMEMBER:

DOCUMENT/WRITE DOWN ALLTHE IDEAS SHARED BY THE PARTICIPANTS THROUGHT THE DISCUSSION, WITHOUT MODIFYING THEM – BE AS ACCURATE AS POSSIBLE WHEN CAPTURING THE IDEAS.

ANNEX 6: Summary Findings- Focus Groups with Coffee Farmers

SUMMARY RESULTS RABIT UGANDA - FOCUS GROUPS WITH COFFEE FARMERS						
KEY ISSUES DISCUSSED / LOCATION OF THE FG	**Strengths of Coffee Farmers**	**Challenges faced by Coffee Farmers**	**CC Manifestations**	**ICT Usage**	**ICT Benefits**	**ICT Challenges**
1.BUKALASI GROWERS COOPERATIVE	Good soils (fertile). Availability of animals that provide manure for soil fertility. Availability of shade trees that give good environment for coffee. Knowledge about local environment and crop production Good rains Good market Linked to the [primary] society Cash crop where they get money to pay school fees Good relationship with buyers including GCCE, BCU and other middlemen Tourist attraction in the Mount Elgon area Provides borrowing power	Pests and diseases e.g. stem-borers Soil erosion Theft of coffee Changes in coffee price Lack of equipment e.g. hand pulpers Inadequate training Lack of drying equipment Deforestation Poverty that make farmers sale off their land Poor roads Un-trusted traders who cheat farmers. Poor (Old types) of coffee seedling variety	Landslide Hailstorms Heavy rains Floods	Ten (10) farmers had phone, two (2) had no phones. Three (3) had two SIM cards; one (1) has three (3) SIM cards.	**Reasons for having more than one (1) SIM card:** To access networks Reduce costs of making calls (i.e. benefit from promotions) To access mobile money services. Storage was not enough for one SIM card. Confidentiality **USES OF MOBILE PHONE:** Easy communication Use as a watch Calculation Health messages – family planning methods Mobile money Use as a torch Calendar Helps travelling (guides in direction)	Family instability Abuses from callers especially wrong numbers. Unreliable information (e.g. lies) Encourages theft Exposure to maintenance Causes sickness especially ear/hearing problem.

	Coffee tree provides nectars to bees to produce honey. Availability of land Transport and communication network Sense of belonging to the society Access to training by GCCE Women empowering Provide income				Saves time Games Gets coffee price information Used for internet Sports news Radio Saves transport To play music Camera To record events Facilitates business **HOW MOBILE PHONES IMPROVE FARMERS LIVELIHOOD:** Access to mobile money services Easy communication For new innovative ideas Saves time Price information	
KEY ISSUES DISCUSSED/ LOCATION OF THE FG	**Strengths of Coffee Farmers**	**Challenges faced by Coffee Farmers**	**CC Manifestations**	**ICT Usage**	**ICT Benefits**	**ICT Challenges**
2. BUMAYOGA GROWERS COOPERATIVE	Availability of fertile soils Favourable growth conditions for Arabica Coffee Availability of market Good price for coffee Other cash and food crops in the	Low prices / changes in coffee prices Delayed payment for coffee Lack of enough capital to invest in coffee production Lack of equipments like	Long periods of draught that starts from November / December to April. Long / prolonged rain seasons that starts from April to sometimes November without break. In 2010 heavy rains were experienced	29 farmers have phones 4 have 2 SIM cards 1 has 3 SIM cards and 2 don't have mobile phones.	For communication Saves transportation Mobile money services Radio To access internet services Price information Get early warning in case of	Costly to maintain Family instability Insecurity – thieves can easily attack when you have phones. Impersonation – someone can use your phone to do crime

	area Good extension support from Gumutindo staff and CKWS. Availability of animals for manure production Farmers have knowledge about coffee production Availability of other crops like beans, soybeans that adds nutrients. Employment opportunities in coffee industry for farmers and their family members. Provision of planting materials provided by GCCE and government. Motivation by GCCE in terms of premiums i.e. social premium, second payments. Enough labour provided by the farmers' family and cheap hired labour.	hand pulpers, drying equipments, farm equipments / tools. Lack of transport facilities. Long periods of sun shine (drought) Pest and disease out breaks Floods that destroy farm lands / coffee fields. Hail stones that destroy the coffee. Landslides that destroy coffee fields Heavy rains that destroy coffee fields	throughout the year i.e. from March 2010 to April 2011. **EFFECTS ON LIVELIHOODS:** Displacement and migrations due to landslides Too much coldness Outbreak of various sicknesses Loss of lives Famine due to long droughts Poverty Floods destroy homes Fears among farmers leading them to abandon farming **EFFECTS ON COFFEE PRODUCTION:** Landslides destroy coffee fields. Pest and disease outbreaks eg stem borers and leaf rust Low coffee yields Floods destroy coffee fields. Water logged soils Soil erosion that destroy coffee fields	None of the farmers use / access internet / computer with internet	problems Secrets / confidentiality **HOW MOBILE PHONES IMPROVE FARMERS' LIVELIHOODS:** Strengthens relationships Self-awareness Eases communication Helps even the illiterate especially interacting through mobile phone can even be done in own languages. Ease sending and receiving money – mobile money Improves security – can easily call police / neighbour in case of a problem. Eases access to transport – can call for transport assistance Weather information is easily available Business discussion information Price information Easily access training	

					programmes. Easy access to weather information Alerts in case of problems (early learning system) Easy access of extension support Easy access to information related to coffee Easy access to support from both local and international communities (e.g. Red Cross).	
KEY ISSUES DISCUSSED/ LOCATION OF THE FG	**Strengths of Coffee Farmers**	**Challenges faced by Coffee Farmers**	**CC Manifestations**	**ICT Usage**	**ICT Benefits**	**ICT Challenges**
3. KONOKOYI GROWERS COOPERATIVE	Good prices for coffee. Rainfall for production They have income from agriculture. They are motivated by GCCE i.e. 2nd payment and bonuses Have good fertile soils. Coffee is of value to them i.e. a cash crop There is good	Pests and diseases e.g. stem borers and leaf rust Sickness of farmers Bulkiness of organic manure to transfer to distance fields. Price fluctuations Inadequate training on farming practices. Not having enough shade trees.	They experience heavy rainfall. Abrupt rainfall i.e. changes in rainfall pattern used to start in March but nowadays starts in late April. Unexpected landslide even in the absence of rainfall. Too much hailstones Prolonged draught i.e. rivers dry Over flooding of rivers Landslides Hailstones	Out of the 18 farmers in the focus group 15 had mobile phones and 3 never had phones. Out of the 18 farmers only one farmer had access to internet usage.	Calling and receiving calls Used for calendar i.e. know events Clock For listening to music For flash light Sending and receiving messages Alert people in case of emergencies Mobile money Used as a calculator For internet	No concentration on books by the children Family instability and misunderstanding because of calls Unreliable information Expensive and costly Encourage pornographic characters Causes diseases like high blood pressure and cancer Rumour mongering Make children waste their time a

	relationship with the buyers. Good co-operative organisation. There is transparency in their transactions. Have access to trainings on coffee management.	Lack of animals to provide enough manure. Deforestation leading to loss of rainfall.	**IMPACTS ON LIVELIHOODS:** Low yield Low income Pests and diseases Shortage of firewood Underdevelopment Migration and relocation of farmers as a result of landslides Loss of lives Poor quality of coffee Loss of crops due to floods. Low incomes.		Taking pictures / photos. **HOW MOBILE PHONES IMPROVED FARMERS LIVELIHOODS:** To know the price for coffee For new innovative ideas Easy communication Easy access to mobile money Saves time Calculator.	

ANNEX 7: Guidelines for KETSO Focus Group Facilitators
Climate Change, Resilience and ICTs in Uganda

This workshop has three main objectives:

- Foster buy-in and appropriation of the project by the local project partners/GCCE staff.
- Gather feedback on the characteristics of the context within which RABIT will be implemented: identify local vulnerabilities (based on a series of key vulnerability dimensions), climate change impacts on coffee livelihoods, as well as the role and potential of ICTs, from the perspective of the participants.

It includes the following issues to be discussed by the group (in the form of branches on Ketso felt):

- **Social aspects**
- **Economic/financial aspects**
- **Water**
- **Food security/nutrition**
- **Migration**
- **Local infrastructure**
- **Health**
- **ICTs**
- **Blank** – for ideas that emerge from discussion / cross cutting ideas

Overview Workshop Plan - (2 Hours)				
	Stage of Workshop	***Adjustment***	**Ketso tool**	**Duration**
1	**Introductions, Clarifications +Warm-up**		Yellow	**15 min**
2	**What are the main strengths of coffee farmers? What works well?**	***Time can be reduced***	Brown	**15 min**
3	**What are the key challenges posed by climate change to coffee farmers?**		Grey	**15 min**
4	**How to overcome the challenges posed by climate change to coffee farmers?**		Yellow	**15 min**
5	**TABLE SWAP / Comments & Questions**		**! Priorities + Comment card**	**15 min**
	Coffee Break			
6	**How could ICTs help coffee farmers do things differently?**		Green	**15 min**
7	**What are the challenges of ICT usage?**		Grey	**15 min**
8	**How to overcome those challenges?**		Green	
9	**Identifying key messages and priorities**	***Time can be reduced***	**! Priorities**	**10 min**
10	**Summing up**		**Personal Action Card**	**5 min**

*Workshop plan based on sample prepared by Ketso, GRAMNet and Renfrewshire Council, and input from Dr. Joanne Tippett. For more information about Ketso, see www.ketso.com

1 Introduction, Clarifications and Warm-up Exercise 10 minutes

- Brief words about Ketso

Warm-up exercise 5 minutes

- In your opinion, **why is resilience an important notion for coffee farmers?** (**Prompt:** based on what was discussed during the morning's presentation)
- Participants work individually, then share one ideas at a time.
- Ideas are placed in the Ketso planner (Small grid), and kept as a reference for other discussions (including timeline/milestones using the Ketso grid).
- Suggest that if ideas are similar, participants place leaves close to each other, if they are different, they place them further apart.

Objectives of the workshop

- Team engagement/appropriation of the project
- Pilot adjustment
- Ways of implementation to respond to expectations and obtain maximum benefits
- Anything to add?

Background Ketso

- It's a hands-on kit for creative group work, and we will be using this kit today to capture and share our ideas.
- Ketso means action in Lesotho, Southern Africa, where it was invented (Slides).
- It's really easy to use. Examples (slides)
- Social business (slides)

How to use it? Instructions and Clarifications

- There are **different coloured leaves** for different kinds of ideas which we'll explain as we go along - write on coloured side of the leaf.
- Write or draw one idea per leaf.
- Use the **special pens** provided so the leaves can be cleaned and re-used.
- Ketso is about working together and having good discussions, but it's more than that. It is also about giving everyone an opportunity to think for themselves and come up with their own ideas. So we will alternate between individual thinking time and group discussion. We call this **'think then share'**. It really helps to keep everyone involved and to get more creative thinking going than a simple discussion would.

Workshop process overview

- We are going to look at what do we know that works when working with communities.
- Then we will consider creative options for the future.
- Then we will think of the challenges and problems we are facing.
- Then we will think of ways of overcoming the challenges.
- We will be prioritising ideas later, so for the moment, please get all the ideas on the table without trying to judge them.
- Each stage will take about 15 minutes. I will be using **a bell** for timekeeping. The first ring will be asking groups to wrap up and finish off what they are doing and the

second ring will ask all the participants to stop what they are doing and listen to next instructions.

- Each time we go on to a new stage, you will be spending a few minutes to write ideas down on your own, then after that time, you will share them with your group. Having this time on your own to develop ideas allows everyone some time to think and put forward ideas that may not be obvious or come out if the group starts by discussing ideas first.
- At any point, if you have a thought, grab a leaf and capture it so we can share it later.

What will happen to the outcomes?

- Photos to be taken of all the workspaces – so please **write or draw clearly** so we can see what the idea was.
- These will be then transformed into a report which will be circulated to participants.
- Key messages will be considered in the next steps of the pilot's implementation.

2 First Stage: What works well? 15 min

What are the main strengths of coffee farmers?

- Ketso felt is on the table, pre-prepared with branches and *folded over* (centrepiece needs to be moved so they fold).
- Write or draw one idea per leaf, use the pens provided.
- We have different colour leaves for the different stages of the workshop. We'll start with **brown leaves. This is the soil we have to grow our ideas in.** Write on the coloured side.
- Ask the question and ask participants to write their own ideas, *without sharing at first*, onto the brown leaves.
- Open felt after participants have had brief time to write some ideas on their own.
- After opening the felt, briefly describe the different branches and explain that the **blank branch** is used for cross cutting themes, which will emerge as a result of the discussion where all those ideas which don't fall under those specified can be placed.
- Read out and put down 1 leaf at a time, going around the table to share your ideas and give everyone a turn.
- Point the leaves at appropriate branches where they seem to fit. If similar ideas come up, point the leaves at each other to create a cluster. You can move the leaves around and discuss what the branches mean.
- If there's still time, encourage people to add more ideas to the felt, going around the tables and encouraging participants to write and add more ideas – perhaps pointing out branches that don't have much on them and suggesting that participants can use the branches to see if they can think of more ideas in that area.

3 Next Stage: Challenges 15 min

What are the key challenges posed by climate change to coffee farmers?

- We'll now use **grey leaves**: is the grey rain clouds hiding the sun and getting in the way of what we want to achieve.
- Come up with the key challenges or difficulties posed by climate change manifestations to coffee farmers in this area.
- Be as creative and open as possible, no right or wrong answers at this stage.

4 Next Stage: Goals **15 min**
How to overcome the challenges posed by climate change to coffee farmers?

- We'll now use again yellow leafs, as we'll reflect on the goals that we need to keep in mind and strive for in order to overcome those challenges.
- Using **yellow leaves**, come up with the key ideas on how to overcome the challenges posed by climate change to coffee farmers.
- Again, start with time on own to develop ideas, then share them with the group and place on the workspace where they seem to fit best. (Think then Share)

5 Next Stage: TABLE SWAP **15 min**

- We are now going to leave our table and go to the other groups' table. Please take a look at their Ketso grid and at the ideas that they have captured so far.
- Each person takes a blank comment card, and writes down comments or questions on specific ideas to the other group.
- Each person takes a priority icon, and places it beside the idea that the consider most important.

Coffee break

6 Next Stage: Solutions **15 min**
How could ICTs help coffee farmers do things differently?

- We don't like to leave problems without solutions.
- This exercise is to get you to think creatively of ways to overcome some of the challenges you have been discussing.
- Take a few **green leaves** and see if you can develop ideas for solutions to the problems identified before.
- Encourage people to take some time on their own to develop the solutions before sharing them.
- There may be ideas on brown leaves (what is working) as well already on the felt, that could be solutions to the challenges, you can move these ideas to point at the grey leaves to show that they could help solve the problems.
- Make sure to clearly point the solution at the grey leaf problem that it refers to.
- Take a few minutes on your own, to develop the ideas, and in a few moments you can share ideas.

7 Next Stage: ICT Challenges **15 min**
What are the main challenges of ICT usage by coffee farmers?

- We'll now use **grey leaves** again to identify challenges faced by coffee farmers, that are specific to the effective use and appropriation of ICT tools.
- Start with time on own to develop ideas, then share them with the group and place on the workspace where they seem to fit best. (Think then Share)
- Consider the most critical or significant blocks or challenges.
- You can come up with barriers to some of the specific new ideas you have developed on green leaves or those developed by other participants.

8 Next Stage: ICT Solutions 15 min

- This exercise is to get you to think creatively of ways to overcome some of the ICT-related challenges you just identified.
- Take a few **green leaves** and see if you can develop ideas for solutions to these problems.
- Encourage people to take some time on their own to develop the solutions before sharing them.
- There may be ideas on brown leaves (what is working) as well already on the felt, that could be solutions to the challenges, you can move these ideas to point at the grey leaves to show that they could help solve the problems.

9 Next Stage: Identifying key messages and priorities 10 min

- This is a stage of filtering ideas, to help everyone see what is important on the felt. It aids in developing goals. Ask each person to take 1 tick icon from the icon pad.
- Without discussing the ideas in the group, **place your icon next to those** leafs that that strike you personally as particularly important for the success of the pilot.
  The way to think if this could be – if we removed every leaf apart from one on this felt, which would be the one that you think is the most important to leave behind for us to consider?

10 Summing up 5 min

- **PERSONAL ACTION CARD:** These ideas could be on the felt already, or they may be something you think of now. You can keep these cards to remind yourself of your next step.
- Facilitator says a few words of thanks and reminds the participants what will happen to the ideas: all the data will be typed up and be developed into a report which will be used as input to RABIT.
- Any questions?.
- Thank you!

ANNEX 8: Guidelines for KETSO (RABIT) Focus Group Facilitators

Resilience Assessment Benchmarking and Impact Toolkit (RABIT): Pilot Implementation in Uganda

This workshop has three main objectives:

- Foster buy-in and appropriation of the RABIT toolkit by the local project partners/GCCE staff.
- Gather feedback on potential adjustments of the toolkit based on its main components (i.e. data collection, stakeholder engagement, analysis and presentation of findings, local impacts and ICTs and resilience).
- Identify collectively ways of implementation of the pilot that respond to the partners' expectations, and obtain maximum benefits.

It includes the following issues to be discussed by the group (in the form of branches on Ketso felt):

- **Data collection**
- **Stakeholder engagement**
- **Analysis and presentation of findings**
- **Expected impacts in the community**
- **Links between ICTs and resilience**
- **Blank** – for ideas that emerge from the discussion / cross cutting ideas

Overview Workshop Plan - (1 h 45 min/2 Hours)				
	Stage of Workshop	***Adjustment***	**Ketso tool**	**Duration**
1	**Introductions, Clarifications +Warm-up**			**15 min**
2	**What would you like to see and do as part of RABIT?**			**15 min**
3	**What are the key challenges for RABIT's implementation?**			**15 min**
4	**How could we overcome those challenges?**			**15 min**
5	**TABLE SWAP / Comments & Questions**		**! Priorities + Comment card**	**15 min**
	Coffee Break			
6	**What are the goals that you would like to achieve as part of this project?**			**15 min**
7	**Identifying priorities: What are the most exciting components of the project for you?**	***Time can be reduced***	**! Priorities**	**10 min**
8	**Summing up**		**Personal Action Card**	**5 min**

*Workshop plan based on sample prepared by Ketso, GRAMNet and Renfrewshire Council, and input from Dr. Joanne Tippett. For more information about Ketso, see www.ketso.com

1 Introduction, Clarifications and Warm-up Exercise 10 minutes

- Brief words about Ketso

Warm-up exercise 5 minutes

- In your opinion, **what is the importance or the value added of RABIT for Uganda's coffee farmers?** (**Prompt:** based on what was discussed during the morning's presentation)
- Participants work individually, then share one ideas at a time.
- Ideas are placed in the Ketso planner (Small grid), and kept as a reference for other discussions (including timeline/milestones using the Ketso grid).
- Suggest that if ideas are similar, participants place leaves close to each other, if they are different, they place them further apart.

Objectives of the workshop

- Team engagement/appropriation of the project
- Pilot adjustment
- Ways of implementation to respond to expectations and obtain maximum benefits
- Anything to add?

Background Ketso

- It's a hands-on kit for creative group work, and we will be using this kit today to capture and share our ideas.
- Ketso means action in Lesotho, Southern Africa, where it was invented (Slides).
- It's really easy to use. Examples (slides)
- Social business (slides)

How to use it? Instructions and Clarifications

- There are **different coloured leaves** for different kinds of ideas which we'll explain as we go along - write on coloured side of the leaf.
- Write or draw one idea per leaf.
- Use the **special pens** provided so the leaves can be cleaned and re-used.
- Ketso is about working together and having good discussions, but it's more than that. It is also about giving everyone an opportunity to think individually, and come up with their own ideas. So we will alternate between individual thinking time and group discussion. We call this **'think then share'**. It really helps to keep everyone involved and to get more creative thinking going than a simple discussion would.

Workshop process overview

- We are going to look at what do we know that works when working with communities.
- Then we will consider creative options for the future.
- Then we will think of the challenges and problems we are facing.
- Then we will think of ways of overcoming the challenges.
- We will be prioritising ideas later, so for the moment, please get all the ideas on the table without trying to judge them.

- Each stage will take about 15 minutes. I will be using **a bell** for timekeeping. The first ring will be asking groups to wrap up and finish off what they are doing and the second ring will ask all the participants to stop what they are doing and listen to next instructions.
- Each time we go on to a new stage, you will be spending a few minutes to write ideas down on your own, then after that time, you will share them with your group. Having this time on your own to develop ideas allows everyone some time to think and put forward ideas that may not be obvious or come out if the group starts by discussing ideas first.
- At any point, if you have a thought, grab a leaf and capture it so we can share it later.

What will happen to the outcomes?

- Photos to be taken of all the workspaces – so please **write or draw clearly** so we can see what the idea was.
- These will be then transformed into a report that will be circulated to participants.
- Key messages will be considered in the next steps of the pilot's implementation.
-

2 First Stage: Future Possibilities 15 min
What would you like to see and do as part of RABIT?

- Using **green leaves**, come up with some ideas and possibilities for the future, what would you like to see and to do as part of this initiative (this is like the shoots of new ideas that grow in the brown soil of what we already have.
- Be as creative and open as possible, no right or wrong answers at this stage.
- Again, start with time on own to develop ideas, then share them with the group and place on the workspace where they seem to fit best. (Think then Share)

3 Next Stage: Challenges 15 min
What are the key challenges for RABIT's implementation? What could get in the way or make things difficult?

- We'll now use Grey leafs: is the grey rain clouds hiding the sun and getting in the way of what we want to achieve.
- Using 2 leafs per each participant, consider what are the problems or challenges that could we face in the pilot's implementation, and what are the key barriers to achieving the ideas being developed here?
- Take a few minutes on your own, to develop the ideas, and in a few moments you can share ideas.
- Consider the most critical or significant blocks or challenges.
- You can come up with barriers to some of the specific new ideas you have developed on green leaves or those developed by other participants.

4 Next Stage: Solutions 15 min
How could we address or overcome those challenges?

- We don't like to leave problems without solutions.
- This exercise is to get you to think creatively of ways to overcome some of the challenges you have been discussing.
- Take a few **green leaves** and see if you can develop ideas for solutions to the problems identified in the previous stage.
- Encourage people to take some time on their own to develop the solutions before sharing them.
- There may be ideas on brown leaves (what is working) as well already on the felt, that could be solutions to the challenges, you can move these ideas to point at the grey leaves to show that they could help solve the problems.
- Make sure to clearly point the solution at the grey leaf problem that it refers to.

5 Next Stage: TABLE SWAP 15 min

- We are now going to leave our table and go to the other groups' table. Please take a look at their Ketso grid and at the ideas that they have captured so far.
- Each person takes a blank comment card, and writes down comments or questions on specific ideas to the other group.
- Each person takes a priority icon, and places it beside the idea that the consider most important.

Coffee break

6 Next Stage: Goals 15 min
What are the goals that you would like to achieve as part of this project?

- Coming close to the end of the exercise
- We are now going to use yellow leafs, the bright sunshine that drives growth and keeps everything going.
- Take a few **yellow leaves** and look at the ideas on the felt.
- What are the goals that you would like to achieve for this project?
- Use the icons as a guide to see what you think are the most important ideas – do these suggest any goals?
- You may want to reword some of the ideas on green leaves to become more like goals, specific things you could aim to achieve.

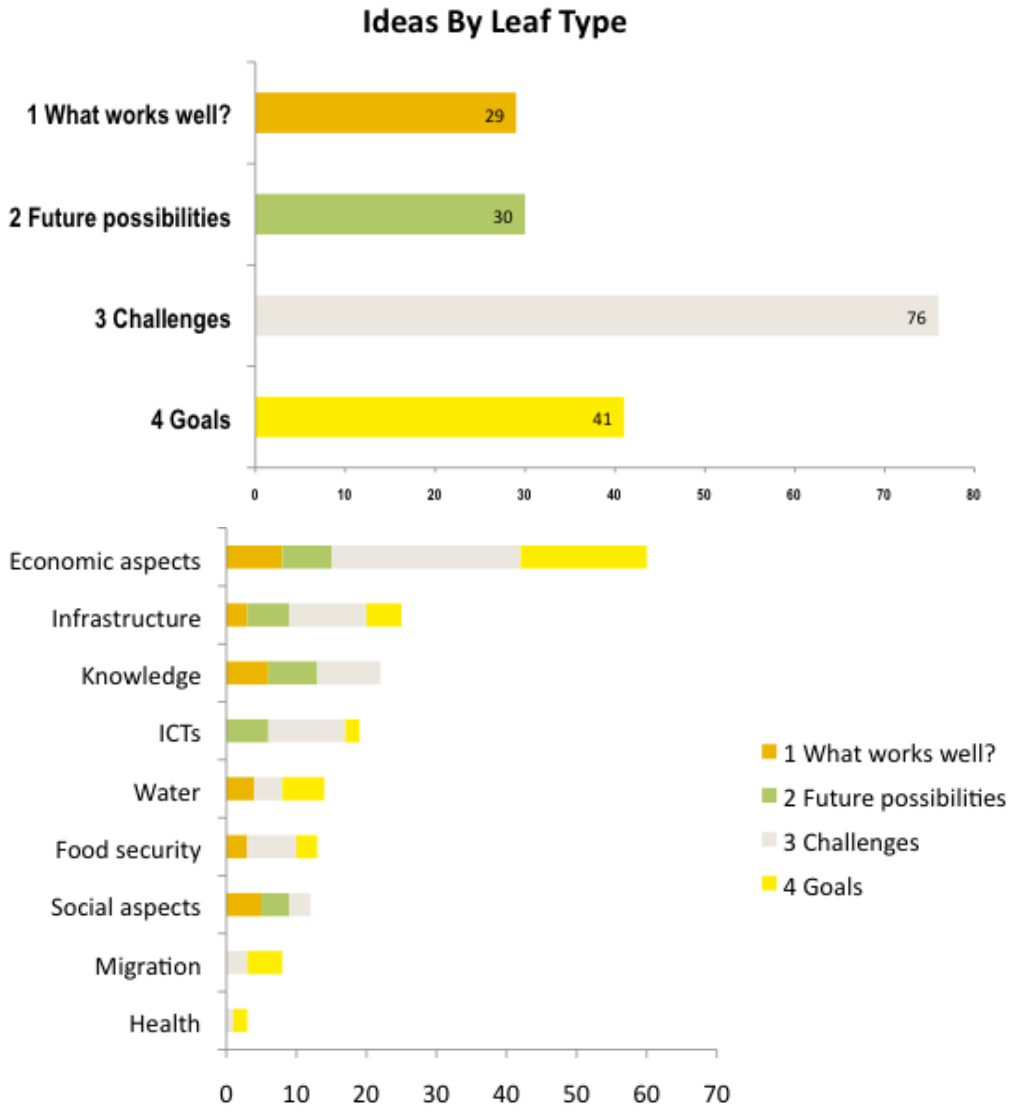
7	**Next Stage: Identifying priorities** **What are the most exciting components of the project for you? What do you expect to learn from the most?**	**10 min**

- This is a stage of filtering ideas, to help everyone see what is important on the felt. It aids in developing goals.
- Ask each person to take 1 tick icon from the icon pad.
- Ask participants to place a red exclamation sign on the leafs/branch that is most exciting for them/from which they expect to learn the most (*this can help to understand expectations and motivations of participants).

8	**Summing up**	**5 min**

- **PERSONAL ACTION CARD:** These ideas could be on the felt already, or they may be something you think of now. You can keep these cards to remind yourself of your next step.
- Facilitator says a few words of thanks and reminds the participants what will happen to the ideas.
- Not only key messages but all the data will be typed up and be developed into a report which will be used as input to RABIT
- Any questions?
- Thank you!

ANNEX 9: Ketso Focus Group (1) Findings, GCCE Staff
Climate Change, Resilience and ICTs in Uganda



IMPORTANT:

- Farmers' training (disease control)
- Environmental conservation
- Tree planting to avoid landslides
- Reforestation
- Good farming practices/terraces
- Timely market information

PRIORITY:

- Economic aspects
- Knowledge sharing
- ICTs
- Infrastructure

Summary Table of Leaf Type per Branch

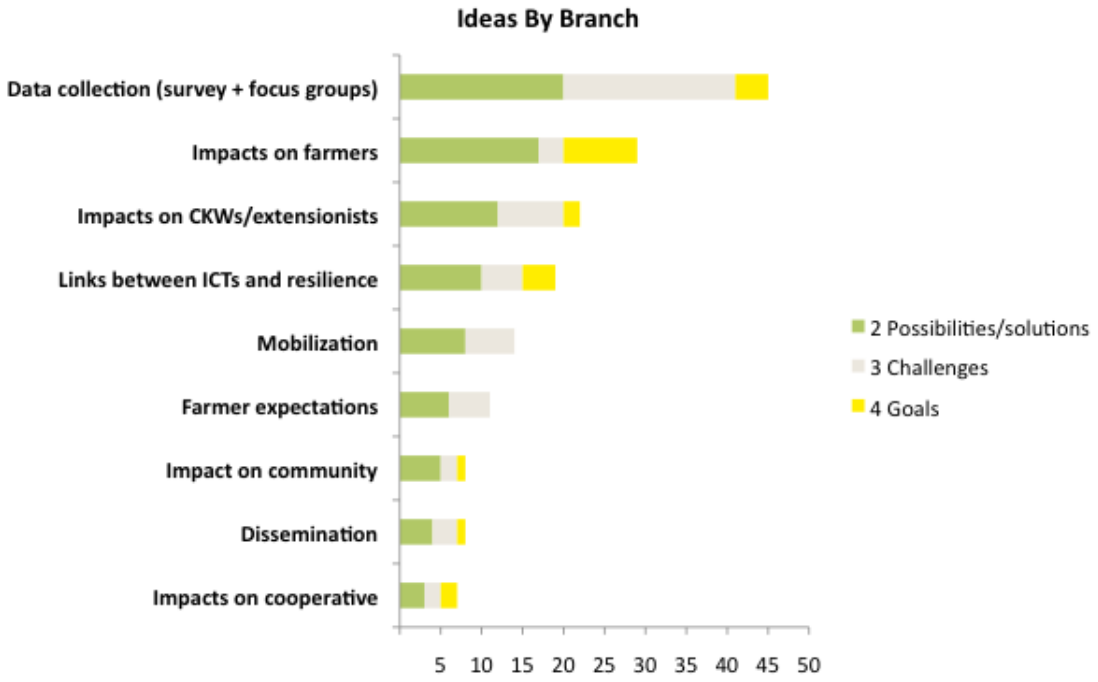
**Higher number of ideas shared per branch/type are circled in red.*

Branch, Leaf Type, Idea	What works well?	Future possibilities	Challenges	Goals	Comments/ Questions	Grand Total
Economic aspects	8	7	27	18	3	63
Food security	3		7	3		13
Health			1	2	2	5
ICTs		6	11	2	3	22
Infrastructure	3	6	11	5		25
Knowledge	6	7	9			22
Migration			3	5	1	9
Social aspects	5	4	3			12
Water	4		4	6	1	15
Grand Total	29	30	76	41	10	186

Summary Table of Ideas Written by Participants

STRENGTHS	Climate Change IMPACTS	TO OVERCOME THEM	ROLE OF ICTs	CHALLENGES OF ICTs
• Cooperative • Services/ marketing • Price information • Proud of quality • Good seasonal rains • Indigenous knowledge • Willingness to learn • Information access/ extensionist • Farming practices	• High rainfall intensity, landslides, flooding, hail storms, drought • Less income, lower productivity, loss of trees, crops and lives. • More diseases and pests, • Migration/ relocation • Problems of storage, transportation and price variation.	• Increase quality • Adopt resistant varieties • Education, training, awareness raising • Weather information • Agroforestry • Plant trees • Relocation • Terraces, contours, trenches • Consult extensionists/CKW • Reduce erosion • Soil/water conservation • Irrigation • Crop management • EWS • Biodiversity/ environmental conservation • **ICTs:** timely information	• **Quick** and easy farmer sensitization/ information access [**rapidity**]. • **Learning:** Capacity building/skills and knowledge • Daily price/market info • **Self-organisation** • Mobilisation of social networks • Weather info. • **Redundancy** of information • Awareness raising: radio • Openness/ **equality** of info • Timely info/EWS • Communicate with **farmers and buyers**, feedback policy/ humanitarian	• Access/lack of mobile phones • COST • Local capacity/ education • Information is irregular, some is not reliable • Lack of electricity • Illiteracy • Poor connectivity/ network problems • Age barriers: 'only for youth' • Usage by youth • [info] Too broad to analyse by farmers.

ANNEX 10: Ketso Focus Group (2) Findings, GCCE Staff
RABIT Implementation in Uganda



Summary Table of Leaf Type per Branch

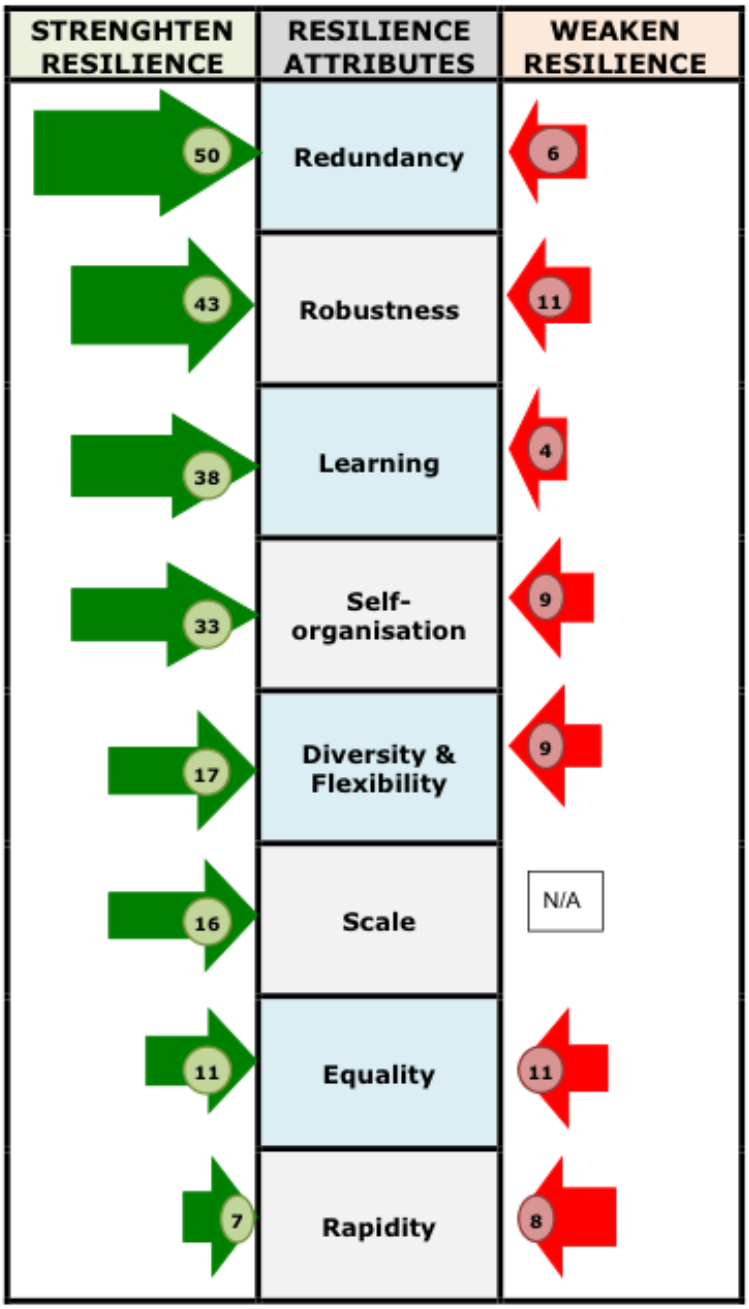
**Higher number of ideas shared per branch/type are circled in red.*

Branch, Leaf Type, Idea	Possibilities/ solutions	Challenges	Goals	Comments/ Questions	Grand Total
Data collection (survey + focus groups)	20	21	4	4	49
Dissemination	4	3	1		8
Farmer expectations	6	5		1	12
Impact on community	5	2	1		8
Impacts on CKWs/extensionists	12	8	2	3	25
Impacts on cooperative	3	2	2		7
Impacts on farmers	17	3	9	1	30
Links between ICTs and resilience	10	5	4	2	21
Mobilization	8	6			14
Grand Total	85	55	23	11	174

Summary Table of Ideas Written by Participants

WOULD LIKE TO SEE/DO	CHALLENGES	SOLUTIONS
• Farmers equipped with information for ICT use • Share/strengthen my knowledge • Improve farmers productivity, income, sustainability, quality • Fully understand resilience • Minimize climate change impacts • Learn about Focus Group discussions [methodology] • Learn about data collection • How to benchmark resilience • Make cooperative leaders more knowledgeable about resilience and climate change	• Managing farmers expectations • Negative attitude towards project • Difficult to organise and use ICTs • Ignorance about ICTs • Long explanations: survey essence • Poor sensitization • Political interference • Information disclosure • Access to farmers • Time • Telecommunications + mobile data upload • Limited understanding ICT • Resources/workload • Lack of supervision/leadership • Dissemination • Reach targets (noise) • Difficult [mountainous] terrain/ weather conditions • Facilitation • Farmers turn out [focus groups]	• Sensitize farmers, explain, transparency • Use local language • Offer an incentive [e.g. FGs] • Clear plan, logistics facilitation, equipment • Dissemination plan • ICT-related training • CKW's training • Time management • Selection of adequate venues for the FGs • Confidentiality of information • Schedule for FGs, farmers' invitation/mobilization • Funds/resources • Speed and accuracy • Coordination

ANNEX 11: Resilience Salience Visualisation: Arrow Diagram



ANNEX 12: Summary Interview Findings: Discourse Analysis

RESILIENCE ATTRIBUTES No. of interviewees mentioning	**Mobile Phone Usage: Benefits and Disadvantages** (based on interview data; *disadvantages in italics*)
Redundancy (30)	• Save time (I2, I3, I6, I8, I10, I11, I14, I16). • [Redundant mechanisms for payments/redundant sources for financial help] Mobile money to pay school fees, transfer/receive money from relatives who live away, receive payments for crops (security) (I7, I8, I10, I12, I13, I14, I15, I16). • [Redundant information sources] Use mobile to listen to the radio (I5, I7, I8, I11, I14, I16) • Save transport costs (I8, I10, I13, I14, I16) • More than one mobile in the family (I1, I7, I8)
Rapidity (27)	• Rapid resource access using mobile money (I4, I5, I6, I7, I10, I14, I15, I16) • Faster/more effective provision of CKW services to farmers (I2, I3, I5, I10, I12, I13) • Swift information sharing between CKW, Cooperative and farmers (I1, I10, I14) • Weather-related alerts (I1, I9, I10) • *Affecting efficiency of CKWs (I6, I8, I12)* • Access to first-hand/real-time information (I1) • Security alerts (I7) • Family emergencies (I7) • Call for help in case of emergencies (I1)
Learning (17)	• Provide farmers with/access relevant information for farming practices (e.g. coffee pests, spacing, maintaining, fertilisation, agricultural practices, poultry/cows/animal care) (I2, I4, I6, I9, I11, I12, I13) • Strengthen farmers' ability to access and interpret, information, get in touch with CKWs (I1, I8, I9, I13) • Access agricultural content through radio [in the mobile phone] (I5, I8, I11) • Trust in information shared (I12, I13) • Information sharing among farmers (I5)
Equality (16)	• *Widen existing divides (e.g. between those with/without access to technology, to information, between elders and youth, between those with higher/lower levels of education) (I1, I2, I4, I5, I6, I7, I9, I10, I11, I12, I13, I15)* • *Exacerbate power/gender differentials (I10, I14)* • Direct access to information (no middlemen) (I8) • Helping to 'leap forward' Internet digital divide (I4)
Self-organisation (16)	• Social networks (I4, I5, I7, I8, I9, I10, I12, I14, I16) • Coordinate meetings with farmers and visits CKWs (I7, I9, I10, I11, I14) • *Creating new/deepening existing dependencies (I8, I10)*
Scale (11)	• Coordination between CKWs, PS, farmers, Grameen (I5, I6, I10, I11, I13, I14, I15) • Access info about global coffee market (I8, I14) • Uses mobile for contacts to sell produce (I14) • Share news about Gumutindo and global news (I1)
Robustness (10)	• [Institutional capacity] Strengthened role/local presence of primary society through the work of CKWs (I1, I2, I4, I5, I6, I10, I11, I12, I13). • Mobile helping farmers to prepare (I12)

Diversity & Flexibility (9)	• Using mobile-based weather information to plan farming practices (e.g. price/market information, weather, availability of cash at the PS, help to plan/adapt practices) (I3, I7, I8, I12, I13, I14, I16). • New ideas to improve farming (I11, I16)

ANNEX 13: Final RABIT Event's Agenda

The workshop *"Strengthening the Resilience of Coffee Farmers to Climate Change with the Support of Information and Communication Technologies (ICTs): Uganda's Experience"* constituted the closing event of the RABIT pilot project implemented jointly by LWR, the University of Manchester, and Gumutindo Coffee Cooperative Enterprise in Uganda.

The aim of this workshop was three-fold. It sought to:

a) explain a new approach to measuring resilience of rural communities in Uganda;

b) share findings from Mount Elgon on measurement and recommendations for use of ICTs to improve climate change resilience; and

c) jointly explore future areas of work for policy-makers and strategists, for practitioners, and researchers to improve the strategic integration between ICTs, climate change and resilience in Uganda.

The event was attended by a group of more than 30 stakeholders working on climate change issues and/or new technologies in Uganda. A similar event was conducted days later in Mbale, Uganda, at the Gumutindo headquarters.

The event's agenda was structured as follows:

"**Strengthening the Resilience of Coffee Farmers to Climate Change with the Support of ICTs: Uganda's Experience"**	
9:00 - 9:15	Welcome and objectives
9:15 - 9:30	Overview and introductions
9:30 - 9:45	Overview of LWR's work in East Africa
9:45 - 10:00	Climate change and ICTs in Uganda: Café project
10:00 - 10:15	'Resilience': What does it mean and why is relevant?
10:15 - 10:30	Resilience Assessment Benchmarking and Impact Toolkit (RABIT): Uganda Coffee Farmers
10:30 - 10:45	*Comments & Questions*
10:45 - 11:00	Coffee Break
11:00 - 11:30	Findings: Resilience Assessment Benchmarking and Impact Toolkit (RABIT): Uganda Coffee Farmers
11:30 - 11:45	*Comments & Questions*
11:45 - 12:45	Future Priorities for Action: Participants' Feedback
12:45 - 13:00	Closing of the event: Summary and next steps
13:00 - 14:00	Networking Lunch

References

[i] Worldatlas, 2014. http://www.worldatlas.com/webimage/countrys/africa/lgcolor/ugcolor.htm
[ii] Ibid.
[iii] World Bank (2013). Uganda: Country Data. http://data.worldbank.org/country/uganda#cp_wdi
[iv] Ibid.
[v] UNDP (2013) Climate Risk Management for Sustainable Crop Production in Uganda: Rakai and Kapchorwa Districts, New York, NY: UNDP:BCPR.
[vi] Republic of Uganda (2010). The State of Uganda Population Report 2010. Kampala, Republic of Uganda.
[vii] UNDP (2013) Climate Risk Management for Sustainable Crop Production in Uganda: Rakai and Kapchorwa Districts, New York, NY: UNDP:BCPR.
[viii] InterMedia (2012), 'Mobile Money in Uganda: Use, Barriers and Opportunities' http://audiencescapes.org/sites/default/files/FITS_Uganda_FullReport_LowRes.pdf
[ix] UNDP (2013) Climate Risk Management for Sustainable Crop Production in Uganda: Rakai and Kapchorwa Districts, New York, NY: UNDP:BCPR.
[x] Parizat, Roy; Hilten, Jan van; Wunderlich, Christopher; Nsibirwa, Robert. 2011. *Ugandan coffee supply chain risk assessment*. Washington DC ; World Bank. http://documents.worldbank.org/curated/en/2011/06/17694191/ugandan-coffee-supply-chain-risk-assessment
[xi] Ibid.
[xii] Dekens, J., Bagamba, F (2014). 'Promoting an Integrated Approach to Climate Adaptation: Lessons from the coffee value chain in Uganda', Climate Resilient Value Chains Briefing Note Series, February 2014.
[xiii] Ibid.
[xiv] Jassogne, L, Laderach, P., Van Asten, P. (2013) The Impact of Climate Change on Coffee in Uganda, OXFAM Research Reports, April 2013.
[xv] UHOA (2014) Uganda Hotel Owners' Association, http://www.hotels-uganda.org/en/index.php/members/eastern
[xvi] SM (2014) SkiMountaineering, http://www.skimountaineer.com/ROF/Beyond/Elgon/ElgonMap.jpg
[xvii] Petursson, J. G., P. Vedeld, and A. Vatn. 2013. Going transboundary? An institutional analysis of transboundary protected area management challenges at Mt Elgon, East Africa. *Ecology and Society* 18(4): 28. http://dx.doi.org/10.5751/ES-05729-180428
[xviii] MDLG (2013). "Integrated Territorial Climate Plan for Mbale Region of Uganda. 2014-2029". Mbale District Local Government (MDLG), in collaboration with the United Nations Development Programme (UNDP) http://tacc.ccu.go.ug/uploads/docs/Project%20documents/ITCP_final_lowrez.pdf
[xix] Ibid.
[xx] Government of Uganda (2002) http://unfccc.int/resource/docs/natc/uganc1.pdf
[xxi] Studies include: Parizat et.al. (2011), UNDP (2013), Jassogne, L. et.al (2013) (Op.cit), and:
OXFAM (2008), 'Climate Change and Poverty Impacts in Uganda',
OXFAM (2008), 'Turning up the Heat: Climate change and Poverty in Uganda', Climate change and Poverty National Reports Series, OXFAM GB. http://policy-practice.oxfam.org.uk/publications/turning-up-the-heat-climate-change-and-poverty-in-uganda-112505
Läderach, P. and P. van Asten. (2012). Coffee and climate change, coffee suitability in East Africa. 9th African Fine Coffee Conference and Exhibition, Addis Ababa, Ethiopia.
FEWSNET (2012), http://pubs.usgs.gov/fs/2012/3062/FS2012-3062.pdf
[xxii] Läderach, P. and P. van Asten. (2012). Op.cit.
[xxiii] Ibid.
[xxiv] Mbogga M.S., (2012) "Consultancy Report: Climate Profiles and Climate Change Vulnerability Assessment for the Mbale Region of Uganda". UNDP Uganda.
[xxv] Ibid.
[xxvi] ITU (2014), ICT Statistics: Time Series by Country, http://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx
[xxvii] InterMedia (2012), Ibid.
[xxviii] Ibid.
[xxix] Ibid.
[xxx] Ibid.
[xxxi] Further information about KETSO is available at www.ketso.com
[xxxii] http://www.ketso.com/resources-downloads/downloads/software