Weather Index-based Insurance as an Effective and Sustainable Climate Change Adaptation Strategy for Smallholder Farmers in Malawi

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Abstract

The impacts of climate change pose a significant threat to the livelihoods of smallholder farmers in developing countries. This is especially true in rural Malawi where farmers rely on rainfed crops as their major source of income. To help low income farmers respond to climate change, development agencies and international financial institutions have proposed a range of agricultural insurance products. While there are numerous insurance strategies, in recent years, weather index-based insurance has become an increasingly attractive option due to low-administration costs and reduction of moral hazard. This paper pulls from empirical evidence of existing weather index-based insurance research along with primary data collected through a case study from Malawi to explore whether weather index-based insurance is an effective and sustainable climate change adaptation strategy for women and men smallholder farmers in Malawi. This is done by examining its enrollment rates and scalability, its effectiveness in meeting the needs of women and men smallholder farmers, and if the weather index-based

insurance coverage is leading to improved agricultural practices and use of improved inputs and technologies**.** This paper finds that a serious and extensive investment into a gender responsive, well designed, robust but flexible weather index-based insurance product, in an enabling environment, could be a much-needed bridge to sustainable climate change resilience for smallholder men and women farmers in Malawi.

Contents

Table of Acronyms

ACRE:	Agriculture and Climate Risk Enterprise
CDF:	Cooperative Development Foundation
CIC:	Co-operative Insurance Company of Kenya Limited
FUM:	Farmers Union of Malawi
LDC:	Least Developed Country GDP – Gross Domestic Product
INVEST Co-op:	Increasing Wealth and Food Security Through the Integrated Cooperative Business Model
MK:	Malawian Kwacha
MUSSCO:	Malawi Union of Savings and Credit Co-operatives
NGO:	Non-government Organization
SACCO:	Savings and Credit Cooperative Organisation
VSLA:	Village Savings and Loan Associations
WFP:	World Food Program
WIBI:	Weather Index-based Insurance
WTP:	Willingness to Pay

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Introduction

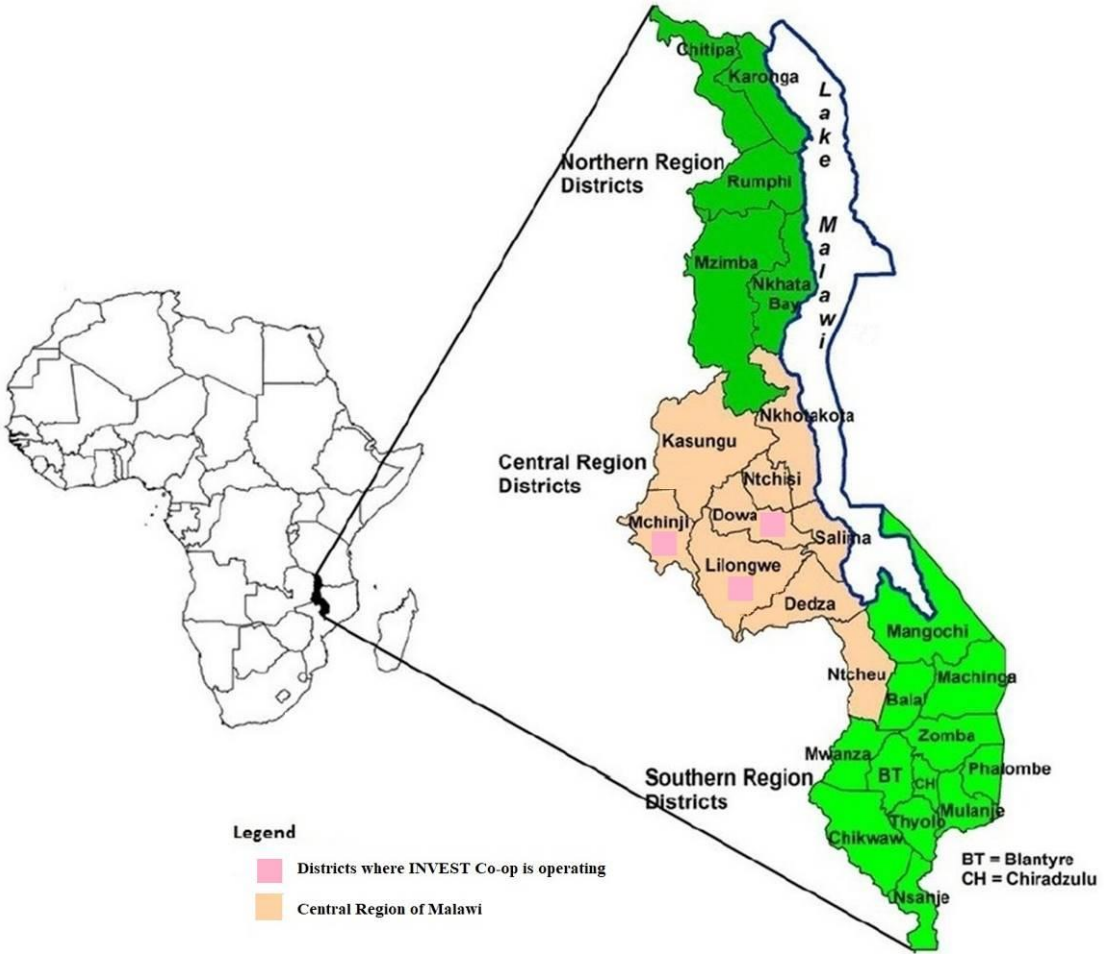
The effects of climate change have brought about more frequent and severe weather conditions including drought and flooding. This has jeopardized smallholder farmers and their families in developing countries who are unable to adapt (Carter et al. 2007). These are farmers who cultivate small plots, utilise family labour and rely on their farms as a primary source of income and food security (Vignola et al., 2015). As climate change persists, woman farmers remain more vulnerable and less able to adapt to the impacts of climate change (Akter et al. 2016). In Malawi, agriculture accounts for over 30 percent of the country's gross domestic product (GDP) and employs roughly 85 percent of the labour force (Murray et al. 2016). As a result of its heavy reliance on agriculture, the 2007 United Nations Human Development Report identified Malawi as one of the most vulnerable countries in sub-Saharan Africa to the impacts of a changing climate (Murray et al. 2016).

To help low income farmers in Latin America, Asia and Africa respond to climate change, development agencies and international financial institutions have proposed a range of agricultural insurance products (Hochrainer et al. 2009). While there are numerous insurance strategies, in recent years, weather index-based insurance (WIBI) has become an increasingly attractive option due to low-administration costs and reduction of moral hazard, which is the increase of risky behaviour while insured (Marr et al. 2016). WIBI uses weather data measured at a local weather station to provide coverage to farmers. A payment is automatically triggered once the predetermined threshold of the index is exceeded (Cole, et al. 2012). For example, "rainfall insurance provides payouts when rainfall levels, measured at a specific reference weather station, meet specific criteria." (Cole et al., 2012, p.2)

This paper pulls from empirical evidence of existing WIBI research along with primary data collected through a case study from Malawi. The Mthangati WIBI pilot program is funded by Global Affairs Canada, and is implemented in three regions, through seven agricultural co-operatives in rural Malawi. This research will explore whether or not WIBI is an effective and sustainable climate change adaptation strategy for women and men smallholder farmers in Malawi by examining its enrollment rates and scalability, its effectiveness in meeting the needs of women and men smallholder farmers, and if the WIBI coverage is leading to improved agricultural practices and use of improved inputs and technologies**.**

Context

Figure 1. Map of Malawi



(CDF Canada, 2019)

Malawi, a landlocked country in southeast Africa (Figure 1), it is considered to be a least developed country (LDC) by the United Nations (Murray et al., 2016). As previously mentioned, agriculture is a large contributor to the country's GDP and employs the majority of the population. Malawi has an agriculture-based economy with 80 percent of the rural population supported by the agricultural sector, with women making up 70 percent of full-time farmers (World Bank, 2018). Smallholder farmers produce approximately 80 percent of the food consumed in Malawi and 20 percent of agricultural exports (World Bank, 2018). Unfortunately, the impacts of climate change have had a negative impact on Malawi's agricultural sector

through devastating climate shocks such as drought and flooding. Since smallholder farmers rely on rainfed crops, the increased frequency of seasonal droughts, intense rainfall, and flooding has had a large impact on their livelihoods (World Bank, 2018). It is estimated that Malawi loses approximately 1.7% of its GDP on an annual bases due to extreme drought events (Makaudze, 2018). Smallholder farmers are becoming increasingly vulnerable to "mid-season dry spells, flooding along river basins and poor rainfall distribution." (Murray et al., 2016, p.123) For example, the flooding that took place in 2015 resulted in losses of approximately USD 335 million, while the drought in 2016 resulted in an estimated loss of USD 365 million (World Bank, 2018).

In addition to the impacts of climate change, challenges in land tenure security and poor agricultural practices have led to soil degradation in many parts of the country, contributing to a loss or decrease in productivity for smallholder farmers (Chikhwenda et al. 2019). As per the Malawi National Agriculture Policy, the key issues preventing small holders from reaching their full production potential is the lack of extension services delivered to smallholder farmers which has hindered the adoption of more sustainable farming practices (Ministry of Agriculture, Irrigation and Water Development, 2016). Additionally there is a lack of access to financial services and support for farmers and a lack of control over productive assets, especially for women and youth (Ministry of Agriculture, Irrigation and Water Development, 2016). The gender gap in the agricultural sector has a significant impact on production as women smallholders tend to be 25 percent less productive than men when it comes to agriculture (Murray et al., 2016). Furthermore, land tenure is complex and usually only accessible to men (Murray et al., 2016).

It is clear that climate change is having a costly impact on the agriculture sector within Malawi, far exceeding the revenue coming from large international climate funds (World Bank, 2018). Due to the increase in extreme weather events impacting the agricultural sector in Malawi, the government has been "determined to implement WIBI as part and parcel of its nationwide disaster risk mitigation strategy." (Makaudze, 2018, p. 126) As a result, in partnership with the World Bank, WIBI was introduced in Malawi in 2005. The pilot project started out promising as 2,600 tobacco producers and 1,700 groundnut and maize producers were insured early on (Makaudze, 2018). Unfortunately, the scheme collapsed, and by 2014, most of the lending institutions had discontinued the WIBI product due to consumer, infrastructural and institutional hurdles (Makaudze, 2018). These hurdles included smallholders' inability to afford premiums, cultural and traditional barriers, inadequate weather data and recording infrastructure, lack of mobile technology, limited provider capacity, and limited crop coverage. Since this time, additional small and large-scale WIBI programs have been introduced and ongoing in Malawi through organizations such as the World Food Program (WFP) and the Agriculture and Climate Risk Enterprise (ACRE) (Weber, 2019 & Dubreuil, 2019). However, the impacts of these programs remain relatively unknown.

Mthangati Insurance Program

The Mthangati WIBI product was developed through the Increasing Wealth and Food Security Through the Integrated Cooperative Business Model (INVEST Co-op) program implemented by The Cooperative Development Foundation of Canada (CDF Canada), Farmers Union of Malawi (FUM) and Malawi Union of Savings and Credit Co-operatives (MUSSCO) and

funded by Global Affairs Canada (CDF Canada, 2020). The program worked in three districts (Lilongwe, Dowa and Mchinji) in Malawi (Figure 1) and supported over 50,000 smallholder farmers to improve agricultural production and productivity, increase access to markets and financial services, build co-operative capacity and strengthen relationships between co-operatives and local governments (CDF Canada, 2020). In order to achieve these goals, the INVEST Co-op program supported and helped establish co-operatives to facilitate marketing, link farmers to credit unions (SACCOs) and encourage the use of improved agricultural techniques (Oetling & Zanzanaini, 2018).

Despite these interventions, it was clear that the above methods were not enough to combat the impacts of climate change being experienced. Therefore, CDF and MUSCCO partnered with Co-operative Insurance Company of Kenya Limited (CIC) to develop a WIBI product to cover the maize and soya production of smallholder farmers (Oetling & Zanzanaini, 2018). Initially, the WIBI product was piloted during the 2018-2019 growing season in seven co-operatives across all three districts. After a period of community consultation, it was determined that lack of rainfall, drought conditions, dry spells and erratic rainfall patterns at all stages of the growing season were the most prevalent and destructive issues facing farmers (Oetling & Zanzanaini, 2018). The rainfall was quantified by satellite measurements and backed up by rain gauges kept at the participating co-operatives (Oetling & Zanzanaini, 2018). The pilot intended to pay out farmers, in the event of a drought, during the planting season and again during the rest of the cropping season (Oetling & Zanzanaini, 2018). By the end of the INVEST Co-op program, 5,614 women and 12,464 men smallholder farmers had received training on the availability and benefits of the Mthangati WIBI product (CDF Canada, 2020). Despite more

than double the number of men attending trainings than women, a total of 54 men and 120 women smallholder farmers had enrolled in the WIBI program by the end of the pilot phase. This higher uptake by women was most likely due to the gender-responsive nature of the WIBI design and marketing (Oetling & Zanzanaini, 2018). As a result, the WIBI product was designed to cover women dominated food crops and made available through Village Savings and Loan Associations (VSLA) in which women make up the majority of the membership.

Once the initial pilot phase of two seasons was complete, the WIBI program was meant to be scaled up to a total of 41 co-operatives. The product was also redesigned to include excess rain coverage in addition to insufficient rainfall with a premium cost of MK6,500 ($11.70 CAD) for maize and MK5,000 ($9.00 CAD) for soya per acre, per year (CDF Canada, 2019). Unfortunately, due to low enrollment (approximately 1% of those targeted by the program accessed the WIBI) CIC did not believe in the viability of the product and that it could be sold at a larger scale. Additionally, CDF Canada cut the marketing budget and CIC was unable to take up this additional cost. Therefore, the Mthangati WIBI product was discontinued once the pilot was complete.

Literature Review

WIBI has recently been popularized within international development circles due to its low-administration costs and reduction of moral hazard (Marr et al. 2016). Despite this, a relatively limited amount of research has been conducted in this area. Of the research that is available, it is primarily focused on empirical evidence derived from limited sampling from developing countries, primarily located in Asia and Africa (Carter et al., 2016, Cole et al., 2014,

Nicola, 2015 & Sopov, 2018). Despite the implementation of a large-scale WIBI program implemented by organizations such as the WFP, World Bank and ACRE among others, limited research has been conducted on the impacts of this market-based approach. This seems to be due to the limited success that these schemes have had in developing contexts long term. The literature is largely made up of research that focusses on WIBI to cover either cash crops, food crops or livestock. The available research primarily looks at three main themes when it comes to WIBI. These include; i) the barriers and incentives of willingness to pay (WTP), ii) the effectiveness of the product in meeting the needs of targeted smallholder farmers, and iii) the impact of accessing the WIBI product on household consumption, wellbeing, agricultural investment and adoption of new technologies and improved agricultural practices.

i) Barriers and Incentives of WTP and Scalability

In order to understand the lack of uptake that WIBI programs have experienced over the years, a handful of primarily quantitative studies have been conducted in developing countries within the last ten years. These studies target smallholder farmers, primarily in African countries such as Kenya, Ethiopia, Rwanda and Malawi in which crop insurance schemes have been piloted. These studies focus on a farmer's willingness and ability to pay for insurance premiums and the factors that influence their decision-making process. By focussing on a relatively small sample size of approximately 300 to 1000 farmers, the studies primarily follow the same quantitative survey methodology accompanied by statistical analysis. These studies (Bogale, 2015, Castellani & Vigano, 2017, Isaboke et al., 2016 & Maganga et al., 2021) look at WTP for WIBI based on experienced weather impacts, socio-economic, institutional and

demographic data. Most studies rely on structured questionnaires that ask farmers to indicate their wiliness to pay for a hypothetical WIBI product or rank and prioritize their coping strategies. There studies include WIBI products that cover either cash crops, food crops and even livestock depending on what was most appropriate for the context.

There seems to be a relative consensus when it comes to the factors influencing WTP among smallholders. Unsurprisingly, factors such as increased education, higher income and larger farm plots and exposure to recent climate hazards have a positive impact on WTP. However, the extent to which these factors are predictors of WTP is not as reliable. Additionally, when it comes to gender as it relates to WIBI, the literature is extremely limited as a large portion of the studies conducted focus on the household as a unit instead of individual farmers. For instance, the first WIBI study that focussed on gender was only conducted in 2015 (Sopov, 2018). Additionally, to date, only one quantitative study using a gender lends to examine WIBI preferences has been conducted by Akter et al. in Bangladesh (2016). Therefore, although extremely important, there is limited understanding around the impacts of gender on WTP. Of the limited information available, the general consensus is that women are less trusting of financial institutions and more risk-averse than men, which reduces their WTP. However this could simply be the result of a lack of WTP for a poorly design WIBI product, that primarily meets the needs of men farmers. More research is needed in this area to improve the design of WIBI offers as well as increase uptake of WIBI products. For this to happen, a shift from a quantitative to qualitative data collection methodology could better engage women in a more meaningful way (Wakefield & Koerppen, 2017). An increase in qualitative data collection

could also provide a deeper and more nuanced understanding of WTP which is clearly still needed to assist WIBI programs from moving beyond the pilot phase.

Additionally, there is consensus in the literature focussing on scalability of WIBI schemes, identifying basis risk as one if not the largest impediments (Castellani & Vigano, 2017, Sopov, 2018, Makaudze, 2018 & Weber, 2019). Through empirical evidence, it has been found that basis risk has a large impact on the effectiveness of a WIBI program as it introduces significant risk into this risk management tool (Weber, 2019; Makaudze, 2018). The lack of attention paid towards addressing bases risk within programs has had and continues to have a significant impact on WIBI uptake and reliability. Literature around addressing basis risk and case studies providing real-world examples of basis risk mitigation are desperately needed.

ii) Effectiveness of meeting the needs of targeted smallholder farmers

The available literature focused on the effectiveness of WIBI is primarily comprised of small-scale empirical studies conducted in developing countries as well as sector scans that bundle the results of multiple theoretical and empirical research. These studies primarily focus on addressing the risks faced by smallholder farmers as well as its impact on income and food security. The general themes of this literature can be organized within three areas of focus. These include sustainable access to WIBI, if risks faced by farmers are being addressed in an effective way and if income or food security is increasing as a result of accessing WIBI schemes.

Within the literature, there seems to be general consensus that a well-designed WIBI product can be effective in meeting the needs of smallholder farmers to a certain extent (Barnett et al., 2008 & Gehrke, 2014). However, a more in-depth gender analysis is needed.

Unfortunately, due to the lack of longevity of large-scale WIBI programs, the literature is extremely limited, especially when it comes to a specific focus in Malawi. ACRE and the WFP are two organizations that have recently launched and reported on large-scale WIBI programs across multiple African countries. Both of these programs have reported an increase in household income, savings and food security as a result of their WIBI intervention (Dubreuil, 2021 & Sopov, 2018). However, it is important to remain critical of the results being provided through published program reports developed by Non-Government Organizations (NGOs) who are vying for future funding. Additionally, there is a focus on contribution over attribution in the absence of an impact evaluation. Therefore, results could be the outcome of multiple interventions or sources of support, since most WIBI schemes are implemented alongside other supportive interventions including improving access to markets and extension support. On the other hand, Makaudze conducted research outlining the reasons for the failure of the WIBI program implemented by the World Bank in Malawi in 2005 (2018). This research outlines lessons learned that could easily be applied to future programs. Due to the external nature of this review, it provides an honest and open overview of the program's implementation, providing an invaluable contribution to the literature around the sustainability of WIBI programs. Despite years of failed WIBI schemes implemented across countless developing countries, there is little documentation around reasons for failure and lessons learned. This knowledge could enable governments and organizations to implement programs designed to succeed beyond the pilot phase. In terms of sustainable access to WIBI, the Hochrainer et al. study conducted in Malawi, took an innovative approach by using WIBI and climate change

modelling to quantitatively estimate the viability of WIBI in Malawi in the face of future climate change projections (2009).

ii) The impact of accessing the insurance product on household and agricultural practices

Within the WIBI literature, whether or not accessing the insurance product leads to further agricultural investment, use of improved practices, access to improved technologies and increased household wellbeing is extremely important. Despite this, the research around these subjects is limited. It includes empirical studies derived primarily from small-scale pilot projects or situations in which WIBI products were suddenly made available to farmers. Notable these studies have been conducted in India and various African countries including Malawi (Cole et al., 2012 & 2014, Elabed & Carter, 2014, Haruna et al. & Nicola, 2015). The majority of the studies are small-scale research initiatives with sample sizes between 400 and 1500 households, benefiting from control groups and a quantitative survey methodology. The results are primarily based on self-reported survey responses at the household level, therefore gender considerations are extremely limited.

Within the literature, there seems to be consensus that, in the right context, including access to inputs, technologies and markets, and with the right WIBI product in place, there is potential for smallholders to increase investment into their production. Unfortunately, once again, the impact of gender within this area of focus is extremely limited. Despite this, there is significant literature around barriers faced by women farmers accessing financial services, agricultural inputs and technologies in Malawi. Therefore, it can be assumed that these limitations would remain unless specifically addressed in the design of the WIBI product

available, such as bundling WIBI with other financial services or inputs. Aside from the empirical research conducted, Carter et al., takes a theoretical approach to understanding which contexts most affect the probability that a farmer accessing WIBI implement improved agricultural practices and investment (2016), an extremely important contribution to the literature as it helps guide WIBI design based on the implementation context.

Methodology

In order to contribute to the existing literature around WIBI, the original intent of this research was to rely heavily on first person data collection through key informant interviews (KII), Focus Group Discussions (FGD) and a household survey to identify the impact of the Mthangati WIBI program. Unfortunately, the Covid-19 pandemic struck just as the data collection was to take place. Due to national restrictions, only a limited amount of first-person data was collected. Therefore, in order to identify whether or not WIBI is an effective and sustainable climate change adaptation strategy for women and men smallholder farmers in Malawi, this research relies primarily on secondary empirical evidence collected through existing research, reinforced with first person data collected to develop a case study of the Mthangati WIBI program. This research uses a qualitative data collection approach through a literature scan of empirical evidence as well as a program case study.

Secondary Empirical Data Collection

Empirical research consists of results that are measurable and observable identified through actual experience (LaSalle University, 2022). A qualitative literature scan was conducted in order to identify scholarly articles and program reports that provided empirical

data and results in relation to WIBI enrollment rates and scalability, effectiveness in meeting the needs of smallholder farmers and WIBI coverage leading to improved agricultural practices and use better quality inputs and improved technologies**.** Through this analysis 17 peer reviewed academic journal articles, 14 reports (including program, country and government reporting), two discussion papers, one dissertation, two systematic reviews and one book chapter were reviewed and coded based on themes and findings. Once all documents had been reviewed, coded and analysed, they were sorted into the three results categories[1] listed above to provide evidence towards the research question.

Primary Data Collection

The primary data for the Mthangati WIBI program case study was collected through a qualitative research approach that worked with key informants and a sub-sample of farming household members. Pandemic-related restrictions did limit the ability to interview the originally planned sample, and prevented any focus group interviews to complement the individual interviews.

The key informant data was collected through structured and semi-structured interviews with two program staff and 16 insurance policy holders from the pilot program (see Annexes 1 and 2). The research targeted the program's WIBI specialist as well as a consultant involved in the early design of the product. They were both involved in the design, marketing and selling of the WIBI product as well as project implementation. As a result, non-probability,

[1] Namely: i) Barriers and incentives of willingness to pay ii) Effectiveness of meeting the needs of women and men farmers, and iii) Impacts on household wellbeing, investment, technology adoption, and agricultural practices.

purposeful sampling was used to select these key interviewees. The interviews were conducted in English by phone and were approximately an hour in duration. The interviews were recorded, transcribed and coded based on the three content themes identified above.

In addition to the staff interviews, women and men smallholder farmers from all three pilot districts were also targeted. In terms of sampling, of the list of 127 women and 46 men participants, each participant was assigned a number and a random number generator website was used to randomly select the eight men and 18 women representing 15 percent of policy holders. Stratified random sampling was used to ensure that participation across all three districts was representative. Unfortunately, due to time constraints and restrictions, such as physical distancing and gathering limits, imposed to reduce the spread of Covid-19, only 5 men and 11 women were interviewed (see Annex 1 for the interview guide and Table 1 for additional details about the respondents). The structured questionnaire made up of both closed and open-ended questions were provided by the researcher and translated into Chichewa and implemented by local program staff in Malawi. The interviews were conducted in Chichewa and lasted between 20 to 30 minutes. The responses were collected orally by phone and transcribed into a questionnaire, which was translated back into English, and coded based on the three content themes listed above. Due to the low number of farmers interviewed, the data collected is not statistically significant but can be used as a case study to reinforce the secondary empirical research identified. Along with the key informant interviews, a review of program documents and reports was conducted to gain a holistic understanding of the context of the program and product design and development choices.

Table 1. KII Smallholder Farmer Sample Breakdown

Number	Sex	District	Co-op	Type of Crop	
				Maize	Soya
1	Woman	Dowa	Chimwankhuku	X	X
2	Woman	Lilongwe	Chileka	X	X
3	Man	Lilongwe	Chileka	X	X
4	Woman	Lilongwe	Milindi	X	
5	Woman	Lilongwe	Milindi	X	X
6	Woman	Lilongwe	Milindi	X	X
7	Woman	Lilongwe	Milindi	X	X
8	Man	Lilongwe	Milindi	X	X
9	Man	Lilongwe	Chimundi	X	X
10	Woman	Mchinji	Thawale	X	X
11	Woman	Mchinji	Kasekese	X	
12	Woman	Mchinji	Kasekese	X	X
13	Woman	Mchinji	Kasekese	X	X
14	Man	Mchinji	Kasekese		X
15	Woman	Mchinji	Titukulane	X	X
16	Man	Mchinji	Titukulane	X	X

Analysis

In order to determine whether or not WIBI is an effective and sustainable climate change adaptation strategy for men and women smallholder farmers in rural Malawi, this analysis will consider the demand and scalability of these WIBI schemes, whether or not such products can meet the needs of both women and men smallholder farmers in rural Malawi and whether or not these practices are leading to improved access to quality inputs and more sustainable agricultural practices.

Demand and Scalability

Willingness to Pay

When identifying demand, it is important to first determine a farmer's WTP. There are several factors that influence a smallholder farmer's WTP for WIBI to cover their crops. These include the types of climate shocks and weather conditions experienced or anticipated

(Castellani & Viganò, 2017), socio-economic factors, gender (Maganga et al., 2021) and cultural norms (Mkaudze, 2018) as well as additional risk reduction strategies in place (Isaboke et al., 2016).

Environmental Impacts

The nature and type of climate shocks and weather conditions experienced play a large role in a smallholder farmer's WTP (Castellani & Viganò, 2017). Based on widespread research looking at WTP in developing countries, including Ethiopia and Malawi, as weather anomalies and climate shocks increase, so does the WTP for WIBI (Castellani & Viganò, 2017). In Ethiopia, it was found that a change in precipitation and temperature can have a large impact on a farmer's WTP, especially if these changes come at a crucial time and risk causing significant economic losses (Castellani & Viganò, 2017). Additionally, those that believe that climate risks will be frequent and impactful on the household have a higher WTP for WIBI (Bogale,2015). This is especially true for households that have recently faced climate shock such as drought or food insecurity within the past couple seasons (Bogale,2015). These households are more willing to access the WIBI product as opposed to those who have not recently experienced poor weather conditions and food insecurity as they are more willing to wait until they are personally impacted by climate shock before paying for WIBI (Bogale,2015). Additionally, households with better growing conditions, such as soil fertility, and expectations of higher yields tend to be more willing to protect their investment through accessing WIBI but at a lower cost (Bogale,2015). While households in more vulnerable areas such as lowlands are also more willing to access WIBI to protect from flooding (Bogale, 2015). In Malawi, research shows that farmers who have experienced drought or flooding within the last two years were more likely

to access WIBI than those who had not experienced the same weather shocks (Manganga et al., 2021).

In 2019, Malawi experienced widespread flooding throughout the month of January (OCHA, 2019). The resulting livelihood insecurity was further exacerbated by Cyclone Idai, which hit Malawi in March of the same year (OCHA, 2019). Approximately 740,000 individuals were affected by the flooding and 16,000 households were impacted by the cyclone (OCHA, 2019). Through the case study on the Mthangati WIBI product, all but one insurance policy holder (15/16) interviewed indicated that their crops of maize, soya and or tobacco where either largely destroyed or lost, during the 2019 flooding, leading to a poor harvest for the season. Additionally, ten of the 16 respondents indicated in one way or another that poor and unpredictable weather challenges such as drought and flooding were the primary reasons for purchasing the WIBI product. For example, a respondent indicated that “we purchased Mthangati after understanding the risk associated with our agricultural production such as drought or failure for crops to grow. With the insurance we realized we would be covered in case of encountering such losses if we do not get adequate rainfall. The money that we would receive from Mthangati would be used to recover from losses incurred in production by buying new crops or fertilizer to grow the crops again.” Other respondents indicated that “I insure my crops so that rainfall challenge should not affect me” and “The possibility of poor rainfall made me to join this insurance.” When asked specifically about anticipated climate hazards, all but one policy holder (15/16) indicated an anticipation of either poor or heavy rainfall.

Socio-economic Factors

In addition to weather impacts and the experience of climate shocks, there are socio-economic factors that impact a farmer's ability and WTP for WIBI coverage. When it comes to household income, research has found that levels of income generally have a positive correlation with a farmer's WTP for WIBI (Bogale, 2015). Additionally, farmers with larger farms and higher anticipated economic loss and income potential are also more willing to insure their crops (Bogale, 2015). In fact, the Bogale study indicates an almost 20 percent increase in willingness to access WIBI related to each additional hectare devoted to crop production (Bogale, 2015). This is because the potential losses on a large farm are a lot more extreme than on a small one. Although farmers with higher incomes are more willing to access WIBI, the source of the income does matter. A study conducted in Malawi indicated that families who receive remittances are less willing to pay to access WIBI since those receiving remittances can use that income to address the adverse effect, such as food insecurity and crop loss, caused by weather shock (Maganga et al., 2021). On the flip side, low-income households and farmers with smaller plots of land are less willing to pay for WIBI coverage, especially if they do not experience a payout within the first couple years of accessing the product, keeping renewal rates among low-income farmers extremely low (Bogale, 2015). During the 2005 World Bank WIBI program in Malawi, it was discovered that smallholder farmers mistakenly confused insurance premiums for investments (Makaudze, 2018). After several payments without returns, farmers considered premium payments to be a bad investment and became disillusioned with the concept of insurance (Makaudze, 2018).

Additionally, a lack of financial resources will discourage farmers from paying for WIBI in the long run, unless the product is made more attractive to them by bundling it with other services or inputs (Bogale, 2015). To encourage uptake of the Mthangati WIBI product in Malawi, a plan was developed to bundle the WIBI with access to a highly sought-after seed variety. When asked about the barriers preventing farmers from accessing the WIBI product, a lack of savings at the time it was offered was one of the primary reasons. Several studies have shown a positive relationship between access to credit and WIBI uptake and an increased WTP (Marr et al., 2016).

For the large part, higher levels of education among farmers translate into an increased willingness to access WIBI (Manganga et al. 2021). This is likely because an educated individual has an increased ability to be forward thinking and identify the value of potential losses in the case of a weather shock, weighing the cost of the premium versus their potential losses (Manganga et al. 2021). Education can also help low income farmers make decisions that will prioritize lowering their risks in an efficient way (Bogale, 2015). In addition to increased education, access to extension services and agricultural guidance is also a predictor of WTP. Through these extension services and training, farmers gain access to valuable information about risk management and therefore become more knowledgeable of WIBI and its potential benefits (Manganga et al. 2021). More specifically, an increase in financial literacy has also been proven to increase interest in WIBI as farmers who receive insurance training are more likely to access WIBI. (Nonguierma, 2022) Despite higher levels of education and financial literacy usually corresponding with an increased WTP, it can also have an adverse effect. In some cases, increased levels of education can lead to farmers becoming more versatile and able to diversify

their income with off farm activities, thereby reducing their likelihood and willingness to purchase WIBI (Isaboke et al., 2016). When asked who were the early adopters of the Mthangati WIBI product, it was expressed that those who had a certain level of understanding of what WIBI was, as well as the ability to understand the product, were more likely to access the product first.

Gender and Cultural Norms

Gender plays a large role when it comes to WTP for WIBI. Studies have shown that women tend to be more risk-averse, less trusting of financial institutions and have a strong aversion to insurance products (Isaboke et al., 2016). However, it has been argued that the WIBI products made available are largely designed for men without considering gender-specific needs and barriers (Isaboke et al., 2016). In addition, women tend to have lower financial literacy than men and therefore struggle to understand concepts associated with WIBI product such as payment triggers and methods of compensation (Sopov, 2018). Women also have less access to financial services such as credit which, as indicated above, encourages WIBI uptake (Marr et al., 2016). Despite this, Maganga et al. have found that, in Malawi, gender had a limited impact on WTP, with men being slightly less willing to pay for WIBI than their female counterparts. However, as opposed to the other studies, this study solely focussed on ensuring food crops which are largely managed by women, while men tend to manage the cash crop production (Maganga et al., 2021).

The piloted Mthangati WIBI product in Malawi saw an overwhelming (more than double) uptake by women (120) as opposed to men (54). The significant uptake of women over men is likely a result of gender being a key consideration during the design and development of

the WIBI product. Through the product development process (reported by Oetling & Zanzanaini, 2018), it was identified early on that there was a large literacy gap between men and women smallholder farmers who would be accessing the product, with men generally having higher rates of literacy than women (Oetling & Zanzanaini, 2018). In addition to this, it was identified that men tend to be the decision makers when it comes to financial decisions at the household level so women would have to have the ability to explain the product to their husbands (Oetling & Zanzanaini, 2018). Additionally, phone owners were largely men, more than double women, and had higher amounts of savings (Oetling & Zanzanaini, 2018). These findings had major implications on how the product should be marketed and communicated leading to a high reliance on the use of in-person visuals and step-by-step explanations during the sensitization phase of the pilot (Oetling & Zanzanaini, 2018). Aside from these considerations, through key informant interviews with project staff, it was indicated that the attractiveness of the product to women was boosted by making it available through the local VSLAs, which are an important form of collective action for women. Additionally, gender was a large consideration during the development of the Mthangati WIBI product itself. As a result, the decision was made for the WIBI scheme to cover food crops (maize and soya), which in Malawi are the crops most likely to be managed by women, as opposed to cash crops, including tobacco, raw sugar, tea, groundnut, and cotton (CIAT & World Bank, 2018), which are more likely to be managed by men. It was also identified that a higher uptake of women could be due to the difference in coping strategies used by women and men. In this context, men have more income diversification opportunities, such as working in construction that women do not have

access to. Without such off-farm livelihood opportunities, women might therefore be more willing to pay for WIBI, as a risk mitigation strategy in the event of crop failure, than men.

In some parts of Malawi, it is culturally taboo to discuss catastrophes and disasters and doing so might even be seen as tempting fate (Mkaudze, 2018). Project staff for the Mthangati WIBI program indicated that, in different contexts, they had heard that farmers were unwilling to discuss WIBI because it could trigger climate disasters, go against God's will and, for Muslim communities, resembles gambling. However, they did not hear this in the pilot areas visited in rural Malawi. In fact, farmers tended to be more open to funeral insurance than crop insurance since they were more worried about the inevitability of death (and the associated high costs of medical and funeral expenses) than the potential of flooding or drought.

Additional Risk Reduction Strategies

A key piece of understanding WTP is understanding the other risk reduction strategies that farmers already have in place and how WIBI ranks within them. In the study conducted by Isaboke et al., Kenyan farmers ranked their coping strategies in order of most to least importance on a scale from one to ten. Through this activity, farmers identified off-farm work, the use of savings, and crop diversification as their most important coping mechanisms at the household level, while WIBI was ranked seventh among these ten options (Isaboke et al., 2016). If farmers are facing multiple risks, or perceive multiple threats to their livelihood, they prefer to engage in multiple risk reduction strategies (Isaboke et al., 2016). By engaging in multiple risk reductions strategies, farmers, with already limited resources, tend to spread themselves too thin and remain vulnerable to all risks (Isaboke et al., 2016). WIBI is a large investment and

farmers will not invest if they feel it leaves their crops vulnerable to risks, such as pests and disease, that are not covered (Isaboke et al., 2016). Selling livestock to cover crop loss is another coping strategy that can impact WTP for WIBI. In Malawi, farmers who keep large livestock have the ability to sell them off to cover crop loss, discouraging farmers from accessing other forms of coverage (Maganga, 2021).

Farmers have many existing ways to manage risk at the community and household level (Sopov, 2018). Because of this, they may be less likely to take up an additional strategy. During the consultation phase for the Mthangati WIBI program, farmers were apprehensive about the product since they claimed to already have strategies in place. They had other income-generating options in the case of crop failure including off farm options such as construction work or working for a neighbouring farm. Additionally, through the INVEST Co-op program, of which Mthangati was a small part, farmers learned on farm, post harvest and land management practices to reduce risk. Because of this, the Mthangati product was seen primarily as an add-on. Farmers preferred to implement newly acquired skills and techniques that they had full control of rather than choosing to buy WIBI. In some cases, farmers were more open to changing farming practices than accessing WIBI. As indicated by a program staff member, “for some, they felt comfortable to be able to adopt the risk management strategies that the project [INVEST] was encouraging over buying the insurance. Their perception was that I would rather do something that I have control over, I can maybe plant different or do ridges so that I am able to manage risk in my farm without buying insurance.” However, there was also an understanding that changing agricultural practices cannot fully address the large-scale risks such as drought and flooding. With the widespread nature of these weather impacts, other

income-generating opportunities, such as working for a neighbouring farm, could also be limited. It was recommended that combining improved agricultural strategies with WIBI would give farmers the best coverage possible.

Scalability

One of the biggest questions surrounding WIBI is its ability to be scaled up beyond a pilot phase and reach a significant number of farmers for long-term coverage. After years of failed traditional insurance offerings, WIBI schemes were introduced to address the problem of moral hazard and reduce transaction costs (Castellani & Vigano, 2017). WIBI has tremendous potential for rural economic development in Sub-Saharan Africa (Weber, 2019), however, over the past two decades, pilot programs have struggled to scale up due to both a lack of demand and overall low uptake, and inconsistent supply due to low profit margins and lack of investment (Makaudze,2018). Causing doubt that WIBI schemes could ever be scaled up to the level required to significantly reduce poverty in rural areas (Sopov, 2018). As indicated above, Malawi faced its own WIBI scheme failure when the pilot project implemented and funded by the World Bank failed to reach its full potential and was discontinued within a decade. More recently, ACRE, through its implementation of the largest WIBI program failed to engage a significant portion of the targeted population across multiple African countries. This section explores the predominant hurdles to scaling up which include basis risk, design and financing issues and a lack of flexible design (Weber, 2019).

Basis Risk

Due to the indexed nature of WIBI schemes, there is the possibly that a farmer is under or over paid after experiencing crop loss (Weber, 2019). This is called basis risk (Weber, 2019). This lack of precision in coverage could be the result of several reasons such as diverse farming practices and input investment, quality and location of land and extreme weather that is not accurately captured by a centralized monitoring station (Weber, 2019). In some cases, a localized or none covered risk can destroy a farmer's entire crop without receiving a single payout (Makaudze, 2018). When Malawi experienced an extreme drought during the 2015-2016 growing season, the government's WIBI protection did not properly cover farmers since they had switched to a maize variety that was more vulnerable to drought than was considered when the product was developed (Weber, 2019). An additional issue relating to basis risk is the lack of availability of quality data and data collection methods needed to determine and continuously monitor the index (Barnett et al., 2008). Basis risk has been identified as a large impediment when it comes to scaling of WIBI offerings beyond a pilot phase, since it weakens the product as a viable risk management tool, discouraging demand (Weber, 2019; Makaudze, 2018). Instead of being covered from the impacts of crop loss, farmers could find themselves in the difficult situation of paying a premium while not being compensated for devastating crop loss (Weber, 2019).

Design and Financing

Most WIBI schemes are offered to individual farmers despite farmers in Malawi preferring a group based option (Makaudze, 2018). A group based option would offer the policy

holder more power and a potentially more affordable insurance premium (Makaudze, 2018). Additionally, the benefits of offering a group based premium include lower administration costs, reduced default rates due to the peer-pressure nature of a group payment, increased bargaining power and higher enrollment rates leading to cheaper interest rates and insurance premiums (Makaudze, 2018). In the case of the Mthangati WIBI product, it was offered through agricultural co-operatives. The co-operative was the insured entity and individual farmers had the opportunity to sign up through the co-operative. This allowed the cooperative members to make the independent decision to access the WIBI product. Once they did register, farmers were accountable to the co-operative. The concept of offering a group based WIBI option was not considered since the program wanted to give farmers the opportunity to choose to access the product for themselves. With the knowledge of farmers in Malawi preferring group WIBI options, offering a group based option could have increased enrollment during the pilot phase.

There is also a perception that WIBI schemes fail to meet the coverage needs of local farmers in the long term due to provider's inability or unwillingness to revise and update their premiums and coverage, and that fixed rates make the product unaffordable for some (Castellani & Viganò, 2017). Farmers are looking for more customized coverage despite the fact that WIBI is intended to cover large populations across several regions at a low cost. Additionally, pilot projects are almost always propped up by governments and aid organizations, relying on donor funding to implement the product as well as subsidize the premium (Weber, 2019). Despite being the cheapest option in terms of insurance coverage, these services are still costly and it is difficult to continue to offer the coverage beyond donor

support, especially without raising premiums (Weber, 2019). This was found to the be the case for the Mthangati WIBI pilot program. For this reason, when designing a program for scalability, it is best to use donor support to fund the expansion of the WIBI program as opposed to subsidize premiums at the start of the program (Weber, 2019). Additionally, Mthangati program staff explained that insurance agencies prefer to use organizations as aggregators between them and the farmers. This way, the insurance agencies do not have to deal with receiving payments from each farmer individually. If organizations and aid agencies can act as the go-between for insurance and farmers, organizations can pay the premiums up front and farmers can make payments over a longer period or when it is most convenient for them. For example, after harvest.

Additionally, covariate risk can easily deplete the insurance reserves, leaving farmers unprotected after widespread losses (Barnett et al., 2008). Covariate risk is often the cause of insurance market failure and why WIBI schemes usually only survive in countries where the government takes on a significant amount of risk (Barnett et al., 2008). Lastly, trust in financial institutions and services is often low, there for, using intermediaries or aggregators that have a long-standing relationship with the farmers could be beneficial. Lack of trust is also derived from the inconsistency of products available due to the precarious nature of WIBI programs (Marr et al., 2016). Because of this, special attention should be paid to ensuring that payouts are processed as soon as possible and that the financial institutions offering the WIBI product are strong and reliable (Marr et al., 2016). Because of these challenges, WIBI schemes have failed to thrive beyond the pilot phase and reach a wider-scale audience among smallholder farmers in Rural Malawi.

Meeting the Needs of Women and Men Smallholder Farmers

Another way to identify if WIBI is an effective climate adaptation strategy for smallholder farmers in rural Malawi is to look at whether or not the available schemes are meeting their needs. Smallholder farmers in Malawi face several types of challenges and although WIBI is not intended to address every issue that farmers face, it is important that it addresses enough to make the premium payments worthwhile. It is also crucial that it does not exacerbate existing stressors and inequalities. This section of the analysis will explore whether on not WIBI address the right risks faced by farmers in Malawi, if other challenges and gender impact the anticipated benefits of the WIBI, and if WIBI is increasing income and food security as anticipated.

Risks and Other Issues Facing Smallholder Farmers

Smallholder farmers in Malawi are increasingly facing severe weather challenges, especially drought, making WIBI a strong option to face this particular environmental challenge (Makaudze, 2018). Due to the indexed nature of this type of insurance, farmers receive automatic payouts once a certain threshold of the index is reached (Cole, et al. 2012), providing a low cost and quick way for farmers to receive their payments (Marr et al. 2016).

The Mthangati WIBI product, like most WIBI, prioritized low rainfall (drought) as its trigger for payouts. This was in part because, during the design stage, farmers themselves did identify rainfall shortfall as the primary risk they are facing (CDF Canada, 2019). This could include extended drought periods, dry spells, or erratic rainfall happening at all stages of the

growing season (CDF Canada, 2019). However, as indicated above, drought is not the only risk facing smallholder farmers in Malawi. Farmers identified pests and disease as their second greatest risk. With little access to treatments, pest and disease can have a detrimental impact to a farmer's crops (CDF Canada, 2019). Although crop disease and pest infestations can be brought on by weather conditions, they are not something that can be covered under the WIBI provided. By excluding this risk from the coverage, smallholder farmers are left quite vulnerable (CDF Canada, 2019). The third greatest risk identified was excess rainfall and flooding in certain regions (CDF Canada, 2019). The regions affected reported an issue with excess water washing away seed, impeding plant development and damaging crop late into the season (CDF Canada, 2019). Based on this feedback, excess water was meant to be added to the index had the Mthangati WIBI program continued beyond the pilot (CDF Canada, 2019). Since 90 percent of cultivated land is rainfed in Malawi (Ministry of Agriculture, Irrigation and Water Development, 2016), a WIBI product that focusses on precipitation is strong approach for this context. Additionally, the Gehrke study finds that most agricultural production risks can be covered by a microinsurance scheme but not necessarily by using an index-based approach. Flexibility and a combination of different approached to insurance are needed to ensure the best and most fulsome coverage for smallholder farmers (Gehrke, 2014). Group insurance products could cover a wide array of risks with the costs shared between a group as opposed to falling on just one individual (Gehrke, 2014).

In addition to risks that cannot be covered by a WIBI product, smallholder farmers in Malawi also indicated a lack of market access having a large impact on their farm income (CDF

Canada, 2019). Despite efforts to improve agricultural marketing systems within Malawi, access to viable markets is still weak and even missing in rural parts of the country (Ministry of Agriculture, Irrigation and Water Development, 2016). This lack of crucial marketing systems is largely due to a lack of quality infrastructure and access to marketing services (Ministry of Agriculture, Irrigation and Water Development, 2016). This limits a farmer's ability to meaningfully participate in the agricultural value chain (Ministry of Agriculture, Irrigation and Water Development, 2016). With a lack of storage facilities, public market infrastructure and transportation infrastructure to move goods, the cost for farmers to get their goods to market is high (Ministry of Agriculture, Irrigation and Water Development, 2016). A lack of investment in basic marketing practices and dissemination of market information puts farmers in financial risk and limits their ability to turn a profit and invest back into their crops (Ministry of Agriculture, Irrigation and Water Development, 2016). This inequality is reinforced through weak and ineffective farmers organizations and co-operatives limiting the farmers' ability to negotiate for fair input and output costs (Ministry of Agriculture, Irrigation and Water Development, 2016).

Such insecurity around marketing impacts the success of a WIBI scheme since farmers will not benefit from insuring their crops, if by the end of the season, they have no ability to market and sell their production. The types of complaints reported by many of the respondents include, "Market availability still a problem. The Covid-19 has exacerbated," "There are no reliable markets and the farm produce are still in storage" and "The market scarcity is still a challenge despite the realization of bumper harvest." As indicated above, respondents

indicated that market provisions and access had not improved since purchasing the Mthangati WIBI product and in some cases, Covid-19 had exacerbated existing marketing issues, leaving harvested production stored at the co-operative without a way to bring it to market. In order to address the issue around accessing inputs at a fair price, it is common for WIBI schemes to bundle the WIBI with inputs (Manganga et al., 2021). The Mthangati WIBI product was bundled with the opportunity to purchase an improved seed variety at a discounted rate since smallholder farmers were looking to receive an immediate benefit. Although bundling WIBI with inputs better supports farmers with poor market access, it is important to ensure that the inputs offered do not overshadow the benefits of the WIBI. If smallholder farmers enroll in WIBI schemes simply for the side benefit of accessing inputs at a reduced rate, other subsidy programs offered could undermine the WIBI product (Makaudze, 2018). For over a decade, the Malawi government has been implementing a large-scale farm inputs subsidy program, increasing access to inputs for millions of smallholder farmers (Makaudze, 2018). With a program like this in place, the immediate benefit of the WIBI scheme could be reduced.

Increased Income and Food Security

In developing countries, households with extremely limited assets can struggle to escape a poverty trap created by implementing low-risk, low-return risk management practices, limiting the amount of revenue and savings that can come from agricultural production, especially in the face of ongoing climate hazards (Barnett et al., 2008). Safety nets, such as WIBI, ensure that smallholder farmers, who experience transitory poverty due to climate shock, do not experience chronic poverty (Barnett et al., 2008). Without initiatives like WIBI in place, households will try to cope with widespread climate shock, such as drought, by selling assets or

through a loss or deterioration of human assets such as education, health and nutrition. Unfortunately, this leads to a further weakened ability to develop the skills and capacity needed to reduce poverty and adapt to the impacts of climate change (Barnett et al., 2008). Additionally, investing in initiatives such as WIBI could alleviate reliance on and the cost of humanitarian aid when it comes to slow onset climate impacts such as drought (Barnett et al., 2008). However, as previously stated, this approach is less effective for countries who experience an existing lack of market integration (Barnett et al., 2008), such as Malawi. There is also evidence of increased income and food security as a result of accessing WIBI in countries like Rwanda and Kenya. After four years of WIBI availability through the ACRE program, smallholder farmers in the Huye District of Rwanda, who accessed the available product, saw an increase in household income of up to $105 USD (Sopov, 2018). This indicates that, in the right enabling environment, accessing WIBI can have a positive impact on household income (Sopov, 2018). In addition to this, smallholder farmers in Kenya, who accessed WIBI, were found to have increased food access and diet diversity as compared to non-adopters of the WIBI (Isaboke et al., 2016). Since 2011, the WFP has been implementing one of the largest WIBI programs across eleven countries including Malawi (Dubreuil, 2021). Through this program a total of 2.9 million smallholder farmers are covered through WIBI, 37,891 in Malawi (Dubreuil, 2021). As a result, farmers in Malawi received a payout of USD 2.4 million during the 2020-2021 season (World Food Program, 2021). This was one of the largest WIBI payouts experienced in Africa, allowing farmers to avoid the negative coping mechanisms mentioned above (World Food Program, 2021). Through this program, 100 precent increase in household savings as a result of accessing the WIBI has been reported (Dubreuil, 2021). Unfortunately, aside from this

program, there is a lack of evidence of increased income due to accessing WIBI for smallholders in Malawi. This is most likely due to the failure to launch, and lack of success and longevity that WIBI schemes have experienced in the Malawi (Makaudze, 2018).

Satisfaction With the Mthangati Insurance Product

The smallholder women (11) and men (5) farmers interviewed about their adoption of the Mthangati WIBI product had not had access to the product long enough to witness a change in income. The interviewed respondents had only accessed the product for one to two seasons. The eleven women respondents paid between MK3,000 ($3.90 CAD) and MK 20,000 ($26.00 CAD) for their insurance premiums, with an average total cost of MK 8,900 ($11.57 CAD). At the time of the interview, only three respondents had received any payout. One participant had received a payout but could not remember the amount and two participants received a small payout of MK 600 ($0.78 CAD) and MK 1,600 ($2.08 CAD) respectively[2]. When asked if the WIBI product was worth accessing, several women claimed it was worth it despite only receiving a very small payout or no payout at all. When asked why, they provided responses such as “It gave me more peace of mind during the agricultural season despite weather conditions uncertainties,” “I am expecting to get something if anything happens because I will continue buying this insurance,” “Yes, it was worth it considering that I got something unlike those not on insurance.” This indicates that, despite a lack of economic benefit, these women farmers benefited from the peace of mind and hopefulness that

[2] Respondents indicated that the weather had been quite favourable during the pilot stage. Since the weather index “trigger” threshold was not exceeded, payouts were quite low for this period.

insurance can bring. When asked if they would continue to access the product, all but one woman replied “yes.”

Lastly, when asked about product satisfaction, the large majority (9/11) of women interviewed indicated a high level of satisfaction with two women indicating a medium level of satisfaction. To explain the high level of satisfaction, despite limited payouts, the women interviewed cited “the continued weather monitoring education,” “Since it has helped me to be at ease” and “The readiness of any disaster has really motivated me to work hard.” As indicated through these statements, satisfaction with the product comes from the new knowledge and information gained through the accompanying weather monitoring education that policy holders received. The WIBI product also put farmers at ease, and gave them a sense of preparedness and hopes of benefiting from the coverage in the near future. When asked about how the product could be improved, the women indicated that they would like to see a reduced premium price and higher payout amounts, since they did not believe that the payout amounts covered their full agricultural costs such as labour and inputs. They also requested a broader coverage to cover more environmental risks. These sentiments are reflected in the following response provided, “Mthangati should also consider risks such as erosion of crops or landslides that frequent in the areas. The payout from Mthangati should increase to enable farmers to get better returns to cover the losses incurred. The payout usually is not enough to cover agricultural costs such a labour and farm inputs to grow crops again,” “The [premium] payment should decrease,” and “The insurance should cover all weathers or hazards, including post heavy rains effects.”

The five men respondents paid premiums covering a wider range than reported by the women (between MK 9000 ($1.17 CAD) and MK 75,000 ($97.50 CAD) total), with an average cost of MK 23,600 ($3.07 CAD). Only one interviewed man had received a payout but he could not remember the value. When asked if the WIBI product was worth accessing, four of the five claimed it was worth it for reasons such as “The crops are always insured and I am sure of getting refunded if any disaster takes place” and “The problems are yet to come so I will still buy this product.” When asked if they would continue to access the product, every man replied yes. They cited their expectation of future weather hazards resulting in payouts as the reason it was worth the premium despite not having received a payment to date.

Lastly, when asked about product satisfaction, some male respondents indicated high levels of satisfaction due to “the trainings and the learning visits,” “The education we get” and being “satisfied due to the insured crops.” They primarily listed co-benefits such as training, education and learning visits received as part of accessing the Mthangati WIBI product. Those who listed medium to low levels of satisfaction claimed it was because “The payout should increase” and “When there is heavy rains, the insurance should cover that as well.” When asked about how the product could be improved, the men indicated that “the insurance should cover all weathers including the heavy rains effects” and “The payout should increase, the payment should decrease.”

Sustainable Access

WIBI is often considered to be a tool to address the impacts of climate change. However, it is important to also consider how climate change will impact WIBI schemes in

return. As insurance modelling is almost always backwards looking, using data from previous years, the future impacts of climate change are often not considered (Hochrainer et al., 2009). In Malawi, a study was conducted using climate change modelling, to test the robustness of WIBI as a viable and sustainable adaptation strategy in the face of future climate change impacts (Hochrainer et al., 2009). When it comes to the impacts of climate change on WIBI schemes, there is worry that increased weather shock and variability brought on by climate change could lead to a default on claims as well as unaffordable cost of premiums (Hochrainer et al., 2009). Short and long-term climate change projections for Malawi, such as extreme changes in rainfall patterns, will have a significant impact on the financial robustness of WIBI schemes (Hochrainer et al., 2009). In the absence of raising premiums, subsidies from sources such as the international community or governments will be required (Hochrainer et al., 2009). In addition to climate change projections, it is also important to consider the feasibility of WIBI in regions that suffer from frequent and prolonged climate shocks such as drought. For those living in these regions, without public subsidies, premium rates would be unaffordable, making WIBI inaccessible to those who need it most (Gehrke, 2014). Based on this, without some form of reliance on subsidization, WIBI schemes will not be sustainable as an adaptation strategy.

Gender

In Malawi's agricultural sector, women hold little decision-making power (Murray et al., 2016). Despite women doing the majority of the farm labour, men tend to be responsible for selling and making decisions around income generation (Murray et al., 2016). Women farmers have, on average, access to less land, produce fewer crops and earn less than men smallholder farmers (Murray et al., 2016). Despite making up the majority of the agricultural sector in

Malawi, women remain disadvantaged with limited access to and control over finances and assets (Ministry of Agriculture, Irrigation and Water Development, 2016). This is also true for other equity seeking groups such as youth and people living with disabilities (Ministry of Agriculture, Irrigation and Water Development, 2016). A lack of control over land and farming resources has led to a 25 percent productivity gap between men and women in rural Malawi (Murray et al., 2016). Without land ownership, women have a lack of decision-making power when it comes to their agricultural production (Murray et al., 2016). With women only experiencing decision-making power if they are both the land owner and head of the household (CIAT & World Bank, 2018). In Malawi, when it comes to land rights, women have remained largely marginalized as land access is primarily controlled by men (Chikhwenda, 2019). As a result, women are less able to reap the benefits derived from WIBI due to their inability to access the product due to a lack of decision-making power, land ownership or control of income.

WIBI schemes are often accused of being designed by men, for men (Akter et al., 2016). This is evidenced by the fact that financial institutions tend to be more willing to develop WIBI products to cover cash crops as opposed to food crops (Makaudze, 2018), as financial institutions prefer to support long-standing and viable industries (Makaudze, 2018). In Malawi, women are generally in charge of food crops, at the household level, while men are largely responsible for cash crops (Maganga, 2021). There is a fairly rigid division of labour within the household, leaving women in charge of child rearing and food crops and men in charge of cash crops (Murray et al., 2016). Where scarcity exists, there can sometimes be a resource competition within the household (Maganga, 2021). Therefore, when WIBI is designed solely

for cash crops, it does not meet the crop insurance needs of women who are looking to invest in their food crops (Maganga, 2021). Gender was a large consideration during the development of the Mthangati WIBI product. As a result, the decision was made for the WIBI scheme to cover food crops (maize and soya) as opposed to cash crops. As a result more than double the number of women accessed the product than men.

Impacts on agricultural practice and use of better quality inputs and technologies

To better adapt to the changing climate, smallholder farmers in Malawi have been encouraged to take up conservation and climate-smart agricultural practices and technologies. Climate smart agriculture aims to increase agricultural production and food security through climate change adaptation and mitigation practices (CIAT & World Bank, 2018). In Malawi, climate-smart agricultural practices include "soil management, crop management (which includes use of drought tolerant crop varieties and crop diversification), water management, livestock management, forestry, fisheries and aquaculture, and energy management." (CIAT & World Bank, 2018, p. 11) Conservation agricultural in this context falls under climate-smart agriculture and primarily deals with improving soil quality and reducing erosion by reducing soil disturbances, and replenishing soil nutrients through the use of cover crops and crop rotation (Ngwira et al., 2014). Planting a diversity and improved varieties, intercropping and improving irrigation are utilised to increase household income and resilience as well as help farmers adapt and mitigate climate change (CIAT & World Bank, 2018). Due to industrialization, GHG emissions have increased significantly in Malawi over the last several years and roughly half of

those emissions derive from the agricultural sector (CIAT & World Bank, 2018). Aside from the practices listed above, inorganic fertilizer management practices are also key to addressing soil erosion (CIAT & World Bank, 2018). Despite the combination of organic and inorganic fertilizers being the most successful approach to reducing soil erosion and increasing production, smallholder farmers are often forced to use only organic fertilizer due to the high cost of inorganic fertilizer (CIAT & World Bank, 2018). This section will identify whether or not accessing WIBI leads to an increase investment into climate-smart agriculture practices and technologies.

Improved Agriculture Investment and Practices

The expectation of implementing a WIBI schemes is that accessing WIBI will lead to an increase adoption of improved agricultural practices and resources and there for lead to further increased resilience (Carter et al., 2016). Once smallholder farmers experience a reduction in risk and vulnerability and return on investment from accessing the WIBI product, they are then meant to increase the use of inputs and transition to high income crops which in turn will increase yield and productivity (Makaudze, 2018). Generally speaking, accessing WIBI tends to influence production and investment decisions of smallholder farmers in developing countries (Marr et al., 2016). This is often reflected through increased investment into crops with higher revenue potential (Marr et al., 2016). Empirical studies have shown that smallholder farmers will invest more into riskier but higher value crops, will invest more credit into production and increase investment into income diversification such as livestock after accessing WIBI products (Marr et al., 2016). There are several reasons why this could be the case, but one of the primary

reasons is that WIBI coverage reduces the need for precautionary savings. Since farmers now have a safety net, their savings can be utilized to further invest into their agricultural production (Marr et al., 2016).

When it comes to inputs, WIBI has been shown to have an impact on the amount and quality of inputs used. A study in India found that smallholder farmers reported a significant increase investment of fertilizer, seeds, and pesticides as opposed to a reduction in use (Cole et al., 2014). Significantly, more farmers reported increasing their fertilizer use than those who reported maintaining the same practice (Cole et al., 2014). Farmers also reported spending approximately 50 percent of their payouts on agricultural investments (Cole et al., 2014). It was also found that having access to WIBI coverage also impacted their agricultural practices as they became more likely to plant earlier in the season and less likely to abandon their crops (Cole et al., 2014). Additionally, a study conducted in Northern Ghana also found an increase in fertilizer use among farmers with WIBI coverage (Hurana et al., 2017). However, additional factors have been found to have an impact of fertilizer use such as past fertilizer use and an improved understanding of the extent of the WIBI coverage (Cole et al., 2012). It has also been found that accessing WIBI can decrease agricultural investment since riskier, high yield options become just as reliable as traditional reliable varieties (Nicola, 2015). In Malawi, there is a big debate over using hybrid seed as opposed to traditional seed due to the volatile nature of the hybrid seed. Smallholders often invest in both as a safety measure (Nicola, 2015). With WIBI coverage, smallholders can fully invest in a smaller amount of hybrid seed only, knowing that they will either benefit from a more productive yield or receive a payout (Nicola, 2015). Unfortunately,

as previously indicated, due to basis risks, this full investment in a more volatile seed can leave farmers underpaid.

Enabling Factors

A study conducted by Carter et al. (2016), reveals that not all contexts in which WIBI schemes are implemented enable the adoption of improved agricultural practices and an increase investment in quality inputs. There are two distinct environments in which accessing WIBI is unlikely to lead to any form of improved agricultural practices or new technology adoption. The first is an environment in which environmental risks are low and loans are easy to access (Carter et al., 2016). The second is an environmental is when environmental risks are high but the WIBI product is poorly designed and unable to cover the anticipated risks (Carter et al., 2016). However, if there is a well designed WIBI product in place, a high level of risk, on its own, does not discourage access to improved technologies and agricultural investment (Carter et al., 2016). In the case of Malawi, smallholder farmers face high levels of risk when it comes to environmental shock such as drought and flooding. Additionally, in a place like Malawi, that has a high environmental risk but easy access to loans through VSLAs and SACCOs, WIBI is found to be most impactful when combined with the availability of credit (Carter et al., 2016). Additionally, in a context in which it is difficult and unaffordable to access loans or in which farmers have the financial capital to access improved technologies on their own, a stand-alone WIBI product would be acceptable (Carter et al., 2016). Therefore, in order to encourage the adoption of improved technologies and increased investment of smallholder farmers in

Malawi, the WIBI product offered must be well designed to adequately cover the identified risks, and be linked with access to credit.

Additionally, in Malawi, land tenure security has been an ongoing challenge for smallholder farmers (CIAT & World Bank, 2018). Unfortunately, this has led to widespread land degradation since farmers are unwilling to meaningfully invest long term into land that they are at risk of losing (CIAT & World Bank, 2018). For this reason, in a context where land legislation is weak, accessing WIBI is unlikely to lead to increased agricultural investment and improved practices.

Improved Welfare

Generally, accessing WIBI has a positive effect on household welfare and consumption. For households with limited assets, they do not experience a reduction in consumption, while households with a larger asset base are not forced to sell them off (Marr et al., 2016). Unfortunately, WIBI can do nothing to reduce (and may even reinforce) existing inequalities between households with limited and those with high levels of assets. For example, in years with favourable weather all farmers pay premiums but do not receive payouts, which might be more burdensome for smallholders with fewer resources (Marr et al., 2016). Additionally, welfare gains made through accessing WIBI will have a greater benefit for wealthier farmers, who are more likely to make increased agricultural investments (and have those investments covered) than poorer farmers (Nicola, 2015). Therefore, it is understood that a WIBI product bundled with credit will have a more equitable impact on household welfare (Marr et al., 2016). Bundling credit can significantly increase a farmer's access to financial services that were

previously unavailable. Accessing these products can lead to further income diversification opportunities (Dubreuil, 2021). Access to WIBI can lead to significant welfare gains at the household level. However this is only the case if smallholder farmers avoid moral hazard and continue to invest the earnings back into their production (Nicola, 2015).

Gender

As previously stated, women smallholder farmers in Malawi have less capacity to adapt to the impacts of climate change than their male counterparts (Murray et al., 2016). This is due to several cultural, social and economic barriers, including low incomes, lack of access to financial services and lack of education. Women also often experience a lack of awareness around the benefits of climate-smart agriculture, that limit their ability to adopt climate-smart agriculture practices and reduce their labour constraints (Murray et al., 2016). Through a study conducted in Malawi by Murray et al. (2016), it was found that women are especially constrained when it comes to using proper irrigation technologies or the adoption of inorganic fertilizer. As indicated above, a lack of access to financial services, which women smallholder farmers are experiencing in Malawi, creates a strong environment for the access of WIBI payouts to be used for increased investment into a farmer's production (Carter et al., 2016). When women do have the financial capacity to invest into climate smart agricultural practices, the tools developed are often not tailored to women or there is a lack of connection between them and the supplier (Murray et al., 2016). Women, systematically have less access to agricultural inputs (CIAT & World Bank, 2018). Because of this, access to a financial service such as WIBI can't fully address a woman's ability to invest into climate smart agricultural practices.

Furthermore, accessing a WIBI product that was not specifically tied to a given crop (i.e., Mthangati's priority for food crops) could reduce women's decision-making power if it encouraged a household switch from the production of food crops to cash crops (Cole et al., 2014), which are predominantly managed by men in Malawi (Maganga, 2021). Additionally, just as levels of education have a large impact on WIBI uptake, it has been identified that it also has a significant impact on agricultural investment decisions and production practices. Farmers tend to improve their agricultural practices if they have a strong understanding of the linkages "between production risk, insurance, and agricultural decisions." (Cole et al., 2014 p. 1937) Once again, women are less likely to utilize the WIBI revenue for improved agricultural practices and the adoption of climate-smart agriculture since they typically have lower levels of education than their male counterparts (Murray et al., 2016).

Malawi

After accessing the WFP WIBI program, other financial services such as grants and loans were made available to the policy holders (Dubreuil, 2021). As a result, the WFP has reported that the number of farmers accessing credit in Malawi had doubled, leading to increased productive capacity based on access to improved inputs, tools and income diversification options such as livestock (Dubreuil, 2021). Additionally, it has been reported that 60 percent of farmers spent their payouts on food, while 34 percent purchased agri-inputs (Dubreuil, 2021). As is the case of this WFP program and the Mthangati WIBI program, WIBI products are often included within a program that addresses preexisting and deep-rooted issues facing smallholder farmers such as poor access to information, agricultural inputs and technologies (Dubreuil,

2021). When WIBI products are offered alone, their impact is limited to addressing the immediate needs of a smallholder farmer once a weather event has occurred (Dubreuil, 2021). However, when the WIBI product is integrated within a program that takes a more holistic approach to addressing the needs of the farmers, the WIBI product has a larger impact on household resilience (Dubreuil, 2021). It was indicated by one of the architects of the Mthangati WIBI product that investing in higher value inputs is often very common, especially when the coverage is paired with seed or other inputs. For example, a project staff member from the Mthangati program indicated that a new WIBI product is currently being developed in Malawi which aims to bundle the WIBI product with a discounted organic fertilizer. This will be crucial to farmers since the price of fertilizer has recently become inaccessible to smallholder farmers due to a price increase of 300 percent caused by the war in Ukraine, as Russia and Ukraine are the primary suppliers of fertilizer to African countries (Gajigo, 2022). Despite this, the obstacle with WIBI coverage leading to improved investment and agricultural practices is that the margins of profit can be quite low. In Malawi, it is anticipated that in general, farmers will experience poor weather every one in five years on average and therefore they will only receive a payment approximately once every five years. If farmers are paying more for premiums than they are receiving in payouts, which was the case with the Mthangati product, there are actually fewer funds to invest into improved agricultural practices, inputs and technologies. Therefore, the WIBI product on its own is not viable enough to promote improved agricultural investment and practices. However, it is successful as part of the INVEST Co-op program, which addresses farming technique, crop diversification, weather forecasting, and other forms of risk reduction.

Of the 16 smallholder farmers interviewed, only three did not grow both crops covered by the Mthangati WIBI product (one man and two women) (Table 1). Based on local knowledge, it was determined that climate smart agricultural practices for maize within these regions would be; the use of improved seed, crop management, pests and disease control, weed management practices, proper spacing, ridge spacing, fertilizer application and crop rotation. In terms of soybean, use of improved and certified seed, early planting, ridge spacing, seed spacing, double rows and crop rotation were identified as climate smart practices. Of the 11 women smallholder farmers interviewed, nine indicated an increase in all the areas that applied to their crops. One farmer indicated that she did not use improved seed and that her pest and disease control practices had not changed for both crops produced. The second woman indicated that her use of improved and certified seed for her soya bean production had also remained the same. As for the men smallholder farmers interviewed, four of the five men indicated they had increased areas for all the crops that applied to them. Only one of the five indicated that his use of improved and certified seed had remained the same for his soya bean production. Despite asking about improved agricultural practices due to accessing WIBI solely, I believe these extremely favourable results are a result of the farmer's involvement in the INVEST Co-op program as a whole.

Discussion and Conclusion

As outlined in this paper. There are several factors that go into determining whether or not WIBI is an effective and sustainable climate change adaptation strategy for women and men smallholder farmers in Malawi. These include enrollment rates and scalability, the WIBI

product's effectiveness in meeting the needs of smallholder farmers, and whether or not the WIBI coverage leads to improved agricultural practices and the use of improved inputs and technologies.

As indicated above, there are several factors that influence demand and a farmer's WTP for WIBI. Higher incomes and education levels tend to encourage WIBI uptake (Bogale, 2015 & Manganga et al. 2021) while cultural norms around not wanting to discuss future tragedies can negatively impact a farmer's WTP (Mkaudze, 2018). Additionally, gender has been found to have an impact, with women being more risk-averse and less likely to trust the financial institutions offering the WIBI product (Isaboke et al., 2016). Lastly, farmers who have recently faced climate shock are more likely to access WIBI while farmers with diversified coping strategies in place may be less willing to pay (Castellani & Viganò, 2017 & Isaboke et al., 2016). These factors are important to consider during the product designed and marketing phase, since a lack of enrollment has caused WIBI programs to struggle to move beyond the pilot phase (Makaudze, 2018). Without an in-depth understanding of the target farmers and their WTP, WIBI schemes will continue to struggle to become a sustainable adaptation strategy. A flexible and well-designed product has the potential to offer strong adaptation support to both women and men smallholder farmers when gender and socio-economic factors, levels of education, existing strategies and past experiences with climate shock are considered.

In addition to WTP, it is also crucial to explore the scalability of WIBI products. By limiting moral hazard and transaction costs (Castellani & Vigano, 2017), WIBI has overcome

issues plaguing traditional insurance models (Weber, 2019). However, due to design and financing issues, WIBI schemes have largely failed to reach a large enough scale to reduce inequality or widespread poverty in rural areas (Sopov, 2018). While WTP factors might limit uptake, WIBI products also face the challenge of basis risk, which would limit the effectiveness of the WIBI coverage and significantly weaken the benefits of accessing the product (Weber, 2019). In addition to this, large and small-scale WIBI programs have largely been stewarded by large international agencies and development organizations (Weber, 2019). Not only do these organizations subsidize the policies but they also cover additional expenses such as marketing that financial institutions do not want to assume since these WIBI schemes do not have large margins of profit for the financial institution (Weber, 2019). These effects mean that (as was the case with Mthangati) once the program concludes and the financial support ends, financial institutions will often discontinue the product. This is either because demand drops once the premiums are no longer subsidized or because, without the intermediary, it is no longer financially viable and efficient for financial institutions to take on all of the expenses and risk. An intermediary, whether it be an international agency, local cooperative or VSLA, is needed to provide marketing, support and collect payments on behalf of the financial institution. Additional, long-term investment from local governments is also needed to subsidise the product and ensure viability for those offering it. With climate change projections anticipating worsening weather conditions, the longevity and sustainable accessibility of these schemes are seriously questioned (Hochrainer et al., 2009). With more frequent, prolonged and widespread climate shocks, the product becomes less financially robust and without external investment or support, the premiums will become unaffordable (Hochrainer et al., 2009). Without this

support, the long-term and sustainable availability of a WIBI in a country like Malawi is extremely unlikely.

When it comes to exploring the potential of WIBI in addressing the needs of smallholder men and women farmers in Malawi, this research considered whether or not the right risks were being addressed along with the factors that could reduce the effectiveness and benefits of WIBI. In terms of weather and the reliance on rainfed crops, Malawi can be seen as the ideal context for this type of intervention since WIBI is a low cost, low maintenance solution to addressing precipitation based climate risks (Marr et al. 2016). Unfortunately, other significant risks such as pests and disease cannot be covered by the same (weather index-based) product, leaving farmers vulnerable to risks that can be as detrimental as erratic rainfall (Isaboke et al., 2016). Despite these aspects of the Malawi agricultural sector, the current lack of access to markets and unaffordability of inputs being experienced by smallholder farmers in rural Malawi greatly undermines the potential benefits of insured crops (Ministry of Agriculture, Irrigation and Water Development, 2016). Bundling WIBI with inputs is a strategy used to mitigate this issue (Manganga et al., 2021). However this technique could lead to reduced interest in WIBI over time (Makaudze, 2018).

In addition, there is limited evidence that accessing WIBI can increase income and food security, especially in Malawi. This is particularly true for women farmers in Malawi, who lack financial and agricultural decision-making power as well as land ownership and access to inputs. (Murray et al., 2016) Additionally, WIBI products are typically geared towards cash crops which

are controlled by men, leaving food crops, which are largely controlled by women, complementary unprotected. (Makaudze, 2018) When it comes to the design and availability of the product, if special attention is not made to ensure equitable access and benefits, this existing inequality will be exacerbated. As outlined through the Mthangati case study, in which the WIBI product was designed to cover women dominated food crops and made available through VSLAs in which women make up the majority of the membership, a well designed gender responsive product can lead to high levels of uptake and benefit for women farmers. Further research is needed to investigate how WIBI schemes can better meet the needs of women smallholder farmers.

The expectation of implementing a WIBI scheme is that accessing insurance will lead to an increase adoption of improved agricultural practices and resources, leading to further increased resilience (Carter et al., 2016). Once smallholder farmers experience a reduction in risk and vulnerability from accessing the WIBI product, they are then meant to increase the use of quality inputs and transition to high income crops which in turn will increase yield and productivity (Makaudze, 2018). This paper highlights empirical evidence indicating that, in general, accessing WIBI can lead to an increase investment in this area (Marr et al., 2016). However this phenomenon is very context specific. Unfortunately, the rural context in Malawi makes it very difficult for farmers to improve their agricultural practices and investments based on accessing WIBI alone (Dubreuil, 2021). This is due to a lack of land tenure security, a weak market leading to the unaffordability of quality inputs such as inorganic fertilizers and a lack of access and knowledge when it comes to improved agricultural technologies (Dubreuil, 2021).

This is especially true for women farmers (Murray et al., 2016). Therefore, in order to have an impact on agricultural investment and practices, the available WIBI product must be bundled with inputs or credit and included within a larger agricultural development program that promotes improved agricultural practices and better market access (Dubreuil, 2021) such as the WFP and INVEST Co-op program in which the Mthangati WIBI product was included. Simply accessing WIBI will not likely increase resilience on its own (Dubreuil, 2021). However, in the short term, it will mitigate the economic impacts of climate shock and reduce the risk of transitory poverty leading to chronic poverty. (Barnett et al., 2008) However, to allow farmers to further invest in technologies such as irrigation that will better equip them and increase resilience in the face of a changing climate long term, the WIBI product must be bundled with additional financial services or access to inputs. A large number of WIBI schemes have failed over the last several years (Makaudze, 2018), however, serious and extensive investment into a gender responsive, well designed, robust but flexible product, in an enabling environment, could be a much-needed bridge to resilience for smallholder men and women farmers in Sub-Saharan Africa.

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Appendices

Appendix 1: Structured Interview Guide

The following two questions are to be answered by the interviewer:

1.1 I have read the consent form text and explicitly asked for informed consent

☐Yes ☐No

1.2 The participant has offered consent their consent

☐Yes ☐No

Phase 2: Questionnaire

2. Demographic

2.1 Gender: ☐Female ☐Male ☐Other: _____

2.2 Marital Status: ☐Single ☐Married ☐Divorced ☐Widowed

☐Other: _____

2.3 Which growing season(s) did you purchase the ***Mthangati*** product for?

2.4 For which crop did you purchase the ***Mthangati*** product for?

☐Maize ☐Soybean ☐Both

2.5 District/Cooperative: Click or tap here to enter text./ Click or tap here to enter text.

3 Open Ended Questions

3.1 The *Mthangati* Product

3.1.1 Who in your household made the decision to purchase the ***Mthangati*** product?
Click or tap here to enter text.

3.1.2 What were the main reasons you had for purchasing the ***Mthangati*** product?
Click or tap here to enter text.

3.1.3 What is your level of satisfaction with the ***Mthangati*** product? Please explain.

☐High ☐Medium ☐Low

Click or tap here to enter text.

3.1.4 How could the ***Mthangati*** product be improved to better meet your needs and the needs of other farmers in your community? (*prompts: price, making claims, payout, less paperwork, appealing to more farmers in my area, etc.)*

Click or tap here to enter text.

3.2 Change in Risk Perception

3.2.1 What weather hazards did you experience before… that prompted to you consider buying the ***Mthangati*** product?

Click or tap here to enter text.

3.2.2 What weather hazards do you expect now, that were not expected before?

Click or tap here to enter text.

3.2.3 After accessing the ***Mthangati*** product:

- What farming practices or techniques have changed? (prompts: changes related to preparation at the start of the growing season? to planting? to growing? to harvesting? to storage? Other?)

  Click or tap here to enter text.

Activity for Maize Crop - Name a range of practices below	Increase (doing more of it)	Or Decrease (doing less of it)	Or Stayed the Same (doing the same amount of it)	Or I am not doing this
Use of improved seeds	☐	☐	☐	☐
Crop management- Pests and disease control	☐	☐	☐	☐
Weed management practices	☐	☐	☐	☐
Proper spacing	☐	☐	☐	☐
Post harvest handling practices etc	☐	☐	☐	☐
Manure/fertiliser application	☐	☐	☐	☐
Crop management- land	☐	☐	☐	☐

preparation and planting				
Crop rotation	☐	☐	☐	☐
Crop spacing	☐	☐	☐	☐
Ride spacing	☐	☐	☐	☐
Activity for Soybean Crop				
Use of improved and certified seed	☐	☐	☐	☐
Early planting	☐	☐	☐	☐
Ridge spacing	☐	☐	☐	☐
Seed spacing/Double rows	☐	☐	☐	☐
Crop rotation	☐	☐	☐	☐

- What cash savings practices have changed? (*prompts: where? at a Bank, a SACCOs, a VSLA? Amounts? Frequency? Taking loans?)*
  Click or tap here to enter text.

- What practices have changed related to the resources you use for farming? (*prompts water, soil, manure, crop stalks, etc*.)
  Click or tap here to enter text.

- What practices have changed related to marketing your harvest? (i.e., agricultural products from your farm) (*prompts: crops, animals, processed foods, etc.)*
  Click or tap here to enter text.

- What household practices have changed (*Prompts: doing other income-generating activities? processing more foods at home? diet changes? water storage? sanitation? Other changes?)*
  Click or tap here to enter text.

- What impact did the 2019 cyclones in Malawi have on your interest in crop insurance - on the ***Mthangati*** product?
  Click or tap here to enter text.

3.3 *Mthangat*i Outcomes

3.3.1 Did you adopt new ways of working/farming as a result of owning insurance?
Click or tap here to enter text.

3.3.2 What was the cost to you of participating in ***Mthangati***?
Click or tap here to enter text.

What did you get for this expense?
Click or tap here to enter text.

Was it worth it? (*prompts – insurance payout, peace of mind, motivation to be a better farmer? Motivation to pay more attention to the weather? to seasonal forecasts?)*
Click or tap here to enter text.

3.3.3 How have you most benefited from accessing the ***Mthangati*** product?
Click or tap here to enter text.

3.3.4 Will you continue to access the ***Mthangati*** product next year?

☐ Yes ☐ No ☐ I don't know

Why? Or why not?

Click or tap to enter a date.

3.4 Other Questions:

3.4.1 Do you discuss the ***Mthangati*** product with others? (ie: neighbours? Farmers? Other coop members?)
Click or tap here to enter text.

3.4.2 Will you recommend the purchase of the ***Mthangati*** product to others (ie: neighbours? to other farmers? to other coop members?)
Click or tap here to enter text.

3.4.3 What have you learned (1-2 things) from having made the decision to purchase the ***Mthangati*** product?
Click or tap here to enter text.

3.4.4 Are there any other things you want to say about your experience with the ***Mthangati*** product?
Click or tap here to enter text.

Appendix 2: Semi-structured Interview Guide

KII Interview Guide

**Since the interview is intended to be unstructured to semi-structured, the follow questions will be used to guide the conversation.*

1. Research Introduction (see consent from)

2. Questions:

2.1 What was your involvement in the development and implementation of the Micro-insurance project?

2.2 How long were you involved with the project?

2.3 Was the *Mthangati* product equally available for all famers (m/f)? Why have significantly more women bought insurance?

2.4 What is the extent of change in farmer's risk perception as a result of their participation in project?

2.5 What effect did participation have on people's attitudes, behaviors, knowledge, and action?

2.6 How do you think the product or implementation of the project could be improved to better meet the needs of the target communities?

2.7 How does the ***Mthangati*** product fit into the co-operative model?

2.8 What do you see for the future of the *Mthangati* product?