Incremental (business as usual) to transformation adaptation: the potential of informal learning and local farming practices via rural women subjects in Lake Chilwa Basin, Malawi

Gibson Mphepo

1. Introduction

Under Article 1 of the United Nations Framework Convention on Climate Change (UNFCCC), which is an international policy framework on climate change issues, climate change has been defined as "*a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is, in addition to natural climate variability, observed over comparable time periods*" (United Nations, 1992, p. 7). Globally, Africa is the most vulnerable continent to the impacts of extreme weather events (Serdeczny, et al., 2016). An extreme weather event is defined by the Intergovernmental Panel on Climate Change (IPCC) (2014, p. 123) as '*an event that is rare at a particular place and time of year.*' In southern Africa, floods and droughts are the two extreme events of concern (Stringer, et al., 2009, p. 10). Extreme weather events of droughts and floods currently affect several sectors including health, livelihoods and food security of people on the African continent. The impact of these events requires '*taking urgent action*' (United Nations, 2016, p. 25; GoM, 2006, p, xi) to build human and natural resource **resilience** to climate change, ultimately reducing resultant suffering. This '*urgent action*'' includes **learning** (Ensor & Harvey, 2015, p. 510; Tschakert & Dietrich, 2010, p. 2). In many instances, **learning** has helped a lot to address impacts of these extremes. For example, at Lake Fagubine women learnt to produce charcoal after one-third of the Lake was converted to natural vegetation following prolonged droughts as reported by Djoudi and Brockhaus (2011, p. 12 & 130). The learning by women at this lake helped them to save their time searching for fuel wood.

Resilience is defined by Folke (2006, p. 259) as '*the capacity of a system to absorb disturbance and re-organize while undergoing change to still retain essentially the same function, structure, identity and feedbacks.*' Resilience is built through two complimentary pathways namely **adaptation** and **mitigation**.

Although both mitigation and adaptation pathways are essential for building climate change resilience, least developed countries such as Malawi may need to focus on adaptation since it has direct relevance to reduction of suffering in vulnerable communities and ecosystems.

Furthermore, least countries mitigation demands are relatively low in comparison to countries producing high carbon emissions (Sutcliffe et. al., 2016, p. 1215). Karabine, et al., (2016, p. 1) distil nine key messages for Africa from IPCC's Fifth Assessment Report. Of these messages, three reflect on current and projected Africa's vulnerability to climate change, one is about low carbon development practices and another one on enhancing international cooperation. Three messages point straight to adaptation and one is on '*integrated climate adaptation, mitigation and development approaches*'. This means that the IPCC also puts more emphasis on adaptation for Africa than mitigation. In view of this global preference of adaptation for Africa, my research will also focus more on *learning to adapt to* adverse effects of extreme weather events mentioned above than learning in the mitigation sphere.

The IPCC (2007, p. 6), defines **adaptation** as "*an adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities."* In my view, adaptation is primarily aimed at addressing **adaptation deficit** which is a gap between the current state of a system and a desired improved state at which point adverse impacts of climate change are minimized. Adaptation is a life-long **learning process** (Osbahr, 2007, p. 17) which evolves and improves with new emerging conditions (McGray et al., 2007 p. 9). Adaptation can be **planned, autonomous, reactive or anticipatory** (Tol, et al., 2009, p. 433). Planned adaptation refers to adaptation strategies that arise because of deliberate and pro-active policy decisions such as National Adaptation Plans of Action (IPCC, 2007, p. 69). Reactive adaptation takes place after preliminary impacts of climate change become unmistakable, while anticipatory adaptation happens before the impacts are obvious. Autonomous adaptations happen naturally, sometimes unknowingly and these are often more individualistic. As the IPCC (2012, p. 56) notes, effective adaptation should prioritize measures that increase current as well as future resilience to threats (i.e. anticipatory). Resilience over time would increase if **learning** were a central pillar of adaptation efforts, including learning focused on addressing current vulnerabilities and enhancing **disaster risk management** efforts.

This research focused on **'anticipatory**' **adaptation** and how this will be achieved following Engeström's (1987) **learning by expansion** and Tschakert and Dietrich's (2010, p. 6) **triple loop learning** that stresses the need for knowledge co-production, power sharing, joint problem solving and reflection as key tenets during the learning process. Triple loop learning, like

Engeström's (1987) work on expansive learning, draws on the work of Bateson (1942) on epistemology and learning. Tschakert and Dietrich (2010, p. 14) add that **scenario development** is an important ingredient during anticipatory learning processes to counter '*surprises, perturbations, and discontinuities'*. The ultimate object of learning by expansion in this research is to **develop models** whose implementation, through anticipatory adaptation practices, will potentially minimize disaster impacts from extremes of droughts and dry spells in the Lake Chilwa Basin.

Scenarios are stories of possible future, the ways they may unfold and pathways to reaching that future. Scenario building is a multi-stakeholder participatory process. My research will also develop scenarios to tell a story on how climate change adaptation and disaster risk reduction strategies and the associated **informal learning processes** can potentially unfold by the year 2030 in line with the vision of Malawi Climate Change Learning Strategy (GoM,2013, p. x) '*that Malawi will become a knowledge-driven climate change resilient population by 2030*'.

1.1 Problem Statement

More research needed in the informal learning arena in the Lake Chilwa Basin

> *'Social learning is a new, emergent arena of research in the fields of environmental education, natural resource management and human development.' (Lotz-Sisitka, 2012, p 12)*

By this statement, Lotz-Sisitka implies that limited social learning research (which includes informal learning, in my view) has been done, thus providing additional motivation for studies such as this one. Also, as Sefton-Green, (2007, p. 6) puts it, informal learning constitutes an important segment of the '*ecology of learning*' and should be '*accorded status and understanding as we seek to enhance the education system more generally.*'

Gaps on historical, present and future learning for adaptation need further investigation in the Lake Chilwa Basin

With respect to resilience building along temporal scales, Tschakert and Dietrich 2010 (p. 2) support Nelson et. al. (2007) that attention should be on "*understanding learning about the past, present and future threats and accumulated memory of adaptive strategies"* because this is

important for policy praxis (Agrawal, 2008, p. 9). Learning *about the about the past* and *accumulated memory* (also highlighted by IPCC, 2014, p. 54) infers understanding historical backgrounds while learning for "*future threats*" are implied in scenarios (Chavula et. al., 2010, p. 236) that will also be studied in this research. At the study site, there is currently no evidence of deep research to understand informal learning in past, present and future time frames.

Social barriers to adaptation not well-researched

As pointed out above, adaptation efforts are challenged by three sets of barriers and among these, the '*social and cultural limits are not well researched*' (Jones & Boyd, 2011; p. 1264 quoting IPCC,2007). Seven years down the line, IPCC reported a similar concern that "*relatively few studies from Africa have focused specifically on barriers and limits to adaptation" (*IPCC, 2014, p. 42). Furthermore, studies that theorize the role of barriers in adaptation are deductive in nature and are not well informed by experiences and opinions of those undertaking adaptation (Waters et. al, 2014, p. 692). The scientific literature has also not clearly framed behavioral barriers related to the uptake of mitigation and adaptation strategies (Garcı´a de Jalo´n, et al., 2015, p. 852). In Malawi, there have been some studies on barriers (Shackleton et. al., 2015, pp. 324-328) but these studies have not systematically identified and analysed barriers at various steps of adaptation such as at planning, monitoring and evaluation and implementation. My view is that unless we identify and understand these barriers, it will be difficult to find solutions (e.g through learning) to address them. While this study is not focussed on barriers only, it will contribute to understandings of barriers.

1.2 Research Questions

The main research question is 'How do drought and inter-seasonal dry spells influence informal learning processes for resilience building among rural women cultivating maize in the Lake Chilwa Basin, Malawi?'. There were four sub-questions as follows:

a. What are the past and current social barriers to adaptation learning processes for maize production under stressors of drought and dry spells?

b. What past and current informal learning processes have been catalyzed by drought and dry spells associated with maize production?

c. What are likely future scenarios relevant to informal learning processes considering the current adaptation drivers and pressures in maize production under extremes of dry spells?

d. How could expansive learning processes in informal learning settings potentially help rural women maize farmers move from incremental to transformational adaptation practices?

This report presents results of sub-questions a, b and d.

2. Research Methods

2.1 Study site: Lake Chilwa

Lake Chilwa is the second largest Lake in Malawi with a surface area of 1,300 km^2. The lake as declared a Ramsar site (a wetland of international importance) in 1997 under the Ramsar Convention. The specific study sites within the Lake Chilwa Basin will be Nsanama and Domasi Extension Planning Areas (EPAs) in Machinga District (Figure 1). Nsanama EPA lies in the northern tip of Lake Chilwa and is relatively drier part of Machinga District which is one of the three Lake Chilwa Basin Districts, the other two being Phalombe and Zomba. The major crop in both EPAs is maize. Other crops include rice, cassava and sorghum. Both areas have highly degraded land and infertile soils (LCBCCAP, 2010). Extreme droughts and dry spells in these two EPAs worsen the situation further. The net effect of degraded land and drought is poor crop yields (including maize) leading to food insecurity and poor nutrition. For these reasons both sites were expected to provide good opportunities for expansive learning to address drought and low crop yields.

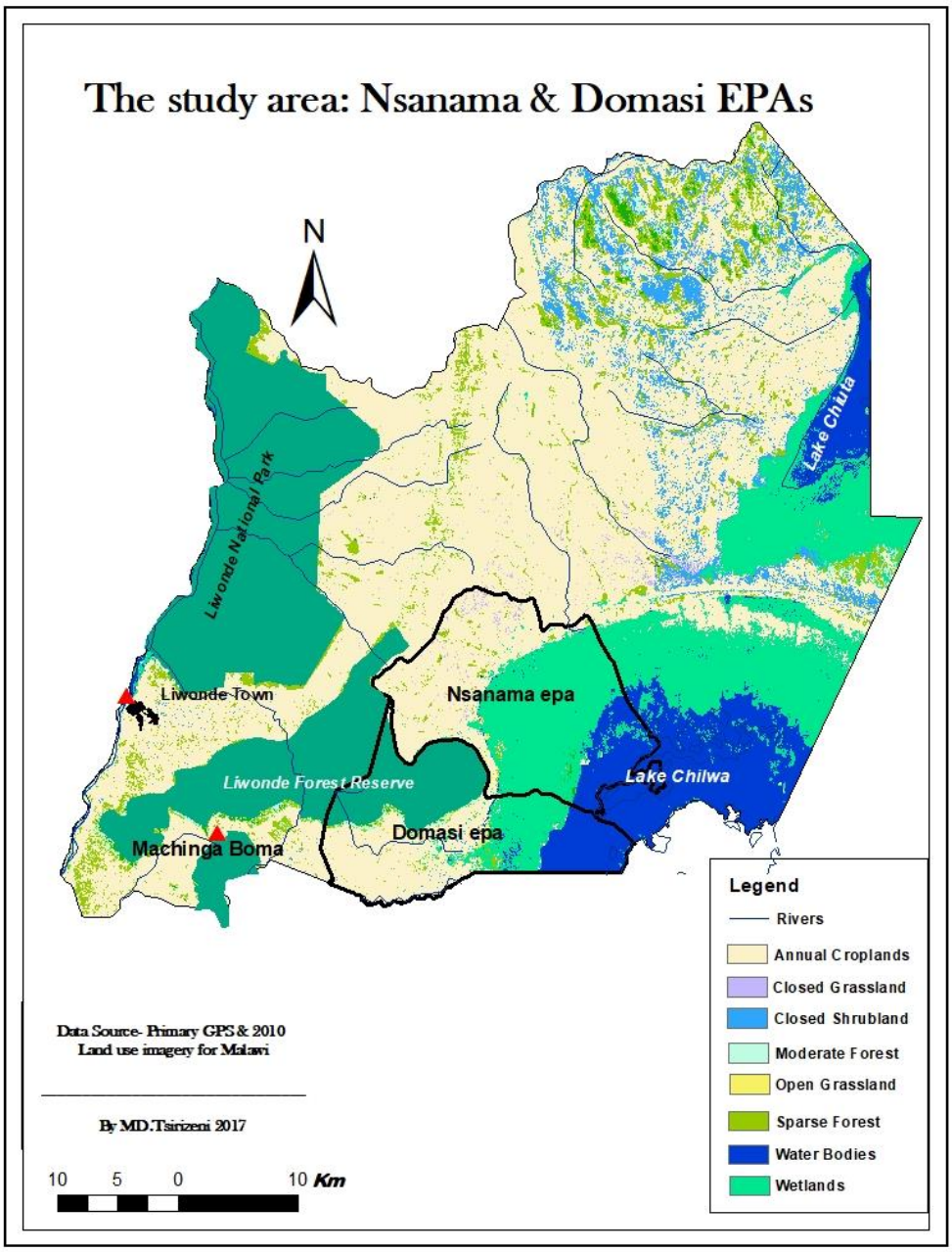

Figure 1: Machinga District showing study sites of Domasi and Nsanama Extension Planning Areas

2.2 Data Collection methods

Data were collected through focus group discussions, document analysis, observation studies and change laboratory workshops.

Document analysis

Document analysis is a meaning making process by a researcher from the documents accessed. The word "document" is here used in a broader context and includes public records (e.g. mission statements and strategic plans); media (e.g. newspaper reports and radio programmes), personal documents (e.g. e-mails and Facebook entries) and physical evidence found in the study site (e.g. artefacts, flyers and posters). For this study, the following documents (mostly from Lake Chilwa Basin) were consulted:

- Newspaper articles
- Videos
- Reports: both published and unpublished

Focus group discussion

Focus group discussion is a qualitative method in which a sample of respondents discuss a chosen topic through facilitation. Most qualitative researchers use a group size of 8-12 (Fern, 1982, p. 12) since too small a sample (<8) may lead to loss of data and too large (>12) may be difficult to manage. For this study, respondents were selected following Respondent Driven Sampling Technique (Global-Global, 2014). In this technique, the existing natural resource management committees in the basin, upon briefing them about this study, were used as "seed" to identify "hidden and hard-to-find" knowledgeable female respondents for the group discussions.

This study conducted **6** focus group discussions involving 72 women who were subjects of this study. The discussions were guided by a questionnaire that focused on current and historical climate change adaptation, disaster risk and coping options along with associated learning pathways. The questionnaire was pre-tested before it was finally administered.

Observation Studies

Baker, 2006 (p. 173) quoting Gorman and Clayton (2005, p. 40), defines observation studies as those that "*involve the systematic recording of observable phenomena or behaviour in a natural setting*". It is a kind of ethnographic study aimed at understanding people within their natural

environment. For this research, observation studies were done to photo capture some observable phenomena said by women during focus group discussions on the following topics:

a. **Adaptation practices:** Manure application (Livestock, Human waste, Whitman, and mpenda mphepo). mphanje (a local farming practice) and irrigation (maize, Irish potatoes, common beans)
b. **Coping practices:** Banana tubers ground into powder replacing maize flour, use of wild yams

During the observation studies trips, 8 other people were also interviewed to validate some of the sayings by women during the group discussions. These 'others' included one girl, one boy, 2 male lead farmers, 2 husbands to women subjects of the study and 2 traditional leaders (of which 1 was female)

.

2.3 Change Laboratory Workshops

Virkkunen and Newnham (2013, p. 15) define a Change Laboratory as '*formative intervention method for developing work activities by the practitioners in collaboration with researcher-interventionists. It is a tool kit for envisioning, designing, and experimenting with new forms of work and a social setting in which this can be done*'. The design is driven by historically formed contradictions (Engeström & Sannino, 2011) in the learners' activities and is the result of their collective efforts to understand and face these contradictions and the problems they engender.

Regarding this study, 5 weekly sessions were conducted as follows:

Session 1 (Questioning Existing Practices): During this session, I explained the concept of change laboratory and the essential steps to be followed to unlock the potential of local farming practices via informal learning help transform current adaptation practices from incremental (business as usual) to transformation. I used the sketch diagram below to help explanation.

A video taken in 2011 on farmers' dilemmas on when and what to plant under unpredictable rainfall patterns was then shown as a first stimulus to trigger discussions. The video shows

two key contradictions of local knowledge and scientific practices of defining onset of rains and adequacy of soil moisture for sowing maize and other crops.

Session 2 (Analysis): During this session, women were examining the current and historical contradictions in the local farming practices and the associated informal learning practices. In particular, they were looking at the local farming practice activity system elements (tools, rules, subject, division of labour, community of others, object and outcomes) and how these how these have evolved over time. During this session, participants were also given an assignment to provide information on which informal learning pathways were used to learn about drought, dry spells and coping strategies using a scale of 0 to 3 (where 0 = did not informally learn through this pathway; 1 = little learning; 2 = More Learning; 3 = Most learning).. In other words, the women were answering a question on how drought has catalysed informal learning.

Session 3 (Modelling): This session was split into 3 sub-sessions. Sub session one engaged women to suggest solutions to some of the contradictions identified in session 2 in away reconceptualizing the initial local farming activity system. Sub-session 2 was about briefing women on scenarios (statements of plausible future) and how to develop them. The final sub-session engaged women to develop and describe scenarios which are stories of possible future, the ways they may unfold and pathways to reaching that future. Scenario building is a multi-stakeholder participatory process. Scenarios help in planning. For this research, scenarios were developed on how local farming practices and the associated informal learning pathways will unfold by 2030. More details about scenarios are presented in a blog titled ‘possibilities of local farming practices in the next 30 years.

Session 4 (Internal Feedback Session): Data generated between sessions 1 and 3 was summarized by myself and a feedback session was done in each extension planning area involving the women subjects.

2.4 Validation workshop

In 2017, one workshop was conducted for Domasi Extension Planning Area. The purpose of this workshop was to engage stakeholders drawn from various institutions to provide feedback on the solutions suggested by women under session 3 of change laboratory workshop. The presentations were made women representatives chosen by the women participating in the study.

3. Results and Discussions

Results are presented separately for each of the four research sub-questions.

Question 1: What are the past and current social barriers to adaptation learning processes for maize production under stressors of drought and dry spells?

> "If so many people are concerned about climate change, the environment, and sustainability, why are more of us not doing what is necessary to ameliorate the problems? Of course, many individuals and organizations have already taken some steps in this direction, and some have taken many steps. However, in the aggregate, humans continue to produce massive quantities of greenhouse gases that will further drive climate change, and we continue to engage in other environmentally destructive behaviour patterns" (Gifford 2011, p. 290)

What Gifford (2011) implies in this quote is that resilience building through adaptation faces obstacles some of which are psychological, that is to do with the mindset. The concerns by Gifford 2011 are shared by Lindley four years later (2015) when he says:

> "Despite extensive awareness of our unsustainable lifestyle, ample evidence of the impact of it, and even a concern to do something about it, we still do not see sufficient action being taken to work towards eco-cultural sustainability'

Gifford calls these obstacles 'dragons of inaction' and they fall into seven categories as follows:

1. Limited cognition about the problem due to ignorance, environmental numbness and ancient brains with deep seated hegemonies
2. Ideologies such as worldviews and the more-than-human powers (e.g. God and Witchcraft)
3. Comparisons with key other people—e.g. if they are not doing it, why should I do it myself? My contribution will be like a drop in the ocean
4. Sunk costs and behavioral momentum such as conflicting values, goals, and aspirations among various players
5. Discredence toward experts and authorities resulting in innovation rejections
6. Perceived risks of change such as unwillingness to take risks from innovations
7. Positive but inadequate behavior change.

For Lake Chilwa case study, social barriers which have been identified mostly relate to denial to use fecal or pig manure due to religious beliefs; skepticism about climate change in the Lake Chilwa Basin; discre-credence toward experts and authorities, ancient brains (e.g. refusing hybrid maize and sticking to local); differing use values among various stakeholders. Some notable quotes about the above barriers are presented below:

Men posing as social barriers: 'There was a conflict between myself and my husband when I planned to try Sasakawa, a modern farming method. He rejected me and refused to buy me fertilizer. Using own money, I bought fertilizer and applied following extension advice. By using Sasakawa, maize yield increased from 3 to 10 bags and my husband started supporting me since then." (Loveness Charles, one of the focus group participants). If Loveness was not determined to try sasakawa and if she followed her husband's 'drug-on' motive instead, she would not have **learnt** about this modern method.

The women have generally tagged men as '*wobwezeretsa m'mbuyo'* or laggards, low risk takers in trying a new innovation. Men only join in later *Akazaona kukoma* (after seeing the fruits)

About use of fecal manure: "A lot of people laugh at me saying '*ndine wozerezeka'* (crazy/mad) such that at first I would even do it in hiding. And I cannot collect fecal manure from other people's pit latrines because they will think *I want to bewitch* them and even use their feces for black magic" (Jennifer Maiteni, one of the participants). At Nsanama Extension Planning Area, it is also believed that use of fecal manure breaks marriages. Husbands tell their wives '*to wash your bodies before you can approach me*.' This means 'a lot of people' will **discouraged to learn or they may even dis-learn** about fecal manure as an adaptive strategy.

Skepticism about climate change: It was completely false to attribute the drying of Lake Chilwa in 2012 due to man-made global warming (Dr. John Wilson, 2014)). This may frustrate **climate change learning** as a man-made phenomenon.

Differing use values among stakeholders: "Even if Lake Chilwa dries, the land could be put to good use through farming and road construction. Certain insects that attack crops would disappear once that lake dries up" (Andrew Daudi, Head of the United Nations Millennium Villages Project in Malawi, 2012). This thinking may trigger **learning to maladapt**.

Discre-credence towards experts and authorities: 'As of me I grow local maize in one field and hybrid maize in another field. Since I am a single woman and I fear I may not find pesticides to apply to the hybrid maize to control weevils and in that instance the local maize will provide me some food to eat' (Rose Mulewa, 2017-one of the focus group participants). Rose wants to maintain local maize cultivation and the **learning** associated with the practice.

Question 2: What past and current informal learning processes have been catalyzed by drought and dry spells associated with maize production?

Table 1: Informal learning pathways in relation to drought episodes, Domasi Extension Planning Area

Year	Radio	TV	News paper	Drama	Posters	Demo	Learning visits	Social groups	Word of mouth	Trials	Totals
1943	1	0	0	1	1	0	0	0	1	0	3
1945	1	0	0	1	1	0	0	0	1	0	3
1949	1	0	0	0	0	0	2	3	3	0	9
1950	1	0	0	1	1	0	0	0	2	0	5
1965	1	0	0	1	1	0	0	0	1	0	3
1967	1	1	1	0	0	0	0	0	3	0	5
1970	1	1	1	0	0	0	0	0	3	0	6
1973	1	1	1	0	0	0	1	0	3	0	7
1980	2	1	1	1	1	0	1	0	3	0	11
1990	2	1	1	1	1	0	1	0	3	2	12
1995	2	1	2	1	1	0	1	0	3	1	12
2002	3	2	2	2	2	1	2	2	3	1	18
2012	2	1	2	2	2	1	2	1	3	1	17
2013	3	1	2	2	2	2	2	2	3	2	19
2015	2	1	2	2	2	2	2	2	3	1	19
2017	2	2	2	2	2	2	2	2	3	2	20
Totals	**24**	**14**	**16**	**15**	**14**	**8**	**16**	**4**	**41**	**10**	**169**

Table 2: Informal learning pathways in relation to drought episodes, Nsanama Extension Planning Area

Year	Radio	Tv	N/paper	Drama	Poster	Demo	Learning Visits	Social groups	Trial	Oral	Poetry	Totals
1943	1	0	0	0	0	0	2	1	1	2	0	7
1945	0	1	1	0	0	0	1	1	0	2	1	7
1949	2	1	1	0	0	0	1	1	1	3	1	10
1950	1	1	0	0	0	0	1	1	1	2	0	7
1965	1	1	1	0	0	0	1	1	1	2	0	8
1967	1	1	1	1	1	0	1	1	1	2	0	9
1970	1	1	1	1	1	0	1	1	1	2	0	11
1973	2	1	1	1	1	1	1	1	1	2	1	12
1980	2	2	1	1	1	1	1	1	1	2	1	15
1990	2	2	2	2	2	1	1	1	2	2	1	18
1995	2	2	2	2	2	2	2	2	1	3	2	22
2002	3	3	3	2	3	2	2	2	2	3	2	26
2012	3	2	2	2	2	2	2	2	2	3	2	24
2013	3	2	2	3	2	3	2	3	3	2	3	28
2015	3	2	3	3	3	3	2	3	3	2	2	29
2017	3	3	3	3	3	3	3	3	3	2	2	28
TOTALS	**29**	**23**	**23**	**21**	**21**	**18**	**26**	**23**	**23**	**37**	**19**	**263**

According to the two tables above, the extent of informal learning was generally higher in drought years than normal years. For example, over the past 6 decades, 1949 was a severe drought year in Malawi. This year was associated with more informal learning pathways than the other years during the same decades. From 2002 to 2017, there have been some severe dry spells. Correspondingly, there had been diverse informal learning pathways

Table 3: Informal learning about coping strategies during drought episodes, Domasi Extension Planning Area

Coping method	'43	'45	'49	'50	'65	'67	'70	'73	'80	'90	'95	*02	*12	*13	*15	*17	Totals
Cassava leaves	0	0	3	3	1	1	2	2	3	3	3	1	1	1	2	2	**28**
Reduced meals	0	0	3	3	0	0	0	0	0	0	0	3	0	0	0	0	**9**
Wild Yam	0	0	3	0	0	0	0	0	0	0	0	3	0	0	0	0	**6**
Banana Tubers	0	0	0	0	0	0	0	0	0	0	0	3	2	2	1	0	**8**
Wild grass seeds	0	0	3	0	0	0	0	0	3	0	0	3	0	0	0	0	**9**
Migration	0	0	3	0	0	0	0	0	2	0	0	3	1	1	1	0	**11**
Sale of household properties	0	0	3	0	0	0	0	0	3	0	0	3	0	0	0	0	**9**
Piece work	0	0	3	3	0	0	0	0	3	0	0	3	1	1	2	0	**16**
Family ties	0	0	3	0	0	0	0	3	0	0	3	0	2	2	0	0	**13**
Prostitution	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	**3**
Theft	0	0	0	0	0	0	0	0	3	0	0	3	0	0	0	3	**9**
Maize Bran	0	0	3	0	0	0	0	0	3	0	0	3	0	0	0	0	**9**
Rice Bran	0	0	3	0	0	0	0	0	0	0	0	3	0	0	0	0	**6**
Charcoal sales	0	0	0	0	0	0	0	0	0	0	0	3	0	3	3	3	**12**
Totals	**0**	**0**	**30**	**9**	**1**	**1**	**2**	**5**	**20**	**3**	**7**	**36**	**7**	**10**	**9**	**8**	**148**

Table 4 : Informal learning about coping strategies during drought episodes, Domasi Extension Planning Area

COPING STRATEGY	'43	'49	'50	'65	'67	'70	'73	'80	'90	'95	*02	*12	*13	*15	*17	TOTAL
Sawdust	0	2	0	0	1	0	0	0	0	1	2	1	1	1	0	**10**
Sawdust+Rice bran	0	2	0	0	0	0	0	0	0	0	2	1	0	1	0	**7**
Cassava leaves	1	3	1	1	1	1	1	2	1	1	2	1	1	1	0	**18**
Reduced meals	1	3	1	1	1	1	1	1	1	1	1	2	1	2	0	**17**
Mango+Juice cola	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	**5**
Wild Yam (Mpama)	1	3	1	1	1	1	1	1	1	1	1	1	1	1	0	**15**
Wild grass seeds	1	3	1	1	1	1	0	0	0	1	1	1	1	1	1	**14**
Migration	1	2	1	1	1	1	1	1	1	1	2	1	1	1	1	**14**
Sale of household items	0	2	1	1	1	1	1	1	1	2	2	2	2	2	1	**19**
Ganyu	1	2	1	1	1	1	2	2	2	2	2	2	2	2	2	**26**
Family ties	2	3	2	2	2	2	2	2	2	2	2	1	2	2	1	**28**
Prostitution	0	0	0	0	0	0	0	1	1	1	2	2	3	3	2	**16**
Theft	0	1	0	0	0	1	1	1	2	2	3	2	3	3	2	**21**
Mkokabwato	1	1	1	0	1	1	1	1	1	1	1	1	1	2	1	**15**
Early girl child marriage	0	0	0	0	0	0	0	1	1	1	2	3	3	3	2	**16**
Bird and mice hunting	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	**15**
Maize Bran	1	2	1	1	1	1	1	1	1	1	2	2	2	2	2	23
Rice Bran	0	1	0	0	0	0	0	0	1	1	2	1	1	1	1	10
Charchoal sales	0	0	0	0	0	0	0	0	1	1	2	3	3	3	3	16
Village Banks	0	0	0	0	0	0	0	1	1	1	2	3	3	3	3	16
Fish sales	2	1	2	2	1	2	2	2	2	2	2	2	2	2	2	27
TOTALS	**14**	**32**	**14**	**13**	**14**	**15**	**16**	**19**	**20**	**25**	**38**	**32**	**32**	**37**	**25**	347

Tables 3 and 4 show that there have been new coping strategies informally learnt during drought and dry spell episodes. For example, mango plus juice cola as a coping strategy has only been informally learnt and practiced since 2002. For the past 6 decades, the year 1949 had the greatest number of coping strategies used implying lots of informal learning during the same year.

Question 3: How could expansive learning processes in informal learning settings potentially help rural women maize farmers move from incremental to transformational adaptation practices?

Results for this question have been presented as general contradictions affecting all local farming practices and individual level local farming contradictions. Solutions suggested by women have also been presented

1. **GENERAL CONTRADICTIONS ABOUT ALL LOCAL FARMING PRACTICES**
    a. They are neglected
    b. Limited Research has been done
    c. Not well included in syllabus
    d. Not well documented
    e. Poorly understood
    f. Westernization/modernity threatens local farming practices

2. **SOLUTIONS TO GENERAL CONTRACTIONS**
    a. Women should lead in organizing meetings through the chief to enlighten people including youth about local knowledge practices.
    b. There should be history books of local farming practices with pictures on IKS to avoid misinterpretation/omissions/modifications which is common with oral transmission, typical of IKS.

        i. The books should highlight importance of IKS and how to use it.
        ii. Researchers and other stakeholders should come to the village, ask the elders and write IKS accordingly.
        iii. Lead has started well. There should be regular programmes on IKS say on Tuesdays and Thursdays and there should be clubs
        iv. Include poetry in books.
        v. The change laboratory sessions secretary should systematically compile what she has documented during the sessions as this is the start of the book at village level

    c. Chiefs should develop an inventory of local farming practices in their areas.
    d. Local farming practices should be included in school syllabus, especially in Agriculture
    e. Integrate IKS with science
    f. Increase usage of the following informal learning pathways based on women's choices (Table 1)

3. INDIVIDUAL LOCAL FARMING PRACTICES CONTRADICTIONS AND SOLUTIONS

No.	Name of the local system	Description	Preference (Out of 15 women)	Absences	Absenting absences
1	'Kuojeka' (Green manure)	Soon after harvest, fresh plant residues are incorporated into the soil to enhance decomposition.	14	Killing useful worms that loosen the soil or help bring nutrients in the soil	Not applicable since women interviewed felt this is a not a problem in their area
				Boosts multiplication of unwanted plants	Crop residue incorporation should be done soon after harvest when the soil is still moist to speed decomposition
				Slow decomposition (e.g. Nansondole and *Sorghum bicolor* (Mapira) Stalks	• Early plant residue incorporation • Burning slow decomposing plants • Early weeding and/or slash down the hard decomposing plants before their seeds mature and bury them later on. • Plant sweet potatoes where we planted maize. If you do this for two years, *nansongole* will be eradicated • Incorporate ripe *makumbuka* banana (Silver bluggoe) sheaths • Only bury fast decomposers. Slow ones should be put in strategic places and burnt
				Laborious	• Engage piece workers (Ganyu) • Engage neighbors
2	Mphanje	Typically, the practice means 'opening a new garden' where cultivation has never taken place. For our purposes, the process starts with burying partially dried plant residues into a mound. Using a small opening that is left on each mound, burning is then later on done to facilitate release of nutrients from the plant residues. The most common crop grown is cucumber which matures in	7	Limited land due to increasing human population	Family planning
				Kills soil organisms	Avoid burning completely
				Labour demanding	Ganyu (piece work) and engagement of relatives and neighbours
				Scarcity of plant residues to incorporate	Collect plant residues such as rice husks out of the Mphanje practicing plot

		February (Hunger month). No fertilizer is applied and there is also no or limited weeding due to burning that kills weed seeds			
3	Livestock manure	Sourced from all livestock types the most common being cattle, goats, chicken and pigs	14	Livestock scarcity	• The government should provide livestock • On their own, local communities can buy small livestock like chickens • Exploit existing social capital opportunities through: i. Begging ii. Livestock provided as token of thanks for caring someone's animals (e.g. Keep a chicken for a neighbor and get chicken reward after multiplication). • Collect from wherever an animal has defaecated • Promote use of maize bran /ash mixture instead as an alternative to livestock manure but this will require need training on mixing • Use alternative sources such as bat manure and mixture of chlorophyll and urine (Green leaves are soaked in water to allow decomposition and release of chlorophyll. Urine is then added to produce *liquid* fertilizer)
				Beliefs that prevent keeping of some livestock types.	• There was no solution suggested to solve this challenge.
				Beliefs hat limit use of manure from some livestock types e.g. pigs	• Noting that religious beliefs that prevent keeping of pigs and other 'unclean' animals generally support '**use**' of manure from these animals, sensitization campaigns can easily win the heart of the few that oppose.
				Slow decomposition	• Add yeast • Put under shed and apply water • Burn • Grinding • Mix burnt and grounded manure (Since burnt manure only encourages height but maize does not green up, according to Agnes Charles)

				Spread of pests, diseases and weeds:	• Bake the manure by adding yeast, ash and sodium bicarbonate so that everything unwanted dies • Burn the manure • Manual selection of visible weed seeds and pests
				Men's perception that it is associated with poverty (Men do not want to be seen as 'osusuka or wotchipa mtengo' (Zione John)	• Women should proceed using manure on their own as 'demonstration' to their husbands • Women should share the proceeds from use of manure to their husbands or 'buy them a pair of trousers'
4	Chimanga cha lokolo (Local maize)	This is the traditional maize variety that local communities have cultivated for several generations because of longer shelf-life of its seed and flour, better taste of the 'nsima' and fresh maize than hybrid.	10	Slow growth and low yields	• Apply adequate amounts of chemical fertilizers or manure
5	Traditional pest and disease control measures	There are several measures including use of sand, ash, mthuthu and neem powder (Neem is a bitter plant), menstrual blood, placement of a sample of infected plants at cross roads, Soak maize seed in paraffin or soap/water mixture (Doom is good because it 'burns' your fingers when washing), sing and dance to "Kapuchi song' to control stalk borers	8	• Slow to act on pests and diseases • Application rates not defined	• Need research and training on application rates and how to enhance effectiveness. (However, for now, the consensus is to use local means because they are easily accessible and cheap)
6	Determination of maize planting time (rainfall forecast)	Local communities mostly use biological indicators such as mango flowers, run-away monkeys, pangolins, and hippopotamus, mosquitoes and ants to determine rainfall onset. They also dig the soil using special hoes after the rains to check moisture depth if it is	12	Loss of wildlife due to habitat degradation and unsustainable harvesting	• Plant more trees to create wild animals habitat including birds • Eliminate corruption especially from Forestry Staff associated with deforestation and charcoal making • Reduce charcoal demand in urban areas

		right time to sow			
7	Mixed Cropping	This is an old farming system where different crops are planted in the same field as a risk aversion strategy in case one crop fails. The system contradicts with 'sasakawa' promoted by Ministry of agriculture. Sasakawa limits mixed cropping.	15	Laborious	• Ganyu (Piece work) • Exploit available social capital opportunities such as labour from neighbours and relatives
				Destruction of crop roots during harvesting and weeding	• Exercise care when harvesting • Crops should be planted in different plots within the same garden • Crops should be planted in different planting stations
				Transferring of pests from other crops: e.g. Nseula source of aphids for maize. (Rose James and Zione John felt the problem is weather/rainfall dependent). For example, If rains are poor (drought) there will be severe pest and disease outbreak	• Mix crops that suffer different types of pest and diseases. • Physical removal • Early Weeding
				Restrictions/dictations from men on which crops to mix	• Women should forge ahead on their own and men will join later after seeing fruits • Entice men • Buy men something from sale of harvests.
				Small number of extension personnel	• Employ more lead farmers but these should be incentivized through training, farmer contributions, small IGAs to source funds for the lead farmers
				Although adequate knowledge exists about optimizing yield by mixing pigeon peas and maize, there is generally limited knowledge on which other crops to mix	• More extension advice and research on new crops depending on agro-climatic zones
8	Fecal manure	Old pit latrines are excavated for the manure. Those who have used it (e.g. Jenifa Maiteni) claim they harvest pumper yields.	3	Religious beliefs and misconceptions (e.g. that eating crop produce from use of human waste is like directly 'eating' feces themselves; those using are witchcrafts)	• Create awareness through demonstrations, trials, drama, discussion forum where those utilizing the manure can share with others
				Health hazard	• Avoid fresh manure • Put on protective materials such as gloves
				Slow drying of the human waste in the toilets for use in the field	• Need training on how to speed up drying processes • Dig knee-deep toilets and mix human waste with ash

					(to reduce smell and compress feces), maize bran and goat or cattle manure to boost drying (Within three months the manure is ready)
				Application rates not defined	• Need soil scientists
9	Traditional maize storage	Maize is stored in 'Nkhokwes' (Granaries)	6	Theft	• Keep dogs
10	Traditional soil nutrient detection techniques	Local farmers use soil color, plant growth rates, leaf color, presence of soil macro-fauna including earthworms	6	Difficult to determine actual quantities of plant nutrients Apart from their knowledge of yellow leaf coloration as a sign of luck of 'fertilizer wachitowe', there is general lack of knowledge about which nutrients are deficient in the soil looking at plant growth patterns.	• Need soil scientists
11	'Mkamwini wa changu' (literally means the fast husband)	Relates to use of fire as a fast means of clearing land for cultivation.	0	Destructive fires since large areas are burnt	The practice should be totally eliminated
12	Clearing and burning	Means bush is first cleared by a farmer and then set on fire. This is different from item 11 where fire does **all** the clearing.	5	Destructive fires	The Practice should be totally avoided
13	Three maize seeds per planting station	Ridges are made 90 cm apart. Planting stations are also 90 cm with 3 seeds per station	0	Making ridges spaced 90 Cm apart is too laborious Very high plant nutrient competition from a station	Practice should be abandoned

References

Fern, E. (1982). The use of focus group discussions for idea generation : effects of group size, aquaintanceship and modertaion on response quality and quanty. *Marketing Research, 19*(1), 1-13.

Global-Global. (2014). *Respondent-Driven Sampling: A Resource Guide for Steering Committee Members.* Unknown: PEPFAR. Retrieved from https://www.nastad.org/sites/default/files/Appendix2-6-RDS-Resource-Guide.pdf

Kemmis, S. (2009). Action Research as a practice-changing practice. *Educational Action Research, 17*(2), 463-474.

LCBCCAP. (2010). *Hotspot Identification Report.* Zomba: Unpublished.

Serdeczny, O., Adams , S., Coumou, D., Robinson, A., Hare, W., Schaeffe, M., . . . Reinhardt, J. (2016). Climate change impacts in Sub-Saharan Africa: from physical changes to their social repercussions. *Regional Environmental Change*, -.

Stringer, L., Dyer, J., Reed, M., Dougill, A., Twyman, C., & Mkwambisi, D. (2009). Adaptations to climate change, drought and desertification: local insights to enhance policy in southern Africa. *Environ. Sci. Policy*, 1-18. doi:10.1016/j.envsci.2009.04.002

UNESCO. (2006). *25 Biosphere Reserves added to UNESCO's Man and Bioshphere Network*. Retrieved October 12, 2015, from htt://www.portal.unesco.org/en/ev.php

United Nations. (1992). *United Nations Convention on Climate Change, Articles.* -: United Nations.

Wilson, John (2014). The History of the Level of Lake Chilwa. The Society of Malawi Journal, Vol. 67, No. 2 (2014), pp. 41-45 Published by: Society of Malawi - Historical and Scientific Stable URL: http://www.jstor.org/stable/24332681